NPL-U33-2-5-R7

U.S. ENVIRONMENTAL PROTECTION AGENCY

REGION 7

HAZARD RANKING SYSTEM
NATIONAL PRIORITIES LIST CANDIDATE SITE
DOCUMENTATION RECORD
FOR
THE RIVERFRONT SITE
NEW HAVEN, MISSOURI

CERCLIS NO. MOD981720246

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JULY 2000

RIVERFRONT SITE

NEW HAVEN, MISSOURI

SITE SUMMARY

RIVERFRONT SITE

NEW HAVEN, MISSOURI

SITE SUMMARY

Site CERCLIS Number: MOD981720246

Site Location: New Haven, Franklin County, Missouri

Site Description:

The site encompasses a plume of tetrachloroethylene (PCE)-contaminated ground water underlying the town of New Haven, Missouri. The plume has contaminated the aquifers that serve as the drinking water supply for New Haven, Missouri. There are 1,737 people in New Haven; all are served by the municipal water supply. Samples collected from two of the city's three wells (New Haven Wells No. 1 and No. 2) have contained concentrations of tetrachloroethylene (PCE) greater than the maximum contaminant level (MCL) of 5.0 ：g/L, since 1986. PCE was first detected in New Haven Wells No. 1 and No. 2 during sampling conducted by the Missouri Department of Natural Resources (MDNR) in 1986. MDNR has conducted routine sampling of the municipal wells since the initial detection. Concentrations of PCE in New Haven Well No. 1 have ranged from 1.8 ：g/L to 21 ：g/L; concentrations in New Haven Well No. 2 have increased steadily. PCE was detected at 140 ：g/L in a sample collected from New Haven Well No. 2 in September 1993. PCE has never been detected in New Haven's third well, New Haven Well No. 3. New Haven Well No. 3 is located approximately one mile southwest of New Haven Wells No. 1 and No. 2 (Figure 1). In May 1993, MDNR issued the city of New Haven a Notice of Violation (NOV), because concentrations of PCE in New Haven Well No. 2 continued to exceed the MCL of 5.0 ：g/L. New Haven Well No. 2 was subsequently taken out of service. In September 1994, a new municipal well, New Haven Well No. 4, was installed. New Haven Well No. 4 is located approximately 0.4 miles north-northwest of Well No. 3 and approximately 0.8 miles southwest of New Haven Wells No. 1 and No. 2 (Figure 1). Sampling by various agencies has shown no detectable concentrations of PCE in New Haven Well No. 4.

The extent of the plume is defined for HRS scoring purposes by the locations of New Haven Wells No. 1 and No. 2 located in the town’s business district adjacent to the Missouri River. More specifically, New Haven Wells No. 1 and No. 2 are about 1,000 feet from the Missouri River (Figure 1). The uppermost aquifer in the site area is the Missouri River alluvium. These alluvial deposits are composed of clay, silt, sand, and gravel, and constitute an alluvial aquifer. Regionally, the alluvium ranges in thickness from zero to 150 feet. The alluvial aquifer is capable of yielding 3,000 gallons of water per minute. Documentation indicating that the alluvial aquifer is used as a drinking water source within the site vicinity is limited; however, it is expected that residences (with private wells) located in the Missouri River floodplain draw water from the alluvial aquifer. The alluvium rests directly on the bedrock; there is no evidence of an aquitard between the alluvium and the underlying bedrock aquifer, the Cambrian-Ordovician aquifer. This aquifer is composed of numerous sandstone, limestone, and dolomite formations. It is relatively uniform in thickness, approximately 1,200

feet. All four of the New Haven municipal wells draw water from this aquifer. The open intervals for New Haven Wells No. 1 and No. 2 begin at 348 feet mean sea level (msl) (or 153 feet below land surface [bls]), and 309 feet msl (or 210 feet bls), respectively; both are uncased for approximately 800 feet. Both draw water from multiple formations within the Cambrian-Ordovician aquifer, ending in the Potosi Formation. For purposes of HRS scoring, the two aquifers were combined into a single hydrological unit. The evident lack of an intervening layer and the similarity in hydraulic conductivity of the bedrock aquifer and the alluvial aquifer indicates that the two aquifers are interconnected.

Based on information gathered during the Preliminary Assessment (PA), Site Inspection (SI), and the Expanded Site Inspection (ESI), several potential sources of the PCE which has been detected in the New Haven Wells No. 1 and No. 2 were identified. The use of PCE has been documented at two potential sources, and analytical data indicate the presence of PCE. However, the PCE detected in the municipal wells cannot be definitely attributed to either of these potential sources, since other potential sources have also been identified.

The site was evaluated using the Hazard Ranking System (HRS) methodology and the PREscore 4.1 program. A pathway score of 100.00 was calculated for the Ground Water Migration Pathway, based on an observed release to the Alluvial/Cambrian-Ordovician aquifer. The observed release was established based on analytical results for ground water samples collected from New Haven Wells No. 1 and No. 2. The concentrations of PCE detected in these wells were significantly greater than background levels. All of the municipal wells draw water from the Cambrian-Ordovician aquifer. New Haven Well No. 3 was used to determine background levels, because it draws water from the Cambrian-Ordovician aquifer.

The original source(s) of PCE has not been identified at this site; thus, a ground water plume with no identified sources was used for purposes of HRS scoring. Identification of the ground water plume with no identified source for this site is based on consideration of the following: the ground water plume has been established based on sampling and the level of effort expended in attempts to identify the original source was an ESI.

Both New Haven Wells No. 1 and No. 2 were evaluated based on actual contamination. Analytical data support an observed release to both municipal wells. New Haven Well No. 2 was closed (in May 1993) due to concentrations of PCE greater than the MCL. The populations served by each of the municipal wells prior to May 1993 were used to determine populations subject to Level I concentrations. New Haven Well No. 4 was not included in this HRS evaluation because this well was not used as a drinking water well prior to the closure of New Haven Well No. 2. From 1990 through May 1993, before use of Well No. 2 was discontinued, Wells No. 2 and No. 3 provided the city's water. Well No. 1 was used on a standby basis in emergencies but has subsequently been removed from service.

RIVERFRONT SITE
NEW HAVEN, MISSOURI

HAZARD RANKING SYSTEM PRESCORE SCORESHEETS

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WORKSHEET FOR COMPUTING HRS SITE SCORE

	S		S^2
1. Ground Water Migration Pathway Score (S_{gw}) (from Table 3-1, line 13)	100		10,000
2a. Surface Water Overland/Flood Migration Component(from Table 4-1, line 30)	____		
2b. Ground Water to Surface Water Migration Component(from Table 4-25, line 28)	____		
2c. Surface Water Migration Pathway Score (S_{sw})Enter the larger of lines 2a and 2b as the pathway score.	____		____
3. Soil Exposure Pathway Score (S_s) (from Table 5-1, line 22)	____		____
4. Air Migration Pathway Score (S_a) (from Table 6-1, line 12)	____		____
5. Total of $S_{gw}^2 + S_{sw}^2 + S_s^2 + S_a^2$			10,000
6. **HRS Site Score** Divide the value on line 5 by 4 and take the square root		50.00	

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revised: w:\share\9911\9911-008\doc-rec4.wpd

GROUND WATER MIGRATION PATHWAY SCORESHEET

REF.1, TABLE 3-1

Factor Categories and Factors	Maximum Value	Value Assigned
Likelihood of Release to an Aquifer:		
1. Observed Release	550	550
2. Potential to Release:		
2a. Containment	10	___
2b. Net Precipitation	10	___
2c. Depth to Aquifer	5	___
2d. Travel Time	35	___
2e. Potential to Release [lines 2a x (2b + 2c + 2d)]	500	___
3. Likelihood of Release (higher of lines 1 and 2e)	550	550
Waste Characteristics:		
4. Toxicity/Mobility	a	100
5. Hazardous Waste Quantity	a	100
6. Waste Characteristics	100	10
Targets:		
7. Nearest Well	50	5.00E+01
8. Population:		
8a. Level I Concentrations	b	1.73E+03
8b. Level II Concentrations	b	0
8c. Potential Contamination	b	3.60E+01
8d. Population (lines 8a + 8b + 8c)	b	1.766E+03
9. Resources	5	5.00E+00
10. Wellhead Protection Area	20	0
11. Targets (lines 7 + 8d + 9 + 10)	b	1.821E+03
GROUND WATER MIGRATION SCORE FOR AN AQUIFER		
12. Aquifer Score [(lines 3 x 6 x 11)/82,500][c]	100	100
GROUND WATER MIGRATION PATHWAY SCORE		
13. Pathway Score (S_{gw}), (highest value from line 12 for all aquifers evaluated)[c]	100	100

[a]Maximum value applies to waste characteristics category.

[b]Maximum value not applicable.

[c]Do not round to nearest integer.

Site Map

A copy of the site map is available at the EPA Headquarters Superfund Docket:

U.S. CERCLA Docket Office
Crystal Gateway #1, 1st Floor
1235 Jefferson Davis Highway
Arlington, VA 22202

Telephone: (703) 603-8917
E-mail: superfund.docket@epa.gov

RIVERFRONT SITE
NEW HAVEN, MISSOURI

REFERENCE LIST

1. U.S. Environmental Protection Agency, Hazard Ranking System, 40 CFR Part 300, Appendix A, July 1999.

2. U.S. Environmental Protection Agency, June 1996, Superfund Chemical Data Matrix (SCDM).

3. U.S. Environmental Protection Agency, Interim Final Hazard Ranking System Guidance Manual, Hazardous Site Evaluation Division, Office of Solid Waste and Emergency Response, Publication 9345.1-07, November 1992.

4. Missouri Department of Natural Resources, St. Louis Regional Office, Potential Hazardous Waste Site Preliminary Assessment for the New Haven Public Water Supply, Franklin County, Missouri, September 10, 1987, 9 pages.

5. Missouri Department of Natural Resources, St. Louis Regional Office, Hazardous Waste Site Investigation Site Inspection Report for the New Haven Public Water Supply, Franklin County, Missouri, November 23, 1988, 9 pages.

6. Jacobs Engineering Group, Inc., Draft Expanded Site Inspection Report with Attachments for the New Haven Public Water Supply Site, New Haven, Missouri, January 1994, 116 pages.

7. Memo to Sandra Carroll, Missouri Department of Natural Resources, Waste Management Program, from Mike Stuckhoff, Missouri Department of Natural Resources, Hazardous Waste Unit, regarding Additional Information on Riverfront Industries, Inc., September 27, 1989, 3 pages.

8. Missouri Department of Natural Resources, Division of Environmental Quality, Laboratory Services Program, Report of Investigation, New Haven Public Water Site, New Haven, Missouri, September 11, 1989, 15 pages.

9. Geotechnology, Inc., Contamination Delineation Report, Kellwood Company, Metalcraft Enterprises Site, New Haven, Missouri, November 6, 1991, 40 pages.

10. Imes, Jeffrey, The Ground-Water Flow System in Northern Missouri with Emphasis on the Cambrian-Ordovician Aquifer, U.S. Geological Survey Professional Paper 1305, 1985, 34 pages.

11. Memo to Kerwin Singleton, Missouri Department of Natural Resources, St. Louis Regional Office, from Charles Williams, Missouri Department of Natural Resources, Division of Geology and Land Survey, regarding the New Haven PA/SI, March 21, 1988, 5 pages.

12. Missouri Department of Natural Resources, Division of Geology and Land Survey, Addendum to the New Haven Public Water Supply PA/SI, Franklin County, Missouri, August 9, 1988, 3 pages.

13. Missouri Department of Natural Resources, well logs for New Haven Wells No. 1 and No. 2 and the Pepsi Well, 6 pages.

14. Missouri Geological Survey and Water Resources, The Stratigraphic Succession in Missouri, Volume XL, 2nd Series, September 1961, pages 14-32.

15. Telephone conversation between Leslie Scally, Jacobs Engineering Group Inc., and Dan Daugherty, Missouri Department of Natural Resources, St. Louis Regional Office, Public Drinking Water, regarding the New Haven Public Water Supply, May 18, 1993, 2 pages.

16. Letter of Transmittal to Leslie Scally, Jacobs Engineering Group Inc., from Mark Feldmann, Buescher Frankenberg Associates Inc., regarding Water Well Record for New Haven Well No. 3, July 20, 1992, 2 pages.

17. Letter to Susan Lackey, Site Assessment and Federal Facilities Section, Superfund Branch, Waste Management Division, U.S. Environmental Protection Agency Region 7, from William E. Price, Environmental Engineer, Missouri Department of Natural Resources, Division of Environmental Quality, February 5, 1993, 2 pages.

18. Missouri Department of Natural Resources, Division of Environmental Quality, Laboratory Services Program, Results of Sample Analysis, January 21, 1987, 2 pages.

19. Letter of Transmittal to Leslie Scally, Jacobs Engineering Group Inc., from Ethan Litney, Environmental Science and Engineering Inc., regarding Sample Chain of Custody and Analytical Data for Sampling Conducted at the City of New Haven on May 15, 1991, September 11, 1992, 550 pages.

20. Letter to Anne Olberding, Superfund Branch, Waste Management Division, U.S. Environmental Protection Agency Region 7, from Kristine Davidson, Missouri Department of Natural Resources, Division of Environmental Quality, regarding samples collected from New Haven Water System, October 27, 1993, 99 pages.

21. Letter to Susan Lackey, Site Assessment and Federal Facilities Section, Superfund Branch, Waste Management Division, U.S. Environmental Protection Agency Region 7, from Thomas McDonald, Mayor of New Haven, January 13, 1993, 2 pages.

22. U.S. Geological Survey, 7.5 Minute Series Topographic Maps for Missouri, Berger Quadrangle, N3837.5-W9115, 1974; Dissen Quadrangle, N3830-W9115, 1973; New Haven Quadrangle, N3830-W9107.5, 1973; Treloar Quadrangle, 38091-F2-TF-024, 1973, photo revised 1985.

23. Telephone conversation between Leslie Scally, Jacobs Engineering Group Inc., and Lisa Conaway, U.S. Census Bureau, regarding population information, December 22, 1993, 1 page.

24. Telephone conversation between Leslie Scally, Jacobs Engineering Group Inc., and Tom Siegel, Missouri Department of Natural Resources, St. Louis Regional Office, Public Drinking Water, regarding Holstein, Treloar, and Etlah municipal water supplies, February 18, 1994, 1 page.

25. Telephone conversation between Leslie Scally, Jacobs Engineering Group Inc. and Pepsi Cola Bottling Company, regarding facility activities, February 17, 1994, 1 page.

26. Telephone conversation between Carolyn McManigal, Jacobs Engineering Group Inc., and Hal Baker, Missouri Department of Natural Resources, Wellhead Protection Division, regarding Wellhead Protection Areas in Franklin County, Missouri, February 9, 1994, 1 page.

27. Missouri Department of Natural Resources, Division of Geology and Land Survey, Missouri Water Atlas, 1986, page 79, 2 pages.

28. Jacobs Engineering Group Inc., General Lithology Description at New Haven Wells No. 1, No. 2, and No. 3, December 5, 1994, 1 page.

29. Missouri Department of Natural Resources, Data for New Haven Well No. 3, June 16, 1988 to October 12, 1993, 26 pages.

30. U.S. Geological Survey, 7.5 Minute Series Topographic Map, Missouri, Berger Quadrangle, N3837.5-W9115, 1974.

31. U.S. Geological Survey, 7.5 Minute Series Topographic Map, Missouri, Dissen Quadrangle, N3830-W9115, 1973.

32. U.S. Geological Survey, 7.5 Minute Series Topographic Map, Missouri, New Haven Quadrangle, N3830-W9107.5, 1973.

33. U.S. Geological Survey, 7.5 Minute Series Topographic Map, Missouri, Treloar Quadrangle, 38091-F2-TF-024, 1973, photo revised 1985.

34. U.S. Geological Survey, Ground-Water Flow in the New Haven, Missouri, Area, March 2000, 24 pages.

35. Missouri Department of Natural Resources, Division of Geology and Land Survey Water Well Record and Pump Information Record for New Haven Well No. 4, 1 page.

36. Agency for Toxic Substances and Disease Registry. Toxicological Profile for Trichloroethylene. October 1989, 3 pages.

RIVERFRONT SITE
NEW HAVEN, MISSOURI

HAZARD RANKING SYSTEM DOCUMENTATION RECORD

OVERVIEW OF SOURCES AT THE RIVERFRONT SITE

A Hazard Ranking System (HRS) score for the Riverfront site in New Haven, Missouri has been calculated according to guidance and values provided in the HRS 40 CFR 300, Appendix A (Reference 1), the Superfund Chemical Data Matrix (SCDM) (Reference 2), and the Interim Final HRS Guidance Manual (Reference 3). Other site-specific references are not included in this overview because all information included here will be presented in detail with references in the remaining pages of this Documentation Record. The majority of the pertinent documents are associated with investigations conducted by the Missouri Department of Natural Resources (MDNR) and contractors to the U.S. Environmental Protection Agency (EPA). The investigations were initially conducted due to the detection of the organic compound tetrachloroethylene (PCE) in New Haven Wells No. 1 and No. 2. The initial investigations focused on identifying potential sources of PCE in New Haven. Several potential sources were identified during the Preliminary Assessment (PA) and the Site Inspection (SI). During the Expanded Site Inspection (ESI), additional information was sought which would identify businesses which use/have used PCE, and soil samples were collected from previously identified potential source areas. Although PCE was detected in soil samples collected from potential source areas, adequate documentation attributing the PCE to one or more of the potential source areas does not exist. Therefore, a ground water plume with no identified source was used for HRS scoring.

The ground water plume with no identified source was characterized as the site source based on the following:

- the plume was established solely by sampling, using the criteria for an observed release to the Ground Water Migration Pathway

- the level of effort to identify the original source(s) of the hazardous substance was an ESI.

Analytical data resulting from samples collected from New Haven Wells No. 1 and No. 2 were used to establish an observed release to the Ground Water Migration Pathway. The plume was identified based on establishment of an observed release of PCE to New Haven Wells No. 1 and No. 2. While potential sources of PCE were identified during the PA, SI, and ESI, a source to which the contamination in the two release wells can be attributed was not identified. Potential sources and the observed release will be discussed in detail on Pages 9, 10, 18, and 19 of this Documentation Record, *Potential Sources Not Evaluated* and *Documentation for Observed Release*. The CERCLA hazardous substance associated with the source is PCE.

Overview of Analytical Data Used in the HRS Scoring Process

As indicated previously, the 1987 PA, the 1988 SI, and the 1994 ESI (Reference 4; Reference 5; Reference 6) represent the primary sources of information used to identify potential sources of contamination. The observed release to the Ground Water Migration Pathway was established from data resulting from ground water samples collected from New Haven's municipal wells in 1991 and 1993 by MDNR and its contractors.

WASTE QUANTITY

1. WASTESTREAM QUANTITY SUMMARY TABLE: **Source No. 1—Ground Water Plume with No Identified Source**

a. Wastestream ID	not applicable
b. Hazardous Constituent Quantity (C) (lbs.)	> 0
c. Data Complete?	NO
d. Hazardous Wastestream Quantity (W) (lbs.)	> 0
e. Data Complete?	NO
f. Wastestream Quantity Value (W/5,000)	not applicable

Documentation for Source Type:

According to the Interim Final HRS Guidance, Section 4.1, if the original source(s) of contamination cannot be identified, evaluate the ground water plume as the source for scoring purposes (Reference 3, page 46). As directed in Section 4.1 of the Interim Final HRS Guidance, the ground water plume was identified based on data used to establish an observed release of PCE to the Alluvial/Cambrian-Ordovician aquifer and following completion of an ESI at the site (Reference 3, page 46). The observed release was established from ground water sample data generated during sampling events conducted at New Haven Wells No. 1 and No. 2 on May 15, 1991 and September 22, 1993). The observed release will be further discussed and documented in the Likelihood of Release portion of this Documentation Record, Pages 12 - 22.

Documentation for Source Hazardous Constituent Quantity:

A Hazardous Constituent Quantity value was not calculated for Source No. 1 (ground water plume with no identified source). Documentation was not adequate to determine the mass of all CERCLA hazardous substances in the source with reasonable confidence (Reference 1, Section 2.4.2.1.1).

Documentation for Source Wastestream Quantity:

A Hazardous Wastestream Quantity value was not calculated for Source No. 1 (ground water plume with no identified source). Documentation was not adequate to determine the total mass of all hazardous wastestreams, CERCLA pollutants, and contaminants for the source (and releases from the source) with reasonable confidence (Reference 1, Section 2.4.2.1.2).

2. SOURCE HAZARDOUS WASTE QUANTITY FACTOR TABLE

a. Source ID		Source No. 1: Ground Water Plume	
b. Source Type		Other	
c. Secondary Source Type		N.A.	
d. Source Volume (yd^3)	Source Area (ft^2)	> 0	N.A.
e. Source Value (yd^3 ÷ 2,500)	Source Value (ft^2 ÷34,000)	> 0	N.A.
f. Source Hazardous Constituent Quantity (HCQ) Value (sum of 1b)		> 0	
g. Data Complete?		No	
h. Source Hazardous Wastestream Quantity (WSQ) Value (sum of 1f)		> 0	
I. Data Complete?		No	
k. Source Hazardous Waste Quantity (HWQ) * Value (2e, 2f, or 2h)		> 0 *	

* The Hazardous Waste Quantity (HWQ)Value is unknown, but is greater than 0.
> greater than

NOTE: The HRS 40 CFR 300, Appendix A (Reference 1, Section 2.4.2.2) specifies that if the Hazardous Waste Constituent Quantity (HCQ) for the source is not adequately determined, and if any target is subject to Level I or Level II concentrations, then the greater of either the value derived from the HRS 40 CFR 300, Appendix A, Table 2-6 or a value of 100 is assigned as the Hazardous Waste Quantity Factor (HWQF) value.

Documentation for Source Volume:

A specific Volume value was not calculated for Source No. 1 (ground water plume with no identified source), but is > 0 cubic yards. New Haven Wells No. 1 and No. 2 have contained concentrations of PCE greater than the Maximum Contaminant Level (MCL) of 5.0 µg/L , since 1986. Several potential sources were identified during the PA, SI, and ESI investigations. PCE was detected in soil samples collected during the ESI from potential source areas; however, adequate documentation attributing the PCE to one or more of the potential source areas does not exist. Documentation was not considered adequate to determine the volume of the source (Reference 1, Section 2.4.2.1.3).

Documentation for Source Area:

An Area value was not calculated for Source No. 1 (ground water plume with no identified source). because Area cannot be evaluated for this source type (Reference 1, Section 2.4.2.1.4).

SOURCE NO. 1 (Ground Water Plume With No Identified Source)
SOURCE HAZARDOUS SUBSTANCES

HAZARDOUS SUBSTANCES Source No. 1 (Ground Water Plume with no Identified Source)	Liquid	Concentrations (: g/L†)	Sample Designation	Sample Quantitation Limit (or equivalent)* (: g/L†)	Reference: Page(s)
Tetrachloroethylene	YES	1.8	New Haven Well No. 1 [Sample No. MODW-196 (5-15-91)]	1.0	19:2, 4
Tetrachloroethylene	YES	95	New Haven Well No. 2 [Sample No. MODW-197 (5-15-91)]	1.0	19:2, 4
Tetrachloroethylene	YES	140	New Haven Well No. 2 [Sample No. 93-4774 (9-22-93)]	<0.20	20:2, 3

<less than
† micrograms per liter
* Method Detection Limit
Note: Samples are discussed on following page

Documentation for Source Hazardous Substances:

The ground water plume source hazardous substances are those hazardous substances for which an observed release was established to the Alluvial/Cambrian-Ordovician aquifer. The release wells for the Alluvial/Cambrian-Ordovician aquifer are New Haven Wells No. 1 and No. 2. Ground water samples have been collected from these two wells for chemical analysis from June 1986 through September 1993 (Reference 6, page 21). Analytical results for ground water samples collected from New Haven Wells No. 1 and No. 2 were compared to background levels. Background levels of hazardous substances associated with the sources were established from analytical results for ground water samples collected from New Haven Well No. 3 (Reference 6, page 21; Reference 19, pages 2 and 6; Reference 20, pages 5 and 6; Reference 29, pages 1-26).

During the time that New Haven Wells No. 1 and No. 2 were in service, they drew water from the following formations and members of the Cambrian-Ordovician aquifer: Jefferson City Dolomite, Roubidoux Formation, Gasconade Dolomite, Van Buren Member (New Haven Well No. 1 only), Gunter Sandstone Member, Eminence Dolomite, and Potosi Dolomite (Reference 10, page 5; Reference 13). New Haven Well No. 3 also drew water from the Cambrian-Ordovician aquifer (Gasconade Dolomite, Gunter Sandstone Member, and Eminence Dolomite) (Reference 10, page 5, Reference 16; Reference 34, page 12). The general lithology encountered at these three municipal wells is shown in Reference 28 to this Documentation Record.

Ground water samples collected during sampling events conducted by MDNR from June 1986 to September 1993 were analyzed for volatile organic compounds (VOCs). PCE was detected at concentrations greater than the detection limits in seven of ten samples collected from New Haven Well No. 1 and in all samples collected from New Haven Well No. 2 during this period (Reference 6, page 21). Analytical results during this time period are summarized in Table 1 of the ESI Report (Reference 6, page 21). The observed release to the Ground Water Migration Pathway was established from data resulting from ground water samples collected from New Haven's municipal Wells No. 1, No. 2, and No. 3 on May 15, 1991 and on September 22, 1993 by MDNR and its contractors. (Reference 19, pages 2-6; Reference 20, pages 2-6; Reference 29, pages 25 and 26).

The concentration of each compound listed in the Source Hazardous Substances Table on Page 5 of this Documentation Record is the highest concentration detected of that particular hazardous substance during a period when the wells were operational and for which data quality is most well documented, and an appropriate background sample could be identified. The observed release to ground water is discussed in detail and further documented in Pages 12 - 22 of this Documentation Record—Ground Water Pathway Likelihood of Release.

BACKGROUND LEVELS OF HAZARDOUS SUBSTANCES DETECTED IN SOURCE NO. 1

	Sample No. MODW-198 (5-15-91)[1]		Sample No.93-4775 (9-22-93)[2]	
Analyte	**Concentration (:g/L†)**	**Quantitation Limit* (:g/L†)**	**Concentration (:g/L†)**	**Quantitation Limit* (:g/L†)**
Tetrachloroethylene	ND	1.0	ND	<0.20

<less than
† micrograms per liter
* Method Detection Limit
ND analyte was not detected

[1] Reference 19, pages 2 and 6.
[2] Reference 20, pages 5 and 6.

Documentation of Background Levels of Hazardous Substances:

New Haven Well No. 3 was selected to document background levels of hazardous substances in the ground water plume, because it draws water from the Cambrian-Ordovician aquifer (Reference 28; Reference 34, page 12). The data used to establish background levels were selected based on the data used to establish the observed release and the guidelines specified in Section 5.2 of the Interim Final HRS Guidance Manual (Reference 3, page 67; Reference 19, pages 2 and 6; Reference 20, pages 5 and 6). The background sample data are shown in the Background Levels of Hazardous Substances Detected in Source No. 1 Table, on Page 7 of this Documentation Record. The background sample data are from samples collected from New Haven Well No. 3. The background samples were collected on the same day as samples were collected from the release wells: May 15, 1991 (Sample No. MODW-198) and September 22, 1993 (Sample No. 93-4775) (Reference 19, pages 2-6; Reference 20, pages 2-6; Reference 29, pages 25 and 26). The release samples collected from New Haven Wells No. 1 and No. 2 and the associated background samples were collected during the same sampling events, May 15, 1991 and September 22, 1993 (Reference 19, pages 2-6; Reference 20, pages 2-6; Reference 29, pages 25 and 26).

Potential Sources Not Evaluated

The following potential sources of PCE were identified during investigations which were conducted at the Riverfront site: property at 203 Front Street, the Kellwood Company Metalcraft Enterprises site (Metalcraft site), Midwest Metal Fabricators, American Recreational Products (ARP) - Coated Fabrics Division, a former municipal landfill, and two dry cleaning facilities (Reference 6, pages 3 and 4). The following paragraphs provide a brief discussion of each of these potential source areas.

The property at 203 Front Street is owned by Mr. Robert Monzyk and is currently occupied by a small industrial facility, Transportation Specialists Inc. (TSI) (Reference 6, page 3). It is located approximately 300 feet northeast of New Haven Well No. 2 (Reference 6, page 3). In the figure on page 14 of Reference 6, the Front Street property is shown as Riverfront Industries. From 1959 to 1987, two manufacturers of metal products occupied this property. Both operators used solvents and one is known to have used PCE in the manufacturing processes (Reference 7, page 1). Spent solvents are known to have been disposed on the ground behind the plant building at the Front Street property when it was used by Riverfront Industries, Inc., (Reference 4, page 3). Soil samples collected during the ESI investigation from the Front Street property have been analyzed for volatile organic compounds, and PCE has been detected at a depth of approximately eight and one-half feet (Reference 6, page 23 and Attachment 3, page 67). The Front Street property was not used as a source due to limited evidence attributing the PCE detected in the municipal wells to this property, the presence of multiple potential contributors to the contamination, and complex hydrogeology. Based on reported ground water flow directions, the property appears to be located hydrogeologically down-gradient of New Haven Well No. 2 and cross-gradient of New Haven Well No. 1 (Reference 11, page 2; Reference 34, pages 7 and 17). Ground water flow direction is discussed in more detail on page 14 of this Documentation Record.

Another potential source which was not evaluated is the Metalcraft site. PCE and trichloroethylene (TCE) were used to clean hollow tubing manufactured on-site from 1972 to 1989. Currently, Metalcraft bends, crimps, and shapes tubing. Tubing is not manufactured on-site any longer, and PCE is no longer used (Reference 9, page 1). This site is located approximately 1,000 feet south of New Haven Well No. 3. Although hazardous substances have not been detected in New Haven Well No. 3, MDNR asked Metalcraft to conduct a site characterization and cleanup activities (Reference 9, page 1). In 1991, Geotechnology, Inc. prepared a "Contamination Delineation Report" for the Metalcraft site; this investigation included collection of soil samples. The highest concentration of PCE detected was 810 mg/kg (Reference 9, page 32); TCE was detected at 9 mg/kg (Reference 9, page 23). MDNR also collected one composite soil sample at this site in September 1989 (Sample No. 89-4354). PCE was detected at 13 mg/kg, and TCE was detected at 6.5 mg/kg (Reference 8, page 13). Currently MDNR is overseeing work at this site. The Metalcraft site is located approximately one mile south-southwest of New Haven Wells No. 1 and No. 2 (Reference 6, page 15; Reference 9, page 9). The Metalcraft site was not used as a source for the Riverfront site due to limited evidence attributing the PCE found at the facility to the New Haven ground water contamination, the presence of multiple potential contributors to the contamination, and complex hydrogeology.

Midwest Metal Fabricators reforms, stamps, cuts, and forms sheet metal. Interviews conducted during the PA indicated that parts were not "cleaned or painted" at this facility (Reference 4, page 4). Midwest Metal Fabricators was not evaluated as a source due to the lack of information

documenting use of PCE at this business. It is located approximately one mile southeast of New Haven Well No. 2 (Reference 4, page 9; Reference 6, page 15; Reference 22).

The ARP - Coated Fabrics Division was included in the PA as a potential source of PCE. However, it was determined during a Hazardous Waste Compliance Inspection, which was conducted at the facility, that xylene was used in the fabric coating operations, not PCE (Reference 4, page 2; Reference 5, page 2). ARP - Coated Fabrics Division was not evaluated as a source, because use of PCE at the facility has not been documented.

The municipal landfill was located at the eastern end of New Haven, north of Highway 100 approximately one mile southeast from New Haven Wells No. 1 and No. 2. (Reference 6, page 15). It has not been used for approximately 20 years. It was the only dump area available to the city before municipal trash collection began; thus, all local municipal and industrial wastes were disposed at this location (Reference 6, page 4). Drums were found in a gully to the west of the dump site, but the contents were not determined (Reference 5, page 3). MDNR collected a soil sample from the dump site in 1989, PCE was detected in the sample at 0.15 mg/kg (Reference 6, page 4; Reference 8, pages 1 and 15). The former municipal landfill was not evaluated as a source, due to limited evidence attributing the PCE found at the municipal landfill to the New Haven ground water contamination, the presence of multiple potential contributors to the contamination, and complex hydrogeology.

Finally, two dry cleaning facilities were identified in New Haven (Reference 6, page 4). The locations of these businesses, New Haven Fabric Care and Professional Linen, are shown on Figure 3 of the ESI Report (Reference 6, page 15). Neither were subject to further investigation, due to the distance from New Haven Wells No. 1 and No. 2. New Haven Fabric Care is approximately three-fourths of a mile south of the two release wells. Professional Linen is approximately one mile southeast of the two release wells (Reference 6, page 15).

3. SITE HAZARDOUS WASTE QUANTITY SUMMARY

No.—Source ID	Migration Pathways	Volume or Area Value (2e)	Constituent or Wastestream Value (2f, 2h)	Hazardous Waste Quantity Value (2k)
1—Ground Water Plume with No Identified Source	GW	> 0	> 0	> 0 *

* The HWQ Value is unknown, but is greater than 0.
> greater than

NOTE: According to the HRS 40 CFR 300, Appendix A (Reference 1, Section 2.4.2.2), a HWQF Value of 100 was assigned for the ground water plume. Assignment of this value is further discussed on pages 4 and 24 of this Documentation Record.

LIKELIHOOD OF RELEASE

Aquifer Summary

Aquifer Number	Aquifer Name	Type	Likelihood of Release	Targets
1	Alluvial/Cambrian-Ordovician	Non-karst	550	1.821E+03

Aquifer Description

The following text provides descriptions of the primary aquifers in the New Haven area. The aquifers are presented in descending order from the land surface. The lithology of the New Haven area is depicted in Reference 28. This reference shows, based on information included in References 10, 13, and 16 of this Documentation Record, a cross-section of the Alluvial/Cambrian-Ordovician aquifer at the two release wells, New Haven Wells No. 1 and No. 2, and the background well, New Haven Well No. 3.

Four major ground water producing strata exist in this portion of Missouri: alluvial valley deposits, surficial deposits of glacial drift, limestone formations of Mississippian Age, and dolomite and sandstone formations of Cambrian and Ordovician age (Reference 10, page 1). The Cambrian-Ordovician aquifer outcrops along the Missouri River where the rocks of Mississippian age have been removed by erosion (Reference 10, pages 1 and 15).

Documentation for the Alluvial/Cambrian-Ordovician Aquifer:

Missouri River Alluvial Aquifer

Alluvial deposits are an important source of water in this portion of Missouri, providing water sufficient for domestic and farm uses (Reference 10, pages 1 and 4). These alluvial deposits consist of clay, sand, and gravel; generally ranging from fine to course grained as depth increases (Reference 10, page 3). The alluvium ranges in thickness from zero to 150 feet (Reference 10, page 4). Permeable deposits yield as much as 3,000 gallons of water per minute along the Missouri River (Reference 10, page 3). Yield will increase with increased permeability in the unit (e.g., percent increase of gravel and sand in deposits) (Reference 10, page 4). This aquifer discharges to and is recharged by the river as the river stage fluctuates (Reference 10, page 3).

Cambrian-Ordovician Aquifer

Other than the Missouri River alluvium, the most important aquifer in this area, based on volume of water withdrawn, is the Cambrian-Ordovician aquifer (Reference 10, page 15). Use of this aquifer in Missouri occurs mainly in the eastern end of the state, because the water is too saline in other parts of the state. The aquifer is composed of a complex layering of permeable and semi-permeable rock units. Table 1 from U.S. Geological Survey Professional Paper 1305 (Reference 10, pages 4 and 5) shows a general stratigraphic column of formations within this aquifer. There is an outcrop of this aquifer along the Missouri River (Reference 10, page 15).

In the New Haven area, the Cambrian-Ordovician aquifer is recharged by precipitation that percolates downward in the unsaturated zone (Reference 11, page 2). Some of the precipitation that falls in the New

Haven area percolates through the soil and into bedrock fractures (Reference 12, page 2). Once this water enters the saturated zone, lateral movement of water is dominant (Reference 12, page 2). Regionally, water flow within the Cambrian-Ordovician aquifer should be to the northeast, toward the Missouri River, where discharge occurs (Reference 11, page 2). Water within the Jefferson City and Cotter Formations recharges the underlying Roubidoux Formation, but they also discharge to the Missouri River and the alluvial aquifer (Reference 12, page 2).

As shown in Table 1 from U.S. Geological Survey Professional Paper 1305 (Reference 10, pages 4 and 5), the Ordovician System is divided into an Upper, Middle and Lower Series, within each of these series are multiple geologic units. The Ordovician System consists mainly of limestone, sandstone, and dolomite. The Cambrian System is comprised of an Upper Series which overlies the Precambrian System. The Cambrian System consists of dolomite, shale, and sandstone (Reference 10, page 5). In the New Haven area, bedrock dips to the northeast, toward the Missouri River (Reference 12, page 2).

The well log for a production well (the Pepsi Well), which is located in New Haven and owned by the Pepsi Cola Company, is discussed to explain the specific stratigraphy of the Cambrian-Ordovician aquifer in New Haven. The Pepsi Well is located approximately one-fourth of a mile northeast of New Haven Well No. 3 and three-fourths of a mile south of New Haven Wells No. 1 and No. 2 (Reference 6, page 16). The surface elevation at the Pepsi Well is 621 feet msl (Reference 13; Reference 34, page 12). The well draws water from the interval 215 feet msl to 534 feet below msl. Although the make-up of the surficial material is not clear from the well log, it is expected that little to no alluvial deposits are present due to the location of the well in the upland portions of New Haven. The land surface elevation at New Haven Well No. 2, which is approximately 800 feet from the Missouri River, is 519 feet msl. Based on the Pepsi Well log, the Cotter Formation is the uppermost bedrock formation encountered; it is present from approximately 591 feet msl to 371 feet msl. The Jefferson City Formation, the uppermost formation from which the municipal wells are producing water, is present from 371 feet msl to 221 feet msl. The Roubidoux Formation extends from 221 feet msl to 111 feet msl. The Gasconade Dolomites are divided into the Upper and Lower Formations. The Upper Gasconade extends from 111 feet msl to 61 feet msl; the Lower Gasconade extends from 61 feet msl to 179 feet below msl. Presence of the Gunter Sandstone Member is limited in this area; it extends from 179 feet below msl to 214 feet below msl. The Eminence Formation extends from 214 feet below msl to 359 feet below msl, and the Potosi Formation extends from the lower portion of the Eminence Formation to at least 534 feet below msl (Reference 13). See Reference 28 for a general lithology description at New Haven Wells No. 1, No.2, and No. 3.

The stratigraphy of the Cambrian-Ordovician aquifer is varied; the remainder of this section includes a general discussion of each of the formations which comprise the bedrock aquifer. The Cotter Dolomite and Jefferson City Dolomite, within the Lower Series of the Ordovician System, are the first bedrock units encountered in the New Haven area (Reference 13). The average thickness of both the Cotter Formation and the Jefferson City Dolomite is 200 feet (Reference 14, pages 23 and 24). These formations were 220 feet thick and 150 feet thick, respectively, at the Pepsi Well (Reference 13). The Lower Series is capable of producing 25 gallons of water per minute. Wells screened in this formation may provide sufficient amounts of water for domestic or farm use (Reference 10, page 5).

The Roubidoux Formation, Gasconade Dolomite, and Gunter Sandstone Member underlie the Jefferson City Dolomite. The thickness of the Roubidoux Formation ranges from 100 to 250 feet. The average thickness of the Gasconade Formation is 300 feet thick, and the Gunter Member is approximately 30 feet thick (Reference 14, pages 22 and 23). The thicknesses of these formations at the Pepsi Well are as follows: Roubidoux, 110 feet; Gasconade, 290 feet; and Gunter, 35 feet (Reference 13). These units produce volumes

of water ranging from 50 to 500 gallons of water per minute. This volume is sufficient for municipal, industrial, and irrigation uses (Reference 10, page 5). A number of deep municipal water wells in Missouri produce from the Gunter Member (Reference 14, page 22).

Many wells in the area draw from the Eminence and Potosi Formations. They comprise the uppermost formations of the Cambrian System. The Eminence Formation is approximately 250 feet thick (145 feet thick at the Pepsi Well), and the Potosi Formation is approximately 200 feet thick (175 feet thick at the Pepsi Well) (Reference 14, pages 19 and 20). Both are excellent water producers, capable of yielding amounts of water large enough to serve large cities, industry, and irrigation (e.g., 440 to 1,100 gallons per minute) (Reference 10, page 5). This is due to high permeability and porosity in the coarse-grained dolomites and well-developed solution channels within this formation (Reference 10, page 15).

The Derby-Doe Run Dolomites and the Davis Formation form the Elvins Group and underlie the Eminence and Potosi Formations. The Elvins Group ranges in thickness from 20 to 300 feet. The Derby-Doe Run is a limited source of water. The Davis Formation is a confining bed at the base of the Cambrian-Ordovician aquifer (Reference 10, pages 5 and 19). Shale and silt comprise as much as 50 percent of the Davis Formation, impeding water movement between the Cambrian-Ordovician aquifer and the Lamotte Sandstone and Bonneterre Dolomite (Reference 10, pages 19 and 32).

Regionally, ground water flows to the northeast towards the Missouri River (Reference 6, page 3; Reference 11, page 2; Reference 34, page 6). This flow direction appears to apply to the deeper portions of the Cambrian-Ordovician aquifer; however, topography affects the local ground water flow direction in the shallower portions of this aquifer. Thus, two ground water flow directions (shallow and deep) exists within the Cambrian-Ordovician Aquifer within the New Haven area. A shallow ground water divide beneath New Haven exist and is approximately parallel to Highway 100, which runs along part of an east-west trending ridge about 1 mile south of the Missouri River (Reference 34, Figure 1, page 14). North of this divide shallow ground water that does not recharge deeper portions of the Cambrian-Ordovician aquifer flows to the north; south of this divide shallow ground water flows towards Boeuf Creek (Reference 34, Figures 3 and 4, pages 16 and 17). The transition depth between the shallow ground water flow system and the deeper regional flow system is unknown; however, it is estimated to be located beneath the Roubidoux Formation (Reference 28; Reference 34, pages 6 and 7).

Documentation of Aquifer Use:

Use of the alluvial material as an aquifer was not documented within the four-mile target distance limit. However, this aquifer is capable of yielding as much as 3,000 gallons of water per minute along the Missouri River (Reference 10, page 3), and serves as a source of ground water along major river systems (Reference 10, page 1).

By late 1993, municipal drinking water was supplied to New Haven by one municipal well, New Haven Well No. 3 (Reference 15). In September 1994, a fourth municipal well was installed and is currently used along with Well No. 3 to serve New Haven with all its drinking water needs (Figure 1; Reference 35). New Haven has two other municipal wells, New Haven Wells No. 1 and 2 both of which are no longer in use. In the early 1990's New Haven Well No. 1 was on standby and only used in emergency situations, and New Haven Well No. 2 was closed on May 11, 1993 (Reference 15; Reference 21). New Haven Wells No. 1 and No. 2 are cased through the alluvium, and open and uncased through portions of the Cambrian-Ordovician aquifer (Reference 10, page 5; Reference 13; Reference 28). The land surface elevation at New Haven Well No. 1 is 501 feet msl; it is open and draws water from 348 feet msl to 494 feet below msl. The land surface elevation at New Haven Well No. 2 is 519 feet msl; it is open and draws water from 309 feet msl to 503 feet below msl (Reference 13; Reference 28). Both are open and uncased from the Jefferson City Dolomite to the Potosi Dolomite, which is in the Upper Series of the Cambrian Age portion of the aquifer (Reference 10, page 5; Reference 13; Reference 28). The land surface elevation at New Haven Well No. 3 is 602 feet msl; it is open from 77 feet msl to 283 feet below msl (Reference 16; Reference 28). It also draws water from the Cambrian-Ordovician aquifer. New Haven Well No. 4 has similar casing depths and draws water from the same formations as Well No. 3 (Upper Gasconade to Eminence Formations)(Reference 28; Reference 35).

Because the boundary between the shallow and deep ground water flow systems is thought to occur below the Roubidoux Formation, Wells No. 1 and No. 2 are thought to be open to both ground water flow systems (Reference 34, page 7). Well No. 3 and No.4 are thought to be open to the deeper ground water flow system (Reference 28; Reference 34, page 7).

Documentation of Aquifer Interconnection:

The Alluvial and Cambrian-Ordovician aquifers are considered to be interconnected and will be combined and evaluated as one aquifer (the Alluvial/Cambrian-Ordovician aquifer) for the purposes of HRS scoring. Based on Section 7.1 of the Interim Final HRS Guidance (Reference 3, page 127), these two aquifers are considered interconnected for the following reasons: there are no intervening materials of significantly lower hydraulic conductivity, a continuous layer with significantly lower hydraulic conductivity which separates the two aquifers has not been identified (Reference 10; Reference 14; Reference 28).

The hydraulic conductivity of the two aquifers was evaluated using the HRS 40 CFR 300, Appendix A, Hydraulic Conductivity of Geologic Materials Table (Reference 1, Table 3-6). Both the Alluvial aquifer and the Cambrian-Ordovician aquifer are best described by the third type of material presented in the table, "Sands; sandy silts; sediments that are predominantly sand; highly permeable till; peat; moderately permeable limestones and dolomites"; thus, the hydraulic conductivity for both is 10^{-4} cm/sec. The Cambrian-Ordovician aquifer crops out along the Missouri River where the Mississippian age bedrock has been eroded (Reference 10, page 15). There is no evidence of any material separating these two aquifers.

OBSERVED RELEASE TO GROUND WATER

An observed release of hazardous substances to ground water in the Alluvial/Cambrian-Ordovician aquifer is established through chemical analysis of ground water samples collected from New Haven Wells No. 1 and No. 2. While it is understood that New Haven Wells No. 1 and No. 2 are cased through the alluvium and draw water from the Cambrian-Ordovician aquifer only, for the remainder of this Documentation Record, any portion of the combined aquifer will be referred to as the Alluvial/Cambrian-Ordovician aquifer. Analytical results for ground water samples collected from New Haven Wells No. 1 and No. 2 indicate the presence of PCE at concentrations significantly greater than background levels.

Documentation of Background Levels in the Alluvial/Cambrian-Ordovician Aquifer:

New Haven Well No. 3 was selected to serve as the background well for the Alluvial/Cambrian-Ordovician aquifer. While in service, New Haven Wells No. 1, No. 2 (Reference 10, page 5; Reference 13), and No. 3 (Reference 10, page 5; Reference 16; Reference 34, page 12) drew water from the Alluvial/Cambrian-Ordovician aquifer. They are of similar depth and are screened over similar members of the Alluvial/Cambrian aquifer, i.e., the Gasconade Dolomite, Gunter Sandstone, and Eminence Dolomite members (Ref. 28, Ref.34, p. 12). Furthermore, TCE is a man-made chemical that does not occur naturally in the environment and it is therefore not expected to be found at any level in background wells (Ref. 36). New Haven Well No. 4 was not evaluated for HRS scoring because it was not in use as a drinking water well prior to the closure of New Haven Well No.2 (May 1993).

Samples were collected from New Haven Well No. 3 during the ten sampling events conducted between May 1988 and September 1993 (Reference 6, page 21; Reference 19, pages 2 and 6; Reference 29, pages 1-26). Collection of ground water samples from New Haven Well No. 3 was conducted in conjunction with collection of ground water samples from the other New Haven municipal wells and from distribution points within the municipal supply system. Background levels were established with data from the samples collected from New Haven Well No. 3 during sampling events which also included the release wells, New Haven Wells No. 1 and No. 2 (Reference 19, pages 2-6; Reference 20, pages 2-6; Reference 29, pages 25 and 26)).

The Background Levels of Hazardous Substances Table on Page 17 of this Documentation Record shows background levels (represented by samples collected from New Haven Well No. 3) of the hazardous substances detected in New Haven Wells No. 1 and No. 2. The suite of hazardous substances that were analyzed for in the background samples was the same as the suite of hazardous substances analyzed for in the ground water samples which established an observed release. Generally, water samples were analyzed for volatile organic compounds (VOCs); VOCs have not been detected in samples collected from New Haven Well No. 3 at concentrations greater than or equal to the detection limits (Reference 6, page 21; Reference 19, pages 2 and 6; Reference 20, pages 5 and 6; Reference 29, pages 25 and 26).

BACKGROUND LEVELS OF HAZARDOUS SUBSTANCES
DETECTED IN THE ALLUVIAL/CAMBRIAN-ORDOVICIAN AQUIFER

Hazardous Substance	Concentration (:g/L†)	Sample Designation	Sample Quantitation Limit (or equivalent)* (:g/L†)	Reference: Page
Tetrachloroethylene	ND	New Haven Well No. 3 [Sample No. MODW-198 (5-15-91)]	1.0	19:2 and 6
Tetrachloroethylene	ND	New Haven Well No. 3 [Sample No. 93-4775 (9-22-93)]	<0.20	20:5 and 6 29: 25 and 26

<less than
† micrograms per liter
* Method Detection Limit
ND Not detected

OBSERVED RELEASE SAMPLE LOCATION SUMMARY

Well Identification	Well Type	Distance from the Ground Water Plume (miles)
New Haven Well No. 1	Standby Well	N.A.
New Haven Well No. 2	Closed Drinking Water Well	N.A.

Documentation for Observed Release:

Samples of ground water from the Alluvial/Cambrian-Ordovician aquifer have been collected for chemical analysis beginning in June 1986 through September 1993 (Reference 6, pages 2 and 21). Analytical results for ground water samples collected from New Haven Wells No. 1 and No. 2 in May 1991 and September 1993 were compared to background levels (Reference 19, pages 2 and 4; Reference 20, pages 2 and 3). Background levels of hazardous substances were established from analytical results for ground water samples collected from New Haven Well No. 3 during the same sampling events (Reference 19, pages 2 and 6; Reference 20, pages 5 and 6; Reference 29, pages 25 and 26). New Haven Well No. 3 is located south-southwest and upgradient of New Haven Wells No. 1 and No. 2 (Reference 6, page 15).

New Haven Wells No. 1 and No. 2 draw water from the following members of the Alluvial/Cambrian-Ordovician aquifer: Cotter Dolomite, Jefferson City Dolomite, Roubidoux Formation, Gasconade Dolomite, Gunter Sandstone Member, Eminence Dolomite and Potosi Dolomite (Reference 13; Reference 28). New Haven Well No. 3 draws water from the same aquifer (Gasconade Dolomite, Gunter Sandstone Member, and Eminence Dolomite) (Reference 28, Reference 34, page 12).

An observed release value of 550 was assigned to the Alluvial/Cambrian-Ordovician aquifer, based on concentrations of PCE detected in New Haven Wells No. 1 and No. 2 (Reference 19, pages 2 and 4; Reference 20, pages 2 and 3). Ground water samples collected during sampling events conducted by MDNR from June 1986 to September 1993 were analyzed for volatile organic compounds (VOCs). PCE was detected at concentrations greater than the detection limits in seven of ten samples collected from New Haven Well No. 1 and in all samples collected from New Haven Well No. 2 during this period. Analytical results during this time period are summarized in Table 1 of the ESI report. (Reference 6, page 21). Sample Quantitation Limits (SQLs) were not calculated for the samples; therefore, detection limits were used (Reference 1, Table 2-3). Analysis was performed by laboratories working for the Missouri Department of Natural Resources. According to MDNR, samples were collected by MDNR "personnel using standard operating procedures and techniques. All samples were preserved with ice and hand-delivered to the laboratory. Chain of custody forms were completed for all samples to ensure the integrity of the samples" (Reference 17).

For purposes of HRS documentation, samples collected before and shortly after May 1993 (May 15, 1991 and September 22, 1993), when New Haven Well No. 2 was closed by MDNR, were used to

establish levels of hazardous substances and establish an observed release to ground water by chemical analysis(Reference 19, pages 2-6; Reference 20, pages 2-6, Reference 29, pages 25 and 26). The hazardous substances listed in the Observed Release Hazardous Substances Table on Page 20 of this Documentation Record represent the hazardous substances that meet the criteria for an observed release by chemical analysis, as specified in the HRS 40 CFR 300, Appendix A (Reference 1, Section 3.1.1). New Haven Well No. 3 has been sampled periodically from 1988 to 1993. PCE has not been detected at concentrations greater than the detection limits, which have ranged from 0.2 ：g/L to 5.0 ：g/L (Reference 29, pages 1-26). Concentrations of PCE detected in ground water samples collected from New Haven Wells No. 1 and No. 2 (the release wells) were compared to the PCE detection limits for the samples collected from New Haven Well No. 3 (the background well). PCE was detected at concentrations significantly above background levels in samples collected from New Haven Well No. 2 during every sampling event (background levels are presented on Page 17 of this Documentation Record) (Reference 6, page 21; Reference 19, pages 2, 4, and 6; Reference 20, pages 2 and 3; Reference 29, pages 25 and 26).

It should be noted that the Observed Release Hazardous Substances Table does not include hazardous substances that were analyzed for and not detected above the required detection limits. The table also does not include the following hazardous substances which were detected in New Haven Well No. 1: benzene, chlorobenzene, chloroform, 1,2-dichloropropane, TCE, and toluene. These contaminants were detected in the ground water sample collected on December 22, 1986; they were not detected in other samples collected from New Haven Well No. 1 (Reference 18, pages 1 and 2). TCE, which was detected in New Haven Well No. 2 on September 22, 1993, is also not included in the Observed Release Hazardous Substances Table. This was the only sample collected from New Haven Well No. 2 in which a compound other than PCE was detected (Reference 20, pages 2 and 4).

According to the HRS 40 CFR 300, Appendix A, attribution is not required when the source itself consists of a ground water plume with no identified source (Reference 1, Section 3.1.1).

OBSERVED RELEASE HAZARDOUS SUBSTANCES
DETECTED IN THE ALLUVIAL/CAMBRIAN-ORDOVICIAN AQUIFER

Hazardous Substance	Concentration (:g/L†)	Sample Designation	Sample Quantitation Limit (or equivalent)* (:g/L†)	Reference: Page
Tetrachloroethylene	1.8	New Haven Well No. 1 [Sample No. MODW-196 (5-15-91)]	1.0	19:2 and 4
Tetrachloroethylene	95	New Haven Well No. 2 [Sample No. MODW-197 (5-15-91)]	1.0	19:2 and 4
Tetrachloroethylene	140	New Haven Well No. 2 [Sample No. 93-4774 (9-22-93)]	<0.20	20:2 and 3

<less than
† micrograms per liter
* Method Detection Limit

POTENTIAL TO RELEASE TO GROUND WATER

Since an observed release was established for the Alluvial/Cambrian-Ordovician aquifer, the potential to release was not evaluated (Reference 1, Section 3.1.2).

LIKELIHOOD OF RELEASE SUMMARY

Observed Release Factor Value:

An observed release factor value of 550 was assigned to the Alluvial/Cambrian-Ordovician aquifer since an observed release by chemical analysis was established to the aquifer (Reference 1, Section 3.2.2).

Likelihood of Release Factor Category Value:

Based on establishment of an observed release, the observed release factor value was assigned as the likelihood of release factor category value for the Alluvial/Cambrian-Ordovician aquifer. A Likelihood of Release Factor Category Value of 550 was assigned to the Alluvial/Cambrian-Ordovician aquifer.

WASTE CHARACTERISTICS

Hazardous Substances Detected in Observed Release to the Alluvial/Cambrian-Ordovician Aquifer

Observed Release Hazardous Substance	Toxicity Value	Mobility Value	Toxicity/ Mobility Value
Tetrachloroethylene	100	1	1.00E+02

Documentation for Toxicity/Mobility Values:

A separate Toxicity/Mobility Value was not calculated for the hazardous substances associated with Source No. 1. The ground water plume source was identified based on the establishment of an observed release; thus, the hazardous substances associated with the source are those defined by the same data used to determine the observed release. A Toxicity/Mobility Value was only calculated for the observed release.

Toxicity values for hazardous substances found in an observed release to the Alluvial/Cambrian-Ordovician aquifer are derived from SCDM (Reference 2, page B-18). A mobility factor value of 1 is assigned to any hazardous substance that meets the criteria for an observed release by chemical analysis to one or more aquifers underlying the sources at the site (Reference 1, Section 3.2.1.2). The toxicity/mobility value of 100 was assigned (Reference 1, Table 3-9).

WASTE CHARACTERISTICS SUMMARY

Toxicity/Mobility Value from Observed Release Hazardous Substances:	**1.00E+02 (Tetrachloroethylene)**
Highest Toxicity/Mobility Factor Value:	**1.00E+02**
Hazardous Waste Quantity Factor:	**100**
Waste Characteristics Factor Category Value:	**10**

Documentation for Hazardous Waste Quantity Factor:

The HRS 40 CFR 300, Appendix A (Reference 1, Section 2.4.2) specifies that if the Hazardous Waste Constituent Quantity for the source is not adequately determined, and if any target is subject to Level I or Level II concentrations, then the greater of either the value derived from Table 2-6 of the HRS 40 CFR 300, Appendix A , or a value of 100 is assigned as the Hazardous Waste Quantity Factor (HWQF) value.

Documentation for Waste Characteristics Factor Category Value:

The HWQF of 100 was multiplied by the highest Toxicity/Mobility Value of 100 (or 1.00E+02**)**. The resultant product of 10,000 (or 1.00E+04) was used to select a Waste Characteristics Factor Category Value of 10 (Reference 1, Table 2-7).

GROUND WATER TARGETS

Target Populations Associated with the Riverfront Site:

Prior to May 11, 1993, when New Haven Well No. 2 was closed (Reference 15), New Haven's municipal drinking water was supplied by three municipal wells (New Haven Wells No. 1, No. 2, and No. 3) (Reference 21). The locations of these wells are depicted in Reference 6, page 14. New Haven Well No. 3 and a combination of New Haven Wells No. 1 and No. 2 were capable of operating as two separate systems. The two systems alternated pumping into the New Haven water towers. The water from the two systems was blended in the New Haven water towers (Reference 21). New Haven Wells No. 1 and No. 2 are located within 1,000 feet of the Missouri River, and New Haven Well No. 3 is over one mile south-southwest of the other two municipal wells (Reference 22; Reference 32). In September 1994, New Haven Well No. 4 was installed about 0.4 miles north-northwest of New Haven Well No. 3, and about 0.8 miles southwest of New Haven Wells No. 1 and 2 (Figure 1 of this HRS documentation record; Reference 35). Sampling by various agencies has shown no detectable concentrations of PCE in New Haven Well No. 4. This well was not used in evaluating ground water targets for the site because this well was not in use as a drinking water well prior to the closure of Well No. 2.

Prior to May 11, 1993, New Haven Well No. 1 supplied one percent of the New Haven's water. It was on standby and was only used in emergency situations. In the case of fire emergencies, New Haven Well No. 1 was used to assure an adequate water supply was available for the town (Reference 21). New Haven Well No. 1 was subsequently removed from service. New Haven Well No. 3 provided the remaining 90 percent of the city's water (Reference 21). The population of New Haven when all three wells were in service was 1,737 people (Reference 23).

According to the Interim Final HRS Guidance Manual (Reference 3, page 162), former drinking water wells can be scored based on actual contamination if analytical data indicate an observed release at the well when it was in use, and the well was closed because of site-related contamination. Both of these factors apply to New Haven Well No. 2. PCE has been detected in New Haven Well No. 2 since 1986 (Reference 6, page 21). It was operating during the period from 1986 to May 1993, and was closed due to concentrations of PCE (Reference 15). PCE concentrations in samples collected from New Haven Well No. 2 exceeded the Safe Drinking Water Act MCL of 5.0 :g/L during this entire period, while it was never detected in New Haven Well No. 3 (the background well) (Reference 6, page 21; Reference 19, pages 2, 4, and 6; Reference 20, pages 2,3, 5, and 6). The HRS Guidance Manual states that the population using the well at the time that the well was closed should be included in calculation of target populations (Reference 3, page 175). New Haven Well No. 1 was also scored based on actual contamination. It was a standby drinking water well, and PCE has been detected at concentrations which exceed background levels. One percent of the New Haven population was apportioned to New Haven Well No. 1. The decision to score New Haven Well No. 1 is based on the following facts: New Haven Wells No. 1 and No. 2 could operate as one system and water from all three municipal wells was blended in the city's water towers. Thus, water produced by any of the wells would have eventually been mixed together, potentially affecting populations served by the municipal drinking water system.

Concentrations of Contaminants Detected in New Haven Well No. 1:

Sample Contaminants	Concentration (:g/L)	Benchmarks\Screening Concentrations		
		MCL/MCLG (:g/L)	Cancer Risk Screen. Conc. (:g/L)	Reference Dose Screen. Conc. (:g/L)
Tetrachloroethylene	1.8	5.0	1.6	370

Documentation for Level I Concentrations in New Haven Well No. 1:

The highest concentration of PCE detected in New Haven Well No. 1 exceeds the screening concentration for cancer, 1.6 :g/L (Reference 2, page B-39), and there is an observed release to the Ground Water Migration Pathway. Thus, the well is associated with Level I concentrations (Reference 1, Section 3.3.2.1).

Concentrations of Contaminants Detected in New Haven Well No. 2:

Sample Contaminants	Concentration (:g/L)	Benchmarks\Screening Concentrations		
		MCL/MCLG (:g/L)	Cancer Risk Screen. Conc. (:g/L)	Reference Dose Screen. Conc. (:g/L)
Tetrachloroethylene	95	5.0	1.6	370

Documentation for Level I Concentrations in New Haven Well No. 2:

The highest concentration of PCE detected in New Haven Well No. 2 (prior to May 11, 1993) exceeds both the screening concentration for cancer, 1.6 :g/L, and the MCL of 5.0 :g/L (Reference 2, page B-39), and there is an observed release to the Ground Water Migration Pathway. Thus, the well is associated with Level I concentrations (Reference 1, Section 3.3.2.1).

Target Populations Associated with the Alluvial/Cambrian-Ordovician Aquifer:

Well Identification	Distance from the Ground Water Plume	Well Type	Concentrations	Population	Population Value
New Haven Well No. 1	N.A.	Standby Well	Level I	17	170
New Haven Well No. 2	N.A.	Closed Drinking Water Well	Level I	156	1560
New Haven Well No. 3	greater than 1 mile to 2 miles	Drinking Water Well	Potential	1564	294

Documentation for Level I Populations Associated with New Haven Well No. 1 and New Haven Well No. 2:

As explained earlier in this Documentation Record, New Haven Wells No. 1 and No. 2 were scored based on actual contamination. Prior to May 11, 1993, New Haven Well No. 1 was on standby and only used in emergencies, providing one percent of the municipal water, and New Haven Well No. 2 provided nine percent of New Haven's water (New Haven Well No. 3 provided the remaining 90 percent) (Reference 21).

Well Number	Percent of Population (1,737) Served	Population Served
New Haven Well No. 1	1%*	17
New Haven Well No. 2	9%	156
New Haven Well No. 3	90%	1,564

* Although water provided by New Haven Well No. 1 was used only in emergency situations, 1% of the population was apportioned to this well. Water from New Haven Wells No. 1 and No. 2 can be blended; thus, a target population subject to actual contamination was identified (Reference 1, Section 3.3.2.1; Reference 21).

Populations apportioned to New Haven Wells No. 1 and No. 2 are subject to Level I concentrations of PCE. Populations apportioned to wells with Level I concentrations are multiplied by 10 (Reference 1, Section 3.3.2.2). Thus the populations attributed to both New Haven Wells No. 1 and No. 2 are multiplied by 10, for Level I population values of 170 and 1,560, respectively. The total Level I target population score for the Alluvial/Cambrian-Ordovician aquifer is 1.73E+03.

Population Subject to Potential Contamination by Distance Category

Alluvial/Cambrian-Ordovician Aquifer

Distance Category (miles)	**Population**	**Distance-Weighted Population Value**
> 0 to ¼	0	0.00E+00
> ¼ to ½	0	0.00E+00
> ½ to 1	0	0.00E+00
> 1 to 2	1,743	2.94E+02
> 2 to 3	298	2.10E+01
> 3 to 4	508	4.20E+01

Potential Contamination Factor Value: **3.60E+01**

Documentation for Populations Subject to Potential Contamination:

The New Haven Municipal Water Supply provides drinking water to all residents within the city limits. Populations located outside the city limits but within the four-mile target distance limit were estimated, using U.S. Geological Survey topographical maps of the target area (Reference 22; Reference 30; Reference 31; Reference 32; Reference 33). The center of the target distance rings was located between New Haven Wells No. 1 and No. 2; these are the release wells on which the observed release and Source No. 1 were based. It was assumed that each house depicted on the maps had a private well, because residences outside the city limits of New Haven are served by private wells (Reference 24). The houses (i.e. wells) within each target distance were counted, and this number was multiplied by the number of people per household for Franklin County, 2.76 (Reference 23). This resulting population estimate was used as the population served by private wells subject to potential contamination. Population numbers were rounded to the nearest whole number.

Alluvial/Cambrian-Ordovician Aquifer

Documentation for Target Population 0 to ¼ mile Distance Category:

Potential populations associated with the Alluvial/Cambrian-Ordovician aquifer were not identified within this target distance limit.

Documentation for Target Population > ¼ to ½ mile Distance Category:

Potential populations associated with the Alluvial/Cambrian-Ordovician aquifer were not identified within this target distance limit.

Documentation for Target Population > ½ to 1 mile Distance Category:

Potential populations associated with the Alluvial/Cambrian-Ordovician aquifer were not identified within this target distance limit.

Documentation for Target Population > 1 to 2 miles Distance Category:

Based on the house count explained earlier in this Documentation Record, a total of 65 residences were located outside of the New Haven city limits and within this target distance limit. The number of residences was multiplied by the number of people per household for Franklin County (Reference 23), for a population of 179 (65 times 2.76).

The population apportioned to New Haven Well No. 3 was also attributed to the >1 to 2 mile target distance limit for the Alluvial/Cambrian-Ordovician aquifer. It is over one mile south-southeast of New Haven Wells No. 1 and No. 2. New Haven Well No. 3 was installed in 1987. The open interval of New Haven Well No. 3 is from 77 feet msl to 283 feet below msl (Reference 16).

Prior to May 1993, New Haven used a blended water supply system, in which New Haven Well No. 3 provided 90 percent of the municipal water. According to Section 7.6 of the Interim Final HRS Guidance, if one well serves more than 40 percent of the population, population is apportioned based on percentage of water supplied by each well (Reference 3, page 180). New Haven Well No. 3 provided 90 percent of the city's water, thus 90 percent of New Haven's population, 1564, was assigned to New Haven Well No. 3 (1,737 times 0.90) (Reference 21; Reference 23).

The population for this target distance limit, 1,743, was calculated by adding the population derived from the house count to the population served by New Haven Well No. 3 (179 + 1,564). A distance weighted population value for potential contamination of 294 was derived for the > 1-mile to 2-mile distance category (Reference 1, Table 3-12).

Documentation for Target Population >2 to 3 miles Distance Category:

A total of 108 residences were located within this target distance limit for the Alluvial/Cambrian-Ordovician aquifer, for a population of 298 (108 times 2.76). A distance weighted population value for potential contamination of 21 was derived for the > 2-mile to 3-mile distance category (Reference 1, Table 3-12).

There is one small town, Treloar, located in this target distance category. According to the MDNR, Treloar does not have a municipal water supply, and the residents are served by private wells (Reference 24). The residences shown on the maps in the vicinity of Treloar were included in the house count for the Alluvial/Cambrian-Ordovician aquifer (Reference 22).

Documentation for Target Population >3 to 4 miles Distance Category:

A total of 184 residences are located within this target distance limit for the Alluvial/Cambrian-Ordovician aquifer, for a population of 508 (184 times 2.76) (Reference 23). A distance-weighted population value for potential contamination of 42 was derived for the > 3-mile to 4-mile distance category (Reference 1, Table 3-12).

There are two small towns, Etlah and Holstein, located in this target distance category. According to the MDNR neither town has a municipal water supply. Residences within these towns are served

by private wells (Reference 24). The residences in the vicinity of Etlah and Holstein were included in the house count for the Alluvial/Cambrian-Ordovician aquifer (Reference 22).

Calculation of the Potential Contamination Factor Value

A Potential Contamination Factor Value, 3.60E+01, was calculated for the aquifer by taking the sum of the distance-weighted population values and dividing this sum by 10, (e.g. (294 + 21 + 42)/10 = 35.7 or 3.60E+01) (Reference 1, Section 3.3.2.4).

Calculation of the Population Factor Value:

The population factor value for the Alluvial/Cambrian-Ordovician aquifer was calculated by summing the factor values for Level I, Level II, and potential contamination. Thus the Population Factor Value is 1.766E+03 (1.73E+03 + 0 + 3.60E+01) (Reference 1, Section 3.3.2.5).

Nearest Well

Level of Contamination: Level I

Nearest Well Factor Values:

Alluvial/Cambrian-Ordovician aquifer: 5.00E+01

Documentation for Nearest Well:

New Haven Well No. 2 was selected as the nearest drinking water well drawing from the Alluvial/Cambrian-Ordovician aquifer (Reference 1, Section 3.3.1). It is one of the two release wells which were used to establish an observed release to the Alluvial/Cambrian-Ordovician aquifer and used to identify the ground water plume source. A Nearest Well Factor Value of 50 was assigned (Reference 1, Table 3-11), because this well is subject to Level I concentrations.

Resources

Resource Use: yes

Resource Factor: 5.00E+00

Documentation for Resources:

The Pepsi Cola Bottling Company (Pepsi) is located within one mile of New Haven Wells No. 1 and No. 2. The Pepsi Cola Company has a private well on-site which provides water used to mix Pepsi products (Reference 25). The Pepsi Well is open from 215 feet msl to 534 feet below msl, drawing water from the Alluvial/Cambrian-Ordovician aquifer (Reference 13). A resource value of 5 is assigned since water drawn from a target well is used as an ingredient in commercial food preparation (Reference 1, Section 3.3.3).

Wellhead Protection Area

Wellhead Protection Area Factor: 0.00E+00

Documentation for Wellhead Protection Area:

New Haven does not lie within a designated Wellhead Protection Area (Reference 26). Therefore, the observed ground water contamination does not lie within a designated wellhead protection area.

GROUND WATER TARGETS SUMMARY

Population Factor Value

Alluvial/Cambrian-Ordovician Aquifer:	1.766E+03

Nearest Well Factor Value

Alluvial/Cambrian-Ordovician Aquifer:	5.00E+01

Resources Factor Value

Alluvial/Cambrian-Ordovician Aquifer:	5.00E+00

Wellhead Protection Area Factor Value

Alluvial/Cambrian-Ordovician Aquifer:	0.00E+00

Targets Factor Category Value

Alluvial/Cambrian-Ordovician Aquifer:	1.821E+03

Documentation for Targets Factor Category Value:

The Targets Value for the Alluvial/Cambrian-Ordovician aquifer is derived by summing the factor values for population (1.766E+03), nearest well (5.00E+01), resources (5.00E+00), and Wellhead Protection Area (0.00E+00), for a total of 1.821E+03 (Reference 1, Section 3.3.5).

GROUND WATER MIGRATION PATHWAY SCORE: **100.00**

Documentation for Ground Water Migration Pathway Score:

The Ground Water Migration Pathway Score for the Alluvial/Cambrian-Ordovician aquifer is derived by multiplying the factor category values for Likelihood of Release (550), Waste Characteristics (10), and Targets (1.821E+03), for a product of 10,015,500, divided by 82,500, for a result of 121.4, subject to a maximum score of 100 (Reference 1, Section 3.4).

As specified in the HRS 40 CFR 300, Appendix A (Reference 1, Section 3.5), the Ground Water Migration Pathway Score for the site is the highest score calculated for an aquifer. The Alluvial/Cambrian-Ordovician aquifer was the only aquifer evaluated for the site; thus, the Ground Water Migration Pathway Score is 100.00.

SURFACE WATER MIGRATION PATHWAY

The Surface Water Migration Pathway was evaluated but not included in calculating a Hazard Ranking System site score for the Riverfront site. The primary reasons for not scoring the Surface Water Migration Pathway include:

- No HRS-quality documentation which indicates a ground water to surface water pathway exists
- An observed release to surface water cannot be established
- No drinking water intakes are present within the 15-mile downstream target distance limit (Reference 27, page 79)
- The Dilution Factor for the Missouri River is high, and would contribute to low human food chain threat and environmental threat scores
- There is limited documentation with which to estimate the fishery production of the Missouri River.

SOIL EXPOSURE PATHWAY

The Soil Exposure Pathway was not evaluated for the Riverfront site. The primary reasons for not evaluating the Soil Exposure Pathway include:

- The source is a ground water plume; thus, a source area of observed contamination within the top two feet of soil has not been established
- The Targets value within the nearby population threat is low
- The Targets value within the resident population threat is low.

AIR MIGRATION PATHWAY

The Air Migration Pathway was not evaluated for the Riverfront site. The primary reasons for not evaluating the Air Migration Pathway include:

- The ground water plume source is not expected to release contaminants to the air
- Targets are subject to potential contamination only
- Population target factor values are low.