

**U.S. ENVIRONMENTAL PROTECTION AGENCY REGION VII
SUPERFUND TECHNICAL ASSESSMENT AND RESPONSE TEAM CONTRACT**

**HAZARD RANKING SYSTEM
NATIONAL PRIORITIES LIST CANDIDATE SITE
DOCUMENTATION RECORD
FOR
OAK GROVE VILLAGE WELL
OAK GROVE VILLAGE, MISSOURI**

**U.S. EPA Contract No.: 68-S7-01-41
Work Assignment No.: G9011.L.01.0003.00
CERCLIS ID No.: MOD981717036**

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**OAK GROVE VILLAGE WELL
OAK GROVE VILLAGE, MISSOURI**

SITE SUMMARY

**OAK GROVE VILLAGE WELL
OAK GROVE VILLAGE, MISSOURI
SITE SUMMARY**

Site CERCLIS Number: MOD981717036

Site Location: Oak Grove Village, Franklin County, Missouri (NE 1/4, SW 1/4, NW 1/4 Section 17T 41NR1W)

Site Coordinates: Latitude: 38^b13'15.5" Longitude: 91^b08'58.06"

Site Description:

The Oak Grove Village Well is the municipal water supply for Oak Grove Village, Missouri (Figure 1). The site (Oak Grove Village Well) was identified in 1986 following the detection of trichloroethylene (TCE) and tetrachloroethylene (PCE) in a sample collected from the Oak Grove Village Well by the Missouri Department of Natural Resources (MDNR). The Oak Grove Village Well was the sole source of water for the Oak Grove Village municipal water supply. MDNR has conducted periodic sampling, including the Oak Grove Village Well and points within the municipal distribution system, since the initial detection of TCE and PCE. Samples collected from the Oak Grove Village Well have contained concentrations of TCE greater than the maximum contaminant level (MCL) of 5.0 micrograms per liter ($\mu\text{g/L}$), since 1986. Concentrations of TCE in the Oak Grove Village Well have ranged from 2.4 $\mu\text{g/L}$ to 18 $\mu\text{g/L}$. Two samples collected from the Oak Grove Village Well have contained concentrations of PCE greater than the MCL of 5.0 $\mu\text{g/L}$, in 1986. Concentrations of PCE in the Oak Grove Village Well have ranged from 16 $\mu\text{g/L}$ to 59 $\mu\text{g/L}$. A total of 421 people were served by the Oak Grove Village municipal water supply. Due to the elevated concentrations of TCE, the Oak Grove Village Well was closed from July 1991 to September 1992. During this period, Oak Grove Village purchased water from the Sullivan municipal water supply; Sullivan is located approximately one mile southwest of Oak Grove Village. In September 1992, Oak Grove Village reopened the Oak Grove Village Well and discontinued service with Sullivan. MDNR continued quarterly sampling after the Oak Grove Village Well was reopened. The Oak Grove Village Well was closed again in January 1994 due to elevated concentrations of TCE. Since closing, the Oak Grove Village Well has been capped.

The geology of the Oak Grove Village area consists of an overburden of approximately 40 feet of gravelly clay residuum, which is the insoluble remains of weathered dolomite and limestone formations which comprise the Cambrian-Ordovician aquifer. The Cambrian-Ordovician aquifer is composed primarily of carbonate rocks (dolomites and limestone). These rocks are highly soluble and characterized by karst features such as caves, springs, and solution conduits. The Cambrian-Ordovician aquifer is approximately 1,200 feet thick. This aquifer is the primary aquifer underlying the site. There is no evidence of the presence of an aquitard between the residuum and the Cambrian-Ordovician bedrock aquifer. The Oak Grove Village Well, the nearby Sullivan municipal wells, and several nearby private wells draw water from the Cambrian-Ordovician aquifer. The land surface elevation at the Oak Grove Village Well is 964 feet above mean sea level (msl). The Oak Grove Village Well is open and uncased from the interval 599 feet msl to 159 feet msl, drawing water from the Eminence and Potosi Formations of the Cambrian-Ordovician aquifer.

Investigations conducted at the site, including a Site Inspection, an Expanded Site Inspection, and investigations by private companies identified the following potential sources of TCE: the Sullivan landfill, the TRW Ramsey facility (a RCRA site), and two automobile service stations. However, based on currently available information, the contamination detected in the Oak Grove Village Well cannot be directly attributed to any of these potential sources. Based on this determination, a ground water plume with an unidentified source was used to evaluate the site.

The overall site score of 50.00 was calculated using the Hazard Ranking System methodology and PRescore program. The site score was based solely on the Ground Water Migration Pathway. The Ground Water Migration Pathway score of 100 is based on an observed release to the Cambrian-Ordovician aquifer and a target population of 421 subject to Level I concentrations. The observed release was established based on analytical data for ground water samples collected from the Oak Grove Village Well. The concentrations of TCE and PCE detected in this well (e.g., 10 µg/L and 59 µg/L respectively) are significantly greater than background levels (e.g., not detected at a detection limit of 0.2 µg/L and 2.8 µg/L). One of Sullivan's municipal wells, Sullivan Well No. 3, was used to determine background levels. It is located approximately three-fourths of a mile southwest of the Oak Grove Village Well.

The site was evaluated based on actual contamination. Although the Oak Grove Village Well was closed from July 1991 to September 1992 and is currently closed, TCE was consistently detected at concentrations greater than the MCL while it was in use, and the elevated concentrations of TCE were the reasons for the well closures. Thus, the population served by the Oak Grove Village Well, when it was in use, was apportioned to the well, constituting the target population subject to Level I concentrations.

The remaining pathways were also evaluated but not scored. The potential for hazardous substances at the site to be released to the Surface Water or Air Migration Pathways or the Soil Exposure Pathway is expected to be limited.

REFERENCES

Oak Grove Village Well- 6/26/01

Figure 1 - Site Location Map

A copy of this figure 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

**OAK GROVE VILLAGE WELL
OAK GROVE VILLAGE, MISSOURI**

HAZARD RANKING SYSTEM SCORESHEETS

REFERENCES

Oak Grove Village Well- 6/26/01

WORKSHEET FOR COMPUTING HRS SITE SCORE

	<u>S</u>	<u>S²</u>
1. Ground Water Migration Pathway Score (S_{gw}) (from Table 3-1, line 13)	<u>100</u>	<u>10,000</u>
2a. Surface Water Overland/Flood Migration Component (from Table 4-1, line 30)	<u>NS</u>	<u>NS</u>
2b. Ground Water to Surface Water Migration Component (from Table 4-25, line 28)	<u>NS</u>	<u>NS</u>
2c. Surface Water Migration Pathway Score (S_{sw}) Enter the larger of lines 2a and 2b as the pathway score.	<u>NS</u>	<u>NS</u>
3. Soil Exposure Pathway Score (S_s) (from Table 5-1, line 22)	<u>NS</u>	<u>NS</u>
4. Air Migration Pathway Score (S_a) (from Table 6-1, line 12)	<u>NS</u>	<u>NS</u>
5. Total of $S_{gw}^2 + S_{sw}^2 + S_s^2 + S_a^2$	<u>10,000</u>	
6. HRS Site Score Divide the value on line 5 by 4 and take the square root	<u>50</u>	

NS = Not scored
S = Site score
S² = Site score squared

REFERENCES

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GROUND WATER MIGRATION PATHWAY Factor Categories & Factors	Maximum Value	Value Assigned
Likelihood of Release to an Aquifer Aquifer: Cambrian-Ordovician		
1. Observed Release	550	550
2. Potential to Release		NS
2a. Containment	10	
2b. Net Precipitation	10	
2c. Depth to Aquifer	5	
2d. Travel Time	35	
2e. Potential to Release [lines 2a(2b+2c+2d)]	500	
3. Likelihood of Release	550	550
Waste Characteristics		
4. Toxicity/Mobility	*	1.00E+02
5. Hazardous Waste Quantity	*	100
6. Waste Characteristics	100	10
Targets		
7. Nearest Well	50	5.00E+01
8. Population		
8a. Level I Concentrations	**	4.21E+03
8b. Level II Concentrations	**	0.00E+00
8c. Potential Contamination	**	2.55E+02
8d. Population (lines 8a+8b+8c)	**	4.465E+03
9. Resources	5	0.00E+00
10. Wellhead Protection Area	20	0.00E+00
11. Targets (lines 7+8d+9+10)	**	4.515E+03
12. Targets (including overlying aquifers)	**	4.515E+03
13. Aquifer Score	100	100.00
GROUND WATER MIGRATION PATHWAY SCORE (Sgw)	100	100.00

NS = Not scored

* Maximum value applies to waste characteristics category.

**Maximum value not applicable

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REFERENCE LIST

REFERENCES

Oak Grove Village Well- 6/26/01

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2. U.S. Environmental Protection Agency, June 1996, Superfund Chemical Data Matrix (SCDM). (Excerpt 1 page).
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4. Missouri Department of Natural Resources, Hazardous Waste Site Investigation Site Inspection Report for Oak Grove Village Public Water Supply Well, Franklin County, Missouri, October 1988. Attachment 1: Potential Hazardous Waste Site Site Inspection Report. EPA Form 2070-13. July 1981. 29 Pages.
5. Jacobs Engineering Group, Inc. Final Expanded Site Inspection Report for Oak Grove Village, Oak Grove Village, Missouri, September 1994. 126 pages.
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12. Analytical Data from Ground Water Samples Collected from Sullivan Well No. 3 between September 9, 1986 and February 22, 1993. 109 pages.
13. Hoffman, David, Geologist, Missouri Department of Natural Resources, Division of Geology and Land Survey, Hydrogeologic Report on the Oak Grove Village Well Contamination, Franklin County, Missouri, December 21, 1987. 21 pages.
14. Letter to Phillip M. Estes, City Administrator, Sullivan, Missouri, from James H. Barks, Chief, Hydrologic Investigations, U.S. Department of the Interior, Geological Survey, Water Resources Division, July 31, 1990. 14 pages.

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16. Letter to Tom Utterback, Weier, Hockensmith and Sherby, from Bob Kent, Certified Ground-Water Professional No. 215, International Technology Corporation, regarding Investigation of Ground-Water Contamination in the Sullivan Area, December 7, 1989. 18 pages.
17. Letter to Kurt Hentz, Weir, Hockensmith and Sherby, from E. Edgerley, President, SITEX Environmental, Inc., regarding City of Sullivan, August 7, 1990. 19 pages.
18. Metcalf & Eddy, Inc., Final RCRA Facility Assessment Report for TRW Automotive Products Inc. Ramsey Division, Sullivan, Missouri, September 30, 1992. 42 pages.
19. Telephone conversation between Leslie Scally, Jacobs Engineering Group Inc., and Don Kerns, Missouri Department of Natural Resources, regarding clean-up at the Ramsey/TRW site, August 10, 1992. 1 page.
20. Imes, J.L. and L.F. Emmett. U.S. Geological Survey Professional Paper 1414-D, Geohydrology of the Ozark Plateaus Aquifer System in Parts of Missouri, Arkansas, Oklahoma, and Kansas. 1994. 137 pages.
21. Missouri Department of Natural Resources, Division of Geology and Land Survey, Addendum to Oak Grove Village Public Water Supply Well PA/SI, Franklin County, Missouri, July 28, 1988. 15 pages.
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23. U.S. Geological Survey, 7.5 Minute Series Topographic Map, Missouri, Meramec State Park Quadrangle, N38091-B1-TF-024, 1969, photorevised 1980.
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27. U.S. Geological Survey, 7.5 Minute Series Topographic Maps for Missouri, Meramec State Park Quadrangle, N38091-B1-TF-024, 1969, photorevised 1980; Spring Bluff Quadrangle, N3815-W9107.5, 1966, photorevised 1980; Stanton Quadrangle, 38091-C1-TF-024, 1965, photorevised 1980; Sullivan Quadrangle, N3807.5 W9107.5, 1969, photorevised 1980.
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Oak Grove Village Well- 6/26/01

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**OAK GROVE VILLAGE WELL
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HAZARD RANKING SYSTEM DOCUMENTATION RECORD

REFERENCES

Oak Grove Village Well- 6/26/01

OVERVIEW OF SOURCES AT THE OAK GROVE VILLAGE WELL

A Hazard Ranking System (HRS) score for the Oak Grove Village Well site (the site) in Oak Grove Village, Missouri has been calculated according to guidance and values provided in the HRS Rule, 40 CFR Part 300, Appendix A (Ref. 1), the Superfund Chemical Data Matrix (SCDM) (Ref. 2), and the HRS Guidance Manual (Ref. 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 a contractor to the U.S. Environmental Protection Agency (EPA). The investigations were initially conducted due to the detection of the organic compounds benzene, tetrachloroethylene (PCE), trichloroethylene (TCE), and trans-1,2-dichloroethylene (1,2-DCE) in the Oak Grove Village Well, which was the sole source of drinking water for the population of Oak Grove Village. The initial investigations focused on identifying potential sources of chlorinated solvents in Oak Grove Village and Sullivan, a town which is approximately one mile southwest of Oak Grove Village. Potential sources were identified during the Preliminary Assessment (PA) and the Site Inspection (SI). Environmental investigations have also been conducted by private consultants at potential source areas. During an EPA expanded site investigation (ESI), additional information was sought which would identify businesses which use/have used chlorinated solvents, and soil samples were collected from previously identified potential source areas. Although PCE, TCE, and 1,2-DCE were detected in soil samples collected from potential source areas, adequate documentation attributing these substances to one or more of the potential source areas was not identified. 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:

- C the plume was established solely by sampling, using the criteria for an observed release to the Ground Water Migration Pathway
- C the level of effort to identify the original source(s) of the hazardous substance was an ESI.

Analytical data from ground water samples collected from the Oak Grove Village Well 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 and TCE to the Oak Grove Village Well. Two of the substances detected in ground water samples collected from the Oak Grove Village Well were not evaluated as observed releases. The analytical data sheets for the ground water samples where 1,2-DCE (Sample No. 87-3773) and benzene (Sample No 87-2226) were detected were not available. In addition, benzene is a naturally occurring constituent of petroleum and it may be part of a petroleum release, which would be subject to the Petroleum Exclusion under CERCLA. While potential sources of 1,2-DCE, PCE, and TCE were identified during the PA, SI, and ESI, a source to which the contamination in the release well can be attributed according to HRS criteria was not identified. Potential sources and the observed release will be discussed in detail on pages 8, 9, 16, and 17 of this Documentation Record, Potential Sources Not Evaluated and Documentation for an Observed Release. The CERCLA hazardous substances associated with the source are PCE and TCE.

Overview of Analytical Data Used in the HRS Scoring Process

The 1988 SI (Ref. 4), which was conducted by MDNR, and the 1994 ESI (Ref. 5), which was conducted by an EPA contractor, represent the primary sources of information used to identify potential sources of contamination. Phases I and II of an Environmental Site Assessment which was conducted in 1991 and 1992 by a private contractor (Ref. 6; Ref. 7) also identified potential sources. The observed release to the Ground Water Migration Pathway was established from analytical data resulting from ground water samples collected from the Oak Grove Village Well from 1986 to 1993 by MDNR.

REFERENCES

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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.)	0.00
e. Data Complete?	No
f. Wastestream Quantity Value (W/5,000)	Not Applicable

Documentation for Source Type:

According to the 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 (Ref. 3, pg. 46). As directed in Section 4.1 of the HRS Guidance, the ground water plume was identified based on analytical data used to establish an observed release of PCE and TCE to the Cambrian-Ordovician aquifer and following completion of an ESI at the site (Ref. 3, pg. 46). The observed release was established from ground water sample data generated during sampling events conducted at the Oak Grove Village Well since 1986. The observed release will be further discussed and documented in the Ground Water Migration Pathway Likelihood of Release portion of this Documentation Record, pages 11 - 19.

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 CERCLA hazardous substances with reasonable confidence, as required in 40 CFR, Part 300, Appendix A, Section 2.4.2.1.1 (Ref. 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 for the source (and releases from the source) with reasonable confidence, as required in 40 CFR, Part 300, Appendix A, Section 2.4.2.1.2 (Ref. 1).

REFERENCES

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2. SOURCE HAZARDOUS WASTE QUANTITY FACTOR TABLE

a. Source ID		Source No. 1: Ground Water Plume	
b. Source Type		Other	
c. Secondary Source Type		Not Applicable	
d. Source Volume (yd ³)	Source Area (ft ²)	0.00E+00	0.00E+00
e. Source Value (yd ³ ÷ 2,500)	Source Value (ft ² ÷ 34,000)	0.00E+00	0.00E+00
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)		0.00E+00	
i. Data Complete?		No	
k. Source Hazardous Waste Quantity (HWQ) Value (2e, 2f, or 2h)		1.00E+02 **	

*The HCQ Value is unknown, but is greater than 0.

**40 CFR, Part 300, Appendix A, Section 2.4.2.2 (Ref. 1) 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 or a value of 100 is assigned as the HWQF value.

Documentation for Source Volume:

A volume value was not calculated for Source No. 1 (ground water plume with no identified source). Documentation was not considered adequate to determine the volume of the source, as required in 40 CFR, Part 300, Appendix A, Section 2.4.2.1.3 (Ref. 1).

REFERENCES

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**SOURCE NO. 1 (GROUND WATER PLUME WITH NO IDENTIFIED SOURCE)
SOURCE HAZARDOUS SUBSTANCES**

HAZARDOUS SUBSTANCES Source No. 1 - Ground Water Plume	Liquid	Concentrations (: g/L†)	Sample Designation	Method Detection Limit* (: g/L†)	References
Trichloroethylene	YES	1.2E+01	Oak Grove Village Well (Sample No. 86-8751 [10-26-86])	1.9E+00	8 pp. 3, 4; 39
Tetrachloroethylene	YES	5.9E+01	Oak Grove Village Well (Sample No. 86-8751 [10-26-86])	4.1E+00	8 pp. 3, 4; 39
Trichloroethylene	YES	1.0E+01	Oak Grove Village Well (Sample No. 93-4659 [2-22-93])	1.9E+00	8 pp. 47 - 49; 39

Note: Samples are discussed on following page

† micrograms per liter

*Method Detection Limit. For the samples collected in 1986 and 1993, the method detection limits were determined from the method specified detection limits reported in the Standard Methods for the Examination of Water and Wastewater (Ref. 39).

REFERENCES

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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 Cambrian-Ordovician aquifer. The release well for the Cambrian-Ordovician aquifer is the Oak Grove Village Well. Ground water samples have been collected from this well for chemical analysis from June 1986 through December 1993 (Ref. 5, Table 1, pg. 21; Ref. 8, pp. 4, 49). Analytical results for ground water samples collected from the Oak Grove Village Well were compared to background levels. Background levels of hazardous substances associated with the source were established from analytical results for ground water samples collected from Sullivan Well No. 3, located approximately three-fourths of a mile southwest of the Oak Grove Village Well (Ref. 5, pg. 13; Ref. 12).

The Oak Grove Village Well draws water from the Eminence Dolomite and Potosi Dolomite Formations of the Cambrian-Ordovician aquifer (Ref. 9). Sullivan Well No. 3 draws water from the same formations, but also from the Derby-Doe Run Formation of the Cambrian-Ordovician aquifer which underlies the Potosi Formation (Ref. 10).

Ground water samples collected during sampling events conducted between June 1986 and December 1993 were analyzed for volatile organic compounds (VOC). TCE was detected at concentrations greater than the detection limits in 19 of 21 samples collected from the Oak Grove Village Well during this period (Ref. 5, pg. 21; Ref. 8). PCE was detected in 2 of 21 samples collected from the Oak Grove Village Well (Ref. 8, pp. 4, 6). Both of the samples which contained PCE were collected in 1986 (Ref. 8, pp. 4, 6). Concentrations of TCE detected in the Oak Grove Village Well have ranged from 2.4 : g/L to 18 : g/L (Ref. 5, pg. 21; Ref. 8, pp. 37, 52 - 54). The Maximum Contaminant Level (MCL) for PCE and TCE is 5.0 : g/L (Ref. 11, pg. 9).

The concentration of each compound listed in the Source No. 1 (Ground Water Plume with No Identified Source) Source Hazardous Substances Table on Page 5 of this Documentation Record represents the highest concentration detected of that particular hazardous substance used in the calculation of the site HRS score. The two concentrations of TCE shown in this table are concentrations of TCE detected in the Oak Grove Village Well during the two periods it was in use (i.e., prior to July 1991 and between September 1992 and January 1994) (Ref. 5, pp. 2 and 21; Ref. 8, pp. 4 and 49). The sample containing PCE was collected during 1986, while the Oak Grove Village Well was in use (Ref. 8, pp. 3, 4; 5, pg. 2). Several samples were collected from the Oak Grove Village Well during the second period in which the Oak Grove Village Well was in use, and TCE was detected at concentrations as high as 12 : g/L (Ref. 5, pp. 2, 21 ; Ref. 8 pp. 52 through 54). However, these analytical results were not included in the Source Hazardous Substances Table, because these results were provided in a summary table and the necessary detailed analytical data (e.g., sample quantitation limits) was not included. Detailed analytical data was available for one sample which was collected during this latter period, Sample No. 93-4659 collected February 22, 1993, in which TCE was detected at 10 : g/L (Ref. 8, pg. 49). The data from this sample are included in the Source Hazardous Substances Table on Page 5 of this Documentation Record.

The observed release to the Cambrian-Ordovician aquifer is discussed in detail and further documented in pages 11 - 19 of this Documentation Record - Ground Water Migration Pathway Likelihood of Release.

REFERENCES

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Documentation of Background Levels of Hazardous Substances:

The table below summarizes the analytical results for samples collected from Sullivan Well No. 3 (the background well) discussed above. The solvents PCE and TCE were not detected in the background well selected. PCE and TCE are man-made chemicals that do not occur naturally in the environment (Ref. 11a, pg. 1; Ref. 11b, pg. 1) and they are therefore not expected in the background well.

BACKGROUND LEVELS OF HAZARDOUS SUBSTANCES

Analyte	Background Sample - Sullivan Well No. 3 (Sample No. 86-8169 [9-9-86]) ¹		Background Sample - Sullivan Well No. 3 (Sample No. 93-4662 [2-22-93]) ²	
	Concentration (: g/L†)	Method Detection Limit (: g/L†)	Concentration (: g/L†)	Method Detection Limit (: g/L†)
Trichloroethylene	ND	2.2E+00	ND	2.0E-01
Tetrachloroethylene	ND	2.8E+00	ND	1.6E-01

† - micrograms per liter

ND - Not detected

¹Ref. 12, pp. 1 and 2²Ref. 12, pp. 9, 10, and 11

Sullivan Well No. 3 was selected to document background levels of hazardous substances detected in the ground water plume. Sullivan Well No. 3 was selected because it draws water from the Cambrian-Ordovician Age aquifer from relatively similar depths as the Oak Grove Village Well (Ref. 10; Ref. 5, Fig. 2, pg. 16). Sullivan Well No. 3 is open and uncased from 629 feet mean seal level (msl) to 85 feet msl (Ref. 10; Ref. 5, Fig. 2, pg. 16). The Oak Grove Village Well is open and uncased from 599 feet msl to 159 feet msl (Ref. 5, pp. 8 and 9; Ref. 9). Also Sullivan Well No. 3 is southwest of the Oak Grove Village Well, and groundwater flow in the Cambrian-Ordovician aquifer is to the northeast; thus, Sullivan Well No. 3 is upgradient of the Oak Grove Village Well (Ref. 13, pg. 2; Ref. 5, Fig. 2, pg. 16). The data used to establish background levels was selected based on the data used to establish the observed release and the guidelines specified in 40 CFR, Part 300, Appendix A, Section 2.3 and Section 5.2 of the HRS Guidance Manual (Ref. 1; Ref. 3, pg. 67; Ref. 8, pp. 4 and 49). The background sample data shown above are from samples collected from Sullivan Well No. 3 on the same day as samples collected from the release well, as is the case with the data from the sampling event conducted by MDNR on February 22, 1993, or from data collected by MDNR during the same time period as the release well. The first background data shown in the table are from samples collected by MDNR on September 9, 1986; the sample from the release well was collected within two months of this sample, on October 26, 1986 (Ref. 8, pp. 4 and 49; Ref. 12, pp. 2 and 11).

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Potential Sources Not Evaluated

The following potential sources of TCE were identified during investigations which were conducted at the Oak Grove Village Well site: the Sullivan Landfill, the TRW Automotive Products Inc. Ramsey Division facility (the Ramsey facility), the Highway 185 Garage, and the Blanton Oil Company/Meramec Tire Center (Meramec Tire Center). The following paragraphs provide a brief discussion of each of these potential source areas.

The Sullivan Landfill is located approximately one mile northeast and hydrologically downgradient of the Oak Grove Village Well (Ref. 13, pg. 2; Ref. 14, pg. 12). From 1970 to 1980, industrial and municipal wastes were accepted at the landfill (Ref. 15, pp. 10 - 13). Generally specific records documenting wastes disposed at the landfill are not available; however, it is known that the following wastes were accepted: barium chromate sludge from the Ramsey facility in Sullivan and volatiles and semi-solid waste from a shoe factory in Bourbon, Missouri (Ref. 4, pg. 4).

Interviews conducted with former employees and city officials explained that industrial waste was delivered to the landfill in drums and disposed of randomly. Many of the drums were punctured prior to being compacted by a front end loader (Ref. 14, pg. 2). There is no evidence of a clay liner underlying the landfill, and wastes may have been placed directly on the sandstone bedrock (Ref. 14, pg. 3). The northern end of the landfill was excavated to the general depth of bedrock, and the trench bottoms sloped to the north (Ref. 16, pg. 3). A thin clay layer remained over the hard, fractured sandstone (Ref. 16, pg. 3). The entire landfill has a very thin cover layer, which is not level due to decomposition and compaction of garbage (Ref. 16, pg. 3). Due to this thin cover layer and relatively large amounts of rainfall leaching has occurred. Visible leachate has been observed along the edge of the landfill. The leachate flow was observed to increase several weeks after a heavy rain. The leachate had an organic odor and the ground, which is saturated with the leachate, is stained red with an oily sheen (Ref. 16, pg. 4). Sullivan's consulting engineer estimated that 17 million pounds of waste material were delivered to the landfill each year. It was estimated that 60 percent of this waste was from the city of Sullivan and 40 percent from sources outside Sullivan (Ref. 16, pg. 4).

In 1990, three leachate samples were collected around the landfill. The samples were analyzed for volatile organic compounds (Ref. 17, pg. 1). TCE was detected at 9 ug/L in a sample collected from the north side of the landfill (Ref. 17, pg. 10). A sample collected from the south side of the landfill contained TCE at 260 ug/L (Ref. 17, pg. 12). Six bedrock monitoring wells were installed at the landfill between February and April 1992, and ground water samples were collected (Ref. 15, pp. 18 - 20). TCE was the only volatile organic compound (VOC) detected above the maximum contaminant level (MCL). It was detected at 6 : g/L in the ground water sample collected from MW-105 (Ref. 15, pp. 52 - 60). MW-105 is located cross-gradient of the landfill, near the former ravine area, and is 203 feet below land surface (bls) (Ref. 15, pp. 18, 19, 22).

It is unclear at this time if the TCE detected in the Oak Grove Village Well is attributable to the landfill, as the landfill is located approximately one mile downgradient of the well (Ref. 15, pp. 10, 11; Ref. 5, Fig. 2, pg. 16). According to the ESI, the landfill currently is being investigated with oversight by the MDNR (Ref. 5 p. 3).

The Ramsey facility is a RCRA site located in southwest Sullivan, near Sullivan Well No. 2. Operations at this location included chrome plating and lapping of piston rings (Ref. 18, pg. 3). The facility operated from the late 1940s until 1984. The site is currently owned by Rokwell Industries, a metal stamper and tool manufacturer (Ref. 18, pg. 2). A phased site inspection was conducted at the Ramsey facility, which included the installation of monitoring wells. Contaminants at the site include: TCE and chromium (Ref. 19). On March 5, 1992, the MDNR corresponded to EPA that a Unilateral and Consensual Corrective Action Order for the Ramsey facility would be drafted with the MDNR taking the lead (Ref. 18 p. 12). According to RCRA Subtitle C, sites subject to corrective action under RCRA Subtitle C authority will only be included in NPL HRS Packages if certain circumstances apply (Ref. 37). Since TRW, the previous owner of the Ramsey facility, is undertaking corrective actions with involvement from MDNR, the Ramsey facility will not be evaluated as a source of the TCE detected in the Oak Grove Village Well (Ref. 19; Ref. 37, pg. 41004).

The Highway 185 Garage is located on property owned by Mr. Jack Sohn, less than one-half of a mile southwest and upgradient of the Oak Grove Village Well (Ref. 5, pg. 17; Ref. 13, pg. 2). It is a full service automobile repair

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facility which was built in 1981 (Ref. 6, pg. 11). During Phase II of an Environmental Site Assessment (ESA) which was conducted by a private contractor, a soil sample (Sample No. 0202921400 from Dug Hole DH-6) was collected from the Sohn property from a depth of two feet on February 2, 1992 (Ref. 7, pp. 1 and 15). The sample was analyzed for VOCs, semi-VOCs, pesticides, polychlorinated biphenyls (PCB), dioxin, and phenols (Ref. 7, pp. 1, 9 - 17). Several VOCs and semi-VOCs were detected, including TCE and PCE, at 35 : g/kg and 74 : g/kg, respectively (Ref. 7, pp. 10 and 11). The location of this sample is not discussed in the ESA Report.

The Highway 185 Garage consists of three service bays and an office. Adjacent to the northern end of the garage is a small drum storage area. Drums are stored directly on the ground surface. The drum storage area is fenced on two sides, but does not have any type of containment to prevent runoff or infiltration. The ground surface in the drum storage area was characterized by stressed vegetation, black staining, and a strong petroleum odor. The soil staining extends north of the fenced area. The remainder of the area which surrounds the garage is grass-covered. A pipe emerges from the west side of the garage, which is connected to the floor drains inside the garage and releases to a drainage area west of the garage. There is standing water beneath the pipe and the soil has a petroleum odor (Ref. 5, pp. 6 and 7).

Several samples were collected at the Highway 185 Garage during the 1994 ESI. TCE was detected (28 : g/kg) in one soil sample (EPA Sample No. DSX74-009) collected from the interval one foot to one and one-half feet bls, north of the drum storage area (Ref. 5, pp. 11, 19, 26, 67, and 68). TCE was not detected in any other sample. The headspace results, shown in Table 3 of the ESI, indicated TCE at the location at which it was detected during laboratory analysis and at two additional sample intervals. Headspace results indicated TCE at location 4S, the outlet of the drain pipe, and at both the one and one-half feet to two feet bls interval and the four feet to four and one-half feet bls interval (Ref. 5, pp. 19 and 23). However, TCE was not detected in either of the samples submitted to the Region VII Laboratory from the outlet of the drain pipe, location 4S (EPA Sample Nos. DSX74-003, DSX74-004, DSX74-004D) (Ref. 5, pp. 10, 11, 26, 68). The Highway 185 Garage was not evaluated as a source of the TCE detected in the Oak Grove Village Well. TCE may have been used at the Highway 185 Garage (Ref. 31); however, evidence is not sufficient to directly attribute the TCE detected in the Oak Grove Village Well to this potential source and a release from the facility to ground water has not been fully documented.

The Meramec Tire Center is located on property owned by Mr. Jack Blanton. It is southwest and less than one-half of a mile upgradient of the Oak Grove Village Well (Ref. 5, pg. 17; Ref. 13, pg. 2). The Meramec Tire Center is an automobile repair facility; previously there was also a gasoline station on this property (Ref. 5, pp. 4 and 7). It was suspected, based on the ESA, that the disposal system from the Meramec Tire Center (the Goodyear facility) may have been discharged, through runoff, to a geographic low area (possibly the lagoon identified in the ESA). Empty motor oil drums are stored in a pile northeast of the Meramec Tire Center; an area of ponded water and soil staining were observed adjacent to the drum pile (Ref. 5, pg. 7). The area, which included the drainage areas and the lagoon has been regraded and some portions covered by a parking lot (Ref. 5, pp. 5 and 7).

Two soil samples (EPA Sample Nos. DSX74-001 and DSX74-002) were collected from this property during the 1994 ESI in drainage areas downgradient of the drum pile, locations 1S and 2S (Ref. 5, pp. 10 and 25). Benzene, ethyl benzene, and total xylenes were detected in EPA Sample No. DSX74-001 from location 1S (collected from the interval four feet to four and one-half feet bgs); TCE was not detected (Ref. 5, pp. 11, 26, 68, and 69). The Meramec Tire Center will not be evaluated as a source, because TCE has not been detected in any soil samples collected from the property.

REFERENCES

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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	GW	NS	> 0.0	100 **

* The Hazardous Constituent Quantity Value is unknown, but greater than 0.

** According to the 40 CFR, Part 300, Appendix A, Section 2.4.2.2 , a Hazardous Waste Quantity Factor (HWQF) Value of 100 was determined for the ground water plume (Ref. 1). Assignment of this value is further discussed on page 21 of this Documentation Record.

NS = Not scored

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LIKELIHOOD OF RELEASE**Aquifer Summary**

Aquifer Number	Aquifer Name	Type	Likelihood of Release	Targets
1	Cambrian-Ordovician	Karst	550	4.325E+03

Aquifer Description

Oak Grove Village, Missouri, is located in the Ozark Plateaus aquifer system in the Central Midwest Regional Aquifer-System Analysis (RASA) study area (Ref. 20, pp. D4 - D6). More specifically, the village of Oak Grove is located within the Salem Plateau section of the of the Ozark Plateaus Province in southeastern Missouri (Ref. 20, pp. D9, D10). At the village of Oak Grove municipal well, casing extends to a depth of 365 feet below ground surface (at an elevation of 599 feet above mean sea level [MSL]) and the well is uncased to a depth of 805 feet below ground surface (at an elevation of 159 feet MSL)(Ref. 13, pg. 1). The uncased portion of the well is in the Eminence and Potosi Formations (both Dolomites) of Cambrian age (Refs. 13, pg. 1; 20, pg. D17). The Cambrian-Ordovician aquifer is overlain by approximately 40 feet of surface soil. The surface soil is a gravelly clay residuum which is the insoluble remains of weathered carbonate bedrock (Ref. 13, pg. 1). According to area well logs, the following geologic formations of the Cambrian-Ordovician aquifer are present in the Oak Grove Village area: the Roubidoux Formation, the Gasconade Formation, and the Gunter Formation, all of Ordovician age, and the Eminence Dolomite, the Potosi Dolomite, Derby-Doe Run Dolomites, and the Davis Formation, all of Cambrian Age (Ref. 13, pg. 2; Ref. 20, pg. D17).

The Cambrian-Ordovician aquifer is comprised primarily of carbonate rocks (dolomites and limestone). These rocks are highly soluble and characterized by karst features such as caves, springs, and solution conduits (Ref. 13, pg. 3). These karst features are caused by weathering. As the volume of bedrock decreases with weathering, the chert and sandstone beds settle, fold, and fracture. Within this residual material, fluids migrate downward rapidly along joints and fractures to the saturated zone (Ref. 21, pg. 1). There are several springs and caves in the site vicinity (as shown on the topographic maps for the site area) (Ref. 23; Ref. 24; Ref. 25; Ref. 26; Ref. 27).

The Roubidoux Formation is the uppermost bedrock formation underlying the Oak Grove Village area. The uppermost 100 feet to 150 feet of bedrock in the Oak Grove Village area is highly weathered. The carbonate beds in the Roubidoux Formation have been reduced by chemical and solution weathering into a red clay (Ref. 21, pg. 1). This residual Roubidoux and Upper Gasconade bedrock is characterized by moderate to extremely high permeability. In the site vicinity, non-weathered bedrock is not encountered until the lower portions of the Gasconade Formation (Ref. 21, pg. 1).

Documentation for Aquifer No. 1, Cambrian-Ordovician Aquifer:

One of the most important aquifers in the site area, based on water usage, is the Cambrian-Ordovician aquifer (Ref. 20, pg. D47). Use of this aquifer in Missouri occurs mainly along the eastern end of the state, because the water is too saline in other parts of the state (Ref. 20, pp. D52, D53). The aquifer is composed of a complex layering of permeable and semi-permeable rock units (Ref. 20, pp. D42, D43). Table 1 from U.S. Geological Survey Professional Paper 1414-D (Ref. 20, pp. D16 and D17) shows a general stratigraphic column of formations within this aquifer. In southern Franklin County, this aquifer is 600 to 800 feet thick (Ref. 20, Fig. 26, pg. D46).

In Missouri, the Ordovician System is divided into the Canadian, Champlainian, and Cincinnati Series, and within each of these series are multiple geologic units (Ref. 22, pp. 20 - 32). At Oak Grove, the village well log indicated that only formations from the lower portion of the Canadian Series remain (ie. Roubidoux and Gasconade formations), with all units above absent from the well log (Ref. 13). The Cambrian System is comprised of an Upper Series which overlies the Precambrian System (Ref. 22, pp. 14, 17). The Oak Grove Village well penetrates only the youngest two formations (Potosi and Eminence) of the upper Cambrian Series (Refs. 13, pp. 1, 5, 6; 22, pg. 17). The Cambrian System formations penetrated by the Oak Grove Village Well consists of dolomites (Ref. 13, pg. 1).

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The uppermost formations of the Cambrian-Ordovician aquifer are composed of highly weathered bedrock of the Roubidoux and Upper Gasconade Formations (Ref. 21, pg. 1). The weathered Roubidoux Formation is highly permeable and located within the vadose zone. Lateral movement within this formation could be in any direction, but it is expected to be minimal (Ref. 21, pp. 1 and 3; Ref. 28, pg. 1).

MDNR developed potentiometric maps for the Oak Grove Village area based on review of wells logs for wells within five miles of Oak Grove Village. During development of the potentiometric maps, the Cambrian-Ordovician aquifer was considered two aquifers: the upper aquifer (ground surface to the Gasconade Formation) and the deep aquifer (Eminence Formation to the Davis Formation, which was the deepest formation encountered in any of the wells) (Ref. 13, pg. 2). According to MDNR, the potentiometric maps suggest that ground water flow is to the northeast, but it could be to the east or north. The uncertainty in ground water flow direction is due to the karst features throughout this area. Karst conduits allow ground water to move quickly without regard to gradients indicated by the potentiometric maps (Ref. 13, pp. 2 and 3).

Although MDNR originally discussed the Cambrian-Ordovician aquifer as two aquifers, subsequent hydrogeologic summaries developed by MDNR for the site indicate the upper and deep aquifers are one aquifer (Ref. 28, pg. 1). Also according to 40CFR, Part 300, Appendix A, Table 3-6, Hydraulic Conductivity of Geologic Materials, all formations within the Cambrian-Ordovician aquifer are comprised of similar materials best described as "karst limestone and dolomites". Thus, all have the same hydraulic conductivities 10^{-2} cm/sec (Ref. 1). All formations of the Cambrian-Ordovician aquifer, which are present in the site vicinity (as shown in well logs), are considered interconnected and will be evaluated as a single hydrologic unit (Ref. 9; Ref. 10).

Very little to none of the highly permeable residuum is saturated. Fluids deposited on the surface or located near the surface are expected to move downward through joints and fractures. The first saturated zone is at the bedrock/residuum interface. This zone is expected to be perched and discontinuous and the source of many area springs. Water in this perched zone recharges regional ground water and large spring conduit systems (Ref. 21, pp. 2 and 3).

The rocks of the Canadian Series (including the Jefferson City Formation, the Roubidoux Formation, and the Gasconade Formation) are composed of cherty dolomite and sandstone. These formations underlie surface material in much of Missouri south of the Missouri River and west of the Mississippi to Cedar County (Ref. 22, pg. 21).

In the following paragraphs the general stratigraphy of the Cambrian-Ordovician aquifer is discussed along with comparison to the specific stratigraphy encountered in the boring log for the Oak Grove Village Well. The land surface elevation at the Oak Grove Village Well is 964 feet msl (Ref. 9).

The Roubidoux Formation consists of sandstone, dolomitic sandstone, and cherty dolomite. The sandstone is composed of fine- to medium-grained quartz sand. The dolomite is finely crystalline in structure and thinly to thickly bedded (Ref. 22, pg. 23). This formation ranges in thickness from 100 to 250 feet (Ref. 22, pg. 23). The Roubidoux Formation is 150 feet thick at the Oak Grove Village Well, present from 964 feet msl to 814 feet msl (Ref. 9). The average thickness of the Gasconade is 300 feet, although in southeastern Missouri the formation has been observed as thick as 700 feet (Ref. 22, pg. 22). The Lower Gasconade Formation is 175 feet thick at the Oak Grove Village Well, present from 814 feet msl to 639 feet msl (Ref. 9). The Gasconade Formation is predominantly cherty dolomite (Ref. 22, pg. 22).

The Gunter Formation is generally 25 feet to 30 feet thick (Ref. 22, pg. 22). The Gunter Formation is 25 feet thick at the Oak Grove Village Well, present from 639 feet msl to 614 feet msl (Ref. 9). The Gunter Formation is composed of a medium-grained, quartzose sandstone (Ref. 22, pg. 22). A number of deep municipal water wells in Missouri produce from the Gunter Member (Ref. 22, pg. 22).

The Eminence Formation is composed of medium to massively bedded, medium- to coarse-grained dolomite (Ref. 22, pg. 19). The Eminence Formation generally ranges in thickness from 200 to 250 feet (Ref. 22, pg. 20). The Eminence Formation is 155 feet thick at the Oak Grove Village Well, present from 614 feet msl to 459 feet msl (Ref. 9). The Oak Grove Village Well is open and uncased through much of the Eminence Formation; the bottom of the casing is at 599 feet msl (Ref. 9). The Potosi Formation is massive, thickly bedded, medium- to fine-grained dolomite. The average thickness of the Potosi is 200 feet (Ref. 22, pg. 19). The Potosi Formation is at least 300 feet thick at the Oak Grove Village Well, present from 459 feet msl to 159 feet msl (Ref. 9).

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The Derby-Doe Run Dolomites and the Davis Formation form the Elvins Group and underlie the Eminence and Potosi Formations (Ref. 22, pg. 18). These formations are collectively referred to as the St. Francois Confining Unit (Ref. 20, pg. D34). The Derby-Doe Run Formation has an average thickness of 150 feet (Ref. 22, pp. 18 and 19). The Derby-Doe Run Formation consists of thin- to medium-bedded dolomite which alternates with thin-bedded siltstone and shale (Ref. 22, pg. 19). The Davis Formation is a confining bed at the base of the Cambrian-Ordovician aquifer (Ref. 20, pp. D34, D38 through D42). The Davis Formation has the most continuous shale unit of the group, impeding water movement between the Cambrian-Ordovician aquifer and the Lamotte Sandstone and Bonneterre Dolomite (Ref. 20, pp. D38, D42). A few wells within the target distance were completed in the Derby-Doe Run and Davis Formations (Ref. 10). Sullivan Well No. 3 and No. 5 are completed in the Derby-Doe Run Formations, and Sullivan Well No. 9 is completed in both the Derby-Doe Run and Davis Formations (Ref. 10).

Documentation of Aquifer Use:

The weathered residuum of the Roubidoux Formation is located in the vadose zone. This zone is expected to be perched and discontinuous (Ref. 21, pp. 2 and 3). Evidence indicating that this material is used as an aquifer was not found.

Municipal drinking water was supplied to Oak Grove Village by one municipal well, the Oak Grove Village Well; however, Oak Grove Village is currently purchasing water from the Sullivan municipal water supply (Ref. 5, pg. 2). Both the Oak Grove Village Well and all six of the Sullivan wells, which are currently used, draw water from the Cambrian-Ordovician aquifer (Ref. 9; Ref. 10; Ref. 30). The Oak Grove Village Well is open and uncased through the Eminence and Potosi Formations, from the interval 599 feet msl to 159 feet msl (Ref. 9). Sullivan Well No. 7 also draws water from these formations. Sullivan Wells No. 3, No. 4, and No. 5 draw water from these formations and also from the Derby-Doe Run Formation (Ref. 10). Sullivan Well No. 8 draws water from the Potosi, Derby-Doe Run, and Davis Formations (Ref. 10).

The residents of Oak Grove Village are currently supplied water by the Sullivan municipal water supply. In the past, water for Oak Grove Village was provided by one municipal well, the Oak Grove Village Well. The Oak Grove Village Well has been closed on two occasions due to concentrations of TCE greater than the MCL (5.0 µg/L). The well was first closed from July 1991 to September 1992. During this period, Oak Grove Village purchased water from the Sullivan municipal water supply. In September 1992, Oak Grove Village reopened the Oak Grove Village Well and discontinued service with Sullivan. MDNR continued quarterly sampling after the Oak Grove Village Well was reopened. The Oak Grove Village Well was closed again in January 1994 due to elevated concentrations of TCE. Since closing, the Oak Grove Village Well has been capped (Ref. 5, pp. 2 and 3).

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OBSERVED RELEASE TO GROUND WATER

An observed release of hazardous substances to ground water in the Cambrian-Ordovician aquifer is established through chemical analysis of ground water samples collected from the Oak Grove Village Well. Analytical results for ground water samples collected from the Oak Grove Village Well, which draws water from the Cambrian-Ordovician aquifer, indicate the presence of TCE and PCE at concentrations significantly greater than background levels.

Documentation of Background Levels in the Cambrian-Ordovician Aquifer:

Sullivan Well No. 3 was selected to serve as the background well for the Cambrian-Ordovician aquifer. Sullivan Well No. 3 draws water from the Eminence, Potosi, and Derby-Doe Run Formations of the Cambrian-Ordovician aquifer (Ref. 10). It is located approximately three-fourths of a mile southwest, upgradient, of the Oak Grove Village Well (Ref. 5, pg. 17; Ref. 13, pg. 2).

Sullivan Well No. 3 was selected as representative of background conditions based on well construction and location. The elevation at Sullivan Well No. 3 is 990 feet msl. The well draws water from the interval 629 feet msl to 85 feet msl (Ref. 10).

Sullivan Well No. 3 has been sampled several times since 1986, when TCE was first detected in the Oak Grove Village Well. Sampling has been conducted by MDNR, but also by private firms for the City of Sullivan and in association with investigations at the Sullivan Landfill (Ref. 12). Collection of ground water samples from Sullivan Well No. 3 was generally conducted in conjunction with collection of ground water samples from the other Sullivan municipal wells. TCE and PCE have not been detected in Sullivan Well No. 3 at concentrations greater than the sample quantitation limit. Samples collected during the first and sixth sampling events which included Sullivan Well No. 3 (conducted September 9, 1986 and February 22, 1993) were used to establish background levels for those hazardous substances detected in the Oak Grove Village Well (Ref. 5, pg. 22; Ref. 12, pp. 2 and 11). Data from these sampling events were selected to represent background levels for several reasons. The background sample collected on September 9, 1986, was collected within two months of the sample collected from the release well. The background sample collected on February 2, 1993, was collected on the same day as the release sample. Also, the sampling at both the release well and the background well was conducted by MDNR; thus, all samples were subject to similar sampling, handling, and analysis methods (Ref. 8; Ref. 12).

The Background Levels of Hazardous Substances Table on page 15 of this Documentation Record shows background levels (represented by data from Sullivan Well No. 3) of hazardous substances which were detected in the Oak Grove Village Well.

PCE and TCE are man-made chemicals that do not occur naturally in the environment (Ref. 11a, pg. 1; Ref. 11b, pg. 1) and they are therefore not expected in the background well.

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

Hazardous Substance	Concentration (\pm g/L\dagger)	Sample Designation	Method Detection Limit (or equivalent)* (\pm g/L\dagger)	Reference: Pages
Trichloroethylene	ND	Sullivan Well No. 3 (Sample No. 86-8169 [9-9-86])	2.2E+00	12:1, 2
Tetrachloroethylene	ND	Sullivan Well No. 3 (Sample No. 86-8169 [9-9-86])	2.8E+00	12:1, 2
Trichloroethylene	ND	Sullivan Well No. 3 (Sample No. 93-4662 [2-22-93])	2.0E-01	12:9, 11
Tetrachloroethylene	ND	Sullivan Well No. 3 (Sample No. 93-4662 [2-22-93])	1.6E-01	12:9, 11

\dagger micrograms per liter

ND Not detected

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OBSERVED RELEASE SAMPLE LOCATION SUMMARY

Well Identification	Well Type
Oak Grove Village Well	Closed Drinking Water Well

Documentation for Observed Release:

Ground water samples have been collected from the Oak Grove Village Well and points within the municipal distribution system from June 1986 through December 1993 (Ref. 5, pg. 21). The majority of the samples have been collected from the Oak Grove Village Well, but sampling has also included collection of samples from the Sullivan municipal wells and private wells in the vicinity of the Oak Grove Village Well (Ref. 5, pg. 22). All wells draw water from the Cambrian-Ordovician aquifer (Ref. 9; Ref. 10; Ref. 29). Analytical results for ground water samples collected from the Oak Grove Village Well were compared to background levels. Background levels of hazardous substances detected in the Oak Grove Village Well were established from analytical results for ground water samples collected from Sullivan Well No. 3. Sullivan Well No. 3 is located approximately three-fourths of a mile southwest, upgradient of the Oak Grove Village Well (Ref. 5, pg. 17; Ref. 13, pg. 2).

The Oak Grove Village Well draws water from the Eminence Dolomite and the Potosi Dolomite formations of the Cambrian-Ordovician aquifer (Ref. 9). The Oak Grove Village Well is 805 feet deep and cased from the surface to 365 feet bls. The land surface elevation at the Oak Grove Village Well is 964 feet msl; it draws water from the interval 599 feet msl to 159 feet msl (Ref. 9). Sullivan Well No. 3 is 905 feet deep and cased from the surface to 361 feet bls (Ref. 10). The land surface elevation at Sullivan Well No. 3 is 990 feet msl, and the well draws water from the interval 629 feet msl to 85 feet msl, from the Eminence, Potosi, and Derby-Doe Run Formations of the Cambrian-Ordovician aquifer (Ref. 10).

According to 40 CFR, Part 300, Appendix A, Section 2.3 (Ref. 1), an observed release is established if the following conditions hold true:

- C The background level is not detected (or is less than the detection limit) and the sample measurement is greater than or equal to the sample quantitation limit.
- C The background concentration is greater than or equal to the detection limit and the sample measurement is at least three times greater than background levels.
- C Some portion of the release is attributable to the site.

Ground water samples collected from the Oak Grove Village Well during sampling events conducted by MDNR from June 1986 through 1993, were analyzed for volatile organic compounds (VOC). PCE was detected in two groundwater samples collected from the Oak Grove Village Well in 1986 at concentrations greater than the detection limits (Ref. 8, pp. 3 through 6). The highest concentration of PCE detected was 59 µg/L in the sample collected in October 26, 1986 (Ref. 8, pp. 3 and 4). PCE was not detected in subsequent groundwater samples collected from the Oak Grove Village Well (Ref. 5, pg. 21; Ref. 8). TCE was detected at concentrations greater than the detection limits in 19 of 21 ground water samples collected during this period (Ref. 5, pg. 21; Ref. 8). TCE was also detected at ten sampling locations within the Oak Grove Village municipal distribution system (Ref. 5, pg. 21). Generally concentrations of TCE in the Oak Grove Village Well have ranged from 6.0 : g/L to 10.0 : g/L (Ref. 5, pg. 21; Ref. 8). The lowest concentration of TCE detected in the Oak Grove Village Well was 2.4 : g/L (Ref. 5, pg. 21; Ref. 8, pg. 37). This sample was collected in July 1990. The highest concentration detected was 18.0 : g/L; this sample was collected in December 1993 (Ref. 5, pg. 21; Ref. 8, pp. 21 and 52 - 54). Analytical results are summarized in Tables 1 and 2 of the ESI, and sampling locations are depicted in Figure 2 of the ESI (Ref. 5, pp. 17, 21, and 22; Ref. 8).

REFERENCES

Oak Grove Village Well- 6/26/01

The hazardous substances listed in the Observed Release Hazardous Substances Table on page 18 of this Documentation Record represent the hazardous substances that meet the criteria for an observed release by chemical analysis, as specified in 40 CFR, Part 300, Appendix A, Section 3.1.1 (Ref. 1). Sullivan Well No. 3 has been sampled periodically between 1986 and 1993. PCE and TCE has not been detected at concentrations greater than the sample quantitation limits, which have ranged from 0.2 : g/L to 5.0 : g/L (Ref. 5, pg. 22). Concentrations of each hazardous substance detected in samples of ground water collected from the Oak Grove Village Well were compared to the highest concentration of the same hazardous substance detected/analyzed in samples collected from Sullivan Well No. 3. The concentration of each listed hazardous substance represents the highest concentration detected for that substance. TCE was detected at concentrations greater than background levels in samples collected from the Oak Grove Village Well during 19 of 21 sampling events. Background levels are presented on page 15 of this Documentation Record. For purposes of HRS documentation, analytical data from samples collected prior to July 1991 (when Oak Grove Village began using water provided by the Sullivan municipal water supply) and between September 1992 and January 1994 (the second period when the Oak Grove Village Well was in use), were both used to establish an observed release to the Cambrian-Ordovician aquifer. It should also be noted that PCE and TCE are man-made chemicals that do not occur naturally in the environment (Ref. 11a, pg. 1; Ref. 11b, pg. 1) and they are therefore not expected in the background well.

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 sample quantitation limit. The table also does not include the following hazardous substances which were detected in the Oak Grove Village Well: methylene chloride, benzene, and cis 1,2-dichloroethylene. These compounds were detected in a limited number of samples collected from the Oak Grove Village Well (Ref. 8, pp. 1, 4, 5, 6, and 42). PCE and TCE were the only compound consistently detected in ground water samples collected from the Oak Grove Village Well; and, it was these compounds for which an observed release could be fully documented.

The background levels of PCE and TCE were non-detect (as shown on page 15 of this Documentation Record) and observed release ground water samples from the Cambrian-Ordovician aquifer were greater than or equal to the detection limit, as shown on page 18 of this Documentation Record. Analysis was performed by laboratories working for the Missouri Department of Natural Resources. An observed release value of 550 was assigned to the Cambrian-Ordovician aquifer, based on concentrations of PCE and TCE detected in the Oak Grove Village Well.

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

REFERENCES

Oak Grove Village Well- 6/26/01

**OBSERVED RELEASE HAZARDOUS SUBSTANCES
DETECTED IN THE CAMBRIAN-ORDOVICIAN AQUIFER**

Hazardous Substance	Concentration (\pm g/L\dagger)	Sample Designation	Method Detection Limit * (\pm g/L\dagger)	References
Trichloroethylene	1.2E+01	Oak Grove Village Well (Sample No. 86-8751 [10-26-86])	1.9E+00	8 pp. 3, 4; 39
Tetrachloroethylene	5.9E+01	Oak Grove Village Well (Sample No. 86-8751 [10-26-86])	4.1E+00	8 pp. 3, 4; 39
Trichloroethylene	1.0E+01	Oak Grove Village Well (Sample No. 93-4659 [2-22-93])	1.9E+00	8 pp. 47 - 49; 39

\dagger micrograms per liter

* Method Detection Limit. For the samples collected in 1986 and 1993, the method detection limits were determined from the method specified detection limits reported in the Standard Methods for the Examination of Water and Wastewater (Ref. 39).

REFERENCES

Oak Grove Village Well- 6/26/01

LIKELIHOOD OF RELEASE SUMMARY**Observed Release Factor Value:**

As specified in 40 CFR, Part 300, Appendix A, Section 3.1.1 (Ref. 1), an observed release factor value of 550 was assigned to the Cambrian-Ordovician aquifer since an observed release by chemical analysis was established to the aquifer.

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 Cambrian-Ordovician aquifer. The following likelihood of release factor category value is assigned:

Cambrian-Ordovician aquifer: 550

REFERENCES

Oak Grove Village Well- 6/26/01

WASTE CHARACTERISTICS**Hazardous Substances Detected in Observed Release to the Cambrian-Ordovician Aquifer**

Observed Release Hazardous Substance	Toxicity Value	Mobility Value	Toxicity/ Mobility Value
Trichloroethylene	10	1	1.00E+01
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. 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 data used to determine the observed release. The Toxicity and Mobility Values assigned to PCE and TCE for the source and the observed release are the same. The Mobility Value for the observed release is assigned a value of 1 which is the same as the Mobility Value assigned to TCE and PCE in the Superfund Chemical Data Matrix (SCDM) (Ref. 2, pp. B-18, B-19).

Characteristic values for hazardous substances found in an observed release to the Cambrian-Ordovician aquifer are derived from SCDM (Ref. 2, pp. B-18, B-19), except for mobility values, which are assigned a value of 1, as specified in 40 CFR, Part 300, Appendix A, Section 3.2.1.2 (Ref. 1). The final Toxicity/Mobility values for PCE and TCE were derived using 40 CFR, Part 300, Appendix A, Table 3-9 (Ref. 1).

REFERENCES

Oak Grove Village Well- 6/26/01

WASTE CHARACTERISTICS SUMMARY

Toxicity/Mobility Value from Observed Release Hazardous Substances:	1.00E+02
Toxicity/Mobility Factor Value:	1.00E+02
Hazardous Waste Quantity Factor:	1.00E+02
Waste Characteristics Factor Category Value:	1.00E+01

Documentation for Hazardous Waste Quantity Values:

40 CFR, Part 300, Appendix A, Section 2.4.2.2 (Ref. 1) 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 or a value of 100 is assigned as the HWQF value. Since a hazardous waste quantity was not determined for the source, a HWQF value of 100 was assigned.

Documentation for Waste Characteristics Factor Category Value:

As specified in 40 CFR, Part 300, Appendix A, Section 3.2.3 (Ref. 1), the HWQF of 100 was multiplied by the highest Toxicity/Mobility Value (100). The resultant product of 10,000 was used to select a Waste Characteristics Factor Category Value of 10 from 40 CFR, Part 300, Appendix A, Table 2-7 (Ref. 1).

REFERENCES

Oak Grove Village Well- 6/26/01

GROUND WATER TARGETS**Target Populations Associated with Oak Grove Village Well:**

Prior to July 1991 and from September 1992 to February 1994, the Oak Grove Village Well was the sole source of public drinking water for Oak Grove Village (Ref. 5, pg. 2). In 1994, the municipal water supply provided water to 421 people in Oak Grove Village (Ref. 5, pp. 28, 29; 32; 38). In addition, there are six residences in Oak Grove Village which are served by private wells, all located within one mile of the Oak Grove Village Well (Ref. 5, pp. 6, 28, 29; Ref. 34; Ref. 36).

After the original detection of TCE and PCE in the Oak Grove Village Well in June 1986, Oak Grove Village continued to use their well (Ref. 5, pg. 2). In July 1991, Oak Grove Village began purchasing water from the City of Sullivan (approximately one mile southwest of Oak Grove Village) (Ref. 5, pg. 2; Ref. 30). In September 1992, Oak Grove Village reopened the Oak Grove Village Well and disconnected from the Sullivan water supply (Ref. 5, pp. 2, 12, 108). MDNR reinstated sampling once the Oak Grove Village Well was reopened; quarterly sampling continued to indicate concentrations of TCE greater than the MCL (Ref. 5, pp. 2 and 3). Detailed analytical data were only available for one of these sampling events; thus, they were not used to document an observed release. Due to the continuing detections of TCE, the well was closed in February 1994. It has since been capped (Ref. 5, pp. 2, 12, 28).

According to the HRS Guidance Manual (Ref. 3, pg. 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 the Oak Grove Village Well. TCE has been detected in the Oak Grove Village Well since 1986 (Ref. 5, pg. 2). It was operating from 1986 to July 1991, and from September 1992 to February 1994. It was closed from July 1991 to September 1992 and is currently closed, due to elevated concentrations of TCE. Concentrations of TCE in samples collected from the Oak Grove Village Well have exceeded the Safe Drinking Water Act MCL of 5.0 : g/L in 18 of 21 samples collected between 1986 and 1993 (Ref. 5, pg. 21; Ref. 8). Concentrations of PCE in samples collected from the Oak Grove Village Well have exceeded the Safe Drinking Water Act MCL of 5.0 : g/L in two samples collected in 1986 (Ref. 8, pp. 3 through 6).

The HRS Guidance Manual states that the population served by the well that was closed should be included in calculation of target populations (Ref. 3, pg. 175); thus, a population of 421 will be assigned to the Oak Grove Village Well (Ref. 38).

REFERENCES

Oak Grove Village Well- 6/26/01

Concentrations of Contaminants Detected in the Oak Grove Village Well:

Sample Contaminants	Concentration (: g/L)	Benchmarks\Screening Concentrations		
		MCL/MCLG (: g/L)	Cancer Risk Screen. Conc. (: g/L)	Reference Dose Screen. Conc. (: g/L)
Trichloroethylene	1.2E+01	5.00E+00	7.7E+00	--
Tetrachloroethylene	5.9E+01	5.00E+00	1.6E+00	3.7E+02
Trichloroethylene	1.0E+01	5.00E+00	7.7E+00	--

Documentation for Level I Concentrations in the Oak Grove Village Well:

The concentrations of TCE shown above include concentrations of TCE detected in the Oak Grove Village Well during both time periods when the Oak Grove Village Well was in operation. These concentrations of TCE exceed both the screening concentration for cancer, 7.7 : g/L, and the MCL of 5.0 : g/L (Ref. 2, pg. B-40). The concentration of PCE is from 1986 and exceeds both the screening concentration for cancer, 1.6 : g/L, and the MCL of 5.0 : g/L (Ref. 2, pg. B-39). An observed release to the Ground Water Migration Pathway has been established based on the detections of PCE and TCE in the Oak Grove Village Well; thus, the well is associated with Level I concentrations (Ref. 1).

REFERENCES

Oak Grove Village Well- 6/26/01

Target Populations Associated with the Cambrian-Ordovician Aquifer:

Well Identification	Well Type	Concentrations	Population	Population Value
Oak Grove Village Well	Closed Drinking Water Well	Level I	421	4.21E+03

Documentation for Level I Populations Associated with the Oak Grove Village Well:

The Oak Grove Village Well is scored based on actual contamination, because an observed release to the Cambrian-Ordovician aquifer has been established, and prior to the closure, the well provided water to 421 people in Oak Grove Village in 1994 (Refs. 5, pp. 28, 29; 32; 38). This figure of 421 people is based on information provided by the city clerk (Refs. 5, pp. 28, 29; 38). According to the city clerk, the population of the Village of Oak Grove has been relatively stable (Ref. 38). The population of Oak Grove as reported in the 1990 Census was 402 (Ref. 32). In 1980 the population of Oak Grove was 386 (Ref. 4, pg. 6). The current population is approximately 382 (Ref. 38). TCE and PCE have been detected at concentrations satisfying the criteria for Level I concentrations in 1986 and in 1993 (TCE only) (Ref. 8, pp. 3, 4, 47, 48, and 49).

The population assigned to the Oak Grove Village Well is subject to Level I concentrations of TCE and PCE. According to 40 CFR, Part 300, Appendix A, Section 3.3.2.2 (Ref. 1), populations apportioned to wells with Level I Concentrations are multiplied by 10. Thus the population attributed to the Oak Grove Village Well is multiplied by 10, for a Level I population value of 4,210 or 4.21E+03.

REFERENCES

Oak Grove Village Well- 6/26/01

Documentation for Populations Subject to Potential Contamination:

Populations subject to potential contamination in the Cambrian-Ordovician aquifer were based on location of wells registered with the Missouri Department of Natural Resources.

The residents of Oak Grove Village, are currently served by the Sullivan municipal water supply. However, this population is apportioned to the Oak Grove Village Well, because it was closed due to elevated concentrations of TCE in ground water (Ref. 5, pp. 2, 28, 29). The only other town located within the target distance limit is Sullivan (Ref. 27). The Sullivan municipal water supply serves the entire population of Sullivan, 5661 people, and approximately 382 people in Oak Grove Village (Ref. 32). Sullivan's water is provided by six wells; all draw water from the Cambrian-Ordovician aquifer (Ref. 10; Ref. 30). According to Section 7.6 of the HRS Guidance (Ref. 3, pg. 177), if one of the supply units does not supply more than 40 percent of the total supply, populations should be divided equally among all the units. Each of the six wells pump between 120,000 and 410,000 gallons per day (gpd) for a total of 2,050,000 gpd (Ref. 30). The most productive well provides 24 percent of the town's water; thus one-sixth or 16.7 percent of the population of Sullivan (943.5 people) was apportioned to each of the Sullivan wells. Oak Grove Village residents are not evaluated under potential contamination as they have been evaluated as subject to Level I concentrations.

A computersearch of private wells registered with the Missouri Department of Natural Resources was reviewed to identify private wells and associated potential target populations within the four-mile target distance limit (Ref. 29). The six private wells within Oak Grove Village were also included in the populations subject to potential contamination (Ref. 36). Target populations were assigned to all private wells identified by MDNR. It was assumed that each private well served one household (Ref. 29; Ref. 32; Ref. 33). The wells located within each target distance were counted, and this number was multiplied by the number of people per household for each of their associated counties. The target distance limit includes two counties; the number of people per household for each is as follows: Franklin County, 2.76 and Crawford County, 2.59 (Ref. 32; Ref. 33). All of the private wells identified in the well search were located on a map of the four mile target distance limit (Ref. 34). The Oak Grove Village Well and the Sullivan municipal wells are also included on this map. The resulting population estimate was used as the potential target population associated with the Cambrian-Ordovician aquifer. A review of the private well logs indicated that all but one of these wells was completed in the Cambrian-Ordovician aquifer, with a majority of the wells being screened in the Gasconde, Eminence, or Potosi formations (Ref. 29).

Population Subject to Potential Contamination by Distance Category**Cambrian-Ordovician Aquifer****Documentation for Target Population 0 to ¼ mile Distance Category:**

Based on the computer search explained earlier in this Documentation Record, one private well was located within this target distance limit (Ref. 29, pg. 56; Ref. 34). The well is located in Franklin County; it was assumed that one household was served by this well. The number of wells was multiplied by the number of people per household for Franklin County, for a population of 2.76 (1 times 2.76). Municipal wells were not identified within this target distance limit.

A distance weighted population value for potential contamination of 4 was derived for the > 0 to ¼-mile distance category using the "karst" portion of 40 CFR, Part 300, Appendix A, Table 3-12 (Ref. 1).

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

The computer search identified two private wells within this target distance limit (Ref. 29, pp. 56 - 58; Ref. 34). Five of the six private wells in Oak Grove Village were also located in this target distance limit (Ref. 34; Ref. 36). These wells are located in Franklin County; it was assumed that one household was served by each well. The number of wells was multiplied by the number of people per household for Franklin County, for a population of 19.32 (7 times 2.76). Municipal wells were not identified within this target distance limit.

REFERENCES

Oak Grove Village Well- 6/26/01

A distance weighted population value for potential contamination of 11 was derived for the $> \frac{1}{4}$ -mile to $\frac{1}{2}$ -mile distance category using the "karst" portion of 40 CFR, Part 300, Appendix A, Table 3-12 (Ref. 1).

Documentation for Target Population $> \frac{1}{2}$ to 1 mile Distance Category:

The computer search identified five private wells within this target distance limit (Ref. 29, pp. 56 - 58; Ref. 34). One of the six private wells in Oak Grove Village was also located in this target distance limit (Ref. 34; Ref. 36). These wells are located in Franklin County; it was assumed that one household was served by each well. The number of wells was multiplied by the number of people per household for Franklin County, for a population of 16.56 (6 times 2.76).

The population apportioned to Sullivan Wells No. 3 and No. 9 were also apportioned to the $> \frac{1}{2}$ to 1 mile target distance limit for the Cambrian-Ordovician aquifer (Ref. 34). Sullivan Well No. 3 is approximately three-fourths of a mile southwest of the Oak Grove Village Well; Sullivan Well No. 9 is approximately three-fourths of a mile southeast of the Oak Grove Village Well. Both of these wells draw water from the Cambrian-Ordovician aquifer. As explained on page 25 of this Documentation Record, Documentation for Populations Subject to Potential Contamination, one-sixth of the population of Sullivan, 943.5 people, was apportioned to each of Sullivan's municipal wells. There are two municipal wells within this target distance limit; thus, 1887 people are apportioned to these two wells.

The population for this target distance limit, 1,903.56 was calculated by adding the population derived from the computer search and from the City Clerk to the population served by Sullivan Wells No. 3 and No. 9 (16.56 + 1,887). A distance weighted population value for potential contamination of 817 was derived for the $> \frac{1}{2}$ -mile to 1-mile distance category using the "karst" portion of 40 CFR, Part 300, Appendix A, Table 3-12 (Ref. 1).

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

Fourteen private wells were located within this target distance limit (Ref. 29, pp. 56 - 58; Ref. 34). Two of these wells are located in Crawford County and 12 are located in Franklin County; it was assumed that one household was served by each well. The number of wells was multiplied by the number of people per household for the appropriate county, for a population of 38.3 [(2 times 2.59) + (12 times 2.76)].

The population apportioned to Sullivan Wells No. 5 and No. 7 were also apportioned to the > 1 to 2 mile target distance limit for the Cambrian-Ordovician aquifer (Ref. 34). Sullivan Well No. 5 is approximately two miles west of the Oak Grove Village Well; Sullivan Well No. 7 is approximately one-half of a mile southeast of the Oak Grove Village Well. Both of these wells draw water from the Cambrian-Ordovician aquifer. As explained on page 25 of this Documentation Record, Documentation for Populations Subject to Potential Contamination, one-sixth of the population of Sullivan or 943.5 people were apportioned to each of Sullivan's municipal wells. There are two municipal wells within this target distance limit; thus, 1887 people are apportioned to these two wells.

The population for this target distance limit, 1,925.3, was calculated by adding the population derived from the computer search to the population served by Sullivan Wells No. 5 and No. 7 (38.3 + 1,887). A distance weighted population value for potential contamination of 817 was derived for the > 1 -mile to 2-mile distance category using the "karst" portion of 40 CFR, Part 300, Appendix A, Table 3-12 (Ref. 1).

REFERENCES

Oak Grove Village Well- 6/26/01

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

Thirty-seven private wells were located within this target distance limit (Ref. 29, pp. 56-58; Ref. 34). Twelve of these wells are located in Crawford County and 25 are located in Franklin County; it was assumed that one household was served by each well. The number of wells was multiplied by the number of people per household for the appropriate county, for a population of 100.8 [(12 times 2.59) + (25 times 2.76)].

The population apportioned to Sullivan Wells No. 4 and No. 8 were also apportioned to the >2 to 3 mile target distance limit for the Cambrian-Ordovician aquifer. Sullivan Wells No. 4 and No. 8 are both approximately two miles southwest of the Oak Grove Village Well (Ref. 34). Both of these wells draw water from the Cambrian-Ordovician aquifer. As explained on page 25 of this Documentation Record, Documentation for Populations Subject to Potential Contamination, one-sixth of the population of Sullivan or 943.5 people were apportioned to each of Sullivan's municipal wells. There are two municipal wells within this target distance limit; thus, 1887 people are apportioned to these two wells.

The population for this target distance limit, 1,987.08, was calculated by adding the population derived from the computer search to the population served by Sullivan Wells No. 4 and No. 8 (100.08 + 1,887). A distance weighted population value for potential contamination of 817 was derived for the > 2-mile to 3-mile distance category using the "karst" portion of 40 CFR, Part 300, Appendix A, Table 3-12 (Ref. 1).

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

Based on the computer search explained earlier in this Documentation Record, 42 private wells were located within this target distance limit (Ref. 29; Ref. 34). Ten of these wells are located in Crawford County and 32 are located in Franklin County; it was assumed that one household was served by each well. The number of wells was multiplied by the number of people per household for the appropriate county, for a population of 114.22 [(10 times 2.59) + (32 times 2.76)]. Municipal wells were not identified within this target distance limit.

A distance weighted population value for potential contamination of 82 was derived for the > 3 to 4-mile distance category using the "karst" portion of 40 CFR, Part 300, Appendix A, Table 3-12 (Ref. 1).

REFERENCES

Oak Grove Village Well- 6/26/01

Calculation of the Potential Contamination Factor Value

As outlined in 40 CFR, Part 300, Appendix A, Section 3.3.2.4 (Ref. 1), a Potential Contamination Factor Value, 2.55E+02, was calculated for the Cambrian-Ordovician aquifer by taking the sum of the distance-weighted population values and dividing this sum by 10 (i.e., $(4 + 11 + 817 + 817 + 817 + 82)/10 = 255$ or 2.55E+02).

Cambrian-Ordovician Aquifer

Distance Category (miles)	Number of Private Wells	County Multiplier*	Population	Number of Municipal Wells	Population Served**	Total Population	Distance-Weighted Population Value
> 0 to ¼	1	2.76	2.76	0	0	3	4
> ¼ to ½	7	2.76	19.32	0	0	19	11
> ½ to 1	6	2.76	16.56	2	1887	1904	817
> 1 to 2	12 and 2	2.76 and 2.59	38.3	2	1887	1925	817
> 2 to 3	25 and 12	2.76 and 2.59	100.08	2	1887	1987	817
> 3 to 4	32 and 10	2.76 and 2.59	114.22	0	0	114	82
Potential Contamination Factor Value:							2.55E+02

*The number of people per household is 2.76 for Franklin County and 2.59 for Crawford County (Ref. 32 and Ref. 33).

**943.5 people (or one-sixth of the population of Sullivan was apportioned to each of the municipal wells (see pg. 25 of the Documentation Record).

Calculation of Population Factor Values:

As outlined in 40 CFR, Part 300, Appendix A, Section 3.3.2.5 (Ref. 1), the population factor value for the Cambrian-Ordovician aquifer was calculated by summing the factor values for Level I, Level II, and potential contamination. Thus the Population Factor Value is 4.465E+03 ($4.21E+03 + 0 + 2.55E+02$).

REFERENCES

Oak Grove Village Well- 6/26/01

Nearest Well**Level of Contamination:** Level I**Nearest Well Factor Values:**

Cambrian-Ordovician aquifer: 5.00E+01

Documentation for Nearest Well:

The Oak Grove Village Well was selected as the nearest drinking water well drawing from the Cambrian-Ordovician aquifer, as specified in 40 CFR, Part 300, Appendix A, Section 3.3.1 (Ref. 1). It is the release well which was used to establish an observed release to the Cambrian-Ordovician aquifer and used to identify the ground water plume source. A Nearest Well Factor Value of 50 was then derived from 40 CFR, Part 300, Appendix A, Table 3-11 (Ref. 1), because this well is subject to Level I concentrations.

Resources**Resource Use:** No**Resource Factor:** 0.00E+00**Documentation for Resources:**

No documented use of ground water for resources, as specified in 40 CFR, Part 300, Appendix A, Section 3.3.3 (Ref. 1), was determined.

Wellhead Protection Area**Wellhead Protection Area Factor:** 0.00E+00**Documentation for Wellhead Protection Area:**

The Oak Grove Village Well does not lie within a designated Wellhead Protection Area (Ref. 35). Therefore, the observed ground water contamination does not lie within a designated Wellhead Protection Area.

REFERENCES

Oak Grove Village Well- 6/26/01

GROUND WATER TARGETS SUMMARY**Population Factor Value****Cambrian-Ordovician Aquifer:** 4.465E+03**Nearest Well Factor Value****Cambrian-Ordovician Aquifer:** 5.00E+01**Resources Factor Value****Cambrian-Ordovician Aquifer:** 0.00E+00**Wellhead Protection Area Factor Value****Cambrian-Ordovician Aquifer:** 0.00E+00**Targets Factor Category Value****Cambrian-Ordovician Aquifer:** 4.515E+03**Documentation for Targets Factor Category Value:**

The Targets Value for the Cambrian-Ordovician aquifer is derived by summing the factor values for population (4.465E+03), nearest well (5.00E+01), resources (0.00E+00), and Wellhead Protection Area (0.00E+00), for a total of 4.515E+03.

REFERENCES

Oak Grove Village Well- 6/26/01

GROUND WATER MIGRATION PATHWAY SCORE:**100.00****Documentation for Ground Water Migration Pathway Score:**

As specified in 40 CFR, Part 300, Appendix A, Sections 3.4 and 3.5 (Ref. 1), the Ground Water Migration Pathway Score for the Cambrian-Ordovician aquifer is derived by multiplying the factor category values for Likelihood of Release (550), Waste Characteristics (10), and Targets ($4.515E+03$), for a product of 24,832,500, divided by 82,500, for a result of 301, subject to a maximum score of 100.

REFERENCES

Oak Grove Village Well- 6/26/01

SURFACE WATER MIGRATION PATHWAY

The Surface Water Migration Pathway was not evaluated for the Oak Grove Village Well site. The primary reasons for not evaluating the Surface Water Migration Pathway include:

- C No HRS-quality documentation is available which indicates that a ground water to surface water pathway exists.
- C An observed release to surface water cannot be established.
- C Target populations are limited.

REFERENCES

Oak Grove Village Well- 6/26/01

SOIL EXPOSURE PATHWAY

The Soil Exposure Pathway was not evaluated for the Oak Grove Village Well site. The primary reasons for not evaluating the Soil Exposure Pathway include:

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

REFERENCES

Oak Grove Village Well- 6/26/01

AIR MIGRATION PATHWAY

The Air Migration Pathway was not evaluated for the Oak Grove Village Well site. The primary reasons for not evaluating the Air Migration Pathway include:

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