



Source Water Assessment

A Hydrogeologic Susceptibility and Vulnerability Assessment for Koyukuk Safe Water Facility Drinking Water System, Koyukuk, Alaska

PWSID # 360214.001

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DRINKING WATER PROTECTION PROGRAM REPORT 1339 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.

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Source Water Assessment for the Koyukuk Safe Water Facility Source of Public Drinking Water, Koyukuk, Alaska

Drinking Water Protection Program Alaska Department of Environmental Conservation

EXECUTIVE SUMMARY

The Koyukuk Safe Water Facility has one Public Water System (PWS) well. The well (PWS No 360214.001) has been used as a drinking water source since it was drilled in November of 1975.

The well is a Class A (community and non-transient non-community) water system located directly outside of the washeteria in Koyukuk, Alaska. Available records indicate that there is secondary storage of drinking water, with a capacity of 5,000-gallons, and that the drinking water source is treated with calcium hypochlorite. This system operates year round and serves approximately 126 residents. The wellhead received a susceptibility rating of **Very High** and the aquifer received a susceptibility rating of **Medium** Combining these two ratings produce a **High** rating for the natural susceptibility of the well.

Identified potential and current sources of contaminants for the public drinking water source include water treatment facilities, fuel tanks, cemeteries, ADEC recognized contaminated sites, airports, power generation facilities, and bulk fuel facilities. A detailed inventory is located on Table 1 of Appendix B. 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, volatile organic chemicals, heavy metals, cyanide and other inorganic chemicals, synthetic organic chemicals, and other organic chemicals.

PUBLIC DRINKING WATER SYSTEM

The Koyukuk Safe Water Facility well is a Class A (community/non-transient/non-community) public water system. The system located directly outside the washeteria in Koyukuk, Alaska (Sec. 17, T007S,

R006E, Kateel River Meridian; see Map A of Appendix A). Koyukuk is located on the Yukon River near the mouth of the Koyukuk River, 30 miles west of Galena. Koyukuk has a population of 111 (ADCED, 2003). Average annual precipitation in Koyukuk is 13 inches, including approximately 60 inches of snowfall. Temperatures range from the 70's °F in summer and 10°F in the winter.

The community of Koyukuk obtains their water supply from the community well at the washeteria. Households are not plumbed, and residents haul honeybuckets to the sewage lagoon (ADCED, 2003). Koyukuk receives electrical power from the city of Koyukuk. Power generating facilities are fueled by diesel. Refuse is collected by individuals and transported to the landfill (ADCED, 2003).

According to information supplied by ADEC for the Koyukuk Safe Water Facility PWS, the depth of the well is 190 feet below the ground surface. It is unknown if the well is screened. The well is completed in a confined aquifer, and is located within a floodplain.

Information acquired from a February 1998 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 not grouted according to ADEC regulations. Proper grouting provides added protection against contaminants traveling along the well casing annulus and into source waters.

Koyukuk is located near the Nulato Hills, on the bank of the Yukon River. The hills are underlain by compact silt (loess) overlying colluvial and alluvial silt and sand underlain at varying depths by shale, siltstone, and muddy sandstone (I.H.S. 1994).

Soils in the area are generally characterized by moderately well-drained silts and sands (I.H.S. 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 Koyukuk Safe Water Facility 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

Zone	Definition
A	¹ / ₄ the distance for the 2-yr. time -of-travel
В	Less than the 2 year time-of-travel
C	Less Than the 5 year time -of-travel
D	Less than the 10 year time-of-travel

The DWPA for the Koyukuk Safe Water Facility PWS was determined using an analytical calculation and includes Zones A, B, C, 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 Koyukuk Safe Water Facility 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 7 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 Koyukuk Safe Water Facility's water well is completed in a confined aquifer. Confined aquifers are less 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	25	Very High
Wellhead		, ,
Susceptibility of the	13	Medium
Aquifer		
Natural Susceptibility	38	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 Chemica	ls 50	Very High
Heavy Metals, Cyanide and	ıd	
Other Inorganic Chemical	s 50	Very High
Synthetic Organic Chemic	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	90	Very High
Nitrates and Nitrites	90	Very High
Volatile Organic Chemicals	90	Very High
Heavy Metals, Cyanide and		
Other Inorganic Chemicals	90	Very High
Synthetic Organic Chemicals	90	Very High
Other Organic Chemicals	90	Very High

Bacteria and Viruses

The contaminant risk for bacteria and viruses is **Very High**. The risk is primarily attributed to the presence of wastewater treatment facilities located in Zone A and a landfill located in Zone B (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, 2002). Positive samples increase the overall vulnerability of the drinking water source, indicating that the source is susceptible to bacteria and virus contamination.

Positive bacteria counts have not 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 wastewater treatment facilities located in Zone A and a landfill located in Zone B (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 nitrate levels have all been below detection limits. 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. 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 bulk fuel facilities located in Zone A (see Table 4 – Appendix B).

Recent sampling data for VOC's indicated the presence of total trihalomethanes (TTHM's). TTHM's are generally a byproduct of water treatment and not indicative of source water conditions. Risk points were not assigned due to the TTHM's not exceeding the MCL in the most recent sampling events for Koyukuk Safe Water Facility (See Chart 7 – Contaminant Risks for Volatile Organic Chemicals in Appendix D).

Possible sources of VOC's include facilities with automobiles, residential areas, fuel tanks, and roads. See Table 4 in Appendix B 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 **Very 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 beryllium in recent sampling events and power generation facilities located in Zone A (see Table 5 – Appendix B).

Based on review of recent sampling records for this public water system, moderate levels of beryllium have been detected in recent sampling history, but have not exceeded the MCL of 0.004 mg/L (see Chart 8 – Contaminant Risks for Heavy Metals, Cyanide, and Other Inorganic Chemicals in Appendix D).

The greatest known naturally occurring concentrations of beryllium are found in certain pegmatite bodies. Certain fossil fuels contain beryllium compounds. Beryllium is not likely to be found in natural water above trace levels due to its relative insolubility. It has been reported to occur in US drinking water at 0.01 to 0.7 ug/L. EPA has found beryllium to potentially cause damage to bones and lungs from long-term exposure.

Although the source of beryllium is unknown, it is likely representative of source water conditions. See Table 5 for a complete listing of possible contaminant sources. 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 in Zone B (see Table 6 – Appendix B).

No recent sampling data was available in ADEC records for the Koyukuk Safe Water Facility (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 bulk fuel facilities in Zone A and a landfill in Zone B (see Table 7 – Appendix B).

No recent sampling data was available in ADEC records for the Koyukuk Safe Water Facility (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 Koyukuk 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.

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APPENDIX A

Drinking Water Protection Area Location Map (Map A)

APPENDIX B

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

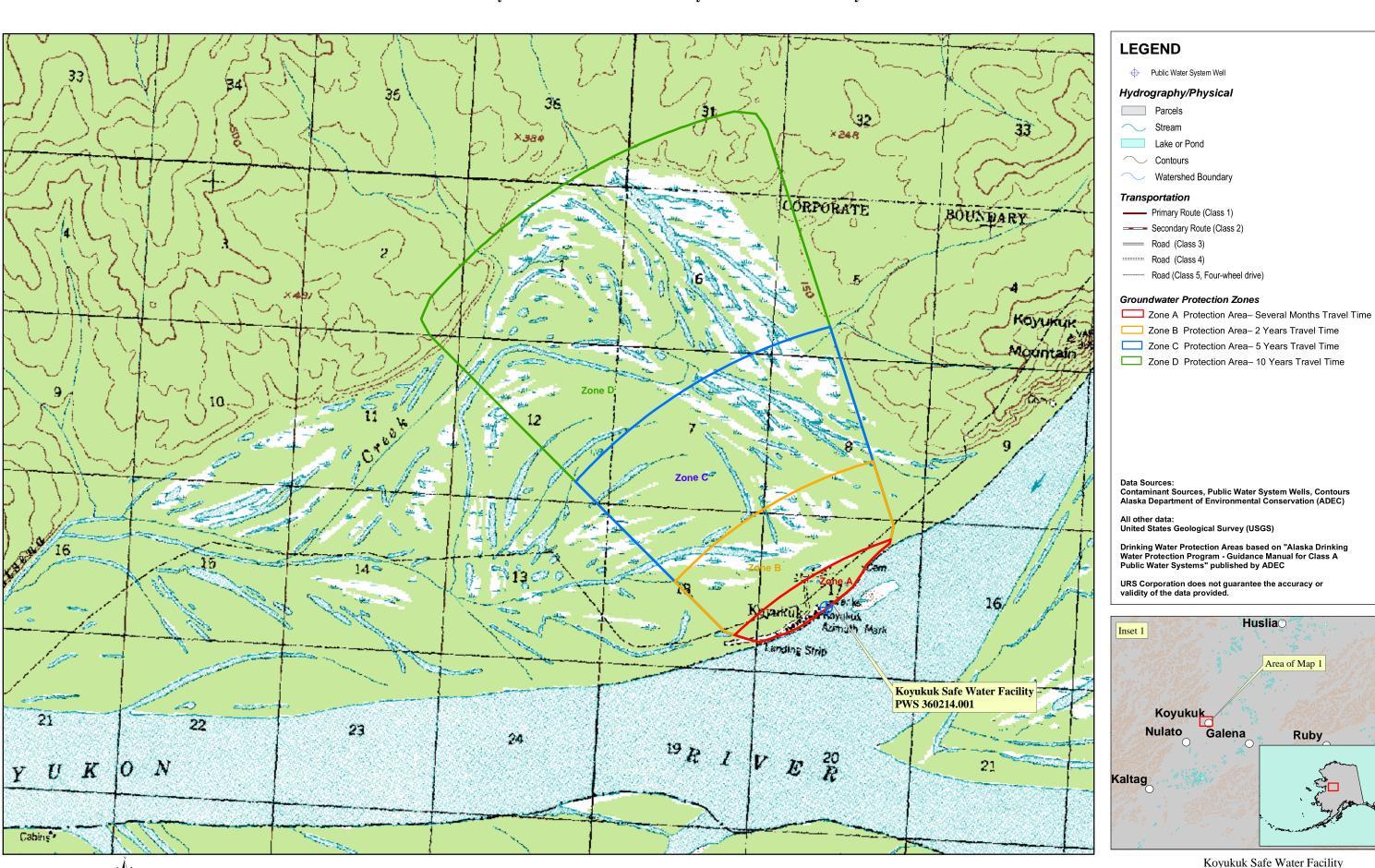
APPENDIX C

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

APPENDIX D

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

Public Water Well System for PWS #360214.001 Koyukuk Safe Water Facility



Koyukuk Safe Water Facility PWS 360214.001 Appendix A Map A

Contaminant Source Inventory for Koyukuk Safe Water Facility

PWSID 360214.001

Contaminant Source Type	Contaminant Source ID	CS ID tag	Zone	Map Number	Comments
Laundromats without dry cleaning	C22	C22-01	A	С	
Motor /motor vehicle repair shops	C31	C31-01	A	С	Airport DOT
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D01-01	A	С	Assume 2 or less sewer lines in Zone A
Domestic wastewater treatment plant disposal ponds/lagoons	D02	D02-01	A	С	
Domestic wastewater treatment plants	D05	D05-01	A	С	Sewage Lagoon
Pit toilets (open hole), nonresidential (one or more)	D16	D16-01	A	С	Assume 35 or less pit toilets/outhouses in Zone A
Septic systems (serves one single-family home)	R02	R02-01	A	С	Assume 3 or less septic systems in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-01	A	С	Assume 5 or less residential heating oil tanks in Zone A
Tanks, diesel (above ground)	T06	T06-01	A	С	School Backup Generator
Tanks, heating oil, nonresidential (aboveground)	T14	T14-01	A	С	City of Koyukuk Power Plant
Tanks, heating oil, nonresidential (aboveground)	T14	T14-02	A	С	Koyukuk Health Clinic
Tanks, heating oil, nonresidential (aboveground)	T14	T14-03	A	С	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-04	A	С	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-05	A	С	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-06	A	С	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-07	A	С	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-08	A	С	City and Tribal Storage Shed
Tanks, heating oil, nonresidential (aboveground)	T14	T14-09	A	С	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-10	A	С	City and Tribal Offices
Tanks, heating oil, nonresidential (aboveground)	T14	T14-11	A	С	Village Public Safety Officer
Tanks, heating oil, nonresidential (aboveground)	T14	T14-12	A	С	

Contaminant Source Type	Contaminant Source ID	CS ID tag	Zone	Map Number	Comments
Tanks, heating oil, nonresidential (aboveground)	T14	T14-13	A	С	City TV Receiver
Tanks, heating oil, nonresidential (aboveground)	T14	T14-14	A	С	School Internet Receiver
Tanks, heating oil, nonresidential (aboveground)	T14	T14-15	A	С	Ella B. Vernetti School
Tanks, heating oil, nonresidential (aboveground)	T14	T14-16	A	С	Preschool
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-01	A	С	Koyukuk Elementary School. Reckey: 1992310114601. Status: Inactive. Heating oil leak from above ground fuel line. Unknown quantity spilled/recovered, line now removed. Estimated approximate surface area of 2,500 square feet.
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-02	A	С	Koyukuk Elementary School. Reckey: 1992310114601. Status: Inactive. Heating oil leak from above ground fuel line. Unknown quantity spilled/recovered, line now removed. Estimated approximate surface area of 2,500 square feet.
Cemeteries	X01	X01-01	A	С	Cemetery 1
Cemeteries	X01	X01-02	A	С	Cemetery 2
Cemeteries	X01	X01-03	A	С	Cemetery 3
Petroleum product bulk station/terminals	X11	X11-01	A	С	City Electric Utility
Petroleum product bulk station/terminals	X11	X11-02	A	С	Pumphouse Tank
Petroleum product bulk station/terminals	X11	X11-03	A	С	YK Schools
Airports	X14	X14-01	A	С	KOYUKUK LANDING STRIP
Highways and roads, dirt/gravel	X24	X24-01	A	С	Assume 1-20 roads in Zone A
Electric power generation (fossil fuels)	X36	X36-01	A	С	City of Koyukuk Power Plant
Medical/veterinary facilities (doctor or dentist offices, hospitals, nursing homes)	X40	X40-01	A	С	Koyukuk Health Clinic
Landfills (municipal; Class III)	D51	D51-01	В	С	Koyukuk Landfill (New)

Table 2

Contaminant Source Inventory and Risk Ranking for Koyukuk Safe Water Facility Sources of Bacteria and Viruses

Contaminant Source Type	Contaminant Source ID	CS ID tag	Zone	Risk Ranking for Analysis	Map Number	Comments
Laundromats without dry cleaning	C22	C22-01	A	Low	C	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D01-01	A	Medium	С	Assume 2 or less sewer lines in Zone A
Domestic wastewater treatment plant disposal ponds/lagoons	D02	D02-01	A	High	С	
Domestic wastewater treatment plants	D05	D05-01	Α	Medium	C	Sewage Lagoon
Pit toilets (open hole), nonresidential (one or more)	D16	D16-01	A	Medium	С	Assume 35 or less pit toilets/outhouses in Zone A
Septic systems (serves one single-family home)	R02	R02-01	A	Low	C	Assume 3 or less septic systems in Zone A
Highways and roads, dirt/gravel	X24	X24-01	A	Low	С	Assume 1-20 roads in Zone A
Medical/veterinary facilities (doctor or dentist offices, hospitals, nursing homes)	X40	X40-01	A	Medium	С	Koyukuk Health Clinic
Landfills (municipal; Class III)	D51	D51-01	В	High	C	Koyukuk Landfill (New)

Table 3

Contaminant Source Inventory and Risk Ranking for Koyukuk Safe Water Facility Sources of Nitrates/Nitrites

Contaminant Source Type	Contaminant Source ID	CS ID tag	Zone	Risk Ranking for Analysis	Map Number	Comments
Laundromats without dry cleaning	C22	C22-01	A	Low	C	
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D01-01	A	Medium	С	Assume 2 or less sewer lines in Zone A
Domestic wastewater treatment plant disposal ponds/lagoons	D02	D02-01	A	High	С	
Domestic wastewater treatment plants	D05	D05-01	A	Medium	C	Sewage Lagoon
Pit toilets (open hole), nonresidential (one or more)	D16	D16-01	A	Medium	С	Assume 35 or less pit toilets/outhouses in Zone A
Septic systems (serves one single-family home)	R02	R02-01	A	Low	С	Assume 3 or less septic systems in Zone A
Cemeteries	X01	X01-01	A	Medium	С	Cemetery 1
Cemeteries	X01	X01-02	A	Medium	С	Cemetery 2
Cemeteries	X01	X01-03	A	Medium	С	Cemetery 3
Airports	X14	X14-01	A	Low	С	KOYUKUK LANDING STRIP
Highways and roads, dirt/gravel	X24	X24-01	A	Low	С	Assume 1-20 roads in Zone A
Medical/veterinary facilities (doctor or dentist offices, hospitals, nursing homes)	X40	X40-01	A	Low	С	Koyukuk Health Clinic
Landfills (municipal; Class III)	D51	D51-01	В	Very High	С	Koyukuk Landfill (New)

Table 4

Contaminant Source Inventory and Risk Ranking for Koyukuk Safe Water Facility Sources of Volatile Organic Chemicals

Contaminant Source Type	Contaminant Source ID	CS ID tag	Zone	Risk Ranking for Analysis	Map Number	Comments
Laundromats without dry cleaning	C22	C22-01	A	Low	С	
Motor /motor vehicle repair shops	C31	C31-01	A	Medium	С	Airport DOT
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D01-01	A	Low	С	Assume 2 or less sewer lines in Zone A
Domestic wastewater treatment plant disposal ponds/lagoons	D02	D02-01	A	Low	С	
Domestic wastewater treatment plants	D05	D05-01	A	Low	C	Sewage Lagoon
Pit toilets (open hole), nonresidential (one or more)	D16	D16-01	A	Low	С	Assume 35 or less pit toilets/outhouses in Zone A
Septic systems (serves one single-family home)	R02	R02-01	A	Low	С	Assume 3 or less septic systems in Zone A
Tanks, heating oil, residential (above ground)	R08	R08-01	A	Medium	C	Assume 5 or less residential heating oil tanks in Zone A
Tanks, diesel (above ground)	T06	T06-01	A	Medium	C	School Backup Generator
Tanks, heating oil, nonresidential (aboveground)	T14	T14-01	A	Low	C	City of Koyukuk Power Plant
Tanks, heating oil, nonresidential (aboveground)	T14	T14-02	A	Low	C	Koyukuk Health Clinic
Tanks, heating oil, nonresidential (aboveground)	T14	T14-03	A	Low	С	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-04	A	Low	С	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-05	A	Low	С	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-06	A	Low	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-07	A	Low	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-08	A	Low	С	City and Tribal Storage Shed
Tanks, heating oil, nonresidential (aboveground)	T14	T14-09	A	Low	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-10	A	Low	С	City and Tribal Offices

Table 4 (continued)

Contaminant Source Inventory and Risk Ranking for Koyukuk Safe Water Facility Sources of Volatile Organic Chemicals

Contaminant Source Type	Contaminant Source ID	CS ID tag	Zone	Risk Ranking for Analysis	Map Number	Comments
Tanks, heating oil, nonresidential (aboveground)	T14	T14-11	A	Low	С	Village Public Safety Officer
Tanks, heating oil, nonresidential (aboveground)	T14	T14-12	A	Low	С	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-13	A	Low	С	City TV Receiver
Tanks, heating oil, nonresidential (aboveground)	T14	T14-14	A	Low	С	School Internet Receiver
Tanks, heating oil, nonresidential (aboveground)	T14	T14-15	A	Low	С	Ella B. Vernetti School
Tanks, heating oil, nonresidential (aboveground)	T14	T14-16	A	Low	С	Preschool
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-01	A	High	С	Koyukuk Elementary School. Reckey: 1992310114601. Status: Inactive. Heating oil leak from above ground fuel line. Unknown quantity spilled/recovered, line now removed. Estimated approximate surface area of 2,500 square feet.
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-02	A	High	С	Koyukuk Elementary School. Reckey: 1992310114601. Status: Inactive. Heating oil leak from above ground fuel line. Unknown quantity spilled/recovered, line now removed. Estimated approximate surface area of 2,500 square feet.
Petroleum product bulk station/terminals	X11	X11-01	A	Very High	С	City Electric Utility
Petroleum product bulk station/terminals	X11	X11-02	A	Very High	С	Pumphouse Tank
Petroleum product bulk station/terminals	X11	X11-03	A	Very High	С	YK Schools
Airports	X14	X14-01	A	High	С	KOYUKUK LANDING STRIP
Highways and roads, dirt/gravel	X24	X24-01	A	Low	С	Assume 1-20 roads in Zone A
Electric power generation (fossil fuels)	X36	X36-01	A	Medium	C	City of Koyukuk Power Plant
Medical/veterinary facilities (doctor or dentist offices, hospitals, nursing homes)	X40	X40-01	A	Low	С	Koyukuk Health Clinic
Landfills (municipal; Class III)	D51	D51-01	В	High	C	Koyukuk Landfill (New)

Table 5

Contaminant Source Inventory and Risk Ranking for Koyukuk Safe Water Facility 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
Motor /motor vehicle repair shops	C31	C31-01	A	Medium	С	Airport DOT
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D01-01	A	Low	С	Assume 2 or less sewer lines in Zone A
Domestic wastewater treatment plant disposal ponds/lagoons	D02	D02-01	A	Low	С	
Domestic wastewater treatment plants	D05	D05-01	A	Low	С	Sewage Lagoon
Pit toilets (open hole), nonresidential (one or more)	D16	D16-01	A	Low	C	Assume 35 or less pit toilets/outhouses in Zone A
Septic systems (serves one single-family home)	R02	R02-01	A	Low	C	Assume 3 or less septic systems in Zone A
Tanks, heating oil, nonresidential (aboveground)	T14	T14-01	A	Low	C	City of Koyukuk Power Plant
Tanks, heating oil, nonresidential (aboveground)	T14	T14-02	A	Low	С	Koyukuk Health Clinic
Tanks, heating oil, nonresidential (aboveground)	T14	T14-03	A	Low	С	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-04	A	Low	С	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-05	A	Low	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-06	A	Low	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-07	A	Low	C	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-08	A	Low	С	City and Tribal Storage Shed
Tanks, heating oil, nonresidential (aboveground)	T14	T14-09	A	Low	С	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-10	A	Low	С	City and Tribal Offices
Tanks, heating oil, nonresidential (aboveground)	T14	T14-11	A	Low	С	Village Public Safety Officer
Tanks, heating oil, nonresidential (aboveground)	T14	T14-12	A	Low	С	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-13	A	Low	С	City TV Receiver

Table 5 (continued)

Contaminant Source Inventory and Risk Ranking for Koyukuk Safe Water Facility 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
Tanks, heating oil, nonresidential (aboveground)	T14	T14-14	A	Low	C	School Internet Receiver
Tanks, heating oil, nonresidential (aboveground)	T14	T14-15	A	Low	С	Ella B. Vernetti School
Tanks, heating oil, nonresidential (aboveground)	T14	T14-16	A	Low	С	Preschool
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-01	A	Low	С	Koyukuk Elementary School. Reckey: 1992310114601. Status: Inactive. Heating oil leak from above ground fuel line. Unknown quantity spilled/recovered, line now removed. Estimated approximate surface area of 2,500 square feet.
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-02	A	Low	С	Koyukuk Elementary School. Reckey: 1992310114601. Status: Inactive. Heating oil leak from above ground fuel line. Unknown quantity spilled/recovered, line now removed. Estimated approximate surface area of 2,500 square feet.
Cemeteries	X01	X01-01	A	Low	C	Cemetery 1
Cemeteries	X01	X01-02	Α	Low	C	Cemetery 2
Cemeteries	X01	X01-03	Α	Low	C	Cemetery 3
Petroleum product bulk station/terminals	X11	X11-01	A	Low	C	City Electric Utility
Petroleum product bulk station/terminals	X11	X11-02	A	Low	C	Pumphouse Tank
Petroleum product bulk station/terminals	X11	X11-03	A	Low	C	YK Schools
Airports	X14	X14-01	A	Low	C	KOYUKUK LANDING STRIP
Highways and roads, dirt/gravel	X24	X24-01	A	Low	C	Assume 1-20 roads in Zone A
Electric power generation (fossil fuels)	X36	X36-01	A	Medium	C	City of Koyukuk Power Plant
Medical/veterinary facilities (doctor or dentist offices, hospitals, nursing homes)	X40	X40-01	A	Low	С	Koyukuk Health Clinic
Landfills (municipal; Class III)	D51	D51-01	В	High	C	Koyukuk Landfill (New)

Table 6

Contaminant Source Inventory and Risk Ranking for Koyukuk Safe Water Facility Sources of Synthetic Organic Chemicals

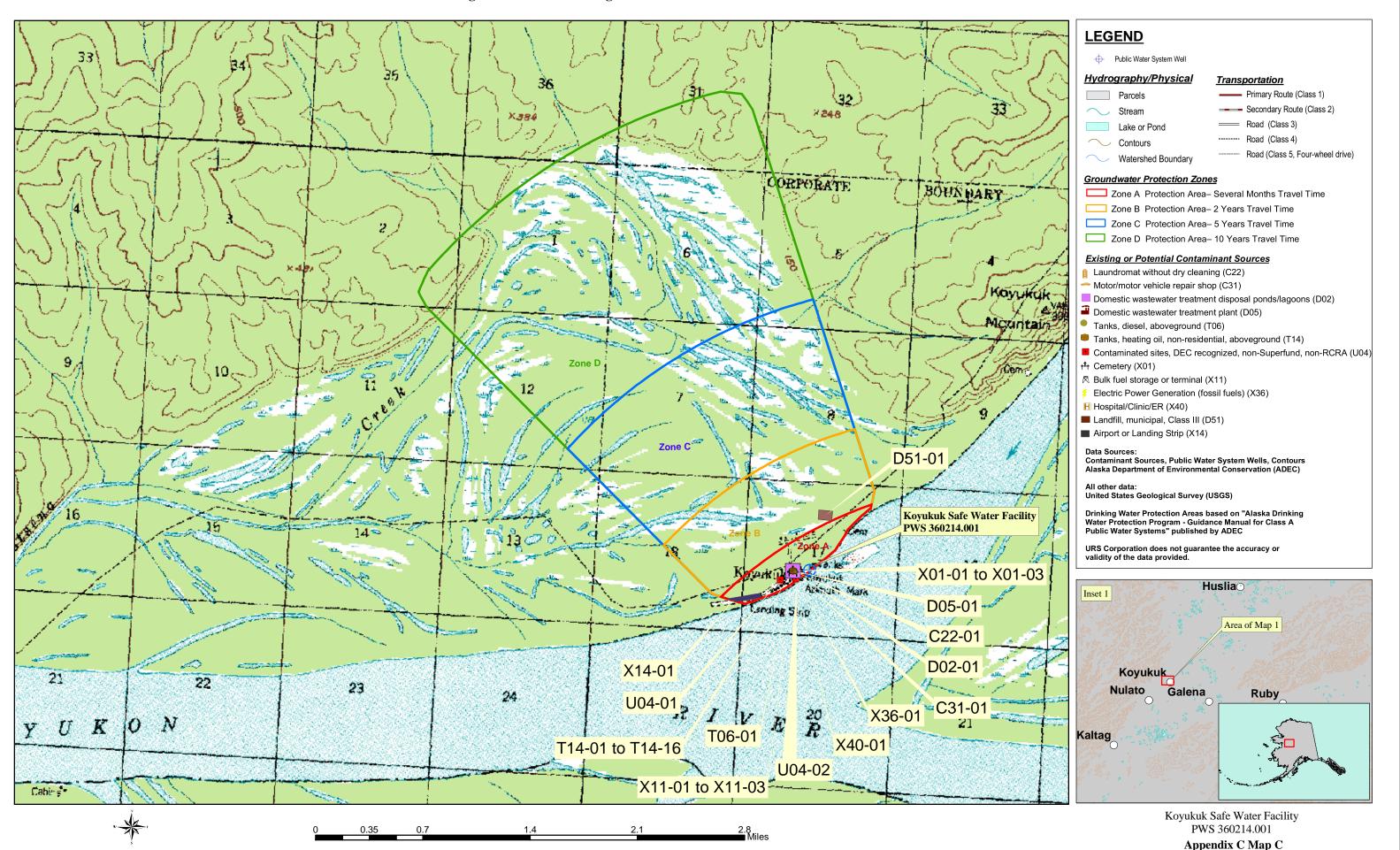
Contaminant Source Type	Contaminant Source ID	CS ID tag	Zone	Risk Ranking for Analysis	Map Number	Comments
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D01-01	A	Low	С	Assume 2 or less sewer lines in Zone A
Domestic wastewater treatment plant disposal ponds/lagoons	D02	D02-01	A	Low	C	
Domestic wastewater treatment plants	D05	D05-01	A	Low	C	Sewage Lagoon
Septic systems (serves one single-family home)	R02	R02-01	A	Low	C	Assume 3 or less septic systems in Zone A
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-01	A	Low	С	Koyukuk Elementary School. Reckey: 1992310114601. Status: Inactive. Heating oil leak from above ground fuel line. Unknown quantity spilled/recovered, line now removed. Estimated approximate surface area of 2,500 square feet.
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-02	A	Low	С	Koyukuk Elementary School. Reckey: 1992310114601. Status: Inactive. Heating oil leak from above ground fuel line. Unknown quantity spilled/recovered, line now removed. Estimated approximate surface area of 2,500 square feet.
Cemeteries	X01	X01-01	A	Medium	С	Cemetery 1
Cemeteries	X01	X01-02	A	Medium	С	Cemetery 2
Cemeteries	X01	X01-03	A	Medium	С	Cemetery 3
Petroleum product bulk station/terminals	X11	X11-01	A	Low	С	City Electric Utility
Petroleum product bulk station/terminals	X11	X11-02	A	Low	С	Pumphouse Tank
Petroleum product bulk station/terminals	X11	X11-03	A	Low	С	YK Schools
Airports	X14	X14-01	A	Medium	С	KOYUKUK LANDING STRIP
Medical/veterinary facilities (doctor or dentist offices, hospitals, nursing homes)	X40	X40-01	A	Low	С	Koyukuk Health Clinic
Landfills (municipal; Class III)	D51	D51-01	В	Very High	C	Koyukuk Landfill (New)

Table 7

Contaminant Source Inventory and Risk Ranking for Koyukuk Safe Water Facility Sources of Other Organic Chemicals

Contaminant Source Type	Contaminant Source ID	CS ID tag	Zone	Risk Ranking for Analysis	Map Number	Comments
Motor /motor vehicle repair shops	C31	C31-01	A	Medium	С	Airport DOT
Domestic wastewater collection systems (sewer lines or lift stations)	D01	D01-01	A	Low	С	Assume 2 or less sewer lines in Zone A
Domestic wastewater treatment plant disposal ponds/lagoons	D02	D02-01	A	Low	С	
Domestic wastewater treatment plants	D05	D05-01	A	Low	C	Sewage Lagoon
Septic systems (serves one single-family home)	R02	R02-01	A	Low	С	Assume 3 or less septic systems in Zone A
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-01	A	Low	С	Koyukuk Elementary School. Reckey: 1992310114601. Status: Inactive. Heating oil leak from above ground fuel line. Unknown quantity spilled/recovered, line now removed. Estimated approximate surface area of 2,500 square feet.
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-02	A	Low	С	Koyukuk Elementary School. Reckey: 1992310114601. Status: Inactive. Heating oil leak from above ground fuel line. Unknown quantity spilled/recovered, line now removed. Estimated approximate surface area of 2,500 square feet.
Petroleum product bulk station/terminals	X11	X11-01	A	High	C	City Electric Utility
Petroleum product bulk station/terminals	X11	X11-02	A	High	С	Pumphouse Tank
Petroleum product bulk station/terminals	X11	X11-03	A	High	С	YK Schools
Airports	X14	X14-01	A	Medium	С	KOYUKUK LANDING STRIP
Highways and roads, dirt/gravel	X24	X24-01	A	Low	С	Assume 1-20 roads in Zone A
Electric power generation (fossil fuels)	X36	X36-01	A	High	С	City of Koyukuk Power Plant
Landfills (municipal; Class III)	D51	D51-01	В	Very High	С	Koyukuk Landfill (New)

Public Water Well System for PWS #360214.001 Koyukuk Safe Water Facility Showing Potential and Existing Sources of Contamination



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

Chart 1. Susceptibility of the wellhead - Koyukuk Safe Water Facility (PWS No. 360214.001)

Chart 2. Susceptibility of the aquifer Koyukuk Safe Water Facility (PWS No. 360214.001)

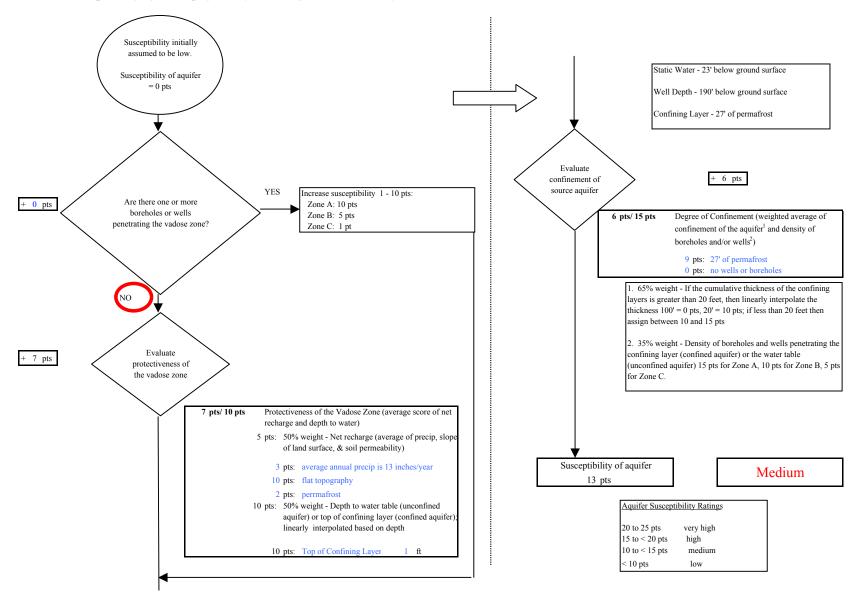


Chart 3. Contaminant risks for Koyukuk Safe Water Facility (PWS No. 360214.001) - Bacteria & Viruses

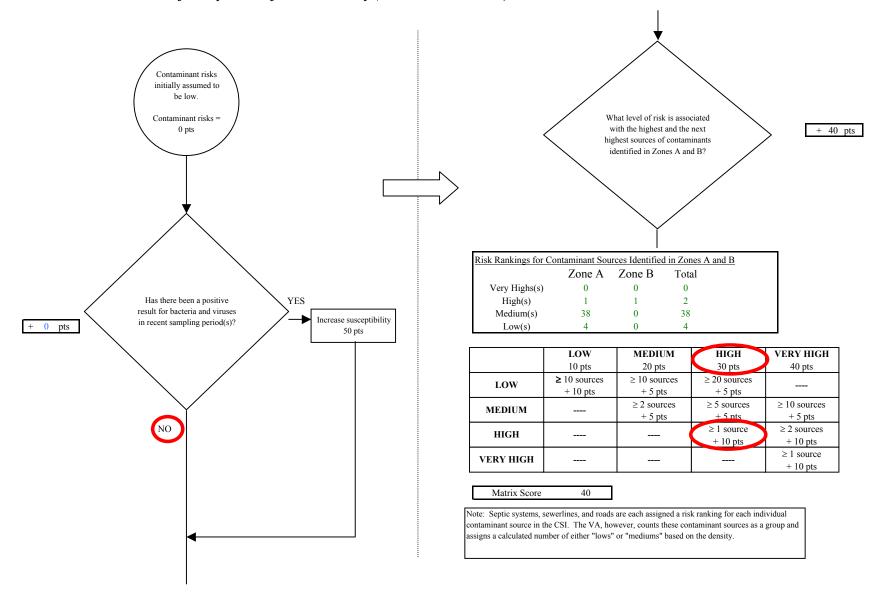


Chart 3. Contaminant risks for Koyukuk Safe Water Facility (PWS No. 360214.001) - Bacteria & Viruses NO Are there sufficient Initial assessment of risk posed by Risk unchanged controls, conditions, or potential sources of contamination monitoring to warrant = 40 pts downgrading risk? Are any YES significant 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 50 + 10 pts Increase risk 1 - 10 pts inventory. Existing Risk due to existing 0 pts contamination Are there any conditions that Risk unchanged Risk posed by potential sources warrant upgrading Potential of contamination with controls risk? 50 pts Contaminant risks Contaminant Risk YES 50 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 30 to < 40 pts high Very High $20 \text{ to} \le 30 \text{ pts}$

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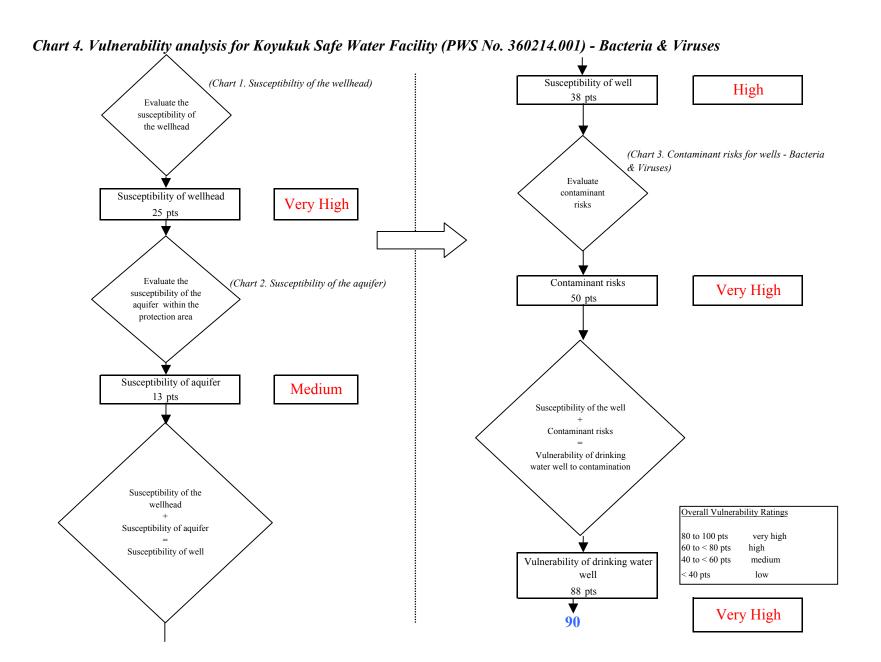
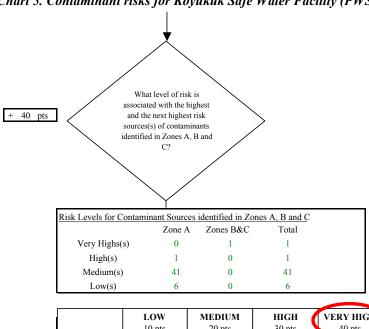


Chart 5. Contaminant risks for Koyukuk Safe Water Facility (PWS No. 360214.001) - Nitrates and Nitrites Contaminant risks initially assumed to be low. Current level of Evaluate the level of Contaminant risks background contamination due to man-= 0 pts contamination from made source(s) natural sources Is the concentration of NO Has nitrates and/or 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) All recent Nitrate and Nitrite sampling data was below detection levels (ND) Increasing: risk up 1 - 10 pts YES Decreasing: risk down 1 - 5 pts + 0 pts Same: risk unchanged 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]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

Chart 5. Contaminant risks for Koyukuk Safe Water Facility (PWS No. 360214.001) - 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

Note: Septic systems, sewerlines, and roads are each assigned a risk ranking for each individua contaminant source in the CSI. The VA, however, counts these contaminant sources as a group and assigns a calculated number of either "lows" or "mediums" based on the density.

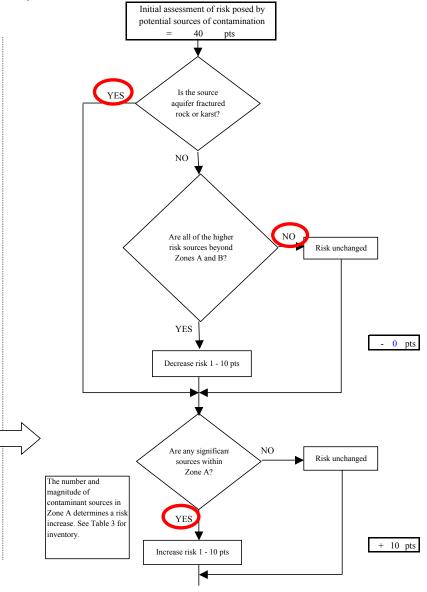


Chart 5. Contaminant risks for Koyukuk Safe Water Facility (PWS No. 360214.001) - Nitrates and Nitrites Existing NO Are there conditions 0 pts Risk unchanged that warrant upgrading risk? Risk due to existing Potential contamination 50 pts The number and magnitude of Risk posed by potential sources contaminant sources in of contamination with controls Contaminant Risk Zone D determines a risk YES 50 pts increase. See Table 3 for Contaminant risks inventory. 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 warrant downgrading 30 to < 40 pts 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

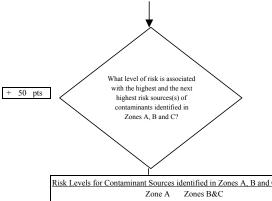
(Chart 1. Susceptibiltiy of the wellhead) Susceptibility of well High 38 pts Evaluate the susceptibility of the wellhead (Chart 5. Contaminant risks for wells - Nitrates and Nitrites) Evaluate Susceptibility of wellhead contaminant risks Very High 25 pts Evaluate the (Chart 2. Susceptibility of the aquifer) Contaminant risks Very High susceptibility of the 50 pts aquifer within the protection area Susceptibility of aquifer Medium 13 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 88 pts Very High 90

Chart 6. Vulnerability analysis for Koyukuk Safe Water Facility (PWS No. 360214.001) - Nitrates and Nitrites

Chart 7. Contaminant risks for Koyukuk Safe Water Facility (PWS No. 360214.001) - Volatile Organic Chemicals Contaminant risks initially assumed to be Current level of Evaluate the level of Contaminant risks background contamination due to man-=0 pts contamination from made source(s) Although other analytes may have reported natural sources 22 pts above detection limits in recent sampling events, the analyte reporting the highest percent MCL exceedence was used for assessing risk points. Points are based on linear interpolation of most recent detect [MCL = 50 pts; detect = 0 pts] Is the concentration of the NO contaminant increasing, Have volatile organic decreasing, or staying the chemicals been detected ir same? the source waters in recent Risk was downgraded sampling period(s)? because TTHMs are a Recent VOC Sampling Results (mg/L) byproduct of water treatment and the MCI Total Trihalomethanes (TTHMs) 11/20/2002 ND was not exceeded in 12/9/1999 0.0356 recent sample result. YES Increasing: risk up 1 - 10 pts Decreasing: risk down 1 - 5 pts + -22 pts Same: risk unchanged Maximum Contaminant Level (MCL) in mg/L % of MCI TTHMs 0.08 45% Risk due to natural Risk due to existing mansources made sources 0 pts 0 pts Existing contamination points based on linear interpolation of most recen detect [MCL = 50 pts; detect = 0 pts] Risk due to existing contamination 0 pts NO. Was the source of Evaluate the level of contamination contamination from mannatural? made sources YES

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	Zone A	Zones B&C	Total
Very Highs(s)	3	0	3
High(s)	3	1	4
Medium(s)	8	0	8
Low(s)	58	0	58

	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 50

Note: Septic systems, sewerlines, and roads are each assigned a risk ranking for each individual contaminant source in the CSI. The VA, however, counts these contaminant sources as a group and assigns a calculated number of either "lows" or "mediums" based on the density.

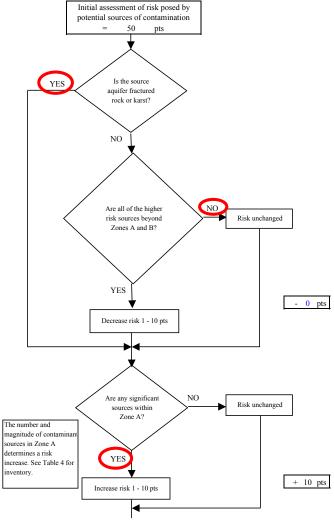


Chart 7. Contaminant risks for Koyukuk Safe Water Facility (PWS No. 360214.001) - Volatile Organic Chemicals Existing NO Are there conditions 0 pts Risk unchanged that warrant upgrading Risk due to existing risk? Potential contamination The number and 60 pts magnitude of Risk posed by potential sources contaminant sources in of contamination with controls Contaminant Risk Zone D determines a risk YES increase. See Table 4 for 60 pts Contaminant risks inventory. + 0 pts Increase risk 1 - 10 pts Risk posed by potential sources of contamination 60 pts *Truncate risk at 50 pts Contaminant risks* 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

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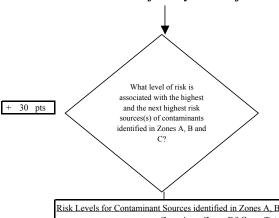
Chart 8. Vulnerability analysis for Koyukuk Safe Water Facility (PWS No. 360214.001) - Volatile Organic Chemicals Susceptibility of well (Chart 1. Susceptibiltiy of the wellhead) High 38 pts Evaluate the susceptibility of the wellhead (Chart 7. Contaminant risks for wells - Volatile Organic Chemicals) Evaluate Susceptibility of wellhead contaminant risks Very High 25 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 Medium 13 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 88 pts Very High 90

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Chart 9. Contaminant risks for Koyukuk Safe Water Facility (PWS No. 360214.001) - Heavy Metals, Cyanide and Other Inorganic 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 19 pts The greatest known NO or Is the concentration of naturally occurring Have heavy metals, UNKNOWN the contaminant concentrations of cyanide or other inorganic increasing, decreasing, beryllium are found in chemicals been detected or staying the same? certain pegmatite bodies. in the source waters in Certain fossil fuels contain recent sampling period(s)? beryllium compounds. Recent Metals Sampling Results (mg/L) Beryllium is not likely to 12/9/1999 0.0015 be found in natural water Beryllium above trace levels due to its relative insolubility. It has been reported to occur in US drinking water at YES 0.01 to 0.7ug/L. EPA has Increasing: risk up 1 - 10 pts found beryllium to Decreasing: risk down 1 - 5 pts + 0 pts potentially cause damage Same: risk unchanged to bones and lungs from Maximum Contaminant long-term exposure. Although other inorganic compounds have Level (MCL) (mg/L) % of MCI been detected in previous sampling events, Beryllium= beryllium has reported the highest percent MCL values in the past 5 years. Risk due to existing man-Risk due to natural Existing contamination points based on linear sources made sources interpolation of most recent detect [MCL = 50 pts; 0 pts 19 pts detect = 0 ptsRisk due to existing contamination 19 pts Evaluate the level Was the source of NO. of contamination contamination from man-made natural? sources YES

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Chart 9. Contaminant risks for Koyukuk Safe Water Facility (PWS No. 360214.001) - Heavy Metals, Cyanide and Other Inorganic Chemicals

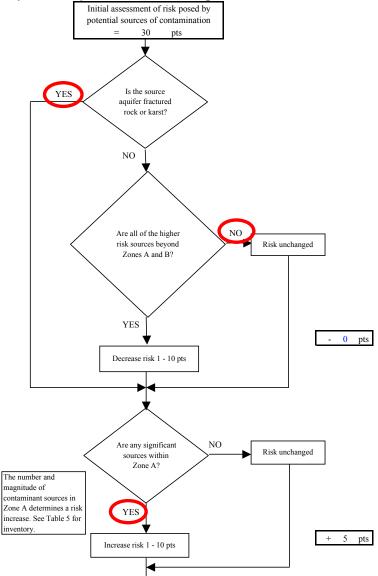


Risk Levels for Contaminant Sources identified in Zones A, B and C						
	Zone A	Zones B&C	Total			
Very Highs(s)	0	0	0			
High(s)	0	1	1			
Medium(s)	2	0	2			
Low(s)	66	0	66			

	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

Note: Septic systems, sewerlines, and roads are each assigned a risk ranking for each individual contaminant source in the CSI. The VA, however, counts these contaminant sources as a group and assigns a calculated number of either "lows" or "mediums" based on the density.



Existing Are there conditions 19 pts Risk unchanged upgrading risk? Risk due to existing Potential contamination 35 pts The number and magnitude of Risk posed by potential sources contaminant sources in of contamination with controls Contaminant Risk Zone D determines a YES 54 pts risk increase. See Table Contaminant risks 5 for inventory. 0 pts Increase risk 1 - 10 pts Risk posed by potential sources of contamination 35 pts Contaminant risks* *Truncate risk at 50 pts 50 Contaminant Risk Ratings Are there sufficient **Very High** NQ controls, conditions, Risk unchanged 40 to 50 pts very high or monitoring to 30 to < 40 pts warrant downgrading high risk? 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 35 pts

Chart 9. Contaminant risks for Koyukuk Safe Water Facility (PWS No. 360214.001) - Heavy Metals, Cyanide and Other Inorganic Chemicals

Chart 10. Vulnerability analysis for Koyukuk Safe Water Facility (PWS No. 360214.001) - Heavy Metals, Cyanide and Other Inorganic Chemicals (Chart 1. Susceptibiltiy of the wellhead) Susceptibility of well High 38 pts Evaluate the susceptibility of the wellhead (Chart 9. Contaminant risks for wells - Heavy Metals, Cyanide and Other Inorganic Evaluate Chemicals) contaminant Susceptibility of wellhead Very High risks 25 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 Medium 13 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 pts Vulnerability of drinking water medium well 40 pts 88 pts Very High 90

Chart 11. Contaminant risks for Koyukuk Safe Water Facility (PWS No. 360214.001) - Synthetic Organic Chemicals Contaminant risks initially assumed to be low. Current level of Evaluate the level of Contaminant risks background contamination due to man-= 0 ptscontamination from made source(s) natural sources NO or Is the concentration of Have synthetic organic UNKNOWN the contaminant chemicals been detected increasing, decreasing, in the source waters in or staying the same? 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 Was the source of Evaluate the level of NO. contamination contamination from man-made sources YES

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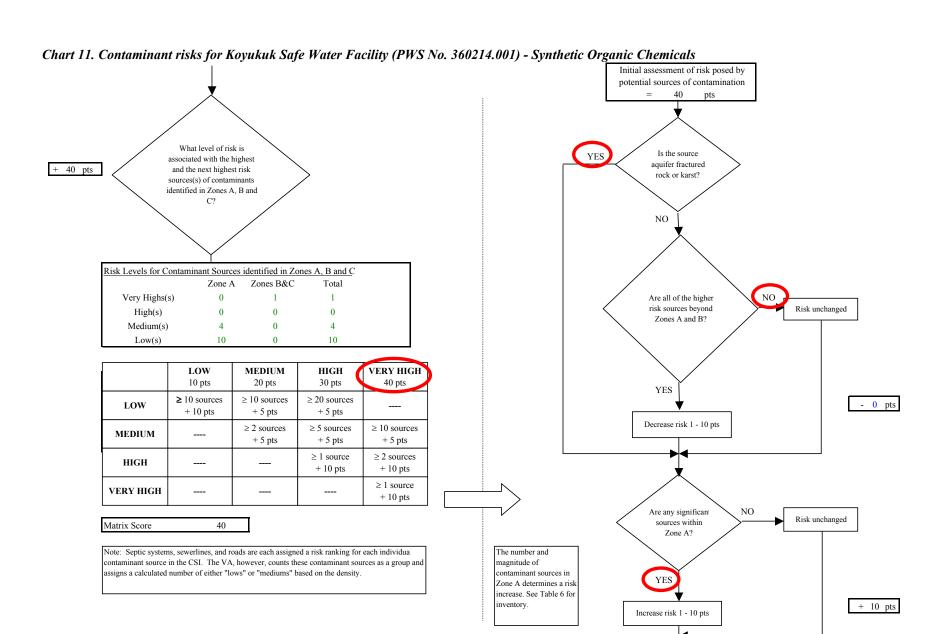
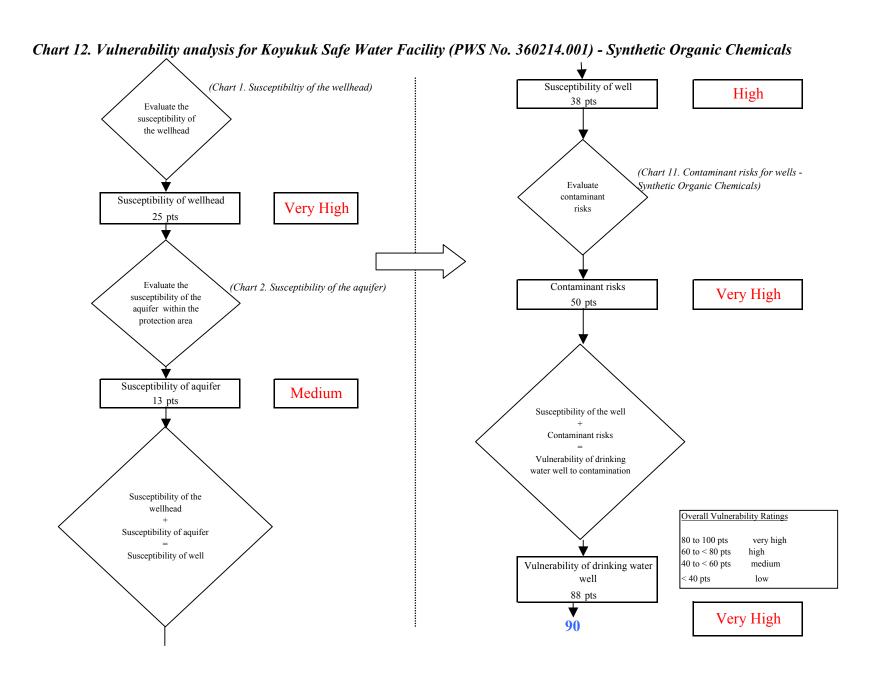


Chart 11. Contaminant risks for Koyukuk Safe Water Facility (PWS No. 360214.001) - Synthetic Organic Chemicals Existing NO Are there conditions 0 pts Risk unchanged that warrant upgrading risk? Risk due to existing Potential contamination 50 pts The number and magnitude of Risk posed by potential sources contaminant sources in of contamination with controls Contaminant Risk Zone D determines a risk YES 50 pts increase. See Table 6 for Contaminant risks inventory. 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 warrant downgrading 30 to < 40 pts 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

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Chart 13. Contaminant risks for Koyukuk Safe Water Facility (PWS No. 360214.001) - Other Organic Chemicals Contaminant risks initially assumed to be low. Current level of Evaluate the level of Contaminant risks background contamination due to man-= 0 ptscontamination from made source(s) natural sources NO or Is the concentration of Have other organic UNKNOWN the contaminant chemicals been detected increasing, decreasing, in the source waters in or staying the same? 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 natural Risk due to existing mansources made sources 0 pts 0 pts Risk due to existing contamination 0 pts Was the source of Evaluate the level of NO. contamination from natural? man-made sources YES

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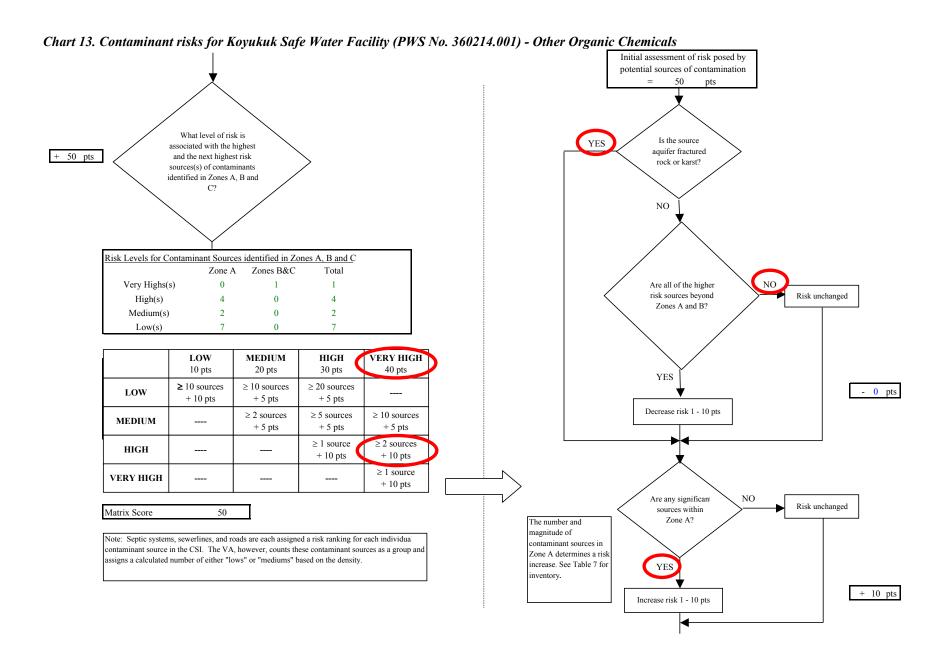


Chart 13. Contaminant risks for Koyukuk Safe Water Facility (PWS No. 360214.001) - Other Organic Chemicals Existing Are there conditions 0 pts Risk unchanged that warrant upgrading risk? Risk due to existing Potential contamination 60 pts The number and magnitude of Risk posed by potential sources contaminant sources in of contamination with controls Contaminant Risk Zone D determines a risk YES 60 pts increase. See Table 7 for Contaminant risks inventory. 0 pts Increase risk 1 - 10 pts Risk posed by potential sources of contamination 60 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 warrant downgrading 30 to < 40 pts 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

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