



Source Water Assessment

A Hydrogeologic Susceptibility and Vulnerability Assessment for Mountain Village Water System Drinking Water System, Mountain Village, Alaska

PWSID # 270150.003

April 2004

DRINKING WATER PROTECTION PROGRAM REPORT 1073 Alaska Department of Environmental Conservation

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The Drinking Water Protection Program (DWPP) is producing Source Water Assessments in compliance with the Safe Drinking Water Act Amendments of 1996. Each assessment includes a delineation of the source water area, an inventory of potential and existing contaminant sources that may impact the water, a risk ranking for each of these contaminants, and an evaluation of the potential vulnerability of these drinking water sources.

These assessments are intended to provide public water systems owners/operators, communities, and local governments with the best available information that may be used to protect the quality of their drinking water. The assessments combine information obtained from various sources, including the U.S. Environmental Protection Agency, Alaska Department of Environmental Conservation (ADEC), public water system owners/operators, and other public information sources. The results of this assessment are subject to change if additional data becomes available. It is anticipated this assessment will be updated every five years to reflect any changes in the vulnerability and/or susceptibility of public drinking water source. If you have any additional information that may affect the results of this assessment, please contact the Program Coordinator of DWPP, (907) 269-7521.

CONTENTS

EXECUTIVE SUMMARY1 PUBLIC DRINKING WATER SYSTEM1 DRINKING WATER PROTECTION AREA2	INVENTORY OF POTENTIAL AND EXISTING CONTAMINANT SOURCES
TAB	LES
Table 1. Definition of Zones	3
APPEN	DICES
APPENDIX A. Mountain Village Water System Drin	nking Water Protection Area (Map A)
Bacteria and Viruses (Table 2) Contaminant Source Inventory and F Nitrates/Nitrites (Table 3) Contaminant Source Inventory and F Volatile Organic Chemicals (Table 4 Contaminant Source Inventory and R Heavy Metals, Cyanide and Other In Contaminant Source Inventory and R Synthetic Organic Chemicals (Table	Risk Ranking for Mountain Village Water System –
C. Mountain Village Water System Dri and Existing Contaminant Source	nking Water Protection Area and Potential ces (Map C)
	ant Source Inventory and Risk Ranking for Public Drinking Water Source (Charts 1 – 14)

Source Water Assessment for Mountain Village Water System Source of Public Drinking Water, Mountain Village, Alaska

Drinking Water Protection Program Alaska Department of Environmental Conservation

EXECUTIVE SUMMARY

The Mountain Village Water System has three Public Water System (PWS) wells. The well (PWS No. 270150.003) has been used as a drinking water source since it was drilled in 1975. This source water assessment report is exclusively limited to PWSID #270150.003.

The well is a Class A (community and non-transient non-community) water system located off of Airport Road, behind the LYSD High School in Mountain Village, Alaska. Available records indicate that there is secondary storage of drinking water, with a combined capacity of 200,000-gallons, and that the drinking water is treated with calcium hypochlorite. This system operates year round and serves approximately 700 residents through 196 service connections. The wellhead received a susceptibility rating of **Low** and the aquifer received a susceptibility rating of **Very High**. Combining these two ratings produce a **Low** rating for the natural susceptibility of the well.

Identified potential and current sources of contaminants for the public drinking water source include: domestic wastewater collection systems, nonresidential pit toilets, landfills, aboveground fuel tanks, roads, and pipelines. These identified potential and existing sources of contamination are considered as sources of bacteria and viruses, nitrates and/or nitrites, volatile organic chemicals, heavy metals, cyanide and other inorganic chemicals, synthetic organic chemicals, and other organic chemicals contaminant categories.

Overall, the water well received a vulnerability rating of **Very High** for the bacteria and viruses, nitrates and nitrites, heavy metals, cyanide and other inorganic chemicals, synthetic organic chemicals, and other organic chemicals and a vulnerability rating of **High** for volatile organic chemicals contaminant categories.

PUBLIC DRINKING WATER SYSTEM

The Mountain Village Water System well is a Class A (community/non-transient/non-community) public water system. The system is located off of Airport Road, behind the LYSD High School, in Mountain Village, Alaska (Sec. 14, T23N, R79W, Seward Meridian; see Map A of Appendix A). Mountain Village is on the north bank of the Yukon River, approximately 20 miles west of St. Mary's and 470 miles northwest of Anchorage. It is at the foot of Azachorok Mountain. The community has a population of 757 (ADCED, 2003). Average annual precipitation in Mountain Village is 16 inches, including approximately 44 inches of snowfall. Temperatures range from -44 to 80°F.

The community of Mountain Village obtains most of their water supply from community wells. Most households are served by the piped sewage collection system (ADCED, 2003). Mountain Village receives electrical power from AVEC. Refuse is collected by individuals and transported to the landfill (ADCED, 2003).

According to information supplied by ADEC for the Mountain Village Water System PWS, the depth of the primary water well is 195 feet below the ground surface. Based on available information for the well, it is in an unconfined aquifer resulting from fractured bedrock. The well is not located within a floodplain.

Information acquired from a July 2003 sanitary survey for the public water system indicated that the land surface was sloped away from the well. Generally, land surfaces that slope away from the wellhead promote surface water drainage, which reduces the potential of contaminant migration down the well casing annulus. The sanitary survey indicates that the well is grouted according to ADEC regulations. Proper grouting provides added protection against contaminants traveling along the well casing annulus and into source waters.

The bedrock in the Mountain Village area consists primarily of sandstone, which form well defined northeast trending hills. These hills are composed of a thick sequence of interbedded marine and nonmarine deposits. The area is underlain by a layer of discontinuous permafrost and has three basic soil types: poorly drained mineral soils, organic rich soils, and well-drained mineral soils (Nakanishi and Dorava, 1994).

DRINKING WATER PROTECTION AREA

In order to evaluate whether a drinking water source is at risk, we must first evaluate what are the most likely pathways for surface contamination to reach the groundwater. These areas are determined by looking at the characteristics of the soil, groundwater, aquifer, and well.

The most probable area for contamination to reach the drinking water well is the area that contributes water to the well, the groundwater recharge area. This area is designated as the drinking water protection area (DWPA). Because releases of contaminants within the protection area are most likely to impact the drinking water well, this area will serve as the focus for voluntary protection efforts. An analytical calculation was used to determine the size and shape of the DWPA for the Mountain Village Water System PWS. The input parameters describing the attributes of the aquifer in this calculation were adopted from Groundwater (Freeze and Cherry, 1979). Available geology and groundwater contours were also considered to take into account any uncertainties in groundwater flow and aquifer characteristics to arrive at a meaningful protection area.

The protection areas established for wells by the ADEC are usually separated into four zones, limited by the watershed. These zones correspond to differences in the time-of-travel (TOT) of the water moving through the aquifer to the well (Please refer to the Guidance Manual for Class A Public Water Systems for additional information).

The time of travel for contaminants within the water varies and is dependent on the physical and chemical characteristics of each contaminant. The following is a summary of the four protection area zones for wells and the calculated time -of-travel for each:

Table 1. Definition of Zones

Definition
½ the distance for the 2-yr. time -of-travel
Less than the 2 year time-of-travel
Less Than the 5 year time -of-travel
Less than the 10 year time -of-travel

The DWPA for the Mountain Village Water System PWS was determined using an analytical calculation and includes Zones A and D (See Map A of Appendix A).

INVENTORY OF POTENTIAL AND EXISTING CONTAMINANT SOURCES

The Drinking Water Protection Program has completed an inventory of potential and existing sources of contamination within the Mountain Village Water System DWPA. This inventory was completed through a search of agency records and other publicly available information. Potential sources of contamination to the drinking water aquifer include a wide range of categories and types. Potential drinking water contaminants are found within agricultural, residential, commercial, and industrial areas, but can also occur within areas that have little or no development.

For the basis of all Class A public water system assessments, six categories of drinking water contaminants were inventoried. They include:

- Bacteria and viruses.
- Nitrates and/or nitrites,
- Volatile organic chemicals,
- Heavy metals, cyanide and other inorganic chemicals.
- Synthetic organic chemicals,
- Other organic chemicals.

The sources are displayed on Map C of Appendix C and summarized in Table 1 of Appendix B.

RANKING OF CONTAMINANT RISKS

Once the potential and existing sources of contamination have been identified, they are assigned a ranking according to what type and level of risk they represent. Ranking of contaminant risks for a "potential" or "existing" source of contamination is a function of toxicity and volumes of specific contaminants associated with that source. Rankings include:

- Low.
- Medium,
- High, and
- Very High.

The time-of-travel for contaminants within the water varies and is dependent on the physical and chemical characteristics of each contaminant. Bacteria and Viruses are only inventoried in Zones A and B

because of their short life span. Only "Very High" and "High" rankings are inventoried within the outer Zone D due to the probability of contaminant dilution by the time the contaminants get to the well. Tables 2 through 4 in Appendix B contain the ranking of potential and existing sources of contamination with respect to bacteria and viruses, nitrates and/or nitrites, volatile organic chemicals, heavy metals, cyanide and other inorganic chemicals, synthetic organic chemicals, and other organic chemicals.

VULNERABILITY OF THE DRINKING WATER SYSTEM

Vulnerability of a drinking water source to contamination is a combination of two factors:

- Natural susceptibility, and
- Contaminant risks.

Appendix D contains fourteen charts, which together form the 'Vulnerability Analysis' for a source water assessment for a public drinking water source. Chart 1 analyzes the 'Susceptibility of the Wellhead' to contamination by looking at the construction of the well and its surrounding area. Chart 2 analyzes the 'Susceptibility of the Aquifer' to contamination by looking at the naturally occurring attributes of the water source and influences on the groundwater system that might lead to contamination. Chart 3 analyzes 'Contaminant Risks' for the drinking water source with respect to bacteria and viruses. The 'Contaminant Risks' portion of the analysis considers potential sources of contaminants as well as a review of contamination that has or may have occurred, but has not arrived or been detected at the well. Chart 4 contains the 'Vulnerability Analysis for Bacteria and Viruses'. Charts 5 through 14 contain the Contaminant Risks and Vulnerability Analyses for nitrates and nitrites, volatile organic chemicals, heavy metals, cyanide and other inorganic chemicals, synthetic organic chemicals, and other organic chemicals, respectively.

A score for the Natural Susceptibility is reached by considering the properties of the well and the aquifer.

Susceptibility of the Wellhead (0 – 25 Points) (Chart 1 of Appendix D)

+

Susceptibility of the Aquifer (0 – 25 Points) (Chart 2 of Appendix D)

=

Natural Susceptibility (Susceptibility of the Well) (0 – 50 Points)

A ranking is assigned for the Natural Susceptibility according to the point score:

Natural Susceptibility Ratings							
40 to 50 pts	Very High						
30 to < 40 pts	High						
20 to < 30 pts	Medium						
< 20 pts	Low						

The Mountain Village Water System's water well is in an unconfined aquifer. Unconfined aquifers are more susceptible to potential groundwater quality impacts posed by the migration of surface water contaminants downward from the surface. Table 2 shows the susceptibility scores and ratings for this PWS.

Table 2. Susceptibility

	Score	Rating
Susceptibility of the	0	Low
Wellhead		
Susceptibility of the	30	Very High
Aquifer		
Natural Susceptibility	30	High

Contaminant risks to a drinking water source depend on the type, number or density, and distribution of contaminant sources. This score has been derived from an examination of existing and historical contamination that has been detected at the drinking water source through routine sampling. It also evaluates potential sources of contamination. Flow charts are used to assign a point score, and ratings are assigned in the same way as for the natural susceptibility:

Contaminant Risk Ratings					
40 to 50 pts	Very High				
30 to < 40 pts	High				
20 to < 30 pts	Medium				
< 20 pts	Low				

Table 3 summarizes the Contaminant Risks for each category of drinking water contaminants.

Table 3. Contaminant Risks

Category	Score	Rating
Bacteria and Viruses	50	Very High
Nitrates and/or Nitrites	50	Very High
Volatile Organic Chemical	ls 45	Very High
Heavy Metals, Cyanide an	ıd	
Other Inorganic Chemicals	50	Very High
Synthetic Organic Chemica	als 50	Very High
Other Organic Chemicals	50	Very High

Finally, an overall vulnerability score is assigned for each water system by combining each of the contaminant risk scores with the natural susceptibility score:

Natural Susceptibility (0 - 50 points)

+

Contaminant Risks (0 – 50 points)

=

Vulnerability of the Drinking Water Source to Contamination (0 – 100).

Again, rankings are assigned according to a point score:

Overall Vulnerability Ratings						
80 to 100 pts	Very High					
60 to < 80 pts	High					
40 to < 60 pts	Medium					
< 40 pts	Low					

Table 4 contains the overall vulnerability scores (0 – 100) and ratings for each of the six categories of drinking water contaminants. Note: scores are rounded off to the nearest five.

Table 4. Overall Vulnerability

Category	Score	Rating
Bacteria and Viruses	80	Very High
Nitrates and Nitrites	80	Very High
Volatile Organic Chemicals	75	High
Heavy Metals, Cyanide and		
Other Inorganic Chemicals	80	Very High
Synthetic Organic Chemicals	80	Very High
Other Organic Chemicals	80	Very High

Bacteria and Viruses

The contaminant risk for bacteria and viruses is **Very High**. The risk is primarily attributed to the presence of domestic wastewater collection systems, nonresidential pit toilets, and a landfill in Zone A (see Table 2 – Appendix B).

Coliforms (a bacteria) are found naturally in the environment and although they aren't necessarily a health threat, they are an indicator of other potentially harmful bacteria in the water, more specifically, fecal coliforms and E. coli, which only come from human and animal fecal waste. Harmful bacteria can cause diarrhea, cramps, nausea, headaches, or other symptoms (EPA, 2003). Positive samples increase the overall vulnerability of the drinking water source, indicating that the source is susceptible to bacteria and virus contamination.

A positive bacteria count has been reported in recent (within five years) sampling events (See Chart 3 – Contaminant Risks for Bacteria and Viruses in Appendix D). Only a small amount of bacteria and viruses are required to endanger public health.

After combining the contaminant risk for bacteria and viruses with the natural susceptibility of the well, the overall vulnerability of the well to contamination is **Very High**.

Nitrates and Nitrites

The contaminant risk for nitrates and nitrites is **Very High**. The risk to this source of public drinking water is primarily attributed to the presence of a landfill in Zone A (see Table 3 – Appendix B).

Nitrates are very mobile, moving at approximately the same rate as water. The sampling history for this well indicates that low levels of nitrates have been detected in recent sampling events. However, the reported concentrations of nitrates do not exceed the maximum contaminant level (MCL) of 10 mg/L. Nitrate concentrations in uncontaminated groundwater are typically less than 2 mg/L; therefore, nitrate concentrations above 2 mg/L may be indicative of man-made sources (See Chart 5 - Contaminant Risks for Nitrates and/or Nitrites in Appendix D).

Nitrate levels are often derived from the decomposition of organic matter in soils. Although the nitrate source is unknown, such occurrences may be attributed to septic systems or other sources. After combining the contaminant risk for nitrates and nitrites with the natural susceptibility of the well, the overall vulnerability of the well to nitrate and nitrite

contamination is Very High.

Volatile Organic Chemicals

The contaminant risk for volatile organic chemicals is **Very High**. The risk is primarily attributed to the presence of a landfill in Zone A. Numerous other potential contaminant sources are also found within the protection area (see Table 4 – Appendix B).

Detectable concentrations of trihalomethanes were reported in sampling events for this public water system. However, the detectible concentrations of trihalomethanes reported in 1999 were well below the MCL of 0.08 mg/L. Trihalomethanes are considered byproducts of the water treatment process and are not from the source waters. Since the reported concentration of TTHM's in recent sampling events did not exceed the applicable MCLs, risk points were not retained.

Aside from being byproducts of the drinking water treatment process, possible sources of volatile organic chemicals include facilities with automobiles, residential areas, fuel tanks, roads, and airports. See Table 4 in Appendix D for a complete listing.

After combining the contaminant risk for volatile organic chemicals with the natural susceptibility of the well, the overall vulnerability of the well to contamination is **High**.

Heavy Metals, Cyanide and Other Inorganic Chemicals

The contaminant risk for heavy metals, cyanide and other inorganic chemicals is **Very High**. The risk is primarily attributed to the presence of a landfill located in Zone A. Numerous other potential contaminant sources are also found within the protection area (see Table 5 – Appendix B).

Based on review of recent sampling records for this public water system, moderate levels of copper, lead, and arsenic have been detected, but have not exceeded their respective MCLs of 1.3 mg/L, 0.015 mg/L, and 0.05 mg/L (see Chart 8 – Contaminant Risks for Heavy Metals, Cyanide, and Other Inorganic Chemicals in Appendix D).

The reported concentrations of copper and lead in recent sampling events are not likely to be representative of source water conditions. These two analytes are likely attributed to either the water treatment process or water distribution network; therefore, no risk points were assigned based on the presence of these analytes. However, risk points were assigned based on the presence of arsenic.

After combining the contaminant risk for heavy metals, cyanide and other inorganic chemicals with the natural susceptibility of the well, the overall vulnerability of the well to contamination is **Very High**.

Synthetic Organic Chemicals

The contaminant risk for synthetic organic chemicals is **Very High**. The risk is primarily attributed to the presence of a landfill located in Zone A. Numerous other potential contaminant sources are also found within the protection area (see Table 6 – Appendix B).

No recent sampling data was available in ADEC records for the Mountain Village Water System (See Chart 11 – Contaminant Risks for Synthetic Organic Chemicals in Appendix D).

After combining the contaminant risk for synthetic organic chemicals with the natural susceptibility of the well, the overall vulnerability of the well to contamination is **Very High**.

Other Organic Chemicals

The contaminant risk for other organic chemicals is **Very High**. The risk is primarily attributed to the presence of a landfill, pipelines, and electric power generation located in Zone A. Numerous other potential contaminant sources are also found within the protection area (see Table 7 – Appendix B).

No recent sampling data was available in ADEC records for the Mountain Village Water System (See Chart 13 – Contaminant Risks for Other Organic Chemicals in Appendix D).

After combining the contaminant risk for other organic chemicals with the natural susceptibility of the well, the overall vulnerability of the well to contamination is **Very High**.

Using the Source Water Assessment

This assessment of contaminant risks can be used as a foundation for local voluntary protection efforts as well as a basis for the continuous efforts on the part of the community of Mountain Village to protect public health. It is anticipated that Source Water Assessments will be updated every five years to reflect any changes in the vulnerability and/or susceptibility of the drinking water source.

REFERENCES

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- Freeze, R. A., and Cherry, J.A. 1979, Groundwater, Prentice-Hall, Englewood Cliffs, New Jersey
- Nakanishi, Allan S. and Joseph M. Dorava. 1994, Overview of Environmental and Hydrogeologic Conditions at St. Mary's, Alaska, U.S. Geological Survey, Open File Report 94-481, prepared in cooperation with the FAA.
- United States Environmental Protection Agency (EPA), 2002 [WWW document]. URL http://www.epa.gov/safewater/mcl.html.

APPENDIX A

Drinking Water Protection Area Location Map (Map A)

Public Water Well System for PWS #270150.003 Mountain Village Water System **LEGEND** Public Water System Well Hydrography/Physical Lake or Pond Contours Transportation Primary Route (Class 1) Secondary Route (Class 2) CORPORATE Road (Class 3) Road (Class 4) Road (Class 5, Four-wheel drive) BOUNDARY **Groundwater Protection Zones** Zone A Protection Area— Several Months Travel Time or Watershed Boundary Azaonoro) Data Sources: Contaminant Sources, Public Water System Wells, Contours Alaska Department of Environmental Conservation (ADEC) Critical Facilities, Federal Emergency Management Agency (FEMA) All other data: United States Geological Survey (USGS) Drinking Water Protection Areas based on "Alaska Drinking Water Protection Program - Guidance Manual for Class A Public Water Systems" published by ADEC Mountain Village Water System PWS 270150.003 URS Corporation does not guarantee the accuracy or validity of the data provided. 16 Mountain Villag Seaplane Anchorage Pitkas Point Scammon Bay Area of Map 1 Mountain Village Water System PWS 270150.003 Appendix A Map A

APPENDIX B

Contaminant Source Inventory and Risk Ranking (Tables 1-7)

Contaminant Source Inventory for Mountain Village Water System

PWSID 270150.003

Contaminant Source Type	Contaminant Source ID	CS ID tag	Zone	Map Number	Comments
Pit toilets (open hole), nonresidential (one or more)	D16	D16-01	A	С	Assume 1 honey bucket pit in Zone A
Landfills (municipal; Class III)	D51	D51-01	A	C	
Tanks, heating oil, residential (above ground)	R08	R08-01	A	С	Assume 20 or less residential heating oil tanks in Zone A
Tanks, heating oil, nonresidential (aboveground)	T14	T14-01	A	С	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-02	A	С	
Highways and roads, dirt/gravel	X24	X24-01	A	С	Assume 1-20 roads in Zone A
Pipelines (oil and gas)	X28	X28-01	A	С	

Contaminant Source Inventory and Risk Ranking for Mountain Village Water System Sources of Bacteria and Viruses

Contaminant Source Type	Contaminant Source ID	CS ID tag	Zone	Risk Ranking for Analysis	Map Number	Comments
Pit toilets (open hole), nonresidential (one or more)	D16	D16-01	A	Medium	С	Assume 1 honey bucket pit in Zone A
Landfills (municipal; Class III)	D51	D51-01	A	High	С	
Highways and roads, dirt/gravel	X24	X24-01	A	Low	С	Assume 1-20 roads in Zone A

Contaminant Source Inventory and Risk Ranking for Mountain Village Water System Sources of Nitrates/Nitrites

Contaminant Source Type	Contaminant Source ID	CS ID tag	Zone	Risk Ranking for Analysis	Map Number	Comments
Pit toilets (open hole), nonresidential (one or more)	D16	D16-01	A	Medium	С	Assume 1 honey bucket pit in Zone A
Landfills (municipal; Class III)	D51	D51-01	A	Very High	С	
Highways and roads, dirt/gravel	X24	X24-01	A	Low	С	Assume 1-20 roads in Zone A

Contaminant Source Inventory and Risk Ranking for Mountain Village Water System Sources of Volatile Organic Chemicals

Contaminant Source Type	Contaminant Source ID	CS ID tag	Zone	Risk Ranking for Analysis	Map Number	Comments
Pit toilets (open hole), nonresidential (one or more)	D16	D16-01	A	Low	С	Assume 1 honey bucket pit in Zone A
Landfills (municipal; Class III)	D51	D51-01	A	High	C	
Tanks, heating oil, residential (above ground)	R08	R08-01	A	Medium	C	Assume 20 or less residential heating oil tanks in Zone A
Tanks, heating oil, nonresidential (aboveground)	T14	T14-01	A	Low	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-02	A	Low	C	
Highways and roads, dirt/gravel	X24	X24-01	A	Low	С	Assume 1-20 roads in Zone A
Pipelines (oil and gas)	X28	X28-01	A	Medium	С	

Table 5

Contaminant Source Inventory and Risk Ranking for Mountain Village Water System Sources of Heavy Metals, Cyanide and Other Inorganic Chemicals

Contaminant Source Type	Contaminant Source ID	CS ID tag	Zone	Risk Ranking for Analysis	Map Number	Comments
Pit toilets (open hole), nonresidential (one or more)	D16	D16-01	A	Low	С	Assume 1 honey bucket pit in Zone A
Landfills (municipal; Class III)	D51	D51-01	A	High	С	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-01	A	Low	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-02	A	Low	C	
Highways and roads, dirt/gravel	X24	X24-01	A	Low	C	Assume 1-20 roads in Zone A
Pipelines (oil and gas)	X28	X28-01	A	Low	С	

PWSID 270150.003

Table 6

Contaminant Source Inventory and Risk Ranking for Mountain Village Water System Sources of Synthetic Organic Chemicals

Contaminant Source Type	Contaminant Source ID	CS ID tag	Zone	Risk Ranking for Analysis	Map Number	Comments
Landfills (municipal; Class III)	D51	D51-01	A	Very High	С	

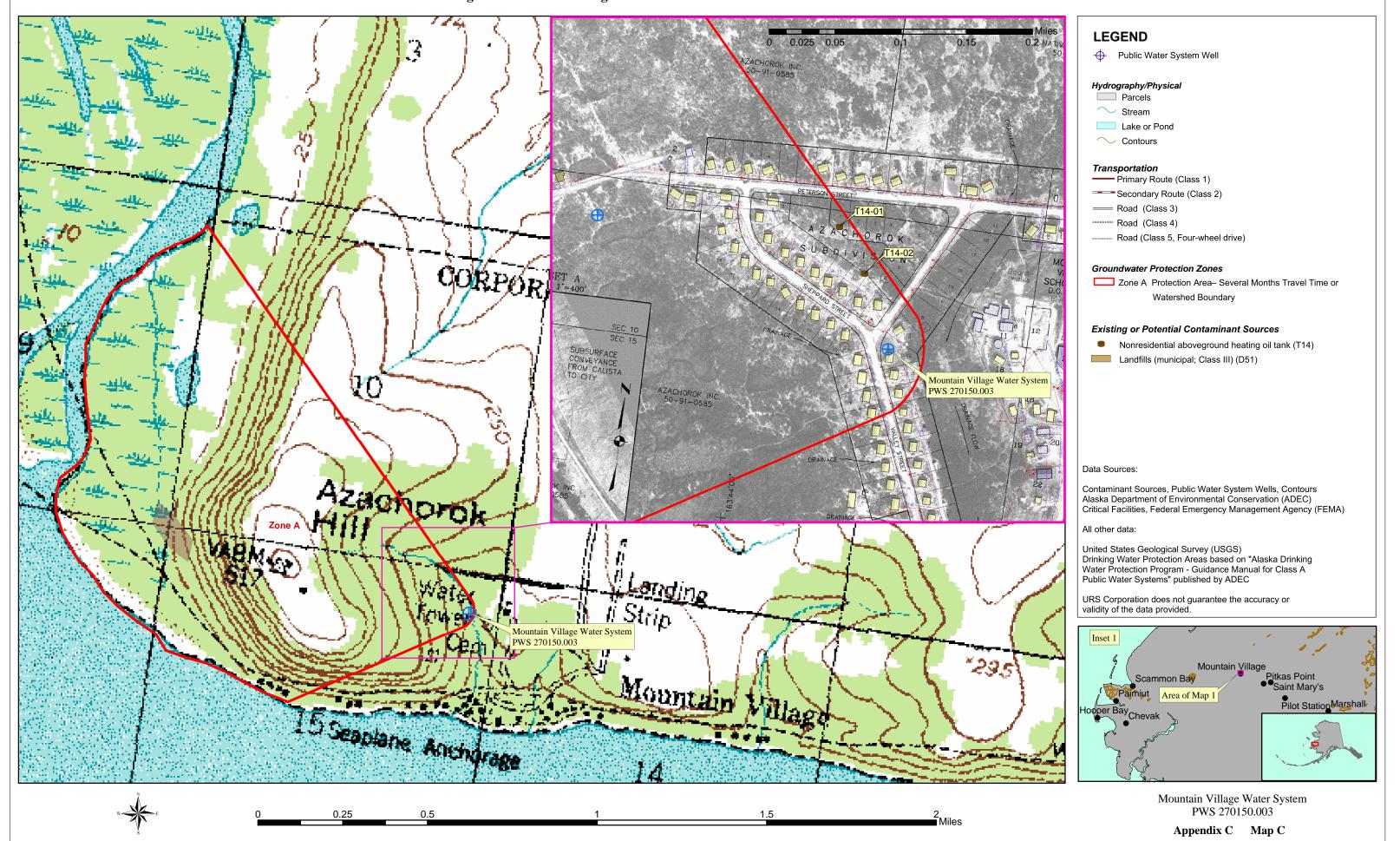
Contaminant Source Inventory and Risk Ranking for Mountain Village Water System Sources of Other Organic Chemicals

Contaminant Source Type	Contaminant Source ID	CS ID tag	Zone	Risk Ranking for Analysis	Map Number	Comments
Landfills (municipal; Class III)	D51	D51-01	A	Very High	С	
Highways and roads, dirt/gravel	X24	X24-01	A	Low	С	Assume 1-20 roads in Zone A
Pipelines (oil and gas)	X28	X28-01	A	High	С	

APPENDIX C

Drinking Water Protection Area and Potential and Existing Contaminant Sources (Map C)

Public Water Well System for PWS #270150.003 Mountain Village Water System Showing Potential and Existing Sources of Contamination



APPENDIX D

Vulnerability Analysis for Public Drinking Water Source (Charts 1-14)

Susceptibility initially assumed to be low. Susceptibility of wellhead = 0 pts NO Is the well Increase susceptibility 5 pts properly + 0 pts grouted? Is the well Increase susceptibility 20 pts 0 pts capped? YES YES Susceptibility of wellhead Low 0 pts YES Increase susceptibility: Is the well 10 pts: suspected floodplain + 0 pts within a Wellhead Susceptibility Ratings 20 pts: known floodplain floodplain? 20 to 25 pts very high 15 to < 20 pts high 10 to < 15 pts medium NO < 10 pts low Is the land surface sloped Increase susceptibility 5 pts + 0 pts away from the

Chart 1. Susceptibility of the wellhead - Mountain Village Water System (PWS No. 270150.003)

Chart 2. Susceptibility of the aquifer Mountain Village Water System (PWS No. 270150.003)

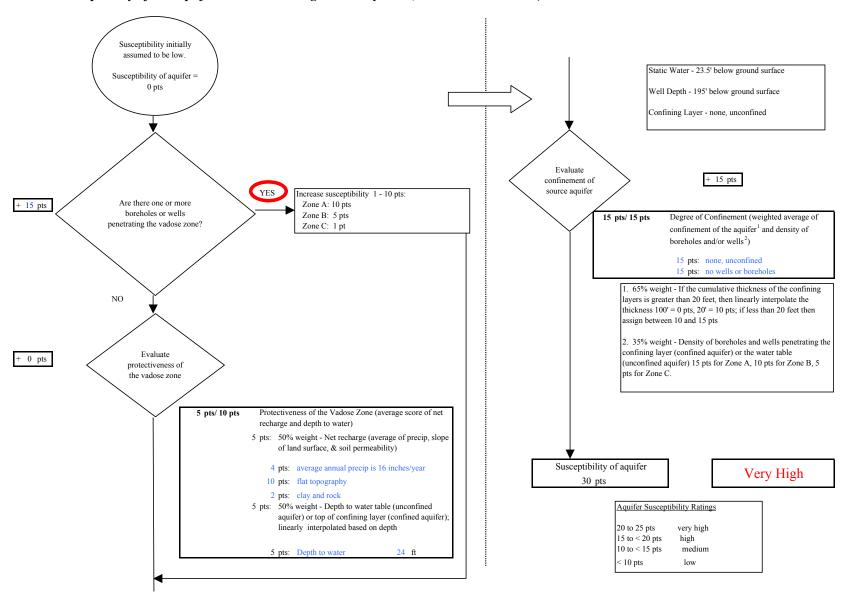


Chart 3. Contaminant risks for Mountain Village Water System (PWS No. 270150.003) - Bacteria & Viruses

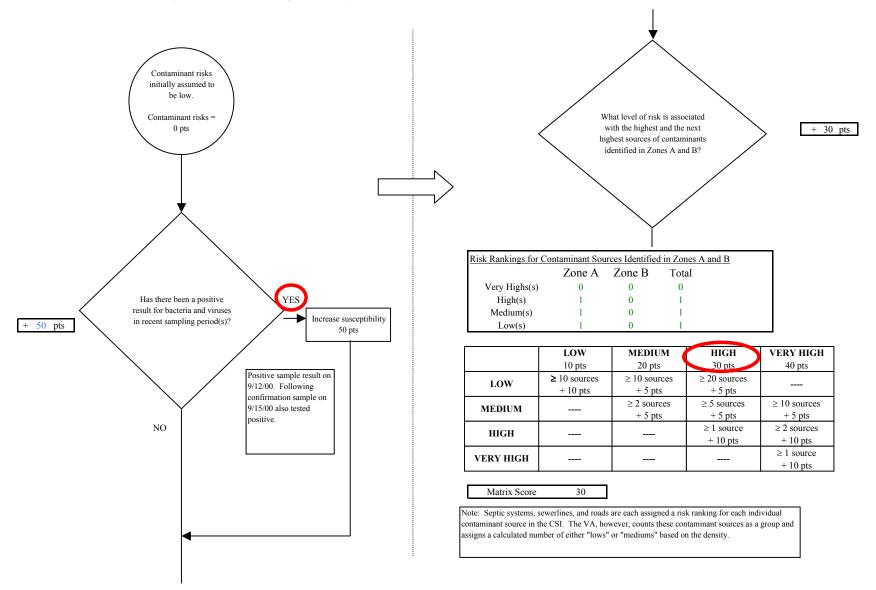


Chart 3. Contaminant risks for Mountain Village Water System (PWS No. 270150.003) - Bacteria & Viruses NO Are there sufficient Initial assessment of risk posed by Risk unchanged controls, conditions, or potential sources of contamination monitoring to warrant = 30 pts downgrading risk? Are any YES significant Risk unchanged contaminant Reduce risk 1 - 10 pts sources within - 0 pts Zone A? The number and magnitude of Risk posed by potential sources of contaminant sources in YES contamination with controls Zone A determines a risk increase. See Table 2 for + 10 pts Increase risk 1 - 10 pts inventory. Existing Risk due to existing 50 pts contamination Are there any NQ conditions that Risk unchanged Risk posed by potential sources warrant upgrading Potential of contamination with controls risk? 40 pts Contaminant risks Contaminant Risk YES 90 pts Increase risk 1 - 10 pts + 0 pts Contaminant risks* * Truncate risk at 50 pts Contaminant Risk Ratings Risk posed by potential sources of contamination 40 to 50 pts very high 40 30 to < 40 pts high Very High $20 \text{ to} \le 30 \text{ pts}$

Page 4 of 25

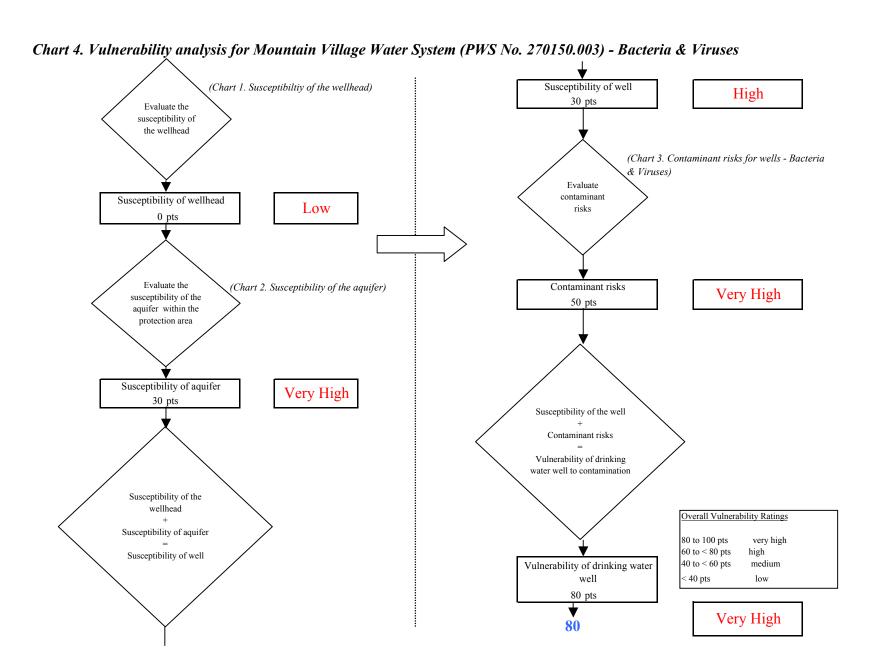
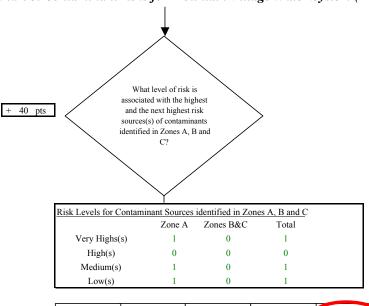


Chart 5. Contaminant risks for Mountain Village Water System (PWS No. 270150.003) - Nitrates and Nitrites Contaminant risks initially assumed to be low. Evaluate the level of Current level of Contaminant risks background contamination due to man-= 0 ptscontamination from made source(s) natural sources Is the concentration of Has nitrates and/or NO the contaminant nitrites been detected in increasing, decreasing, the source waters in or staying the same? recent sampling period(s)? Recent Nitrate Sampling Results (mg/L) 1/9/2002 12/27/2000 1.36 The nitrate concentration is 12/28/1999 1.6 assumed to be natural if less 2/9/1998 0.81 than 2 mg/L (20%), or Increasing: risk up 1 - 10 pts YES attributed to man made Decreasing: risk down 1 - 5 pts sources if greater than 2 + 0 pts Same: risk unchanged mg/L. Maximum Contaminant Level (MCL) = 10 mg/LDetected Nitrate Level = Existing contamination points based on Risk due to existing man-Risk due to natural linear interpolation of most recent detect sources made sources [MCL = 50 pts; detect = 0 pts]8 pts Risk due to existing contamination 8 pts Was the source of Evaluate the level of NO. contamination contamination from natural? man-made sources

Chart 5. Contaminant risks for Mountain Village Water System (PWS No. 270150.003) - Nitrates and Nitrites



	LOW 10 pts	MEDIUM 20 pts	HIGH 30 pts	VERY HIGH 40 pts
LOW	≥ 10 sources + 10 pts	≥ 10 sources + 5 pts	≥ 20 sources + 5 pts	
MEDIUM		≥ 2 sources + 5 pts	≥ 5 sources + 5 pts	≥ 10 sources + 5 pts
HIGH			≥ 1 source + 10 pts	≥ 2 sources + 10 pts
VERY HIGH				≥ 1 source + 10 pts

Matrix Score 40

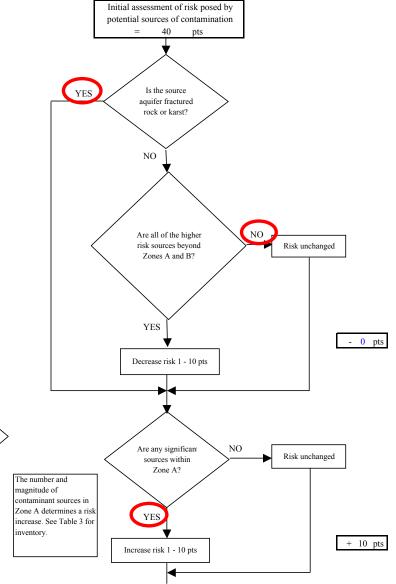
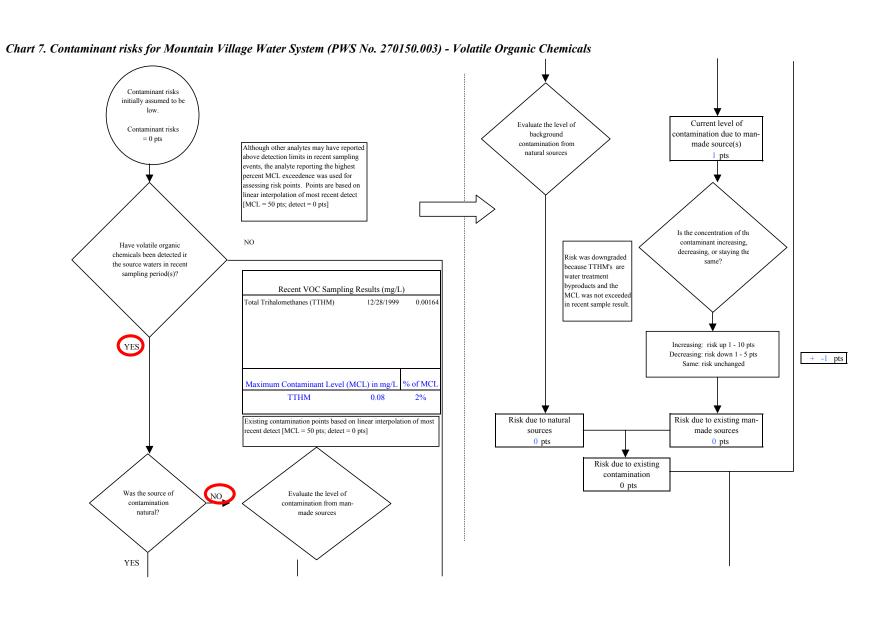


Chart 5. Contaminant risks for Mountain Village Water System (PWS No. 270150.003) - Nitrates and Nitrites Existing NO Are there conditions 8 pts Risk unchanged that warrant upgrading risk? Risk due to existing Potential contamination 50 pts Risk posed by potential sources of contamination with controls Contaminant Risk YES 58 pts Contaminant risks 0 pts Increase risk 1 - 10 pts Risk posed by potential sources of contamination 50 pts *Truncate risk at 50 pts Contaminant risks* 50 Are there sufficient Contaminant Risk Ratings Very High controls, conditions, NO Risk unchanged or monitoring to 40 to 50 pts very high 30 to < 40 pts warrant downgrading high 20 to < 30 pts medium < 20 pts low YES 0 pts Decrease risk 1 - 10 pts Risk posed by potential sources of contamination with controls

Page 8 of 25

Chart 6. Vulnerability analysis for Mountain Village Water System (PWS No. 270150.003) - Nitrates and Nitrites (Chart 1. Susceptibiltiy of the wellhead) Susceptibility of well High 30 pts Evaluate the susceptibility of the wellhead (Chart 5. Contaminant risks for wells - Nitrates and Nitrites) Evaluate Susceptibility of wellhead contaminant risks Low 0 pts Evaluate the (Chart 2. Susceptibility of the aquifer) Contaminant risks Very High susceptibility of the 50 pts aquifer within the protection area Susceptibility of aquifer Very High 30 pts Susceptibility of the well Contaminant risks Vulnerability of drinking water well to contamination Susceptibility of the wellhead Overall Vulnerability Ratings Susceptibility of aquifer 80 to 100 pts very high Susceptibility of well 60 to < 80 pts high 40 to < 60 pts medium Vulnerability of drinking water well < 40 pts 80 pts Very High **80**



Page 10 of 25

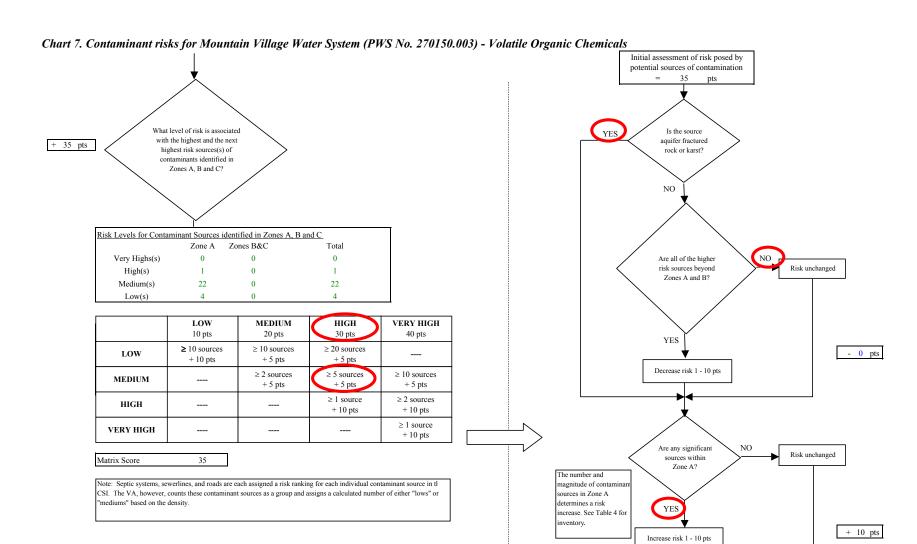


Chart 7. Contaminant risks for Mountain Village Water System (PWS No. 270150.003) - Volatile Organic Chemicals Existing NO Are there conditions 0 pts Risk unchanged that warrant upgrading Risk due to existing risk? Potential contamination 45 pts Risk posed by potential sources of contamination with controls Contaminant Risk YES 45 pts Contaminant risks + 0 pts Increase risk 1 - 10 pts Risk posed by potential sources of contamination 45 pts Contaminant risks* *Truncate risk at 50 pts 45 Contaminant Risk Ratings Are there sufficient Very High NO , controls, conditions, or Risk unchanged 40 to 50 pts very high monitoring to warrant 30 to < 40 pts high downgrading risk? 20 to < 30 pts medium < 20 pts YES 0 pts Decrease risk 1 - 10 pts Risk posed by potential sources of contamination with controls

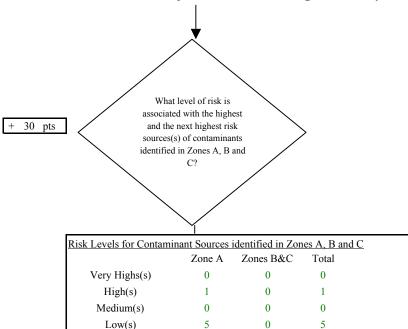
Chart 8. Vulnerability analysis for Mountain Village Water System (PWS No. 270150.003) - Volatile Organic Chemicals (Chart 1. Susceptibiltiy of the wellhead) Susceptibility of well High 30 pts Evaluate the susceptibility of the wellhead (Chart 7. Contaminant risks for wells - Volatile Organic Chemicals) Evaluate Susceptibility of wellhead contaminant risks Low 0 pts Evaluate the (Chart 2. Susceptibility of the aquifer) Contaminant risks Very High susceptibility of the 45 pts aquifer within the protection area Susceptibility of aquifer Very High 30 pts Susceptibility of the well Contaminant risks Vulnerability of drinking water well to contamination Susceptibility of the wellhead Overall Vulnerability Ratings Susceptibility of aquifer 80 to 100 pts very high Susceptibility of well 60 to < 80 pts high 40 to < 60 pts medium Vulnerability of drinking water well < 40 pts 75 pts High **75**

Page 13 of 25

Chart 9. Contaminant risks for Mountain Village Water System (PWS No. 270150.003) - Heavy Metals, Cyanide and Other Inorganic Chemicals Contaminant risks initially assumed to be Current level of Evaluate the level of Contaminant risks contamination due to manbackground =0 pts contamination from made source(s) natural sources 24 pts Is the concentration of Have heavy metals, NO the contaminant cyanide or other inorganic increasing, decreasing, chemicals been detected or staying the same? in the source waters in recent sampling period(s)? Recent Metals Sampling Results (mg/L) 12/31/2002 0.212 Copper 6/30/1999 0.138 12/31/1998 0.211 12/31/2002 0.004 Lead YES 12/31/1998 0.003 Increasing: risk up 1 - 10 pts Decreasing: risk down 1 - 5 pts Arsenic 12/23/2002 0.024 + 0 pts Same: risk unchanged **Maximum Contaminant** Although other inorganic compounds have Level (MCL) (mg/L) % of MCI been detected in previous sampling events, Copper= 16% arsenic has reported the highest percent MCL values in the past 5 years. Lead = 0.015 27% 0.05 48% Risk due to existing man-Arsenic= Risk due to natural sources made sources Existing contamination points based on linear 0 pts 24 pts interpolation of most recent detect [MCL = 50 pts; detect = 0 ptsRisk due to existing contamination 24 pts Evaluate the level Was the source of NO of contamination contamination from man-made natural? sources YES

Page 14 of 25

Chart 9. Contaminant risks for Mountain Village Water System (PWS No. 270150.003) - Heavy Metals, Cyanide and Other Inorganic Chemicals



	LOW 10 pts	MEDIUM 20 pts	HIGH 30 pts	VERY HIGH 40 pts
LOW	≥ 10 sources + 10 pts	≥ 10 sources + 5 pts	≥ 20 sources + 5 pts	
MEDIUM		≥ 2 sources + 5 pts	≥ 5 sources + 5 pts	≥ 10 sources + 5 pts
HIGH			≥ 1 source + 10 pts	≥ 2 sources + 10 pts
VERY HIGH				≥ 1 source + 10 pts

Matrix Score 30

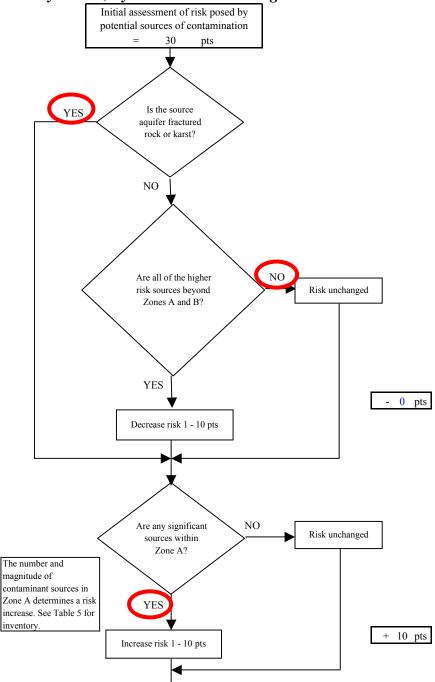


Chart 9. Contaminant risks for Mountain Village Water System (PWS No. 270150.003) - Heavy Metals, Cyanide and Other Inorganic Chemicals Existing NO Are there conditions 24 pts Risk unchanged that warrant upgrading risk? Risk due to existing Potential contamination 40 pts Risk posed by potential sources of contamination with controls Contaminant Risk YES 64 pts Contaminant risks 0 pts Increase risk 1 - 10 pts Risk posed by potential sources of contamination 40 pts Contaminant risks* *Truncate risk at 50 pts 50 Contaminant Risk Ratings Are there sufficient Very High controls, conditions, NQ I Risk unchanged or monitoring to 40 to 50 pts very high 30 to < 40 pts high warrant downgrading 20 to < 30 pts risk? medium < 20 pts low YES 0 pts Decrease risk 1 - 10 pts Risk posed by potential sources of contamination with controls 40 pts

Page 16 of 25

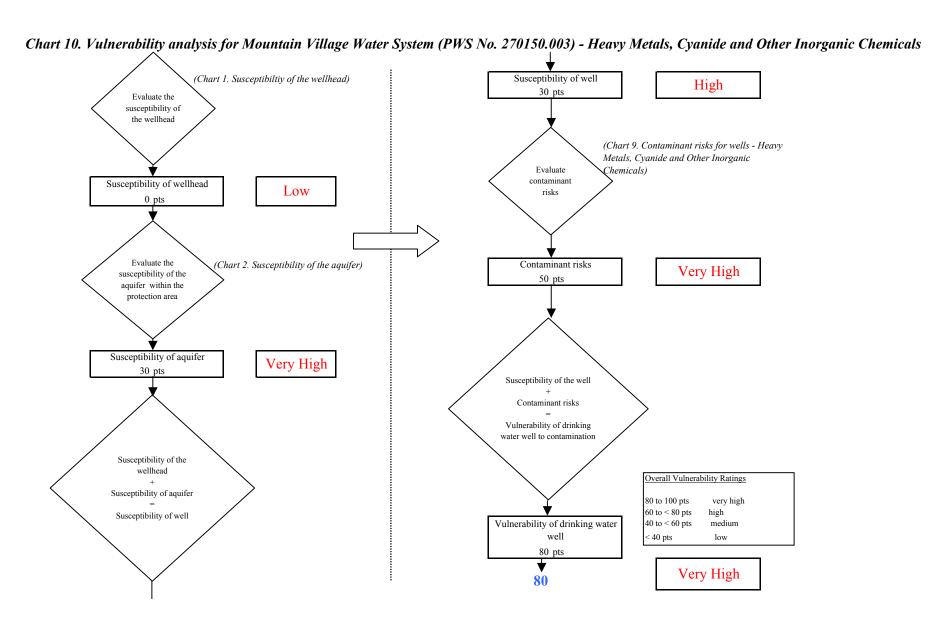
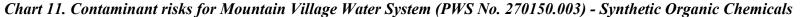
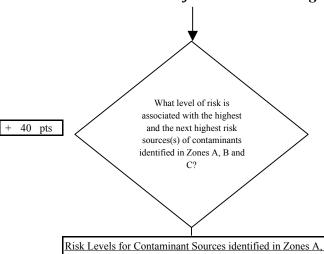


Chart 11. Contaminant risks for Mountain Village Water System (PWS No. 270150.003) - Synthetic Organic Chemicals Contaminant risks initially assumed to be low. Current level of Evaluate the level of Contaminant risks contamination due to manbackground = 0 ptscontamination from made source(s) natural sources 0 pts Is the concentration of UNKNOWN the contaminant Have synthetic organic increasing, decreasing, chemicals been detected or staying the same? in the source waters in recent sampling period(s)? Recent SOC Sampling Results (mg/L) No recent SOC sampling data was available in ADEC records for this PWSID Increasing: risk up 1 - 10 pts YES Decreasing: risk down 1 - 5 pts + 0 pts Same: risk unchanged Existing contamination points based on linear interpolation of most recent detect [MCL = 50 pts; detect = 0 pts]Risk due to natural Risk due to existing mansources made sources 0 pts 0 pts Risk due to existing contamination 0 pts Evaluate the level of Was the source of NO. contamination contamination from natural? man-made sources YES

Page 18 of 25

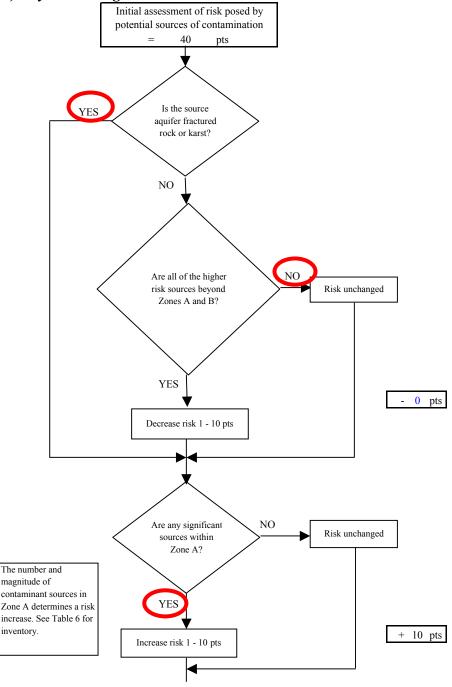


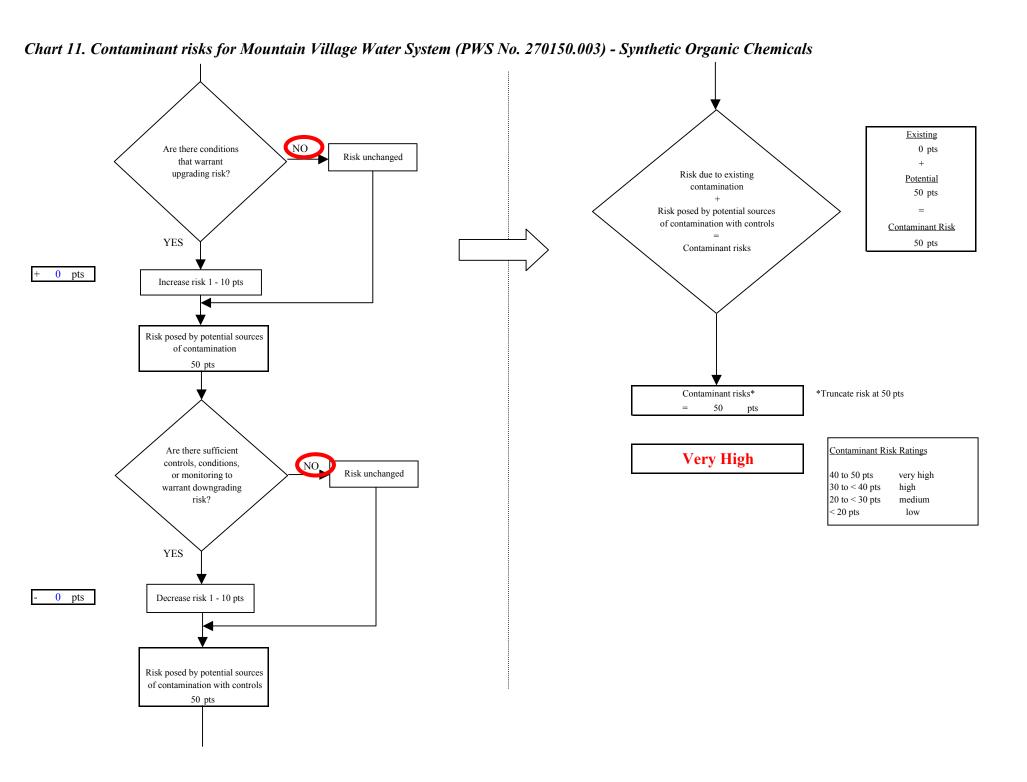


tisk Levels for Contaminant Sources identified in Zones A, B and C					
	Zone A	Zones B&C	Total		
Very Highs(s)	1	0	1		
High(s)	0	0	0		
Medium(s)	0	0	0		
Low(s)	0	0	0		

	LOW 10 pts	MEDIUM 20 pts	HIGH 30 pts	VERY HIGH 40 pts
LOW	≥ 10 sources + 10 pts	≥ 10 sources + 5 pts	≥ 20 sources + 5 pts	
MEDIUM		≥ 2 sources + 5 pts	≥ 5 sources + 5 pts	≥ 10 sources + 5 pts
HIGH			≥ 1 source + 10 pts	≥ 2 sources + 10 pts
VERY HIGH				≥ 1 source + 10 pts

Matrix Score 40





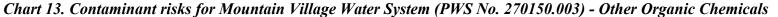
Page 20 of 25

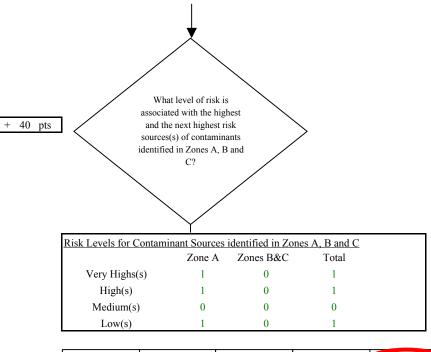
Chart 12. Vulnerability analysis for Mountain Village Water System (PWS No. 270150.003) - Synthetic Organic Chemicals Susceptibility of well (Chart 1. Susceptibiltiy of the wellhead) High 30 pts Evaluate the susceptibility of the wellhead (Chart 11. Contaminant risks for wells -Evaluate Synthetic Organic Chemicals) contaminant Susceptibility of wellhead Low risks 0 pts Evaluate the (Chart 2. Susceptibility of the aquifer) Contaminant risks Very High susceptibility of the 50 pts aguifer within the protection area Susceptibility of aquifer Very High 30 pts Susceptibility of the well Contaminant risks Vulnerability of drinking water well to contamination Susceptibility of the wellhead Overall Vulnerability Ratings Susceptibility of aquifer 80 to 100 pts very high 60 to < 80 pts high Susceptibility of well 40 to < 60 ptsVulnerability of drinking water medium well < 40 pts low 80 pts Very High 80

Page 21 of 25

Chart 13. Contaminant risks for Mountain Village Water System (PWS No. 270150.003) - Other Organic Chemicals Contaminant risks initially assumed to be Current level of Evaluate the level of Contaminant risks contamination due to manbackground = 0 ptscontamination from made source(s) natural sources NO or Is the concentration of UNKNOWN the contaminant Have other organic increasing, decreasing, chemicals been detected or staying the same? in the source waters in recent sampling period(s)? Recent OOC Sampling Results (mg/L) No recent OOC sampling data was available in ADEC records for this PWSID Increasing: risk up 1 - 10 pts YES Decreasing: risk down 1 - 5 pts + 0 pts Same: risk unchanged Existing contamination points based on linear interpolation of most recent detect [MCL = 50 pts; detect = 0 pts]Risk due to existing man-Risk due to natural made sources sources 0 pts 0 pts Risk due to existing contamination 0 pts Was the source of Evaluate the level of NO. contamination contamination from natural? man-made sources YES

Page 22 of 25





	LOW 10 pts	MEDIUM 20 pts	HIGH 30 pts	VERY HIGH 40 pts
LOW	≥ 10 sources + 10 pts	≥ 10 sources + 5 pts	≥ 20 sources + 5 pts	
MEDIUM		≥ 2 sources + 5 pts	≥ 5 sources + 5 pts	≥ 10 sources + 5 pts
HIGH			≥ 1 source + 10 pts	≥ 2 sources + 10 pts
VERY HIGH				≥ 1 source + 10 pts

Matrix Score 40

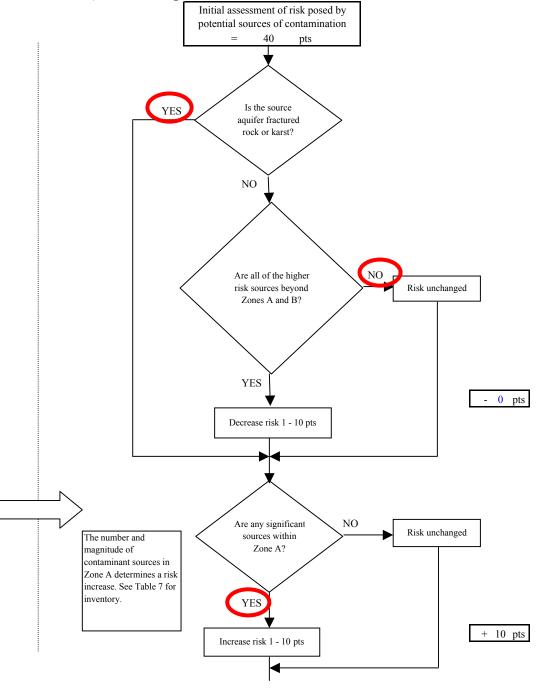
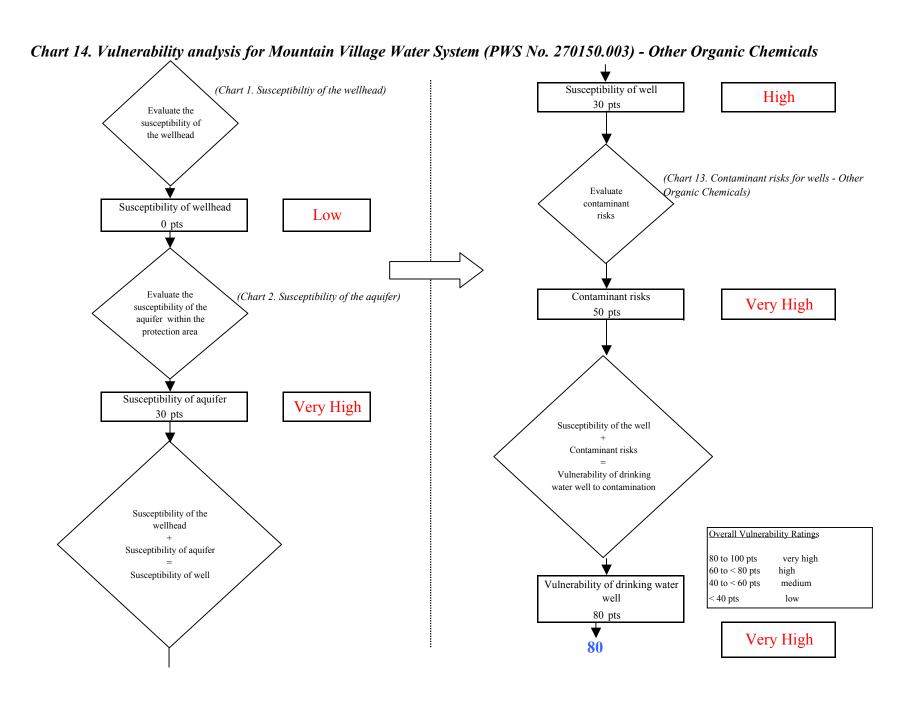


Chart 13. Contaminant risks for Mountain Village Water System (PWS No. 270150.003) - Other Organic Chemicals Existing NO Are there conditions 0 pts Risk unchanged that warrant upgrading risk? Risk due to existing Potential contamination 50 pts Risk posed by potential sources of contamination with controls Contaminant Risk YES 50 pts Contaminant risks 0 pts Increase risk 1 - 10 pts Risk posed by potential sources of contamination 50 pts Contaminant risks* *Truncate risk at 50 pts 50 Contaminant Risk Ratings Are there sufficient Very High controls, conditions, NO. Risk unchanged or monitoring to 40 to 50 pts very high 30 to < 40 ptswarrant downgrading high 20 to < 30 ptsrisk? medium < 20 pts low YES 0 pts Decrease risk 1 - 10 pts Risk posed by potential sources of contamination with controls 50 pts

Page 24 of 25



Page 25 of 25