Source Water Assessment

A Hydrogeologic Susceptibility and Vulnerability Assessment for AK Premium Foods West Drinking Water System,
Wasilla, Alaska
PWSID 224806

November 2006

DRINKING WATER PROTECTION REPORT Report 1585
Alaska Department of Environmental Conservation

Source Water Assessment for AK Premium Foods West Drinking Water System Wasilla, Alaska PWSID 224806

October 2006

DRINKING WATER PROTECTION REPORT Report 1585

The Drinking Water Protection (DWP) section of the Drinking Water Program 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 DWP, (907) 269-7521.

CONTENTS

TABLES

APPENDICES

Source Water Assessment for AK Premium Foods West Source of Public Drinking Water, Wasilla, Alaska

Drinking Water Protection
Alaska Department of Environmental Conservation

EXECUTIVE SUMMARY

This source water assessment provides an evaluation of the vulnerability of the public water system serving the AK Premium Foods West to potential contamination. This Class A (community) water system consists of one well off of Pittman Road in Wasilla. The well received a natural susceptibility rating of **Medium**. This rating is a combination of a susceptibility rating of **Low** for the actual wellhead and a **Very High** rating for the aquifer in which the well is drawing water from. Identified potential and current sources of contamination for the AK Premium Foods West public water system include: motor vehicle repair shops, injection wells, residential areas, septic systems, under/aboveground storage tanks, ADEC recognized contaminated sites, abandoned wells, monitoring wells, and roads. These are considered as sources of bacteria and viruses, nitrates and/or nitrites, volatile organic chemicals (VOCs), heavy metals, cyanide, and other inorganic chemicals, synthetic organic chemicals (SOCs), and other organic chemicals (OOCs). Combining the natural susceptibility of the well with the contaminant risk, the public water system for AK Premium Foods West received an overall vulnerability rating of **High** for VOCs, OOCs, nitrates and/or nitrites, heavy metals, cyanide, and other inorganic chemicals, bacteria and viruses, and SOCs.

AK PREMIUM FOODS WEST PUBLIC DRINKING WATER SYSTEM

AK Premium Foods West public water system is a Class A (community) water system within the Meadow Creek Watershed. The system consists of one well off of the Parks Highway on Pittman Road.

The Meadow Creek watershed, located in south-central Alaska, lies within the Matanuska-Susitna Borough. The Borough encompasses 24,694 square miles and supports a population in 2000 of 59,322. The Borough's close proximity to Anchorage and its abundance of surface-water resources has helped contribute to rapid growth over the last two decades. The population has tripled since 1980. The projected growth rate is expected to be 3.3% per year, three times higher than the state rate (ADOL, 1999).

The Borough is contained within the watersheds of the Matanuska and Susitna Rivers which flow from the glacier melt waters in the Alaska Range, Talkeetna Mountains, and the Chugach Mountains to tidewater in the Knik Arm of Upper Cook Inlet (Jokela, Munter and Evans, 1991). The area between the Matanuska and Susitna Valley is commonly referred to as the Mat-Su Valley. The Meadow Creek watershed contains 115 lakes, including Big Lake, and extends from an area northwest of Wasilla to the west end of Big Lake (Jokela, Munter and Evans, 1991).

Surface elevations in the Matanuska-Susitna Borough range from sea level where the Knik River and Matanuska River enter the Cook Inlet to well over 6,000 feet in the peaks that bound the area. Glacial moraine and outwash deposits primarily mantle the surface of the Mat-Su Valley.

The regional geology and ground water conditions of the Mat-Su Valley vary greatly depending on location. The terrain is dominated by distinctive landforms created by repeated glacial advances and retreats during the Pleistocene epoch (2 million to 10,000 years before present). The unconsolidated layers, layers of sediment that are not cemented together, are comprised of various mixtures of fine- to coarse-grained particles (clay to boulders). The majority of wells in the Mat-Su Valley are located in unconsolidated layers consisting of relatively well sorted sands and gravels. These unconsolidated layers vary substantially in size and distribution throughout the Valley. In general, the unconsolidated layers increase in thickness as you move towards Cook Inlet. (Jokela, Munter, Evans, 1991). Throughout the area numerous confining layers ranging from less than 1- to 60- feet thick separate the unconsolidated layers.

In the Mat-Su Valley, the groundwater is primarily recharged by snowmelt and precipitation infiltrating into the foothill slopes of the Talkeetna or Chugach Mountains and by direct precipitation and snowmelt throughout the study area.

Groundwater flow in the confined aquifer is generally, north to south in the central region of the valley, toward the Matanuska River in the eastern region and the slope is predominantly northeast to northwest in the western region. The groundwater flow direction in upper unconfined aquifers is more variable due to influence from surficial topography as well as its close

connection with surface water bodies. (Jokela, Munter and Evans, 1991).

The AK Premium Foods West public water system serves approximately 160 non-residents through 3 service connections.

AK PREMIUM FOODS WEST DRINKING WATER PROTECTION AREA

The pathways most likely for surface contamination to reach the groundwater are identified as the first step in determining a drinking water system's risk. 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 capture zone. The groundwater capture zone is located in the area circling the well (the area influenced by pumping) and also the area of the water table upgradient of the well, usually forming a parabola shape.

There are many different methods for calculating the size of capture zones. Drinking Water Protection (DWP) uses a combination of two simple groundwater flow equations, the Thiem and uniform flow equations for all groundwater wells screened in unconsolidated material. The orientation of the capture zone is then drawn using a water table elevation map (if available) or a land surface elevation map of the area. The capture zone calculated by the DWP is an estimate using the available information and resources, and may differ slightly from the actual capture zone.

The parameters used to calculate the shape of this capture zone are general for the whole alluvial plain and were obtained from various United States Geological Survey (USGS) reports, area well logs, and the Groundwater textbook by Freeze and Cherry (Freeze and Cherry, 1979).

Because of uncertainties and changing site conditions, a factor of safety is added to the groundwater capture zone to form the drinking water protection area for the well.

The protection areas established for wells are usually separated into two zones, limited by the watershed. These zones correspond to times-of-travel (TOT) of the water moving through the aquifer to the well (plus the factor of safety).

The following is a summary of the two zones for wells and the calculated time-of-travel for each:

Table 1. Definition of Zones

Zone	Definition
A	Several months travel time
B	Less than 2 years time-of-travel

The time of travel for contaminants within the water varies with their unique physical and chemical characteristics.

The drinking water protection area outlined for the AK Premium Foods West on Map 1 of Appendix A will serve as the focus for voluntary protection efforts.

INVENTORY OF POTENTIAL AND EXISTING CONTAMINANT SOURCES

Drinking Water Protection (DWP) has completed an inventory of potential and existing sources of contamination within the AK Premium Foods West protection area. This inventory was completed through a search of agency records and other publicly available information. 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; and
- Other organic chemicals.

The sources are displayed on Map 2 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 each 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 combination of toxicity and volume associated with that source. Rankings include:

- Low
- Medium
- High
- Very High

Tables 2 through 7 in Appendix B contain the ranking of inventoried 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 chemical

VULNERABILITY OF AK PREMIUM FOODS WEST DRINKING WATER SYSTEM

The vulnerability of public drinking water systems to regulated contaminants is determined by assessing the susceptibility of the wellhead, the susceptibility of the aquifer and the potential contaminant sources identified within the protection area.

The Drinking Water Protection developed a vulnerability assessment tool that assigns a vulnerability risk ranking based upon various factors associated with the well, aquifer and potential and existing contaminants identified within the protection area.

Factors contributing to the susceptibility of the wellhead are: whether the sanitary seal in place, protection from flooding, and if the well casing is properly grouted.

The wellhead for the AK Premium Foods West received a **Low** susceptibility rating. Plan review information from 2005 indicates the well is capped with a sanitary seal, the land surface is sloped away from the well, and the well is grouted. A sanitary seal prevents potential contaminant from entering the well while sloping of the land surface and grouting help to prevent potential contaminants from traveling down the outside of the well casing.

Factors contributing to the susceptibility of the aquifer are: whether the aquifer is confined or unconfined, whether the well is completed in unconsolidated or fractured bedrock, whether wells and bore holes are penetrating the aquifer and, if applicable, the confining layer.

The aquifer the AK Premium Foods West well is completed in received a **Very High** susceptibility rating. The highly transmissive aquifer material and the high water table in the area allow contaminants to travel downward from the surface with the precipitation and surface water runoff. In addition, the presence of boreholes within the protection area may provide contaminants a direct route to the groundwater. Table 2 summarizes the Susceptibility scores and ratings for AK Premium Foods West.

Table 2: Susceptibility

	Rating
Susceptibility of the Wellhead	Low
Susceptibility of the Aquifer	Very High
Natural Susceptibility	Medium

The Contaminant Risk has been derived from an evaluation of the routine sampling results of the water system and the presence of potential sources of contamination. Contaminant risks to a drinking water source depend on the type and distribution of contaminant sources.

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

Table 3. Contaminant Risks

Category	Rating
Bacteria and Viruses	Very High
Nitrates and/or Nitrites	Very High
Volatile Organic Chemicals	Very High
Heavy Metals, Cyanide, and Other Inorganic Chemicals	Very High
Synthetic Organic Chemicals	Very High
Other Organic Chemicals	Very High

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

Natural Susceptibility
+
Contaminant Risks
=
Vulnerability of the
Drinking Water Source to Contamination

Table 4 contains the overall ratings for each of the six categories of drinking water contaminants.

Table 4. Overall Vulnerability

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

Bacteria and Viruses

Abandoned wells and Class V injection wells in the protection area represent the greatest risk for bacteria and viruses to the drinking water well. For a complete listing of potential sources for bacteria and virus contamination please see Table 2 in Appendix B.

Only a small amount of bacteria and viruses are required to endanger public health. Coliforms are found naturally in the environment and although they aren't necessarily a health threat, it is 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 (EPA, 2006). Harmful bacteria can cause diarrhea, cramps, nausea, headaches, or other symptoms (EPA, 2006). No samples have tested positive for coliforms in recent history.

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 high.

Nitrates and Nitrites

Abandoned wells and Class V injection wells in the protection area also represent the greatest risk to to nitrates and nitrites for this source of public drinking water. For a complete listing of potential sources for nitrate and nitrite contamination please see Table 3 in Appendix B.

Nitrates are very mobile, moving at approximately the same rate as water. Nitrates have not been detected in recent sampling history for the AK Premium Foods West well.

After combining the contaminant risk for nitrates and nitrites with the natural susceptibility of the well, the overall vulnerability of the well to contamination is high.

Volatile Organic Chemicals

Underground gasoline tanks and abandoned wells represent the greatest identified risk for volatile organic chemical contamination to the well. For a complete listing of potential sources for bacteria and virus contamination please see Table 4 in Appendix B.

Volatile Organic Chemicals have not been detected within source waters. 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

Abandoned wells and underground gasoline tanks represent the greatest risk for inorganic chemicals to the well. For a complete listing of potential sources for bacteria and virus contamination please see Table 5 in Appendix B.

Inorganic chemicals were sampled on 9/26/2005, and none were detected. However, on 6/24/2005 arsenic was detected at 395% of its maximum contaminant level (MCL). The MCL for arsenic is 0.01 mg/L. In greater quantities, arsenic is known to cause skin damage, problems with circulatory systems, and may create an increased risk of developing cancer (EPA, 2006).

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 high.

Synthetic Organic Chemicals

Abandoned wells represent the greatest risk for synthetic organic chemicals to the well. For a complete listing of potential sources for bacteria and virus contamination please see Table 6 in Appendix B.

Synthetic organic chemicals have not been sampled for in this water system.

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

Other Organic Chemicals

Abandoned wells represent the greatest risk for other organic chemicals to the well. For a complete listing of potential sources for bacteria and virus contamination please see Table 7 in Appendix B.

Other organic chemicals have not been sampled for in this water system.

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

REFERENCES

Freeze, R.A. and Cherry, J.A., 1979. Groundwater. Prentice-Hall, Englewood Cliffs, NJ.

United States Environmental Protection Agency (EPA), 2006 [WWW document]. URL http://www.epa.gov/safewater/mcl.html.

Alaska Department of Labor, State of Alaska 2001 [WWW document]. URL http://146.63.75.45/census2000/

Jokela, J.B., Munter, J.A., and Evans, J.G., 1991, Ground-water resources of the Palmer-Big Lake area, Alaska: a conceptual model. Division of Geological & Geophysical Surveys Reports of Investigations 90-4, State of Alaska Department of Natural Resources, Fairbanks, AK.

APPENDIX A

AK Premium Foods West
Drinking Water Protection Area Location Map
(Map 1)

Map 1- AK Premium Foods West and Surrounding Water Systems

PWSID: 224806.001

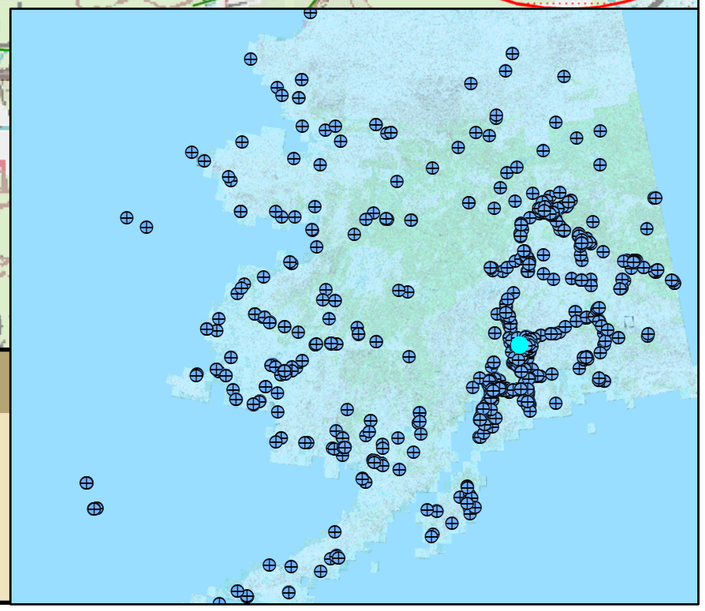
Alaska Department of Environmental Conservation

Alaska Drinking Water Protection Program

0 1:19,249 Feet 4,600

Data Sources:
Kenai Borough: Roads and parcels
Aerial Photo: USGS and Microsoft Terraserver
Potential Sources of Contamination: ADEC

- Public Water Sources
- Zone A Protection Area
- Zone B Protection Area



APPENDIX B

Contaminant Source Inventory and Risk Ranking for AK Premium Foods West (Tables 1-7)

Table 1

Contaminant Source Inventory for ***Alaska Premium Foods West***

PWSID 224806.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Map Number*	*Comments*
Motor /motor vehicle repair shops	C31	C31-1	A		
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1-2	A		
Residential Areas	R01	R01-1-8	A		8 acres in Zone A.
Septic systems (serves one single-family home)	R02	R02-1-3	A		
Tanks, gasoline (underground)	T12	T12-1	A		
Tanks, heating oil, nonresidential (aboveground)	T14	T14-1-2	A		
Contaminated sites, DEC recognized, non-Superfund, non-RCRA	U04	U04-1	A		
Abandoned wells	W01	W01-1	A		
Monitoring wells	W06	W06-1-3	A		
Highways and roads, paved (cement or asphalt)	X20	X20-1-3	A		
Residential Areas	R01	R01-9-23	B		14 acres in Zone B.
Highways and roads, paved (cement or asphalt)	X20	X20-4-5	B		

Table 2

Contaminant Source Inventory and Risk Ranking for Alaska Premium Foods West Sources of Bacteria and Viruses

PWSID 224806.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1-2	A	High		
Residential Areas	R01	R01-1-8	A	Low		8 acres in Zone A.
Septic systems (serves one single-family home)	R02	R02-1-3	A	Low		
Abandoned wells	W01	W01-1	A	Medium		
Highways and roads, paved (cement or asphalt)	X20	X20-1-3	A	Low		
Residential Areas	R01	R01-9-23	B	Low		14 acres in Zone B.
Highways and roads, paved (cement or asphalt)	X20	X20-4-5	B	Low		

Table 3

Contaminant Source Inventory and Risk Ranking for Alaska Premium Foods West Sources of Nitrates/Nitrites

PWSID 224806.001

Contaminant Source Type	***Contaminant Source ID***	***CS ID tag***	***Zone***	***Risk Ranking for Analysis***	***Map Number***	***Comments***
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1-2	A	High		
Residential Areas	R01	R01-1-8	A	Low		8 acres in Zone A.
Septic systems (serves one single-family home)	R02	R02-1-3	A	Low		
Abandoned wells	W01	W01-1	A	High		
Highways and roads, paved (cement or asphalt)	X20	X20-1-3	A	Low		
Residential Areas	R01	R01-9-23	B	Low		14 acres in Zone B.
Highways and roads, paved (cement or asphalt)	X20	X20-4-5	B	Low		

Table 4

Contaminant Source Inventory and Risk Ranking for Alaska Premium Foods West Sources of Volatile Organic Chemicals

PWSID 224806.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1-2	A	Low		
Residential Areas	R01	R01-1-8	A	Low		8 acres in Zone A.
Septic systems (serves one single-family home)	R02	R02-1-3	A	Low		
Tanks, gasoline (underground)	T12	T12-1	A	High		
Tanks, heating oil, nonresidential (aboveground)	T14	T14-1-2	A	Low		
Abandoned wells	W01	W01-1	A	High		
Highways and roads, paved (cement or asphalt)	X20	X20-1-3	A	Low		
Residential Areas	R01	R01-9-23	B	Low		14 acres in Zone B.
Highways and roads, paved (cement or asphalt)	X20	X20-4-5	B	Low		

Table 5

Contaminant Source Inventory and Risk Ranking for Alaska Premium Foods West

Sources of Heavy Metals, Cyanide and Other Inorganic Chemicals

PWSID 224806.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1-2	A	Low		
Residential Areas	R01	R01-1-8	A	Low		8 acres in Zone A.
Septic systems (serves one single-family home)	R02	R02-1-3	A	Low		
Tanks, gasoline (underground)	T12	T12-1	A	Medium		
Tanks, heating oil, nonresidential (aboveground)	T14	T14-1-2	A	Low		
Abandoned wells	W01	W01-1	A	Very High		
Highways and roads, paved (cement or asphalt)	X20	X20-1-3	A	Low		
Residential Areas	R01	R01-9-23	B	Low		14 acres in Zone B.
Highways and roads, paved (cement or asphalt)	X20	X20-4-5	B	Low		

Table 6

Contaminant Source Inventory and Risk Ranking for Alaska Premium Foods West Sources of Synthetic Organic Chemicals

PWSID 224806.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1-2	A	Low		
Residential Areas	R01	R01-1-8	A	Low		8 acres in Zone A.
Septic systems (serves one single-family home)	R02	R02-1-3	A	Low		
Abandoned wells	W01	W01-1	A	High		
Residential Areas	R01	R01-9-23	B	Low		14 acres in Zone B.

Table 7

Contaminant Source Inventory and Risk Ranking for Alaska Premium Foods West Sources of Other Organic Chemicals

PWSID 224806.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Map Number*	*Comments*
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-1-2	A	Low		
Residential Areas	R01	R01-1-8	A	Low		8 acres in Zone A.
Septic systems (serves one single-family home)	R02	R02-1-3	A	Low		
Abandoned wells	W01	W01-1	A	High		
Highways and roads, paved (cement or asphalt)	X20	X20-1-3	A	Low		
Residential Areas	R01	R01-9-23	B	Low		14 acres in Zone B.
Highways and roads, paved (cement or asphalt)	X20	X20-4-5	B	Low		

APPENDIX C

AK Premium Foods West
Drinking Water Protection Area and
Potential and Existing Contaminant Sources
(Map 2)

5 Roads
3 Zone A
2 Zone B

23 acres of residential land use
8 in Zone A
14 in Zone B

5 Septics in Zone A

8 "Others" in Zone A

Zone A
Zone B
parcels
MSB_roads selection 2
Public Water Sources
septics_msb selection
W06
W01
U04
T14
T12
C31

Map 2- AK Premium Foods West Potential Contaminants

PWSID: 224806.001

Alaska Department of Environmental Conservation

Alaska Drinking Water Protection Program

0 1:5,367 Feet 1,420

Data Sources:
Kenai Borough: Roads and parcels
Aerial Photo: USGS and Microsoft Terraserver
Potential Sources of Contamination: ADEC