SENECA FOODS, WASTEWATER TREATMENT PLANT CLASS II INSPECTION

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ABSTRACT

A Class II Inspection was conducted at the Port of Benton wastewater treatment plant in Prosser, Washington on May 1-2, 1990.

The wastewater generated at the plant was treated by a system consisting of settling lagoons, an aerated lagoon, and land application of the effluent on three sprayfields. This discharge is regulated under a state waste discharge permit. Non-contact cooling water discharges separately into the Yakima River and is regulated under an NPDES permit.

The aerated lagoon was not adequately pretreating the wastewater prior to slow rate land application. Turbidity, total suspended solids, total nonvolatile suspended solids, and alkalinity were all present in greater concentrations in the effluent stream than in the influent to the aerated lagoon indicating that minimal treatment was occurring. The effluent stream from the aerated lagoon was characterized as having elevated concentrations of arsenic, lead, zinc, acetone, methyl ethyl ketone, and toluene. The effluent also exhibited high toxicity.

The impact of the waste treatment system was apparent from an inspection of the analytical results obtained from ground water samples collected from two monitoring wells adjacent to the sprayfield area. The downgradient monitoring well typically contained a higher level of solids, some nutrients and some metals compared to the upgradient monitoring well. Ground water is anaerobic as illustrated by the presence of ferrous iron and the accompanying absence of nitrate. The lagoons are unlined and apparently losing as much as 60% of the wastewater to evaporation and seepage. This may contribute to the observed results.

A second round of sampling was conducted on January 10, 1991, to see if the aerated lagoon sludge and a nearby occurrence of an orange slime (iron bacteria) were hazardous. Another objective was to compare the results of analyzing the metals content of iron bacteria samples from the Seneca facility and a control site. TCLP analysis on these samples showed that although both samples contained some metals in varying concentrations, these were not hazardous. These findings suggest that iron bacteria and the associated metals are not unique to the Seneca facility. Metals associated with the iron bacteria were also not readily available to higher trophic levels.

Installation of additional monitoring wells, dredging of the settling lagoons and aerated lagoon, installation of a lining in the aerated lagoon, and separating the wastewater from two other dischargers (Hogue and Holtzinger) are recommended to provide better treatment of the Seneca effluent generated at this site.

INTRODUCTION

A Class II Inspection was conducted at the Port of Benton Wastewater Treatment Facility (WTF) on May 1-2, 1990. Limited follow-up sampling was conducted on January 10, 1991. The Port is engaged in providing wastewater treatment and disposal service for three industries located in the Port's Industrial Park just east of Prosser in Benton County. The Port has contracted the operation of the wastewater system to one of the tenants of the industrial park. The operator is Seneca Foods (Seneca), which is also the largest discharger to the system. They operate an apple and grape juice processing plant, and wastewater is generated predominantly as a by-product of this processing. City of Prosser water is used for general cleaning purposes. C. M. Holtzinger apple packers and Hogue Winery also discharge wastewater to the WTF. The facility location is described in Figure 1.

The WTF consists of settling lagoons and an aerated lagoon followed by treatment in a slow rate land application system. The aerated lagoon has a volume of 5 million gallons. Four small settling lagoons precede the aerated lagoon. At any given time, only three lagoons may be in use while the other is drying sludge prior to dredging. By use of three settling lagoons, a combined volume of approximately one million gallons is available for settling treatment before the wastewater enters the aerated lagoon.

The WTF is presently regulated under a state waste discharge permit, ST 5523. Seneca has received a new state waste discharge permit which expands and shifts the lagoon and sprayfield operations to a much larger site across the Yakima River. Seneca's non-contact cooling water discharges separately into the Yakima River as regulated under NPDES permit #WA-002136-9.

The inspection also included sampling at a spring which was located adjacent to the Yakima River between the lagoon/sprayfield complex and the river. An orange slime (subsequently identified as a type of iron bacteria) was noted near the spring and was also sampled as part of the inspection. Iron bacteria have been reported in association with other springs along the Yakima River, and one of these growths was later sampled for chemical comparison with the iron bacteria located at the Seneca facility.

The Class II inspection was requested by Cindy George of Ecology's Central Regional Office (CRO). The inspection was conducted by Pat Hallinan of the Environmental Investigations and Laboratory Services (EILS) Program with assistance from Denis Erickson of EILS. Kathy Doig-Ellertson, Technical Manager of Seneca, provided on-site assistance. The investigational report was written by Tom Nell of EILS and Bob Raforth of the Central Regional Office (CRO). The objectives of the investigation were to:

1) Evaluate the efficiency of the settling and aerated lagoon treatment system;

2) Chemically characterize plant intake water, untreated plant wastewater, and aerated lagoon effluent;

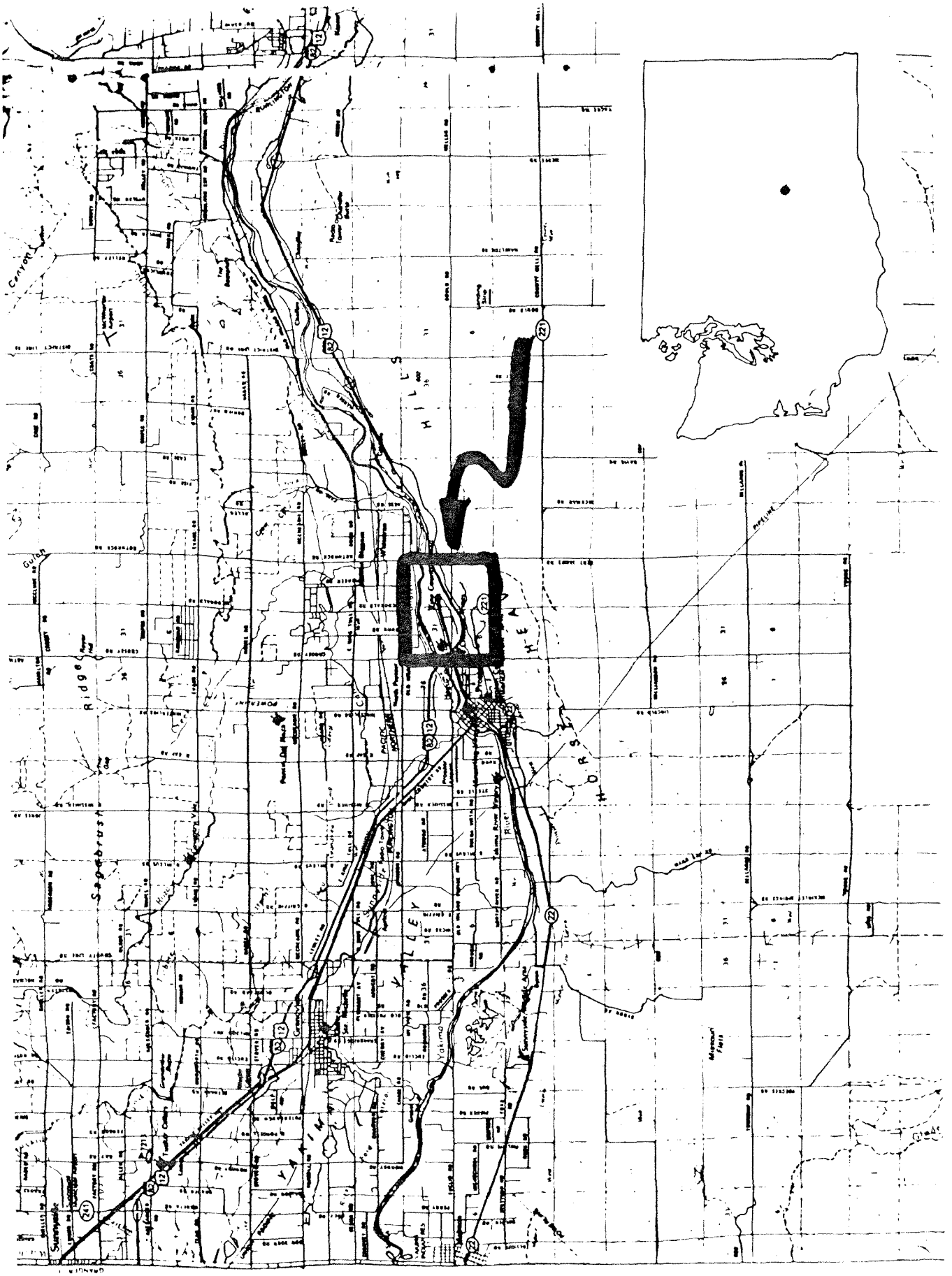

Figure 1. Port of Benton Wastewater Treatment Facility (WWTF).

3) Assess the toxicity of aerated lagoon effluent;

4) Evaluate Seneca's sampling and flow measurement procedure;

5) Chemically characterize ground water collected from the two monitoring wells;

6) Chemically characterize water collected at a spring found near the aerated lagoon; and

7) Verify compliance with NPDES and state waste discharge permit requirements.

Additional samples were collected on January 10, 1991. The second set of samples was needed to assist in evaluating analytical results from the first inspection and to provide additional information on the occurrence and geochemical characteristics of the iron bacteria. It was also necessary to determine if the aerated lagoon sludge and the iron bacteria were hazardous. The second sampling was done by Tom Nell and Norm Glenn of EILS and Bob Raforth of the CRO. On-site assistance was provided by Kathy Doig-Ellertson. The objectives of the second round of sampling were to:

a) Compare the metals content of iron bacteria samples collected from the spring near the aerated lagoon at Seneca to a sample previously collected from an upstream location;

b) Assess the hazardous nature of iron bacteria and lagoon sludge with Toxic Characteristic Leaching Procedure (TCLP) tests; and

c) Assess water quality of the spring before and after contact with the iron bacteria.

LOCATION AND DESCRIPTION

Seneca is located on the Port of Benton County property near Prosser, Washington, about 45 miles from Yakima. Figure 2 is a close-up of Seneca's location.

Seneca's wastewater is filtered and discharged to settling lagoons. Filtered solids are dewatered, and removed for cattle feed. Hogue's wastewater was combined with Seneca's filtrate prior to the settling lagoons, and before it went into the aerated lagoon. Wastewater from Holtzinger bypasses the settling lagoons and discharges directly into the aerated lagoon. Effluent from the aerated lagoon is then applied alternately to three sprayfields (Figure 2). The total land application area is 33 acres.

PROCEDURES

Ecology composite samples were collected from the filtered (but untreated) plant wastewater and the influent to and effluent from the aerated lagoon using ISCO automatic samplers. Samples

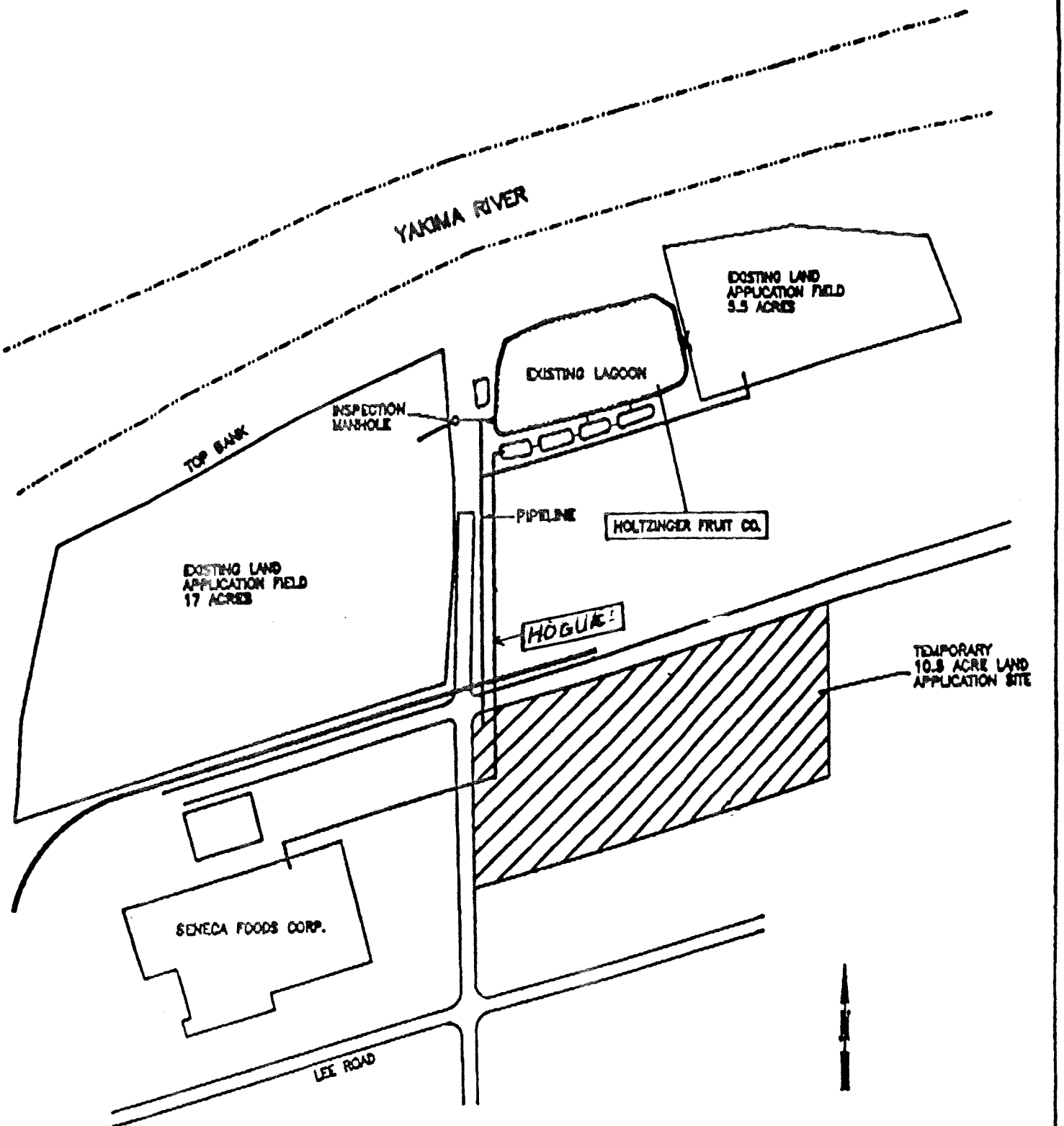

Figure 2. Port of Benton WWTF (Courtesy of JUB Consultants)

were collected at 30-minute intervals for 24 hours. The composite samplers were fitted with teflon tubing and glass sampling bottles. Sampling equipment was precleaned with non-phosphate detergent, washed with tap-water, rinsed with 10% dilute nitric acid and rinsed three times with deionized water, followed by one rinse with methylene chloride and acetone. Collection equipment was air dried and sealed with aluminum foil until used in the field. Seneca also collected a composite sample of untreated plant wastewater.

Table 1 and Figure 3 can supplant the following discussion of sampling locations:

Filtered (but untreated) plant wastewater samples are identified as PLNT WW and the same taken by the facility operator is labelled as SENECA WW. Hogue's wastewater enters downstream of this sampling station. INF LGN is the composite of the influent to the aerated lagoon including Hogue's discharge and EF LGN is the effluent from the aerated lagoon. A grab-composite (consisting of 3 grabs composited over an 8-hour period) of aerated lagoon effluent collected for bioassay is labelled EF LGN1.

Numerous grab samples were collected. Grabs were collected in the morning on consecutive days at the same locations where the composites were collected. PLNT WW1 and PLNT WW2 were grab samples of the untreated plant wastewater and INF LGN1 and INF LGN2 of the influent to the aerated lagoon. A sample of Yakima River water (RIVER) was collected about two miles upstream of Seneca. Grab samples of Prosser city water (PLNT INT), two monitoring wells (WELL1 and WELL2), cooling water (COOL WT1 and COOL WT2), and the Holtzinger discharge (LGN1 and LGN3) were also collected.

Samples SEEP and SEEP SLG were collected in May 1990. Both samples were collected at the same location but for different purposes. SEEP SLG is the iron bacteria portion that accumulated on the margin of the channel which drained a seep originating below the lower sprayfield, while SEEP is the clear water that was flowing near the iron bacteria.

Samples designated as SEEP1, SEEP2, and OOZ LGN were collected on January 10, 1991. These samples could not be collected at the same location as the May 1990 samples due to high water in the Yakima River in January. However, the origin and environment of occurrence of the iron bacteria was considered to be substantially the same for both sets of samples.

The north edge of one of the sprayfields terminates in an embankment with a vertical drop of approximately 25 feet to the Yakima River. A small spring emerges approximately midpoint between the edge of the embankment and the river bank. SEEP1 was spring water collected at the place where the spring first emerges from the embankment and where it was not in contact with the iron bacteria. Some limited digging and clearing of the sample point was necessary. The natural flow from the spring was allowed to clear the small pond created at the sample point before the sample was obtained. The flow from this spring combines with the flow from other nearby springs and seeps to create a small

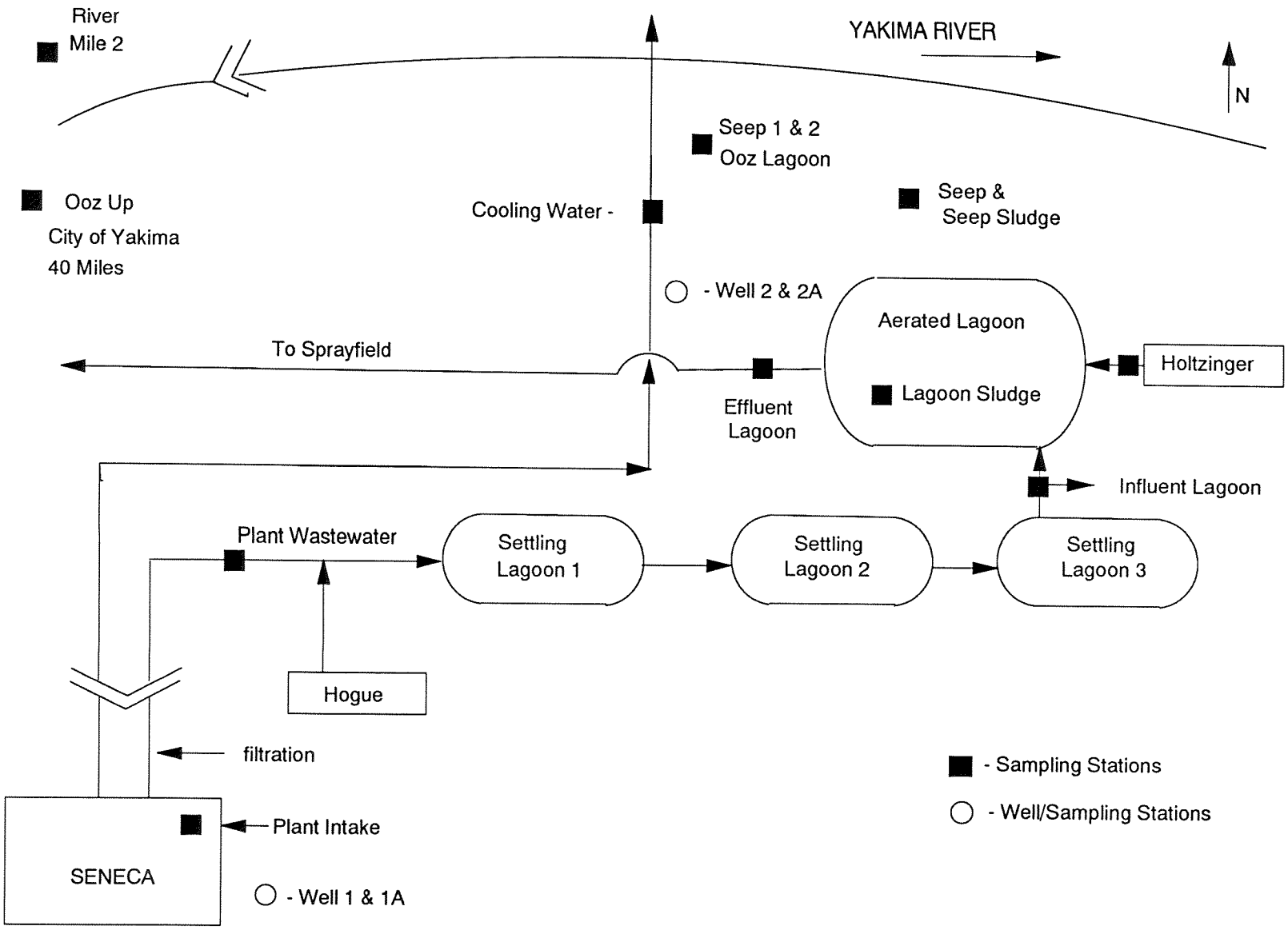

Figure 3. Port of Benton Wastewater Treatment Facility (WTF).

TABLE 1

DESCRIPTION OF SAMPLING STATIONS - SENECA FOODS 5/90 AND 1/91

STATION	TYPE	DATE	TIME	LOCATION DESCRIPTION
PLNT WW	comp.	5/1-5/2	24 hr.	Untreated plant wastewater from Seneca
SENECA WW	comp.	5/1-5/2	24 hr.	Untreated plant wastewater collected by Seneca
PLNT WW1	grab	5/1	0925	Untreated plant wastewater from Seneca
PLNT WW2	grab	5/2	1023	Untreated plant wastewater from Seneca
INF LGN	comp.	5/1-5/2	24 hr.	Influent to aerated lagoon (after settling lagoons)
INF LGN1	grab	5/1	1906	Influent to aerated lagoon (after settling lagoons)
INF LGN2	grab	5/2	1053	Influent to aerated lagoon (after settling lagoons)
LGN 2	grab	5/1	1041	Influent to aerated lagoon (after settling lagoons)
EF LGN	comp.	5/1-5/2	24 hr.	Effluent from the aerated lagoon
EF LGN1	grab	5/1	1835	Effluent from the aerated lagoon
LGN 1	grab	5/1	1035	Holtzinger discharge to aerated lagoon
LGN 3	grab	5/1	1523	Holtzinger discharge to aerated lagoon
COOL WT1	grab	5/1	1110	Non-contact cooling water
COOL WT2	grab	5/2	1143	Non-contact cooling water
WELL 1	grab	5/1	1655	Upgradient well located by Seneca entrance
WELL 2	grab	5/1	1845	Downgradient well located by aerated lagoon
WELL 1A	grab	5/1	1730	WELL 1 - for total recoverable metals
WELL 2A	grab	5/1	1845	WELL 2 - for total recoverable metals
PLNT INT	grab	5/1	1140	Plant intake water (city water)
RIVER	grab	5/2	1205	Yakima River sample
SEEP	grab	5/2	0855	Seep located near the lagoon
SEEP SLG	grab	5/2	0905	Orange slime associated with the seep
SEEP 1	grab	1/10/91	1425	Seep before slime comes in contact
SEEP 2	grab	1/10/91	1400	Seep after slime comes in contact
LGN SLG	grab	1/10/91	1530	Aerated lagoon sludge
OOZ LGN	grab	1/10/91	1415	Slime collected near the lagoon
OOZ UP	grab	1/14/91	1500	Slime collected from the city of Yakima

swampy area which had sluggish but visible flow in a channel toward the Yakima River. Priority pollutant-cleaned stainless steel utensils were used to collect the spring water without debris or sediment.

The iron bacteria were spread along the channel, starting about 2 feet downstream from the SEEP1 location. Iron bacteria were collected from three to four different locations, using priority pollutant-cleaned stainless steel utensils and mixed thoroughly in a beaker before transferring into sample bottles for analysis. This sample was designated as OOZ LGN.

Sample SEEP2 was collected the same way as SEEP1, but located close to the confluence with the Yakima River where the spring water was running off the river bank. Again, extreme care was exercised to avoid collecting any visible iron bacteria, which was present in the flowing spring water. The total distance from sample SEEP1 to sample SEEP2 was about 25 feet.

The sample OOZ UP was collected on January 14, 1991, from a location near the City of Yakima. This location is about 45 miles upstream of the Seneca facility (or WTP).

On January 10, 1991, several sludge samples were taken from the aerated lagoon using an Emery pipe dredge and combined to create sample LGN SLG. This sample was tested for TCLP constituents and total metals.

All samples were placed on ice and shipped to Ecology's Manchester Laboratory by next-day delivery. The schedule of sampling and parameters analyzed during May 1990 is presented in Table 2; samples and analytes during January 1991 are presented in Table 2A. Ecology analytical methods and laboratories performing the analyses are given in Appendix A.

The potential for contamination of samples by wastewater sampling equipment was determined by field blanks provided by the Manchester Lab. This organic-free, deionized water was pumped through one compositor immediately prior to set-up in the field (Huntamer and Smith, 1988). An equipment blank was analyzed for priority pollutants and metals.

The Palmer-Bowlus Flume between the Seneca plant and the settling lagoons was inspected for proper installation and physical dimensions. Depth of flow through the Flume was measured manually, and the resulting calculated instantaneous flow was compared to the reading on the plant flow recording device. Holtzinger flow was measured manually by timing and collecting 2,600 ml of effluent. An instantaneous flow measurement of the cooling water flow was also taken.

TABLE 2

WATER AND SOIL SAMPLING TIMES AND PARAMETERS ANALYZED - SENECA FOODS; 5/90

	Location:	CITY WATER	UNTREATED PLANT WASTEWATER				INFLUENT TO AERATED LAGOON				HOLTZINGER WW	
	Station:	PLNT INT	PLNT WW	SENECA WW	PLNT WW1	PLNT WW2	INF LGN	INF LGN1	INF LGN2	LGN 2	LGN 1	LGN 3
	Type:	Grab	Comp	Comp	Grab	Grab	Comp	Grab	Grab	Grab	Grab	Grab
	Date:	5/1/90	5/1/90	5/1/90	5/1/90	5/2/90	5/1/90	5/1/90	5/2/90	5/1/90	5/1/90	5/1/90
	Time:	1140	24 hr	24 hr	0925	1023	24 hr	0706	1053	1523	1035	1041
Parameter	Lab #:	1881-92	-80	-81	-86	-87	-82	-88	-89	-98	-97	-99
GENERAL CHEMISTRY												
Conductivity			x	s			x					
pH			x	s			x					
Alkalinity			x	s			x					
Turbidity			x	s			x					
TS		x	x	s	x	x	x	x		x	x	x
TNVS		x	x	s	x	x	x	x		x	x	x
TSS		x	x	s	x	x	x	x		x	x	x
TNVSS		x	x	s	x	x	x	x		x	x	x
BOD5			x	s			x					
BOD5 (Soluble)			x				x					
COD		x	x	s	x	x	x	x	x	x	x	x
NH3-N		x	x	s	x	x	x	x	x	x	x	x
NO3+NO2-N		x	x	s	x	x	x	x	x	x	x	x
T-Phosphorus		x	x	s	x	x	x	x	x	x	x	x
Kjel-N		x	x	s			x					
TOC		x	x				x					
ORGANICS + METALS												
pp metals (+iron)		x										
VOC (water)		x										
BNAs (water)		x										
Pest/PCB (water)		x										
BIOASSAYS												
Trout												
Microtox (water)			x				x					

S = Collected by Seneca and analyzed by Ecology

X = Collected and analyzed by Ecology

TABLE 2 CONTINUED

WATER AND SOIL SAMPLING TIMES AND PARAMETERS ANALYZED - SENECA FOODS; 5/90

	Location:	EFFL. FROM AER. LGN		UPSTREAM	COOLING WATER		MONITORING WELLS		SEEP NEAR LGN	
	Station:	EF LGN	EF LGN1	RIVER	COOL WT1	COOL WT2	WELL 1	WELL 2	SEEP	SEEP SLG
	Type:	Comp	Gr-Comp	Grab	Grab	Grab	Grab	Grab	Grab	Grab
	Date:	5/1/90	5/1/90	5/2/90	5/1/90	5/2/90	5/1/90	5/1/90	5/2/90	5/2/90
	Time:	24 hr	8 hr.	1205	1110	1143	1655	1845	0855	0905
Parameter	Lab #:	1881-83	-90	-06	-84	-85	-93	-94	-95	-96
GENERAL CHEMISTRY										
Conductivity		x		x	x		x	x	x	
pH		x		x	x		x	x	x	
Alkalinity		x		x	x		x	x	x	
Turbidity		x		x	x		x	x	x	
TS		x	x	x	x	x	x	x	x	
TNVS		x	x	x	x	x	x	x	x	
TSS		x	x	x	x	x	x	x	x	
TNVSS		x	x	x	x	x	x	x	x	
BOD5		x			x	x				
BOD5 (Soluble)		x								
COD		x	x	x	x	x	x	x	x	
NH3-N		x	x	x	x	x	x	x	x	
NO3+NO2-N		x	x	x	x	x	x	x	x	
T-Phosphorus		x	x	x	x	x	x	x	x	
Kjel-N		x			x					
TOC		x		x	x	x	x	x	x	
ORGANICS + METALS										
pp metals (+iron)		x		x	x		x	x	x	x
VOC (water)		x		x					x	x
BNAs (water)		x		x					x	x
Pest/PCB (water)		x		x					x	x
BIOASSAYS										
Trout		x							x	
Microtox (water)		x							x	

TABLE 2A

WATER AND SOIL SAMPLING TIMES AND PARAMETERS ANALYZED - SENECA FOODS; 1/91.

	Location:	SEEP NR LGN			LAGOON	CITY OF YAKIMA
	Station:	SEEP 1	SEEP 2	OOZ LGN	LGN SLG	OOZ UP
	Type:	Grab	Grab	Grab	Grab	Grab
	Date:	1/10/91	1/10/91	1/10/91	1/10/91	1/14/91
	Time:	1425	1400	1415	1530	1500
Parameter	Lab # 0280-:	-53	-55	-52	-50	037371
GENERAL CHEMISTRY						
Conductivity						
pH						
Alkalinity						
Turbidity						
TS						
TNVS						
TSS						
TNVSS						
BOD5						
BOD5 (Soluble)						
COD						
NH3-N						
NO3+NO2-N						
T-Phosphorus						
Kjel-N						
TOC						
ORGANICS + METALS						
pp metals (+iron)		x	x	x		x
VOC (water)						
BNAs (water)						
Pest/PCB (water)						
BIOASSAYS						
Trout						
Microtox (water)						
TCLP				x	x	x

DATA QUALITY ASSURANCE

Field Blank

Neither priority pollutants nor metals were detected in the field blanks, indicating sampling equipment and procedures were adequate to prevent sample contamination.

Laboratory quality assurance and quality control (QA/QC) methods were followed during the analyses of general chemistry parameters (Kirchmer, 1988).

Priority Pollutants (Metals)

All analyses were performed within holding time limits. The laboratory method blank showed none of the analytes above its detection limit.

Matrix Spikes and Matrix Spike Duplicates (MS/MSD) were analyzed for two water samples and one sludge sample. Percent recoveries and relative percent differences are tabulated in Appendix B1. The acceptable matrix spike recovery was $\pm 25\%$ of the true value. All values were within the targeted limits on water samples, except for iron on WELL 2A (130%). All values for the iron bacteria sample (SEEP SLG) were within the targeted limits except arsenic (65%) and iron. The iron spike sample was not valid because the spike concentration was too low in comparison to the high sample concentration.

Sample duplicates and laboratory control samples were also within acceptable limits of $\pm 20\%$. Results indicate that the analyses were done properly and are acceptable. Quality control data on laboratory standards is given in Appendix B2.

Priority Pollutants (VOAs, BNAs, & Pesticides/PCBs)

Samples were extracted and analyzed within the recommended holding times. The method blank and all but one surrogate recovery were acceptable. Recovery of the surrogate, Terphenyl, in the SEEP and EF LGN samples for BNA scan was low. Terphenyl is known to frequently have low recovery rates and does not necessarily indicate a problem with the analyses (Magoon, 1990). Recoveries for other surrogates are acceptable. The results of analyses on the method blank are tabulated in Appendix B3. The surrogate recovery of both water matrix and soil matrix is given in Appendix B4.

Nutrients

Results on spike recoveries, check standard, and duplicate analyses are all given in Appendix B5. Analyses were done within the holding time limits (APHA-AWWA-WPCF, 1989). Matrix spike recoveries were within the acceptable range of $\pm 30\%$, and check standard and duplicate results were within the acceptable range of $\pm 5\%$.

BODs, CODs, TOCs, AND TKNs

The QA/QC reports are given in Appendix B6. Method blanks, spike recoveries, duplicate analyses, and holding times were all within accepted limits. The standard procedure for BOD analyses was not followed by the Ecology contract laboratory, so results of the BOD_5 analyses should be considered estimates.

Bioassay

Microtox analyses were done on four different samples - PLNT WW, INF LGN, EF LGN, and SEEP. QA/QC documentation is adequate for the analyses. The test organisms were rainbow trout *(Oncorhynchus mykiss)*. No mortalities were observed in the salmonid control test confirming that the test organisms were suitable. Appropriate levels of dissolved oxygen could not be maintained continuously because of very high levels of BOD in one of the test solutions (EF LGN).

RESULTS AND DISCUSSION

Flows

An instantaneous flow measurement of the Seneca wastewater passing through the Palmer-Bowlus Flume yielded 79,000 gallons per day (gpd). The plant record was checked within 10 minutes of the above measurement and gave an instantaneous reading of 214,000 gpd. This dramatic difference is possibly attributable to debris which had accumulated around the flume.

Average daily flows (gpd) of four waste streams obtained during the inspection are as follows:

Flows	May 1 - 2, 1990	May 2 - 3, 1990
Through Flume	290,000	350,300
Holtzinger	51,500	51,500
Land application	132,600	179,900
Cooling water	133,920	133,920

These flow data indicate that as much as 60% of the wastewater could be lost within the WTF due to evaporation and seepage.

The average of two instantaneous measurements of Holtzinger flow was 36 gallons per minute (gpm), or 51,800 gpd. This slightly exceeded their daily average permit limit of 50,000 gpd.

There is a requirement in the NPDES permit to monitor the volume of discharge of cooling water discharge to the Yakima River. The flow of cooling water on the day of the inspection was 93 gpm or 133,920 gpd. The permit limit is a daily average not to exceed 142,000 gpd.

Table 3
Results of General Chemistry Analyses – Seneca Foods, 5/90.

Location:	CITY WATER	UNTREATED SENECA WASTEWATER				INFLUENT TO AERATED LAGOON				HOLTZ. TO AER. LGN	
Station:	PLANT INT	PLNT WW	SNECA WW	PLNT WW1	PLNT WW2	INF LGN	INF LGN1	INF LGN2	LGN2	LGN 1	LGN 3
Type:	Grab	Comp	Comp	Grab	Grab	Comp	Grab	Grab	Grab	Grab	Grab
Date:	5/1/90	5/1/90	5/1/90	5/1/90	5/2/90	5/1/90	5/1/90	5/2/90	5/1/90	5/1/90	5/1/90
Time:	1140	24 hr	24 hr	0925	1023	24 hr	1906	1053	1041	1035	1523
Lab Log #: 1881	-92	-80	-81	-86	-87	-82	-88	-89	-98	-97	-99
GENERAL CHEMISTRY											
Conductivity (umhos/cm)		859	1340			1550					
pH		6.6 H	6.1 H			4.4 H					
Alkalinity (mg/L as CaCO3)		3.4	30.6			1.0 U					
Turbidity (NTU)		13	38			33					
SOLIDS (4)											
TS (mg/L)	321	4150	4140	4080	7700	2550	2480	2520	2410	8900	16870
TNVS (mg/L)	239	534	879	914	708	872	810	846	760	790	1590
TSS (mg/L)	1 U	120	345	260	274	126	109	149	108	660	432
TNVSS (mg/L)	1 U	52	212	134	70	34	22	22	28	280	200
BOD5 (mg/L)		3780 J	696 J			4460 J					
BOD5 (Soluble) mg/L		1780 J				2100 J					
COD (mg/L)	10 U	5040	4520	5040	9920	5040	5040	5280	4780	13100	19800
NUTRIENTS (mg/L)											
NH3-N	0.01	4.30	3.25	3.04	5.44	0.67	0.13	0.17	0.85	3.23	9.19
NO3+NO2-N	0.02	0.41	0.10 U	0.07	0.30	0.10 U	0.17	0.10 U	1.17	1.31	1.90
T-Phosphorus	0.60	3.56	2.78	3.54	5.94	2.90	2.50	2.48	2.96	7.05	7.80
Kjel-N (mg/L)	0.96	2.72	2.64			2.54					
TOC (mg/L)	12.8	1580.0				1390.0					
FIELD OBSERVATIONS											
TEMP(C)	22.7			34.9	26.2		24.5	23.9	23.5	26.8	27.2
pH (S.U.)	8.2			6.5	5.0		4.6	4.1	4.4	5.9	4.2
Conductivity (umhos/cm)	430.0			1173.0	890.0		1540.0	1560.0	1480.0	960.0	2040.0

U - Less Than J - Estimated value. H - Over Holding Time

Table 3 continued.

Results of General Chemistry Analyses - Seneca Foods, 5/90.

Location:	EFFL FROM AER LGN		UPSTREAM	COOLING WATER		MONITORING WELLS		SEEP NEAR LGN
Station	EF LGN	EF LGN1	RIVER	COOL WT1	COOL WT2	WELL1	WELL2	SEEP
Type:	Comp	Grab	Grab	Grab	Grab	Grab	Grab	Grab
Date:	5/1/90	5/1/90	5/1/90	5/1/90	5/2/90	5/1/90	5/1/90	5/2/90
Time:	24 hr	1835	1205	1110	1140	1655	1845	0855
og #: 1881	-83	-90	-06	-84	-85	-93	-94	-95
GENERAL CHEMISTRY								
Conductivity (umhos/cm)	1610		181	480		596	1450	148
pH	7.4		7.3 H	7.9 H		7.7 H	7.0 H	7.3 H
Alkalinity (mg/L as CaCO3)	1020.0		73.9	221.0		280.0	1460.0	1590.0
Turbidity (NTU)	142		9	3		37	92	73
SOLIDS (4)								
TS (mg/L)	2190	2180	189	322	349	586	952	951
TNVS (mg/L)	919	900	128	250	280	499	816	751
TSS (mg/L)	1150	1900	34	5	2	240	94	66
TNVSS (mg/L)	212	400	31	2	1	227	85	60
BOD5 (mg/L)	2740 J			19 J	24 UJ			
BOD5 (Soluble) mg/L	96 J							
COD (mg/L)	580	479	10 U	32	19	10 U	11	15
NUTRIENTS (mg/L)								
NH3-N	0.34	0.78	0.06	0.04	0.01	0.01	1.30	2.40
NO3+NO2-N	0.01	0.11	0.71	0.01 U	0.01 U	0.38	0.06	0.01 U
T-Phosphorus	1.32	1.02	0.11	0.70	0.82	0.24	0.88	1.10
Kjel-N (mg/L)	13.20			1.01				
TOC (mg/L)	232.0		3.2	19.0	4.1	1.5	21.0	17.4
FIELD OBSERVATIONS								
TEMP(C)		14.8	14.0	27.6	26.4			16.4
pH (S.U.)		6.5	9.0	8.6	8.5			7.4
Conductivity (umhos/cm)		1570	183	470	510			1490

U - Less Than H - Over Holding Time J - Estimated value, not accurate.

Wastewater Treatment Facility

General Chemistry Parameters

General chemistry parameters and other related parameters are summarized in Table 3. Comparing values of BOD_5, COD, and TOC at stations PLNT WW and EF LGN indicates that the BOD_5 values are disproportionate. BOD_5 data show only a 28% reduction in concentration, while COD and TOC data show approximately 85%. A possible explanation is that the BOD_5 data were qualified when received from the lab. A high COD value often indicates high organic content (Hyre, 1991), also reflected in the Seneca wastewater TOC readings.

Better quality and more uniformity should be evident in wastewater which has resided in settling lagoons before entering an aerated lagoon. This is not evident from some of the data, as COD and TOC are relatively unchanged in concentration. It is difficult to determine removal efficiencies in the WTF due to the large loss of wastewater within the system. COD and TOC removal appeared to be good; but total solids removal was low, and total suspended solids (TSS) increased by an order of magnitude. The Holtzinger influent does not account for these dramatic differences. Soluble BOD_5 in the effluent as well as reduced nitrite suggest inefficient aeration in the lagoon.

Priority Pollutant (Organic) Scan

No significant quantities of VOCs, BNAs, or pesticides/PCBs were found in any of the sampled wastewater streams, except as noted in Table 4.

Table 4: Priority pollutant (organic) results.

COMPOUND	'EF LGN' (ppb)	'PLNT INT'(ppb)
Acetone	1100 E	85
2-butanone (MEK)	39	10 U
Toluene	23	5 U

U = Less than detection limit
E = Sample amount exceeded the known calibration, use only as an estimate

Since the plant intake has no contamination of MEK or toluene, the source may be the day-to-day operation of the plant. Contamination from MEK and toluene is non-significant. The MEK contamination might be due to its use in cleaning the Video Jet Cleaner (Doig-Ellertson, 1991). A cleaning agent such as lacquer thinner which may be used at the plant could be the source of toluene. The contribution from acetone is of concern. It was confirmed during the second inspection when the same concentration was measured (85 ppb) as in the first inspection. The complete priority pollutant (organic) scan is presented in Appendix C.

TABLE 5

Results of Priority Pollutant (Metal) Scan – Seneca Foods, 5/90 and 1/91

Station:	LNT INT	EF LGN	RIVER	COOL WT1	WELL 1	WELL 2	WELL 1A	WELL 2A	SEEP	SEEP SLG	SEEP1	OOZ LGN	SEEP2	OOZ UP
Type:	Grab	Comp	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab
Date:	5/1/90	5/1/90	5/1/90	5/1/90	5/1/90	5/1/90	5/1/90	5/1/90	5/1/90	5/1/90	1/10/91	1/10/91	1/10/91	1/14/91
Lab #:	188192	188183	188206	188184	188193	188194	188204	188205	188195	188196	028053	028052	028055	037371
Metals	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/Kg)	(ug/L)	(ug/L)
Sb	6 U	6 U	6 U	6 U	6 U	6 U	6 U	6 U	6 U	1100	ND	ND	ND	ND
As	10 U	13	44	10 U	10	10	10	10	10	99600	12	590	ND	60
Be	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	500 U	ND	ND	ND	ND
Cd	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	12100	ND	ND	ND	ND
Cr	10 U	10 U	10 U	10 U	10 U	20	10 U	30	40	77500	ND	ND	ND	ND
Cu	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	3700	ND	ND	ND	ND
Pb	5 U	8	5 U	6	7	5 U	5 U	5 U	5 U	1080	ND	ND	ND	13
Ni	40 U	40 U	40 U	40 U	40 U	40 U	40 U	40 U	100	33200	ND	ND	ND	ND
Se	5 U	5 U	6	5 U	5 U	5 U	5 U	5 U	6	3680	ND	ND	ND	ND
Ag	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	1900	ND	ND	ND	ND
Tl	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	1000 U	ND	ND	ND	10
Zn	150	280	20 U	110	20	20 U	20 U	20 U	20 U	27900	ND	ND	ND	ND
Fe	100	100 U	100	500	3500	17500	400	18100	21600	4.0E+08	11500	1.8E+06	3260	4.1E+05
Hg	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	100 U	ND	ND	ND	1
Mn	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5110	19600	3920	3750

U – indicates compound was analyzed for but not detected at the given quantitation limit

NA = Not Analyzed

ND = Not Detected at or above Method Reporting Limit

Priority Pollutant (Metal) Scan

Results of the metals scan can be found in Table 5. The concentrations of arsenic, zinc, and lead in the effluent from the aerated lagoon were slightly higher than those measured in city water. Since other samples collected between these two stations were not analyzed for metals, it is difficult to determine the source. One possible explanation is that anaerobic conditions in the sludge at the bottom of the lagoon allow re-entrainment of metals by wastewater.

Bioassay

The Microtox analysis is a method of determining the effect of a fluid, such as effluent, on a special type of light-emitting bacteria. This is accomplished by measuring the change in the light-emitting ability of the bacteria after the bacteria are exposed to the fluid. Microtox analyses were done on untreated plant wastewater, influent to the aerated lagoon, effluent from the aerated lagoon, and the seep below the lagoon. Results of Microtox analyses are presented in Table 6. An EC_{50} value less than 20% is considered high toxicity.

Table 6: Results of Microtox Analyses

SAMPLE IDENTIFICATION	EC_{50} (% Effect)	
	5 MINUTES	15 MINUTES
Untreated plant wastewater	4.9%	13.5%
Influent to aerated lagoon	2.8%	3.2%
Effluent from aerated lagoon	>100%	>100%
Seep adjacent to iron bacteria	*	*

* = Not possible to estimate EC_{50} (very low toxicity)

Influent to the aerated lagoon (exclusive of Holtzinger's wastewater) had a slightly higher and more persistent effect on the bacteria than Seneca's untreated plant wastewater, which would suggest Hogue was the origin of the primary toxicity. The effect of influent to the aerated lagoon (representing combined Seneca and Hogue wastewater) at five minutes was not significantly different from the effect at 15 minutes. Untreated plant wastewater exhibited a significant decrease in effect between 5 and 15 minutes. This seems to indicate that, unlike the toxicity in the influent, the toxic agent originating from the Seneca plant wastewater alone can be metabolized or decays. Effluent sample results from the aerated lagoon indicate negligible toxicity.

The sample identified as SEEP also exhibited negligible toxicity.

Microtox test results suggest that although toxicity is present in wastewater originating from the Seneca and Hogue facilities, this toxicity does not persist in the seep originating below the lower sprayfield. This may be attributable to successive treatment by the lagoons and sprayfields.

Effluent from the aerated lagoon was also tested for toxicity using the salmonid bioassay. Results are given in Table 7.

Table 7: Results of Salmonid Bioassay

SAMPLE IDENTIFICATION	INITIAL # OF FISH	FINAL # OF FISH	MORTALITY RATE
100% effluent from the aerated lagoon	30	0	100%

The 100% mortality rate in the salmonid bioassay (Table 7) occurred during the last 24 hours of the 96-hour test. The test was conducted at 100% effluent concentration. No mortalities were observed during the testing of controls. The laboratory reported that due to the high content of BOD, they could only maintain a very low dissolved oxygen level in the sample despite aeration throughout the test (Stinson, 1991). This resulted in trout mortality after 72 hours, when the level of D.O. became so low that life could not be sustained. A contributing factor to the mortalities could also be the high concentration of solids in the aerated lagoon effluent. As illustrated by the Microtox analysis, the bioassay results are of limited usefulness, since the wastewater is being applied to land where additional treatment is occurring.

Monitoring Wells

There are two monitoring wells at the facility. WELL1 is located upgradient of the plant site and sprayfields, while WELL2 is located near the aerated lagoon and downgradient of the sprayfields.

Table 8 shows a comparison of various parameters in each well. Several changes in ground water chemistry may be attributed to the application of wastewater in the Seneca sprayfields. For example, the increase in NH_3-N may be an indication that anaerobic conditions have been created in the ground water beneath the site. The accompanying decrease in NO_3+NO_2-N is evident; ammonia release from the sludge organic nitrogen may also be taking place. Likewise, the increase in iron and chromium concentrations could be due to reducing conditions. Solubilizing metals would be further assisted by a decrease in pH in a downgradient direction. The observed increase in TOC could be an indicator of the mechanism for the creation of the anaerobic conditions.

Table 8 indicates that iron and arsenic exceeded ground water quality criteria in both upgradient and downgradient wells. The relationship between ground water standards and the concentrations of various parameters in the monitoring wells must be considered in light of background data. When Seneca analyzed samples from new monitoring wells installed in the

TABLE 8

Comparison of upgradient vs. downgradient monitoring wells – Seneca Foods, 5/90.

Location:	UPGRADIENT		DOWNGRADIENT	
Station:	WELL 1		WELL 2	
Type:	Grab		Grab	
Date:	5/1/90		5/1/90	
Lab Sample #: 1881	-93		-94	
GENERAL CHEMISTRY				
Conductivity (umhos/cm)	596		1450	
pH	7.7	H	7.0	H
Alkalinity (mg/L as CaCO3)	280.0		1460.0	
Turbidity (NTU)	37		92	
SOLIDS (4)				
TS (mg/L)	586		952	
TNVS (mg/L)	499		816	
TSS (mg/L)	240		94	
TNVSS (mg/L)	227		85	
COD (mg/L)	10	U	11	U
NUTRIENTS (mg/L)				
NH3-N	0.01		1.30	
NO3+NO2-N	0.38		0.06	
T-Phosphorus	0.24		0.88	
TOC (mg/L)	1.49		21.00	
TOTAL RECOVERABLE METALS (ppb)				
ARSENIC	10		10	
CHROMIUM	10	U	30	
IRON	400		18100	

U - Less Than

H - Over Holding Time

proposed sprayfield across the Yakima River, similar concentrations of arsenic (in the range of 10 ppb) were noted. Therefore, arsenic concentrations on the order of 10 ppb appear to represent background levels. The source of the increase in the iron concentration will be discussed in the following section.

If all three sprayfields are to remain operational in the future, additional monitoring wells should be installed to adequately determine ground water flow direction and changes in ground water quality due to the facility.

Significance of Iron Bacteria

Iron bacteria near the Seneca facility occur at various locations as an orange-colored slime. The slime growth has been identified as the iron bacterium, *Gallionella ferruginea*, which uses reduced iron as an energy source and CO_2 as a sole source of carbon (Pacha, 1990). As an incidental part of this chemosynthetic activity, *Gallionella* "scavenges" metals from dilute aqueous solution and co-precipitates these metals with ferric compounds.

An objective of the January 1991 sampling was to check the scavenging efficiency of *Gallionella*. Three sample locations were selected to provide more information on the association of metals and *Gallionella*: (1) background, unaffected by *Gallionella*, (2) *Gallionella* prevalent location, (3) downstream of affected area. The first of the three samples was labeled SEEP1; the second OOZ LGN; and the third was SEEP2.

Referring to Table 5, data on the three samples supports the concept of the ability of the iron bacteria to remove certain metals from dilute aqueous solution. For the three metals which were above the level of detection (arsenic, iron, and manganese), each was more concentrated in the sample collected upstream from the *Gallionella* than in the downstream sample. While this may be an over-simplification of the dynamics in a spring ecosystem, it is a reasonable assumption that oxygen, aeration, reduction oxidation (redox) and other dynamics influence where the *Gallionella* "live", rather than the chemosynthetic process.

Since May 1990, Seneca has conducted monthly ferrous iron monitoring of the soil and the ground water associated with the sprayfields as part of their state waste discharge permit. The terms of this permit require testing for anaerobic conditions in the soil of the sprayfields and the ground water in the monitoring wells on a monthly basis. The test is conducted using 2-2 dipyridyl as the indicator. For most months, the results show that aerobic conditions are found to a depth of at least 24 inches in the sprayfield. Aerobic conditions are also found in the upgradient monitoring well (typical water depth approximately 60 feet). However, the downgradient monitoring well typically tests anaerobic (typical water depth approximately 30 feet). The source of this apparent anomaly is ascribed to the production of CO_2 by the bacteria operating below the depth of the soil sample. This condition is likely created by microbial activity related to high BOD in the wastewater. Bacteria modify the constituents in the percolating wastewater, notably the sugars and carbohydrates remaining in the effluent from the aerated lagoon. As a result of this process, bacteria consume oxygen faster than it is replaced

from the atmosphere, thus creating anaerobic conditions and byproducts which include reduced iron, reduced manganese, ammonia and CO_2. All of these constituents are highly soluble. Indirectly, bacteria can lower the pH which, in combination with reducing aqueous conditions, can increase the solubility of metals.

Another sample of iron bacteria was collected along the Yakima River in the City of Yakima a few days after the January 1991 sampling at Seneca. The purpose of this sample was to determine whether the potential association between metals scavenging and iron bacteria was a local phenomenon or an indication of a regional pattern. This sample was designated as OOZ UP. The sample was obtained near the confluence of a drainage which is tributary to the Yakima River. Although no fruit processing industry is located nearby, a log deck spraying operation is in the vicinity and the lignins and sugars could be contributing to the anaerobic conditions necessary for the occurrence of iron bacteria (Sherwood, 1991). Brannon and Patrick (1987) noted that accumulation of copious amounts of water, such as associated with a dam or in an excessively watered sprayfield, can cause anaerobic ground water conditions which in turn favor anaerobic bacterial growth.

The following table, Table 9, is a comparison of the priority pollutant metals content among iron bacteria samples at the Seneca facility and the Yakima sample. These results suggest that the relative concentrations of metals are similar, while reognizing that some differences are present. Whether these differences are caused by dilution in the sampling process, seasonality or some other cause is not apparent. The significance of the comparison is to illustrate the concept that the scavenging effect associated with iron bacteria is independent of geographic location. Instead, iron bacteria represent the end product of a process which involves a mechanism for creating anaerobic conditions in ground water and the accompanying develpment elsewhere in the ground water system of a redox interface which promotes development of iron bacteria. The incidental role of iron bacteria is to serve as the agent for extracting and precipitating metals from dilute ground water solution.

Table 9: Comparison of iron bacteria samples

PP Metals	OOZ LGN(ppb)	OOZ UP(ppb)	SEEP SLG (ppb)
Antimony	ND	ND	1,100
Arsenic	590	60	99,600
Cadmium	ND	ND	12,100
Chromium	ND	ND	77,500
Copper	ND	ND	3,700
Iron	1,840,000	411,000	401,686,000
Lead	ND	13	1,080
Manganese	19,600	3,750	NA
Mercury	ND	0.1	ND
Nickel	ND	ND	33,200
Thallium	ND	10	< 1000
Selenium	ND	ND	3,680
Silver	ND	ND	1,900
Zinc	ND	ND	27,900

ND = Not detected at or above the Method Reporting Limit
NA = Not analyzed

Toxicity Characteristics Leaching Procedure (TCLP) was done on two of the iron bacteria samples, as well as the sludge from the aerated lagoon, to see if they should be classified as hazardous waste. The results are given in Table 10.

Table 10: Results of TCLP analyses

TCLP (Metal)	OOZ LGN (ppm)	OOZ UP (ppm)	LGN SLG (ppm)	Regulated lmt. (ppm)
Arsenic	ND	ND	ND	5
Barium	0.8	0.02	0.2	100
Cadmium	ND	ND	ND	1
Chromium	ND	ND	ND	5
Lead	ND	ND	ND	5
Mercury	ND	ND	ND	0.2
Selenium	ND	ND	ND	1
Silver	ND	ND	ND	5

ND = Not detected at the lower detection limit.

The filtration procedure employed in the TCLP analysis may prevent detection of metals that are entrapped with solid material, such as sediments. In this case, the solid material is filtered out with a 0.7 micron filter, and the filtrate is then analyzed for the TCLP procedure. The only

TCLP constituent detected in any of the samples was barium (0.02 - 0.8 ppm). The low concentration of barium is far below the regulatory limit of 100 ppm. Since potentially toxic metals are tied up with iron, they are not bio-available. It is unlikely that animals or fish would be inclined to ingest the bacteria due to the general low tolerance for iron by these life-forms.

Cooling Water and NPDES Permit Compliance

The NPDES permit applies only to the cooling water discharge. pH slightly exceeded the permitted daily maximum on the day of the inspection (Table 11).

Table 11: A comparison of cooling water discharge limits vs. inspection data

	EFFLUENT	LIMITATIONS	INSPECTION DATA
PARAMETER	DAILY AVERAGE	DAILY MAXIMUM	
FLOW	None specified	140,000 gpd	133,900 gpd
pH	6.5 to 8.5	8.5	8.6, 8.5

High influent pH likely contributed to high cooling water pH unless there was a leak in a pipe. An on-line pH monitoring device (with alarm capability in case of exceedance) will help Seneca to operate within the permit limit. At the same time, allowance for a variance when the intake water pH exceeds 8.5, should also be explored. The flow of cooling water to the Yakima River on the day of the inspection was 96% of the permitted daily maximum of 140,000 gallons per day.

The Yakima River

During the May 1990 inspection, a sample of water (RIVER) was taken from the Yakima River about 4 miles upstream from the Seneca facility below Prosser Dam. Table 5 shows that detectable levels of arsenic, iron and selenium were found.

Split Sample Comparisons

The 24-hour composite samples of plant wastewater were collected simultaneously by Ecology and Seneca. Both samples were analyzed by Ecology; the results are compared in Table 12. For some measured parameters the results appear to compare well, such as total solids (TS), COD, NH3-N and T-Phosphorus. For other parameters, notably alkalinity and some measures of suspended solids (TSS and TNVSS), the comparison is poor. Since the samples were collected over the same time period and in close proximity, there is a possibility of equipment malfunction or differences in sampling procedures.

TABLE 12
Comparison of samples collected by WDOE and Seneca – Seneca Foods, 5/90

Location:	UNTREATED PLANT WASTEWATER			
Station:	PLNT WW		SNECA WW	
Type:	Comp		Comp	
Date:	5/1–2/90		5/1–2/90	
Time:	24 hr		24 hr	
Lab Sample #: 1881	–80		–81	
GENERAL CHEMISTRY				
Conductivity (umhos/cm)	859		1340	
pH	6.6	H	6.1	H
Alkalinity (mg/L as CaCO3)	3.4		30.6	
Turbidity (NTU)	13		38	
SOLIDS (4)				
TS (mg/L)	4150		4140	
TNVS (mg/L)	534		879	
TSS (mg/L)	120		345	
TNVSS (mg/L)	52		212	
BOD5 (mg/L)	3780	J	696	J
BOD5 (Soluble) (mg/l)	1780	J		
COD (mg/L)	5040		4520	
NUTRIENTS (mg/L)				
NH3–N	4.3		3.25	
NO3+NO2–N	0.41		0.1	U
T–Phosphorus	3.56		2.78	
Kjel–N (mg/L)	2.72		2.64	
TOC (mg/L)	1580			

U – Less Than
J – Estimated value, not accurate.
H – Over Holding Time

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

1. There was a dramatic difference between the instantaneous flow measurement taken manually by Ecology and the reading from Seneca's instrumentation at the Palmer-Bowlus Flume.

2. WTF flow data indicate that as much as 60% of the wastewater could be lost within the WTF to evaporation and seepage.

3. There is insufficient aeration in the WTF as indicated by relatively high concentrations of soluable BOD_5 and ammonia.

4. The concentration of acetone in effluent from the WTF is cause for concern.

5. Wastewater from the WTF exhibited high toxicity to salmonids. These results are of limited usefulness, since the wastewater is being applied to land where additional treatment is occurring. Toxicity does not persist in the seep below the lower sprayfield.

6. Arsenic exceeded ground water quality criteria in both upgradient and downgradient wells. Measureable background levels were confirmed by data from new monitoring wells installed in the proposed land application site across the Yakima River.

7. If all three existing land application sites are to remain operational in the future, additional monitoring wells should be installed to adequately determine ground water flow direction and changes in ground water quality due to the facility.

8. Ground water beneath the existing land application sites is anaerobic due to microbial activity related to application of high BOD wastewater. Bacteria consume oxygen faster than it is replaced from the atmosphere, thus creating anaerobic conditions and byproducts which include reduced iron and manganese, ammonia, and carbon dioxide; lowered pH and increased solubility of metals.

9. Iron bacteria "fixing" of certain metals (arsenic, iron, manganese) appears to be independent of location and source. These potentially toxic metals are tied up with iron and probably not bio-available.

10. pH in the cooling water slightly exceeded the permitted daily maximum on the day of the inspection.

11. Comparison of split samples was poor for several parameters, notably alkalinity

11. Comparison of split samples was poor for several parameters, notably alkalinity and two measures of suspended solids (TSS and TNVSS).

Recommendations

1. The Palmer-Bowlus Flume must be cleaned, maintained and calibrated on a regular schedule.

2. Efficiency of the lagoon system must be improved. To achieve this the following actions are recommended:

   a) redirect Holtzinger's wastewater to the settling lagoons,

   b) increase retention time in the settling lagoons,

   c) eliminate short-circuiting and increase aeration in the aeration lagoon,

   d) install liners in all lagoons,

   e) dredge the lagoons and, in the future, monitor sludge accumulation more closely,

   f) routinely monitor effluent from the aerated lagoon for NH_3-N, NO_3-N and soluble BOD_5;

3. Locate the sources of acetone, MEK and toluene and eliminate;

4. Install additional monitoring wells if the three existing land application sites are to remain operational;

5. Continue the routine monitoring program for anaerobic conditions in the existing monitoring wells;

6. Periodically test the seep water and iron bacteria for toxicity;

7. Install a continuous, on-line pH monitoring device with alarm capability;

8. Check sampling and analytical procedures used for measuring alkalinity and suspended solids parameters.

REFERENCES

Brannon, James M. and Patrick, William H. Fixation, Transformation, and Mobilization of Arsenic in Sediments. Enviro. Sci. Technol., Vol. 21, No. 5, 1987.

Doig-Ellertson, Cathy. Telephone conversation. Seneca Foods, Prosser, 1991.

Huntamer and Smith. Ecology Laboratory Users Manual. Washington State Department of Ecology, August 1988.

Hyre, Janet. Telephone Conversation. April 1991.

Kirchmer, C. Quality Assurance Manual. Manchester Laboratory, Washington Department of Ecology, Manchester, WA, 1988.

Magoon, Stuart. Personal Communication. March 1990.

Pacha, R. E. Central Washington University. Memorandum to Mike Quezada of Seneca Foods, 1990.

Sherwood, Kim. Personal Communication. Central Regional Office, Department of Ecology, Yakima, 1991.

Stinson, Margaret. Personal Communication. Manchester Laboratory, Washington Department of Ecology, Manchester, WA, 1991.

APPENDICES

APPENDIX A

CHEMICAL ANALYTICAL METHODS AND LABORATORIES–SENECA FOODS, 5/90 AND 1/91.

PARAMETER	METHOD USED	LABORATORY
Turbidity	EPA, 1979: 180.1	MANCHESTER LAB; WA
Conductivity	EPA, 1979: 120.1	MANCHESTER LAB; WA
pH	EPA, 1979: 150.1	MANCHESTER LAB; WA
Alkalinity	EPA, 1979: 310.1	MANCHESTER LAB; WA
SOLIDS		
TS	EPA, 1979: 160.3	MANCHESTER LAB; WA
TNVS	EPA, 1979: 106.4	MANCHESTER LAB; WA
TSS	EPA, 1979: 160.2	MANCHESTER LAB; WA
TNVSS	EPA, 1979: 106.4	MANCHESTER LAB; WA
% Solids	APHA, 17: 2540G	MANCHESTER LAB; WA
BOD5	EPA, 1979: 405.1	AM TEST LAB; WA
COD	EPA, 1979: 410.1	AM TEST LAB; WA
TOC (water)	EPA, 1979: 415.2	MANCHESTER LAB; WA
TOC (soil)	APHA, 17: 5310	MANCHESTER LAB; WA
NUTRIENTS		
NH3–N	EPA, 1979: 350.1	AM TEST LAB; WA
NO2+NO3–N	EPA, 1979: 353.2	AM TEST LAB; WA
Phosphorus–Total	EPA, 1979: 365.1	AM TEST LAB; WA
VOC (water)	EPA, 1979: 624	WEYERHAEUSER LAB; WA
VOC (soil)	EPA, 1979: 8240	WEYERHAEUSER LAB; WA
BNAs (water)	EPA, 1979: 625	WEYERHAEUSER LAB; WA
BNAs (soil)	EPA, 1979: 8270	WEYERHAEUSER LAB; WA
Pest/PCB (water)	EPA, 1979: 608	WEYERHAEUSER LAB; WA
Pest/PCB (soil)	EPA, 1979: 8080	WEYERHAEUSER LAB; WA
PP Metals	EPA, 1979: 200	SOUND ANALYTICAL LAB; WA
TCLP (water)	EPA, 1990: 1311	COLUMBIA ANALYTICAL LAB; WA
TCLP (soil)	EPA 8240, 3510, 8270	COLUMBIA ANALYTICAL LAB; WA
Salmonid (acute)	Ecology, 1981	BIOMED LABORATORIES; WA
Microtox (acute)	Beckman, 1982	ECOVA LAB; WA

APHA-AWWA-WPCF, 1989. Standard Methods for Examination of Water and Wastewater, 17th ed.

Beckman Instruments, Inc., 1982. Microtox System Operating Manual.

Ecology, 1981. Static Acute Fish Toxicity Test, DOE 80-12, revised July 1981.

EPA, 1979. Methods for Chemical Analysis of Water and Wastes, EPA-600-4-79-020 (Rev. March, 1983).

EPA, 1984. 40 CFR Part 136, October 26, 1984.

EPA, 1986. Test Methods for Evaluating Solid Waste Physical/Chemical Methods, SW-846, 3rd ed., November, 1986.

EPA, 1990. 40 CFR Part 261, March 29, 1990.

Appendix B1

RESULTS OF MATRIX SPIKES AND MATRIX SPIKE DUPLICATES ON PP METAL SCAN - SENECA FOODS, 5/90.*

SAMPLE ID: 'COOL WT1'

	Sb	As	Be	Cd	Cr	Cu	Pb	Ni	Se	Ag	Th	Zn	Hg	Fe
spiked sample result (ssr)	0.013	0.044	0.913	0.988	1.080	1.130	0.022	1.150	0.046	0.952	0.027	1.090	0.002	1.620
sample result (sr)	<.006	<.01	<.005	<.005	<.01	<.025	<.006	<.04	<.005	<.005	<.01	0.110	*.0002	0.550
spike added (sa)	0.015	0.050	1.000	1.000	1.000	1.000	0.025	1.000	0.050	1.000	0.025	1.000	0.002	1.000
sample (s)	0.013	0.044	0.913	0.988	1.080	1.130	0.022	1.150	0.046	0.952	0.027	1.090	0.002	1.620
duplicate (d)	0.015	0.049	0.913	0.992	1.090	1.140	0.023	1.150	0.040	0.969	0.026	1.100	0.002	1.670
%R=[(ssr-sr)/sa]*100	86.7	88.0	91.3	98.8	108.0	113.0	88.0	115.0	92.0	95.2	108.0	98.0	90.0	107.0
RPD=[(s-d)/((s+d)/2]*100	-14.3	-10.8	0.0	-0.4	-0.9	-0.9	-4.4	0.0	14.0	-1.8	3.8	-0.9	11.8	-3.0

SAMPLE ID: 'WELL2A'

	Sb	As	Be	Cd	Cr	Cu	Pb	Ni	Se	Ag	Th	Zn	Hg	Fe
spiked sample result (ssr)	0.015	0.052	1.030	0.856	0.953	0.967	0.022	1.010	0.046	0.826	0.022	0.945	0.002	19.40
sample result (sr)	<.006	<.01	<.005	<.005	<.03	<.025	<.005	<.04	<.005	<.005	<.01	<.02	<.0002	18.10
spike added (sa)	0.015	0.050	1.000	1.000	1.000	1.000	0.025	1.000	0.050	1.000	0.025	1.000	0.002	1.00
sample (s)	0.015	0.052	1.030	0.856	0.953	0.967	0.022	1.010	0.046	0.826	0.022	0.945	0.002	19.40
duplicate (d)	0.015	0.044	1.060	0.862	0.957	0.980	0.022	1.010	0.046	0.839	0.024	0.963	0.002	19.30
%R=[(ssr-sr)/sa]*100	100.0	104.0	103.0	85.6	95.3	96.7	88.0	101.0	92.0	82.6	88.0	94.5	110.0	130.0
RPD=(s-d)/[(s+d)/2]*100	0.0	16.7	-2.9	-0.7	-0.4	-1.3	0.0	0.0	0.0	-1.6	-8.7	-1.9	20.0	0.5

SAMPLE ID: 'SEEP SLG'

	Sb	As	Be	Cd	Cr	Cu	Pb	Ni	Se	Ag	Th	Zn	Hg	Fe
spiked sample result (ssr)	2.6	170.0	115.0	119.0	183.0	129.0	3.7	145.0	9.6	104.0	3.1	157.0	0.3	3.9E+05
sample result (sr)	1.1	99.6	<.5	12.1	77.5	3.7	1.1	33.2	3.7	1.9	<1	27.9	<.1	4.0E+05
spike added (sa)	1.6	109.0	109.0	109.0	109.0	109.0	2.7	109.0	5.5	109.0	2.7	109.0	0.2	1.1E+02
sample (s)	2.6	170.0	115.0	119.0	183.0	129.0	3.7	145.0	9.6	104.0	3.1	157.0	0.3	3.9E+05
duplicate (d)	2.2	160.0	111.0	119.0	186.0	123.0	3.3	145.0	8.4	100.0	2.8	155.0	0.2	3.9E+05
%R=[(ssr-sr)/sa]*100	93.75	64.59	105.50	98.07	96.79	114.95	96.34	102.57	108.61	93.67	113.55	118.44	118.18	-9E+03
RPD=(s-d)/[(s+d)/2]*100	16.67	6.06	3.54	0.00	-1.63	4.76	13.22	0.00	13.08	3.92	10.17	1.28	8.00	3.6E-01

* = all units are ppm %R = Percent Recovery RPD = Relative Percent Difference

[ ] = Recovery is too low

Appendix B2

QA/QC REPORT
ANALYSIS LABORATORY STANDARD

COMPOUND	RESULT (ppm)
Sb	<0.006
As	<0.01
Be	<0.005
Cd	<0.005
Cr	<0.01
Cu	<0.025
Pb	<0.005
Ni	<0.04
Se	<0.005
Ag	<0.01
Tl	<0.01
Zn	<0.02
Fe	<0.1
Hg	<0.0002

COMPARISON OF RESULTS ON LAB. STANDARD VS. TRUE VALUE

COMPOUND	RESULT (R)	TRUE VALUE (TV)	*RPD
Sb	0.01	0.01	0.00
As	0.008	0.01	-22.22
Be	0.996	1	-0.40
Cd	0.988	1	-1.21
Cr	1	1	0.00
Cu	0.907	1	-9.75
Pb	0.009	0.01	-10.53
Ni	1	1	0.00
Se	0.012	0.01	18.18
Ag	0.891	1	-11.53
Tl	0.009	0.01	-10.53
Zn	0.895	1	-11.08
Fe	0.0018	0.002	-10.53
Hg	1.11	1	10.43

*RPD = RELATIVE PERCENT DIFFERENCE

*RPD = ((R-TV)/((R+TV)/2)*100 Outside the acceptable range

Appendix B3

QA/QC REPORT ON VOAs, BNAs, AND PESTICIDES/PCBs – SENECA FOODS, 5/90

BLANK ANALYSIS FOR VOCs

	MATRIX	
COMPOUND	WATER (ppb)	SOIL (ppb)
Chloromethane	10 U	10 U
Bromomethane	10 U	10 U
Vinyl Chloride	10 U	10 U
Chloroethane	10 U	10 U
Methylene Chloride	5 U	5 U
Acetone	10 U	14
Carbon Disulfide	5 U	5 U
1,1-Dichloroethene	5 U	5 U
1,1-Dichloroethane	5 U	5 U
1,2-Dichloroethene(Tot)	5 U	5 U
Chloroform	5 U	5 U
1,2-Dichloroethane	5 U	5 U
2-Butanone (MEK)	10 U	10 U
1,1,1-Trichloroethane	5 U	5 U
Carbon Tetrachloride	5 U	5 U
Vinyl Acetate	10 U	10 U
Bromodichloromethane	5 U	5 U
1,2-Dichloropropane	5 U	5 U
cis-1,3-Dichloropropene	5 U	5 U
Trichloroethene	5 U	5 U
Dibromochloromethane	5 U	5 U
1,1,2-Trichloroethane	5 U	5 U
Benzene	5 U	5 U
trans-1,3-Dichloropropene	5 U	5 U
Bromoform	5 U	5 U
4-Methyl-2-Pentanone	10 U	10 U
2-Hexanone	10 U	10 U
Tetrachloroethene	5 U	5 U
1,1,2,2-Tetrachloroethane	5 U	5 U
Toluene	5 U	5 U
Chlorobenzene	5 U	5 U
Ethylbenzene	5 U	5 U
Ethenylbenzene (Styrene)	5 U	5 U
Total Xylenes	5 U	5 U

U = LESS THAN THE MINIMUM DETECTION LIMIT

Appendix B3 continued
BLANK ANALYSIS FOR BNAs

COMPOUND	MATRIX WATER (ppb)	SOIL (ppb)
Phenol	10 U	660 U
Bis(2-Chloroethyl)Ether	10 U	660 U
2-Chlorophenol	10 U	660 U
1,3-Dichlorobenzene	10 U	660 U
1,4-Dichlorobenzene	10 U	660 U
Benzyl Alcohol	10 U	660 U
1,2-Dichlorobenzene	10 U	660 U
2-Methylphenol	10 U	660 U
Bis(2-chloroisopropyl)ether	10 U	660 U
4-Methylphenol	10 U	660 U
N-Nitroso-Di-n-Propylamine	10 U	660 U
Hexachloroethane	10 U	660 U
Nitrobenzene	10 U	660 U
Isophorone	10 U	660 U
2-Nitrophenol	10 U	660 U
2,4-Dimethylphenol	10 U	660 U
Benzoic Acid	50 U	3200 U
Bis(2-Chloroethoxy)Methane	10 U	660 U
2,4-Dichlorophenol	10 U	660 U
1,2,4-Trichlorobenzene	10 U	660 U
Naphthalene	10 U	660 U
4-Chloroaniline	10 U	660 U
Hexachlorobutadiene	10 U	660 U
4-Chloro-3-Methylphenol	10 U	660 U
2-Methylnaphthalene	10 U	660 U
Hexachlorocyclopentadiene	10 U	660 U
2,4,6-Trichlorophenol	10 U	660 U
2,4,5-Trichlorophenol	50 U	3200 U
2-Chloronaphthalene	10 U	660 U
2-Nitroaniline	50 U	3200 U
Dimethyl Phthalate	10 U	660 U
Acenaphthylene	10 U	660 U
2,6-Dinitrotoluene	10 U	660 U
3-Nitroaniline	50 U	3200 U
Acenaphthene	10 U	660 U
2,4-Dinitrophenol	50 U	3200 U
4-Nitrophenol	50 U	3200 U
Dibenzofuran	10 U	660 U
2,4-Dinitrotoluene	10 U	660 U
Diethyl Phthalate	10 U	660 U

U = LESS THAN THE MINIMUM DETECTION LIMIT

Appendix B3 continued

BLANK ANALYSIS FOR BNAs continued

COMPOUND	MATRIX WATER (ppb)	SOIL (ppb)
4-Chlorophenyl-Phenylether	10 U	660 U
Fluorene	10 U	660 U
4-Nitroaniline	50 U	3200 U
4,6-Dinitro-2-Methylphenol	50 U	3200 U
N-Nitrosodimethylamine	10 U	660 U
4-Bromophenyl-Phenylether	10 U	660 U
Hexachlorobenzene	10 U	660 U
Pentachlorophenol	50 U	3200 U
Phenanthrene	10 U	660 U
Anthracene	10 U	660 U
Di-n-Butylphthalate	10 U	660 U
Fluoranthene	10 U	660 U
Pyrene	10 U	660 U
Butylbenzylpthalate	10 U	660 U
3,3'-Dichlorobenzidine	20 U	1300 U
Benzo(a)Anthracene	10 U	660 U
Chrysene	10 U	660 U
Bis(2-Ethylhexyl)phthalate	10 U	660 U
Di-n-Octyl Phthalate	10 U	660 U
Benzo(b)Fluoranthene	10 U	660 U
Benzo(k)Fluoranthene	10 U	660 U
Benzo(a)Pyrene	10 U	660 U
Indeno(1,2,3-cd)Pyrene	10 U	660 U
Dibenzo(a,h)Anthracene	10 U	660 U
Benzo(g,h,i)Perylene	10 U	660 U

U = LESS THAN THE MINIMUM DETECTION LIMIT

Appendix B3 continued

ANALYSIS OF BLANK FOR PESTICIDES/PCBs

COMPOUND	MATRIX WATER (ppb)	SOIL (ppb)
alpha-BHC	0.05 U	16 U
beta-BHC	0.05 U	16 U
delta-BHC	0.05 U	16 U
gamma-BHC (Lindane)	0.05 U	16 U
Heptachlor	0.05 U	16 U
Aldrin	0.05 U	16 U
Heptachlor Epoxide	0.05 U	16 U
Endosulfan I	0.05 U	16 U
Dieldrin	0.1 U	32 U
4,4'-DDE	0.1 U	32 U
Endrin	0.1 U	32 U
Endosulfan II	0.1 U	32 U
4,4'-DDD	0.1 U	32 U
Endosulfan Sulfate	0.1 U	32 U
4,4'-DDT	0.1 U	32 U
Methoxychlor	0.5 U	160 U
Endrin ketone	0.1 U	32 U
alpha-Chlordane	0.5 U	160 U
gamma-Chlordane	0.5 U	160 U
Toxaphene	1 U	320 U
Aroclor-1016	0.5 U	160 U
Aroclor-1221	0.5 U	160 U
Aroclor-1232	0.5 U	160 U
Aroclor-1242	0.5 U	160 U
Aroclor-1248	0.5 U	160 U
Aroclor-1254	1 U	320 U
Aroclor-1260	1 U	320 U

U = LESS THAN THE MINIMUM DETECTION LIMIT

APPENDIX B4

QA/QC REPORT ON VOAs, BNAs, AND PESTICIDES/PCBs – SENECA FOODS, 5/90

VOA'S SURROGATE RECOVERY (WATER MATRIX)

SURROGATE	QC LIMITS	EFF LGN	VBLKW1*	PLNT INT	SEEP	RIVER	VBLKW2**
TOLUENE-D8	88-110	105	95	99	108	101	99
BROMOFLUOROBENZENE	86-115	101	101	101	101	99	98
1,2-DICHLOROETHANE-D4	76-114	82	88	105	103	106	97

* = BLANK ANALYSIS1 FOR VOA (WATER MATRIX)

** = BLANK ANALYSIS2 FOR VOA (WATER MATRIX)

VOA'S SURROGATE RECOVERY (SOIL MATRIX)

SURROGATE	QC LIMITS	SEEP SLG	VBLKS1*
TOLUENE-D8	81-117	109	106
BROMOFLUOROBENZENE	74-121	109	106
1,2-DICHLOROETHANE-D4	70-121	112	95

* = BLANK ANALYSIS FOR VOA (SOIL MATRIX)

VOA'S SURROGATE RECOVERY (WATER MATRIX)

SURROGATE	QC LIMITS	EFF LGN	PLNT INT	SEEP	RIVER	BLKW1	SBLKW2**
NITROBENZENE-D5	35-114	71	82	60	83	81	76
2-FLUOROBIPHENYL	43-116	65	70	58	70	70	71
TERPHENYL	33-141	14	94	21	42	93	40
PHENOL-D5	10-94	65	26	59	61	73	70
2-FLUOROPHENOL	21-100	73	67	71	73	83	78
2,4,6-TRIBROMOPHENOL	10-123	81	71	64	69	74	81

* = BLANK ANALYSIS 1 (WATER MATRIX)

** = BLANK ANALYSIS 2 (WATER MATRIX)

PESTICIDES/PCB'S SURROGATE RECOVERY (WATER MATRIX)

SURROGATE	QC LIMITS	EFF LGN	PLNT INT	SEEP	RIVER	BLK1*
DIBUTYLCHLORENDATE	24-154	36	100	77	94	111

* = BLANK ANALYSIS ON WATER SAMPLE FOR PESTICIDE/PCBs

APPENDIX B5

QA/QC REPORT ON NUTRIENT ANALYSIS - SENECA FOODS 5/90

SPIKE RECOVERIES (70-130%)

SAMPLE	PARAMETER	CONC. (ppm)	RECOVERY (%)
COOL WT1	AMMONIA	0.10	100.00
PLNT INT	AMMONIA	0.10	90.00
PLNT INT	NITR(ATE+ITE)	0.10	95.00
RIVER	NITR(ATE+ITE)	0.10	107.00
RIVER	T PHOSPHORUS	0.10	96.00

CHECK STANDARDS (+/- 2 or +/- 5%)

NUMBER	PARAMETER	VALUE (ppm)	TEST VALUE (ppm)	RECOVERY (%)
CS1	AMMONIA	6.80	6.90	101.00
CS2	NITR(ATE+ITE)	9.00	9.15	102.00
CS3	T PHOSPHORUS	5.00	5.14	103.00

DUPLICATE ANALYSIS (+/- 5%)

SAMPLE	PARAMETER (mg/L)	ANALYSIS 1	ANALYSIS 2	DIFFERENCE
COOL WT1	AMMONIA	0.043	0.040	0.003
PLNT INT	AMMONIA	0.003	*0.005	-0.002
RIVER	NITR(ATE+ITE)	0.691	0.729	0.038**
PLNT INT	NITR(ATE+ITE)	0.024	0.020	0.004
RIVER	T PHOSPHORUS	0.111	0.109	0.002
WELL1	T PHOSPHORUS	0.258	0.220	0.038**

* - LESS THAN THE VALUE

** - DENOTES OUTSIDE THE ACCEPTED RANGE (+/- 5%)

APPENDIX B6

QA/QC REPORT ON COD, TOC, %SOLID, & TKN ANALYSIS - SENECA FOODS, 5/90

SPIKE RECOVERIES (70-130%)

SAMPLE	PARAMETER	SPIKE CONC. (ppb)	RECOVERY (%)
EF LGN	TKN	1.00	99.00

CHECK STANDARDS

NUMBER	PARAMETER	KNOWN VALUE (ppb)	TEST VALUE (ppm)	RECOVERY (%)
CS1	TKN	2.90	3.13	107.90
CS2	TOC	3.50	3.49	99.70

DUPLICATE ANALYSIS

SAMPLE	PARAMETER	ANALYSIS 1	ANALYSIS 2	DIFFERENCE
SEEP SLG	TOC (%)	1.05	0.99	0.06
SEEP SLG	%SOLID (%)	4.10	4.10	0.00
EF LGN	TKN (mg/L)	14.80	11.60	3.20
INF LGN1	COD (mg/L)	5040.00	5040.00	0.00
WELL2	COD (mg/L)	11.30	<10	1.30
RIVER	COD (mg/L)	<10.0	<10.0	0.00

< - LESS THAN THE VALUE

APPENDIX C

RESULTS OF PRIORITY POLLUTANT SCAN – SENECA FOODS, 5/90

Field Station:	PLNT INT	EF LGN	SEEP	EEP SLG	RIVER
Type:	Grab	Comp	Grab	Grab	Grab
Date:	5/1/90	5/1/90	5/1/90	5/1/90	5/2/90
Time:	11:40	24 hr	09:05	09:05	12:05
Lab sample#:	1881-92	-83	-95	-96	1882-06
VOC	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
Chloromethane	10 U	10 U	10 U	110 U	10 U
Bromomethane	10 U	10 U	10 U	110 U	10 U
Vinyl Chloride	10 U	10 U	10 U	110 U	10 U
Chloroethane	10 U	10 U	10 U	110 U	10 U
Methylene Chloride	5 U	5 U	5 U	56 U	5 U
Acetone	85	1100 E	10 U	190 U	10 U
Carbon Disulfide	5 U	5 U	5 U	56 U	5 U
1,1-Dichloroethene	5 U	5 U	5 U	56 U	5 U
1,1-Dichloroethane	5 U	5 U	5 U	56 U	5 U
2-Dichloroethene(Tot)	5 U	5 U	5 U	56 U	5 U
Chloroform	2 J	5 U	5 U	56 U	5 U
1,2-Dichloroethane	5 U	5 U	5 U	56 U	5 U
2-Butanone (MEK)	10 U	39	10 U	110 U	10 U
1,1,1-Trichloroethane	5 U	5 U	5 U	56 U	5 U
Carbon Tetrachloride	5 U	5 U	5 U	56 U	5 U
Vinyl Acetate	10 U	10 U	10 U	110 U	10 U
Bromodichloromethane	2 J	5 U	5 U	56 U	5 U
1,2-Dichloropropane	5 U	5 U	5 U	56 U	5 U
cis-1,3-Dichloropropene	5 U	5 U	5 U	56 U	5 U
Trichloroethene	5 U	5 U	5 U	56 U	5 U
Dibromochloromethane	2 J	5 U	5 U	56 U	5 U
1,1,2-Trichloroethane	5 U	5 U	5 U	56 U	5 U
Benzene	5 U	5 U	5 U	56 U	5 U
trans-1,3-Dichloropropene	5 U	5 U	5 U	56 U	5 U
Bromoform	5 U	5 U	5 U	56 U	5 U
4-Methyl-2-Pentanone	10 U	10 U	10 U	110 U	10 U
2-Hexanone	10 U	10 U	10 U	110 U	10 U
Tetrachloroethene	5 U	5 U	5 U	56 U	5 U
1,1,2,2-Tetrachloroethane	5 U	5 U	5 U	56 U	5 U
Toluene	5 U	23	5 U	56 U	5 U
Chlorobenzene	5 U	5 U	5 U	56 U	5 U
Ethylbenzene	5 U	5 U	5 U	56 U	5 U
Ethenylbenzene (Styrene)	5 U	5 U	5 U	56 U	5 U
Total Xylenes	5 U	5 U	5 U	56 U	5 U

APPENDIX C Continued

RESULTS OF PRIORITY POLLUTANT SCAN - SENECA FOODS, 5/90

Field Station:	PLNT INT	EF LGN	SEEP	SEEP SLG	RIVER
Type:	Grab	Comp	Grab	Grab	Grab
Date:	5/1/90	5/1/90	5/1/90	5/1/90	5/2/90
Time:	11:40	24 hr	09:05	09:05	12:05
Lab sample#:	-92	1881-83	-95	-96	1882-06
BNA Compounds	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
Phenol	10 U	67 U	10 U	6600 U	10 U
Bis(2-Chloroethyl)Ether	10 U	67 U	10 U	6600 U	10 U
2-Chlorophenol	10 U	67 U	10 U	6600 U	10 U
1,3-Dichlorobenzene	10 U	67 U	10 U	6600 U	10 U
1,4-Dichlorobenzene	10 U	67 U	10 U	6600 U	10 U
Benzyl Alcohol	10 U	67 U	10 U	6600 U	10 U
1,2-Dichlorobenzene	10 U	67 U	10 U	6600 U	10 U
2-Methylphenol	10 U	67 U	10 U	6600 U	10 U
Bis(2-chloroisopropyl)ether	10 U	67 U	10 U	6600 U	10 U
4-Methylphenol	10 U	67 U	10 U	6600 U	10 U
N-Nitroso-Di-n-Propylamine	10 U	67 U	10 U	6600 U	10 U
Hexachloroethane	10 U	67 U	10 U	6600 U	10 U
Nitrobenzene	10 U	67 U	10 U	6600 U	10 U
Isophorone	10 U	67 U	10 U	6600 U	10 U
2-Nitrophenol	10 U	67 U	10 U	6600 U	10 U
2,4-Dimethylphenol	10 U	67 U	10 U	6600 U	10 U
Benzoic Acid	50 U	330 U	50 U	**690** J	50 U
Bis(2-Chloroethoxy)Methane	10 U	67 U	10 U	6600 U	10 U
2,4-Dichlorophenol	10 U	67 U	10 U	6600 U	10 U
1,2,4-Trichlorobenzene	10 U	67 U	10 U	6600 U	10 U
Naphthalene	10 U	67 U	10 U	6600 U	10 U
4-Chloroaniline	10 U	67 U	10 U	6600 U	10 U
Hexachlorobutadiene	10 U	67 U	10 U	6600 U	10 U
Chloro-3-Methylphenol	10 U	67 U	10 U	6600 U	10 U
2-Methylnaphthalene	10 U	67 U	10 U	6600 U	10 U
Hexachlorocyclopentadiene	10 U	67 U	10 U	6600 U	10 U
2,4,6-Trichlorophenol	10 U	67 U	10 U	6600 U	10 U
2,4,5-Trichlorophenol	50 U	330 U	50 U	32000 U	50 U
2-Chloronaphthalene	10 U	67 U	10 U	6600 U	10 U
2-Nitroaniline	50 U	330 U	50 U	32000 U	50 U
Dimethyl Phthalate	10 U	67 U	10 U	6600 U	10 U
Acenaphthylene	10 U	67 U	10 U	6600 U	10 U
2,6-Dinitrotoluene	10 U	67 U	10 U	6600 U	10 U
3-Nitroaniline	50 U	330 U	50 U	32000 U	50 U
Acenaphthene	10 U	67 U	10 U	6600 U	10 U
2,4-Dinitrophenol	50 U	330 U	50 U	32000 U	50 U
4-Nitrophenol	50 U	330 U	50 U	32000 U	50 U
Dibenzofuran	10 U	67 U	10 U	6600 U	10 U
2,4-Dinitrotoluene	10 U	67 U	10 U	6600 U	10 U
Diethyl Phthalate	10 U	67 U	10 U	6600 U	10 U
4-Chlorophenyl-Phenylether	10 U	67 U	10 U	6600 U	10 U
Fluorene	10 U	67 U	10 U	6600 U	10 U
4-Nitroaniline	50 U	330 U	50 U	32000 U	50 U

APPENDIX C continued

RESULTS OF PRIORITY POLLUTANT SCAN - SENECA FOODS, 5/90

Field Station:	PLNT INT	EF LGN	SEEP	SEEP SLG	RIVER
Type:	Grab	Comp	Grab	Grab	Grab
Date:	5/1/90	5/1/90	5/1/90	5/1/90	5/2/90
Time:	11:40	24 hr	09:05	09:05	12:05
Lab sample#:	-92	1881-83	-95	-96	1882-06
BNA Compounds	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
4,6-Dinitro-2-Methylphenol	50 U	330 U	50 U	32000 U	50 U
N-Nitrosodimethylamine	10 U	67 U	4 J	6600 U	10 U
4-Bromophenyl-Phenylether	10 U	67 U	10 U	6600 U	10 U
Hexachlorobenzene	10 U	67 U	10 U	6600 U	10 U
Pentachlorophenol	50 U	330 U	50 U	32000 U	50 U
Phenanthrene	10 U	67 U	10 U	6600 U	10 U
Anthracene	10 U	67 U	10 U	6600 U	10 U
Di-n-Butylphthalate	10 U	67 U	10 U	6600 U	10 U
Fluoranthene	10 U	67 U	10 U	6600 U	10 U
Pyrene	10 U	67 U	10 U	6600 U	10 U
Butylbenzylpthalate	10 U	67 U	10 U	6600 U	10 U
3,3'-Dichlorobenzidine	20 U	330 U	20 U	13000 U	20 U
Benzo(a)Anthracene	10 U	67 U	10 U	6600 U	10 U
Chrysene	10 U	67 U	10 U	6600 U	10 U
Bis(2-Ethylhexyl)phthalate	10 U	67 U	10 U	690 J	10 U
Di-n-Octyl Phthalate	10 U	67 U	10 U	6600 U	10 U
Benzo(b)Fluoranthene	10 U	67 U	10 U	6600 U	10 U
Benzo(k)Fluoranthene	10 U	67 U	10 U	6600 U	10 U
Benzo(a)Pyrene	10 U	67 U	10 U	6600 U	10 U
Indeno(1,2,3-cd)Pyrene	10 U	67 U	10 U	6600 U	10 U
Dibenzo(a,h)Anthracene	10 U	67 U	10 U	6600 U	10 U
Benzo(g,h,i)Perylene	10 U	67 U	10 U	6600 U	10 U
PESTICIDE/PCB Compounds	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
alpha-BHC	0.05 U	0.05 U	0.05 U	180 U	0.05 U
beta-BHC	0.05 U	0.05 U	0.05 U	180 U	0.05 U
delta-BHC	0.05 U	0.05 U	0.05 U	180 U	0.05 U
gamma-BHC (Lindane)	0.05 U	0.05 U	0.05 U	180 U	0.05 U
Heptachlor	0.05 U	0.05 U	0.05 U	180 U	0.05 U
Aldrin	0.05 U	0.05 U	0.05 U	180 U	0.05 U
Heptachlor Epoxide	0.05 U	0.05 U	0.05 U	180 U	0.05 U
Endosulfan I	0.05 U	0.05 U	0.05 U	180 U	0.05 U
Dieldrin	0.1 U	0.1 U	0.1 U	360 U	0.1 U
4,4'-DDE	0.1 U	0.1 U	0.1 U	360 U	0.1 U
Endrin	0.1 U	0.1 U	0.1 U	360 U	0.1 U
Endosulfan II	0.1 U	0.1 U	0.1 U	360 U	0.1 U
4,4'-DDD	0.1 U	0.1 U	0.1 U	360 U	0.1 U
Endosulfan Sulfate	0.1 U	0.1 U	0.1 U	360 U	0.1 U
4,4'-DDT	0.1 U	0.1 U	0.1 U	360 U	0.1 U
Methoxychlor	0.5 U	0.5 U	0.5 U	1800 U	0.5 U
Endrin ketone	0.1 U	0.1 U	0.1 U	360 U	0.1 U
alpha-Chlordane	0.5 U	0.5 U	0.5 U	1800 U	0.5 U
gamma-Chlordane	0.5 U	0.5 U	0.5 U	1800 U	0.5 U
Toxaphene	1 U	1 U	1 U	3600 U	1 U

APPENDIX C continued

RESULTS OF PRIORITY POLLUTANT SCAN – SENECA FOODS, 5/90

Field Station:	PLNT INT	EF LGN	SEEP	SEEP SLG	RIVER
Type:	Grab	Comp	Grab	Grab	Grab
Date:	5/1/90	5/1/90	5/1/90	5/1/90	5/2/90
Time:	11:40	24 hr	09:05	09:05	12:05
Lab sample#:	-92	1881-83	-95	-96	1882-06
PESTICIDE/PCB Compounds	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
Aroclor-1016	0.5 U	0.5 U	0.5 U	1800 U	0.5 U
Aroclor-1221	0.5 U	0.5 U	0.5 U	1800 U	0.5 U
Aroclor-1232	0.5 U	0.5 U	0.5 U	1800 U	0.5 U
Aroclor-1242	0.5 U	0.5 U	0.5 U	1800 U	0.5 U
Aroclor-1248	0.5 U	0.5 U	0.5 U	1800 U	0.5 U
Aroclor-1254	1 U	1 U	1 U	3600 U	1 U
Aroclor-1260	1 U	1 U	1 U	3600 U	1 U

U – indicates compound was analyzed for but not detected at the given quantitation limit.

J – indicates an estimated value because result is less than specified quantification limit.

E – Sample amount exceeded the known calibration should be considered an estimate.