
PROJECT SUMMARY OF THE APRIL 1991
CLASS II INSPECTION AT THE
ARCO PETROLEUM PRODUCTS COMPANY
CHERRY POINT REFINERY

by
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ABSTRACT

A Class II inspection was conducted on April 8-10, 1991, at the ARCO Petroleum Products Company Cherry Point Refinery (ARCO). Sediments were collected near the ARCO outfall on April 16, 1991, as part of the inspection. Inspection results were within daily maximum and daily average NPDES permit limits. Some differences in Ecology laboratory results and ARCO laboratory results for BOD₅, TSS, COD, and hexavalent chromium were noted. Also, amphipod and echinoderm larvae mortality was observed in the edge of dilution zone sediment and echinoderm larvae mortality was observed in the background sediment.

INTRODUCTION

A Class II inspection was conducted on April 8-10, 1991, at the ARCO Petroleum Products Company Cherry Point Refinery (ARCO). The inspection was conducted by Tapas Das and Marc Heffner of the Ecology Environmental Investigations Compliance Monitoring Unit. Brian Lynch represented ARCO and provided on-site assistance. ENSR Consulting and Engineering (ENSR) was retained by ARCO to accompany Ecology and split samples with Ecology during the inspection. Laurie Ihle represented ENSR.

Sediments were collected near the ARCO outfall on April 16, 1991, as part of the inspection. Bernie Strong, Scott Noble, and Marc Heffner represented Ecology and collected the sediments. Ardea Enterprises, Inc. (Ardea) was retained by ARCO to accompany Ecology

and split samples with Ecology during the sediment sampling. Michael Kyte and Dale Dickinson represented Ardea.

The ARCO Cherry Point Refinery is approximately twelve miles northwest of Bellingham. The facility refines approximately 180,000 barrels of oil per day to produce gasoline, diesel fuel, and other petroleum based products. The plant wastewater discharge is via a single outfall into the Strait of Georgia. The discharge includes treated process wastewater, stormwater that is treated as necessary, and treated sanitary wastewater. The discharge is regulated by NPDES permit WA-002290-0, which was issued on March 1, 1990, and expires March 1, 1995.

The inspection was designed to focus on the wastewater treatment system and receiving water sediments. Specific objectives included:

1. verify NPDES permit self monitoring;
2. assess effluent toxicity with bioassays and pollutant scans;
3. assess secondary wastewater treatment plant loading and treatment efficiency; and
4. assess receiving water sediments with bioassays and chemical analyses.

PROCEDURES

Ecology collected composite and grab samples of secondary influent (after the API separator), trickling filter effluent, settled stormwater, and final effluent. Ecology Isco composite samplers were set up to collect equal volumes of sample every 30 minutes for 24 hours. Sampler configurations and locations are summarized in Appendix A.

ARCO also collected an effluent composite sample. The sampler was set to collect equal volumes of sample every 15 minutes for 24 hours.

All composite samples were split and all grab samples taken in pairs for Ecology and ARCO analysis. Samples collected, sampling times and parameters analyzed are summarized in Appendix B.

Receiving water sediments were collected by Ecology with a 0.1 m² van Veen grab sampler at two stations; one at a background site and near the edge of the dilution zone (Appendix A). Sediment collection at a third station near the outfall was unsuccessfully attempted. Dale Dickinson accompanied Ecology in the Ardea boat to help locate station positions. At each station, the top two centimeters of sample from successive grab samples were collected. VOA bottles for Ecology and ARCO analysis were filled from the first grab. The remainder of the first grab and subsequent grabs were put in a two gallon stainless steel bucket. When the bucket was full, the contents of the bucket were homogenized and put in

appropriate containers for Ecology analysis. One additional grab was collected and added to the bucket. The contents of the bucket were homogenized and put in appropriate containers for ARCO analysis. Samples collected, sampling times and parameters analyzed are summarized in Appendix B.

Samples for Ecology analysis were placed on ice and delivered to the Ecology Manchester Laboratory. Analytical procedures and laboratories doing the analysis are summarized in Appendix C.

Samples for ARCO analysis were handled in one of two ways. NPDES permit parameters were analyzed by or for ARCO as is typically done for self-monitoring (Appendix B). Additional parameters were analyzed by contract labs and the results were included in an ENSR report for ARCO (ENSR, 1991).

QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

Sampling

Water and sampling quality assurance/quality control (QA/QC) steps included priority pollutant cleaning all sampling equipment, including the composite samplers, prior to the inspection. Also, a field transfer/equipment blank was collected prior to sampling. The QA/QC procedures are summarized in Appendix D.

Sediment sampling QA/QC steps included collecting only sediment not in direct contact with the sampler and pre-inspection priority pollutant cleaning of equipment that would contact the samples (Appendix D).

Field chain of custody was maintained on all samples.

General Chemistry Analysis

Holding times, duplicate analysis results, spike recoveries, and check standard results met Ecology quality standards for most general chemistry parameters. Weak and dissociable cyanide and phenolics analysis of sediment samples had low spike recoveries. Total cyanide and phenolics analysis of sediment samples were done after the recommended holding time had been exceeded. Total-P and phenolics analysis of water samples were done after the recommended holding time had been exceeded. A "J" qualifier (J = estimated value) is attached to sediment total cyanide data, sediment weak and dissociable cyanide, water Total-P data, and all phenolics data.

Priority Pollutant Organics Analysis

Holding times, method blanks, surrogate recoveries, and matrix spike and spike duplicate data met Ecology standards for data use without further qualification.

Priority Pollutant Metals Analysis

Holding times, method blanks, laboratory control sample data, and matrix spike and spike duplicate data met Ecology standards for data use without further qualification, with one exception. Selenium spike duplicate results for the water sample analyzed (22%) were slightly greater than target limits (+/-20%): all water sample selenium results are qualified with an "N" qualifier (N = value not within control limits).

Bioassays

Control results, reference toxicant results, and test solution chemistry data (dissolved oxygen, pH, etc. as applicable) were acceptable for all organisms tested.

RESULTS AND SUMMARY

Results are presented in relation to the inspection objectives.

Objective 1 - Verify NPDES permit self monitoring

Table 1 NPDES Permit Limits/Inspection Results Comparison

- inspection results were within daily maximum and daily average permit limits

Table 2 Split Sample Results Comparison for Permit Parameters

- There were serious differences in the Ecology laboratory and ARCO laboratory results for some of the BOD₅, COD, and TSS split sample results. There was also some variability in hexavalent chromium results.
- split sample results for the other parameters look reasonable

Objective 2 - Assess effluent toxicity with bioassays and pollutant scans

Table 3 Ecology Effluent Bioassay Results

- No significant toxicity was noted in:
 - Daphnia magna* - survival test
 - Echinoderm sperm cell - fertilization test
 - Rainbow trout - survival test
 - Sheepshead minnow - survival portion of test

- Toxicity was noted as follows:
 Bivalve larvae (acute and chronic NOEC = 35% effluent)
 Fathead minnow (acute NOEC = 50% effluent)
 Sheepshead minnow (chronic NOEC = 50% effluent)
- Erratic rainbow trout behavior was noted in the 100% effluent sample at test termination

Table 4 Comparison of Ecology and ARCO Effluent Bioassay Results

- ARCO and Ecology results were similar. ARCO found end points to occur at slightly lower effluent concentrations in the bivalve larvae and echinoderm sperm cell bioassays.

Table 5 Organic Compounds Detected by Ecology and Comparison with EPA Water Quality Criteria

- The BTEX compounds and 2-butanone (MEK) were the organics detected at the highest concentrations in the influent sample.
- Organics were removed from the wastewater by the treatment process. No measurements were made to determine if the losses were due to compound destruction, volatilization, or attachment to sludge.
- Only two compounds were detected in the effluent; both at estimated concentrations.
- In the effluent, all concentrations were less than Water Quality Criteria (EPA, 1986).
- A complete listing of parameters analyzed by Ecology and analytical results is included in Appendix E. Tentatively identified compounds (TICs) are noted in Appendix F.

Table 6 Comparison of Organic Compounds Detected by Ecology and ARCO Analysis of Water Samples

- ARCO results and Ecology results are similar

Table 7 Metals Scan Results

- There were some differences in Ecology and ARCO cadmium, selenium, and hexavalent chromium analytical results. Most other Ecology and ARCO results compare well.
- Ecology had high detection limits for arsenic and copper.

Table 8 Comparison of Effluent Metals Concentrations to EPA Water Quality Criteria

- Concentrations of several metals exceeded one or more of the EPA toxicity criteria (EPA, 1986).

Objective 3 - Assess secondary wastewater treatment plant loading and treatment efficiency.

Table 9 Ecology Laboratory General Chemistry Results

Influent

- TSS low (34 mg/L)
- BOD₅ moderate (220 mg/L)
- TS high (5930 mg/L)

Trickling Filter

- No net BOD₅ reduction
- TSS had increased (97 mg/L)
- May serve as a selector for the activated sludge system

Stormwater

- BOD₅, COD, and TOC concentrations are similar to final effluent concentrations
- TSS concentration greater than final effluent concentration

Effluent

- Low BOD₅ (< 10 mg/L)
- Low TSS (14-19 mg/L)
- Cyanide, total phenolics, and oil and grease concentrations less than influent concentrations
- Nutrient concentrations roughly the same through the treatment process (some reduction in total-P)

Table 10 Organic Compound Removal by the Trickling Filter

- VOA compound concentrations reduced 44-85%
- BNA compound concentrations reduced 6-53%
- No measurements were made to determine if the losses were due to compound destruction or volatilization.

Objective 4 - Assess receiving water sediments with bioassays and chemical analysis

Table 11 Ecology Sediment Bioassay Results

- Significant amphipod mortality was observed in the Sed-2 (edge dilution) sample.

- Nearly complete echinoderm larvae mortality was observed in the Sed-1 (background) and Sed-2 (edge dilution) samples.
- Worms and sea anemones were observed in the sediments during collection.
- A sediment sample near the outfall could not be collected (see Appendix A).

Table 12 Comparison of Ecology and ARCO Sediment Bioassay Results

- ARCO found no amphipod mortality in either sample - Ecology found mortality in the Sed-2 (edge dilution) sample.
- ARCO did not do an echinoderm larvae test.

Table 13 Comparison of Ecology and ARCO Sediment Results with Marine Sediment Criteria

- Ecology detected some toluene, ethylbenzene, and total xylenes in the Sed-1 (background) sample. There are no Ecology Marine Sediment Standards for these compounds (Ecology, 1991). Other Ecology and ARCO VOA results were similar.
- Ecology and ARCO BNA, pesticide/PCB, and metals results were similar. All detected organics were estimated concentrations.
- One compound (at an estimated concentration) in Sed-1 (background) was the only compound in the sediment samples exceeding Ecology Marine Sediment Standards (Ecology, 1991).
- A complete listing of parameters analyzed by Ecology and analytical results is included in Appendix E. Tentatively identified compounds (TICs) are noted in Appendix F.

RECOMMENDATIONS

- Differences in Ecology laboratory results and ARCO laboratory results for BOD₅, TSS, COD, and hexavalent chromium were noted. In some cases, these differences were substantial. Sample splits should be made during future inspections to determine if differences commonly occur and corrective action is necessary. The Ecology Quality Assurance Section may provide useful information for a corrective action strategy.
- Bivalve larvae, fathead minnow, and sheepshead minnow bioassays should be considered when selecting sensitive species for routine testing.
- The amphipod and echinoderm larvae mortality observed in the sediments should be investigated.

REFERENCES

Ecology, 1991. Sediment Management Standards, Chapter 173-204 WAC. Washington State Department of Ecology, April, 1991.

ENSR, 1991. Chemical and Bioassay Test Results - Enhanced Class II Inspection - April, 1991. ARCO Products Company Cherry Point Refinery - Blaine, Washington, October, 1991.

EPA, 1986. Quality Criteria for Water, EPA 440/5-86-001. U.S. Environmental Protection Agency.

Noble, Scott, 1991. ARCO Class II Results of Salmonid Bioassay, memo to Marc Heffner. Washington State Department of Ecology, May 24, 1991.

Table 1 - NPDES Permit Limits/Inspection Results Comparison - ARCO, April 1991.

| | Effluent Limits | | Location: | | | | | | | | | |
|--------------------------------|--------------------------------------|------------------|------------|--------|------------|--------|------------|--------|------------|--------|------------|--------|
| | Daily Average | Daily Maximum | Ef-1 | | Ef-2 | | Ef-3 | | Ef-4 | | Ef-arco | |
| | | | Type: | Grab | Type: | Grab | Type: | Comp | Type: | H-Comp | Type: | Comp |
| | | | Date: | 4/9 | Date: | 4/9 | Date: | 4/9 | Date: | 4/9 | Date: | 4/9 |
| | | | Time: | 1055 | Time: | 1440 | Time: | *** | Time: | ** | Time: | *** |
| | | | Lab Log #: | 158140 | Lab Log #: | 158141 | Lab Log #: | 158142 | Lab Log #: | 158143 | Lab Log #: | 158144 |
| | | | Laboratory | | | | | | | | | |
| BOD5 (lbs/day) | | | Ecology | | Ecology | | Ecology | <314 | Ecology | | Ecology | <314 |
| | | | ARCO | | ARCO | | ARCO | 470 | ARCO | | ARCO | 423 |
| COD (lbs/day) | 8240 | 16,500 | Ecology | | Ecology | | Ecology | 1568 | Ecology | | Ecology | 1662 |
| | | | ARCO | | ARCO | | ARCO | 2665 | ARCO | | ARCO | 2665 |
| TSS (lbs/day) | 950 | 1540 | Ecology | | Ecology | | Ecology | 439 | Ecology | | Ecology | 564 |
| | | | ARCO | | ARCO | | ARCO | 815 | ARCO | | ARCO | 878 |
| Oil and Grease (lbs/day) | 350 | 650 | Ecology | 50 | Ecology | <31 | Ecology | | Ecology | | Ecology | |
| | | | ARCO | 138 | ARCO | 122 | ARCO | | ARCO | | ARCO | |
| Total Phenolics (lbs/day) | 7.1 | 16.5 | Ecology | | Ecology | | Ecology | 0.6J | Ecology | | Ecology | 0.3J |
| | | | ARCO | | ARCO | | ARCO | <3 | ARCO | | ARCO | 3.1 |
| NH3-N (lbs/day) | 830 | 1790 | Ecology | | Ecology | | Ecology | 176 | Ecology | | Ecology | R |
| | | | ARCO | | ARCO | | ARCO | 229 | ARCO | | ARCO | 232 |
| Sulfide (lbs/day) | 6.4 | 14.1 | Ecology | <3 | Ecology | <3 | Ecology | | Ecology | | Ecology | |
| | | | ARCO | <3 | ARCO | <3 | ARCO | | ARCO | | ARCO | |
| Total Chromium (lbs/day) | 11.9 | 27 | Ecology | | Ecology | | Ecology | 1.6 | Ecology | | Ecology | 2.2 |
| | | | ARCO | | ARCO | | ARCO | <1.6 | ARCO | | ARCO | 1.9 |
| Hexavalent Chromium (lbs/day) | 0.9 | 1.9 | Ecology | | Ecology | | Ecology | 0.6 | Ecology | | Ecology | 0.6 |
| | | | ARCO | | ARCO | | ARCO | <0.6 | ARCO | | ARCO | 0.6 |
| pH | within range of 6.0 to 9.0 | | Ecology | 8.1 | Ecology | 8.0 | Ecology | | Ecology | | Ecology | |
| | | | ARCO | 7.9 | ARCO | 7.8 | ARCO | | ARCO | | ARCO | |
| F-Coliform (#/100mL) | 200 | 400 | Ecology | 6H | Ecology | 17H | Ecology | | Ecology | | Ecology | |
| | | | ARCO | ++ | ARCO | ++ | ARCO | | ARCO | | ARCO | |
| Chlorine (mg/L) | — | 1.0 | Ecology | <0.1 | Ecology | <0.1 | Ecology | | Ecology | | Ecology | |
| | | | ARCO | 0.04 | ARCO | 0.04 | ARCO | | ARCO | | ARCO | |
| Salmonid Bioassay (% survival) | 80% survival in min. of 65% effluent | | Ecology | | Ecology | | Ecology | | Ecology | 100 | Ecology | |
| | | | ARCO | | ARCO | | ARCO | | ARCO | 100 | ARCO | |
| Flow (MGD) | — | — | | | | | | 3.76 * | | | | 3.76 * |

- Ef Final effluent sample
- * Flow rate provided by ARCO
- ** Equal volumes collected with the 1055 and 1440 grab samples
- *** Composite samples were collected from midnight to midnight
- ++ Test invalidated due to contamination by foreign organisms
- No limit
- H Exceeded holding time requirements
- J The analyte was positively identified. The associated numerical result is an estimate.
- R Sampling or analytical error resulted in unusable data.

Table 2 – Split Sample Results Comparison for Permit Parameters – ARCO, April 1991.

| | | | | | | | | | | | |
|------------|--------|--------|--------|---------|---------|---------|--------|--------|--------|--------|---------|
| Location: | Inf-1 | Inf-2 | Inf-3 | Tf-ef-1 | Tf-ef-2 | Tf-ef-3 | Strm-3 | Ef-1 | Ef-2 | Ef-3 | Ef-arco |
| Type: | Grab | Grab | Comp | Grab | Grab | Comp | Grab | Grab | Grab | Comp | Comp |
| Date: | 4/9 | 4/9 | 4/9 | 4/9 | 4/9 | 4/9 | 4/9 | 4/9 | 4/9 | 4/9 | 4/9 |
| Time: | 1155 | 1605 | *** | 1225 | 1510 | *** | 1705 | 1055 | 1440 | *** | *** |
| Lab Log #: | 158131 | 158132 | 158133 | 158134 | 158135 | 158136 | 158139 | 158140 | 158141 | 158142 | 158144 |

| Parameter | Laboratory * | | | | | | | | | | |
|----------------------------|--------------|------|------|-------|------|------|-------|--------|-------|--------|---------|
| BOD5 (mg/L) | Ecology | | | 220 | | | 220 | <10 | | <10 | <10 |
| | ARCO | | | 18 | | | 25 | 3 | | 15 | 13.5 |
| COD (mg/L) | Ecology | | | 420 | | | 330 | 35 | | 50 | 53 |
| | ARCO | | | 887 | | | 699 | 102 | | 85 | 85 |
| TSS (mg/L) | Ecology | | | 34 | | | 97 | 60 | | 14 | 18 |
| | ARCO | | | 87 | | | 68 | 89 | | 26 | 28 |
| Oil and Grease (mg/L) | Ecology | 32 | 19 | | 30 | 26 | | <1 | 1.6 | <1 | |
| | ARCO | 45 | 24 | | 53 | 27 | | 4.4 | 4.4 | 3.9 | |
| Total Phenolics (mg/L) | Ecology | | | 5.9 J | | | 3.9 J | 0.01 J | | 0.02 J | <0.01 J |
| | ARCO | | | 4.1 | | | 3.0 | 0.1 | | <0.1 | 0.1 |
| NH3-N (mg/L) | Ecology | | | 3.5 | | | 4.7 | 1.7 | | 5.6 | R |
| | ARCO | | | 4.3 | | | 5.8 | 2.4 | | 7.3 | 7.4 |
| Sulfide (mg/L) | Ecology | <0.1 | <0.1 | | <0.1 | <0.1 | | <0.1 | <0.1 | <0.1 | |
| | ARCO | <0.1 | <0.1 | | <0.1 | <0.1 | | <0.1 | <0.1 | <0.1 | |
| Total Chromium (mg/L) | Ecology | | | 0.53 | | | 0.70 | 0.06 | | 0.05 | 0.07 |
| | ARCO | | | 0.53 | | | 0.28 | 0.04 | | <0.05 | 0.06 |
| Hexavalent Chromium (mg/L) | Ecology | | | 0.121 | | | 0.173 | 0.022 | 0.016 | 0.046 | 0.019 |
| | ARCO | | | <0.02 | | | <0.02 | <0.02 | <0.02 | <0.02 | 0.02 |
| F-Coliform (#/100mL) | Ecology | | | | | | | | 6 H | 17 H | |
| | ARCO | | | | | | | | ++ | ++ | |
| Chlorine (mg/L) | Ecology | | | | | | | | <0.1 | <0.1 | |
| | ARCO | | | | | | | | 0.04 | 0.04 | |
| pH | Ecology | | 7.6 | | 7.6 | 7.6 | | | 8.1 | 8.0 | |
| | ARCO | | 7.5 | | 7.5 | 7.4 | | | 7.9 | 7.8 | |
| Temperature (C) | Ecology | 28.0 | 30.6 | | 29.3 | 29.7 | | | 15.7 | 16.3 | |
| | ARCO | 35.6 | 36.7 | | 32.8 | 33.9 | | | 15.6 | 16.1 | |

Inf – Influent sample

Tf-ef – Trickling filter effluent sample

Ef – Final effluent sample

*** Composite samples were collected from midnight to midnight

R – Sampling or analytical error resulted in unusable data

++ Test invalidated due to contamination by foreign organisms

J – The analyte was positively identified. The associated numerical result is an estimate.

H – Exceeded holding time requirements

* ARCO lab analysis done by the ARCO laboratory or, if parameter analysis is usually contracted out, by the usual contract laboratory

Table 3 – Ecology Effluent Bioassay Results – ARCO, April, 1991

NOTE: All tests were run on the effluent (Ef-4 sample – lab log # 158143)

Daphnia magna – 48 hour survival test
(*Daphnia magna*)

| Sample | # Tested * | Percent Survival |
|----------------|------------|------------------|
| Control | 20 | 100 |
| 25 % Effluent | 20 | 100 |
| 50 % Effluent | 20 | 100 |
| 100 % Effluent | 20 | 100 |

LC50 = >100 % effluent

LOEC = >100 % effluent

* 4 replicates of 5 organisms each

Bivalve Larvae – 48 hour survival and development test
Pacific oyster (*Crassostrea gigas*)

| Sample ** | Effluent | | Brine Control *** | |
|------------------|-----------------------|-------------------------------|---------------------|-----------------------------|
| | Average % Mortality * | Average % Abnormal and Dead * | Average % Mortality | Average % Abnormal and Dead |
| Seawater Control | -0.6 | 1.3 | | |
| 4.4 % Solution | 8.9 | 9.8 | 9.7 | 11.0 |
| 8.75 % Solution | 8.9 | 9.1 | 17.4 | 18.1 |
| 17.5 % Solution | 4.9 | 5.0 | 19.4 | 20.6 |
| 35 % Solution | 1.2 | 2.8 | -4.5 | -2.6 |
| 70 % Solution | 26.2 + | 98.5 + | 18.1 | 18.7 |

Acute
LC50 = >70 % effluent
NOEC = 35 % effluent
LOEC = 70 % effluent

Chronic
EC50 = 48.3% effluent
NOEC = 35 % effluent
LOEC = 70 % effluent

* Average of 3 replicates – effluent data adjusted using control results

** salinity for effluent and brine control tests adjusted with concentrated brine solution

*** 4.5 ppt seawater substituted for effluent

+ Result significantly different (p=0.05) from the control

Echinoderm Sperm Cell Fertilization Test
(*Strongylocentrotus purpuratus*)

| Sample Concentration ** | % Fertilized Eggs * |
|-------------------------|---------------------|
| Lab Water Control | 81.3 |
| Brine control *** | 74.3 |
| 3.1 % Sample | 88.3 |
| 6.2 % Sample | 80.5 |
| 12.5 % Sample | 86.5 |
| 25 % Sample | 80.5 |
| 50 % Sample | 78.0 |

NOEC = >50 % effluent

* Average of 4 replicates

** Salinity adjusted with concentrated brine

*** Brine control prepared with concentrated brine and deionized water

Table 3 (cont'd) – Ecology Effluent Bioassay Results – ARCO, April, 1991

Fathead Minnow – 48 hour survival test
(*Pimephales promelas*)

| Sample | # Tested * | Percent Survival |
|-----------------|------------|------------------|
| Control | 30 | 100 |
| 1.56 % Effluent | 30 | 100 |
| 3.12 % Effluent | 30 | 100 |
| 6.25 % Effluent | 30 | 100 |
| 12.5 % Effluent | 30 | 100 |
| 25 % Effluent | 30 | 100 |
| 50 % Effluent | 30 | 100 |
| 100 % Effluent | 30 | 50 |

NOEC = 50 % effluent
LC50 = 100 % effluent

* 3 replicates of 10 organisms each

Rainbow Trout – 96 hour survival test
(*Oncorhynchus mykiss*)

| Sample | # Tested | Percent Survival |
|---------------|----------|------------------|
| Control | 28 | 100 |
| 65% Effluent | 30 | 100 |
| 100% Effluent | 30 | 97 * |

* Several fish in 100% concentration were stressed at test termination—erratic swimming and standing on head (Noble, 1991).

Sheepshead Minnow – 7 day survival and growth test
(*Cyprinodon variegatus*)

| Sample *+ | # Tested * | Percent Survival | Average Weight per Fish (mg) |
|-----------------|------------|------------------|------------------------------|
| Control | 40 | 100 | 1.99 |
| ASW ** | 40 | 100 | 2.29 |
| Brine Control * | 40 | 100 | 1.84 |
| 6.25 % Effluent | 40 | 100 | 1.92 |
| 12.5 % Effluent | 40 | 100 | 2.02 |
| 25 % Effluent | 40 | 100 | 2.01 |
| 50 % Effluent | 40 | 100 | 2.10 |
| 100 % Effluent | 40 | 98 | 1.60 |

Acute
LOEC = >100 % effluent
LC50 = >100 % effluent

Chronic
NOEC = 50 % effluent
LOEC = 100 % effluent

* 4 replicates of 10 organisms each

** ASW stands for Artificial Sea Water—made by dissolving sea salts in deionized water

*** the brine control was made by diluting concentrated brine with deionized water

*+ 100% effluent salinity adjusted with sea salts: other concentrations salinity adjusted with concentrated brine

NOEC – no observable effects concentration
LOEC – lowest observable effects concentration
LC50 – lethal concentration for 50% of the organisms
EC50 – effect concentration for 50% of the organisms

Table 4 – Comparison of Ecology and ARCO Effluent Bioassay Results – ARCO, April, 1991

| Species | Test Duration | End Point | RESULTS | |
|-----------------------|---------------|-----------------------------|----------------|----------------|
| | | | Ecology | ARCO * |
| <i>Daphnia magna</i> | 48 hr | LC50 | >100% effluent | >100% effluent |
| Bivalve Larvae | | | | |
| survival | 48 hr | LC50 | >70% effluent | 62% effluent |
| development | 48 hr | NOEC | 35% effluent | 12.5% effluent |
| Echinoderm Sperm Cell | 20 min | NOEC | >50% effluent | 50% effluent |
| Fathead Minnow | 48 hr | LC50 | 100% effluent | >100% effluent |
| Sheepshead Minnow | | | | |
| survival | 7 day | LC50 | >100% effluent | >100% effluent |
| growth | 7 day | NOEC | 50% effluent | 50% effluent |
| Rainbow Trout | 96 hr | % survival in 65% effluent | 100% | 100% |
| | | % survival in 100% effluent | 97% | 100% |

* ARCO analysis by contract lab (ENSR, 1991)

Table 5 – Organic Compounds Detected by Ecology and Comparison with EPA Water Quality Criteria – ARCO, April 1991

| Location: | | INF-1 | INF-2 | TF-EF-1 | TF-EF-2 | STRM-3 | EF-1 | EF-2 | EPA Water Quality Criteria (EPA, 1986) | | | |
|------------------|--|---------|---------|---------|---------|--------|--------|--------|--|---------|---------|---------|
| Type: | | Grab | Grab | Grab | Grab | Grab | Grab | Grab | | | | |
| Date: | | 4/9 | 4/9 | 4/9 | 4/9 | 4/9 | 4/9 | 4/9 | | | | |
| Time: | | 1155 | 1605 | 1225 | 1510 | 1705 | 1055 | 1440 | Acute | Chronic | Acute | Chronic |
| Lab Log#: | | 158131 | 158132 | 158134 | 158135 | 158139 | 158140 | 158141 | Fresh | Fresh | Marine | Marine |
| VOA Compounds | | (ug/L) | (ug/L) | (ug/L) | (ug/L) | (ug/L) | (ug/L) | (ug/L) | (ug/L) | (ug/L) | (ug/L) | (ug/L) |
| (Group) | | | | | | | | | | | | |
| 2-Butanone (MEK) | | 500 U | 17000 | 500 U | 2500 U | 10 U | 10 U | 10 U | | | | |
| Benzene | | 14000 D | 28000 | 4700 | 10000 | 11 | 5 U | 5 U | 5,300 * | | 5,100 * | 700 * |
| Toluene | | 20000 D | 77000 D | 7400 | 24000 | 29 | 4 J | 5 U | 17,500 * | | 6,300 * | 5,000 * |
| Ethylbenzene | | 1800 | 16000 | 590 | 2500 | 4 J | 5 U | 5 U | 32,000 * | | 430 * | |
| Total Xylenes | | 12000 D | 83000 D | 6700 | 21000 | 51 | 5 U | 5 U | | | | |

| Location: | | INF-3 | TF-EF-3 | STRM-3 | EF-3 | EPA Water Quality Criteria (EPA, 1986) | | | |
|------------------------------|--|--------|---------|--------|--------|--|---------|------------|----------|
| Type: | | Comp | Comp | Grab | Comp | | | | |
| Date: | | 4/9 | 4/9 | 4/9 | 4/9 | | | | |
| Time: | | *** | *** | 1705 | *** | | | | |
| Lab Log#: | | 158133 | 158136 | 158139 | 158142 | Acute | Chronic | Acute | Chronic |
| BNA Compounds | | (ug/L) | (ug/L) | (ug/L) | (ug/L) | Fresh | Fresh | Marine | Marine |
| | | | | | | | | | |
| Phenol | | 1900 D | 1000 D | 10 U | 10 U | 10,200 * | 2,560 * | 5,800 * | |
| 2-Methylphenol | | 1000 D | 770 D | 10 U | 10 U | | | | |
| 4-Methylphenol | | 540 D | 400 D | 10 U | 10 U | | | | |
| 2,4-Dimethylphenol | | 980 D | 920 D | 10 U | 10 U | 2,120 * | | | |
| n Naphthalene | | 530 D | 250 D | 10 U | 10 U | 2,300 * | 620 * | 2,350 * | |
| 2-Methylnaphthalene | | 510 D | 320 D | 10 U | 10 U | | | | |
| n Fluorene | | 33 DJ | 26 DJ | 10 U | 10 U | | | 300 *(n) | |
| n Phenanthrene | | 66 DJ | 56 DJ | 10 U | 10 U | | | 300 *(n) | |
| i Bis(2-Ethylhexyl)Phthalate | | 100 U | 100 U | 10 U | 6 J | 940 *(i) | 3 *(i) | 2,944 *(i) | 3.4 *(i) |

- INF Influent sample
 TF-EF Trickling filter effluent sample
 STRM Stormwater sample
 EF Final effluent sample
 *** Composite samples were collected from midnight to midnight
 U The analyte was not detected at or above the reported result
 D The result was derived from an analysis of a sample that required a secondary dilution
 J The analyte was positively identified. The associated numerical result is an estimate
 * Insufficient data to develop criteria. Value presented is the LOEL–Lowest Observed Effects Level.
 i Total Phthalate Esters
 n Total Polynuclear Aromatic Hydrocarbons
 (i) Phthalate Esters criteria
 (n) Polynuclear Aromatic Hydrocarbons criteria

Table 6 – Comparison of Organic Compounds Detected by Ecology and ARCO Analysis of Water Samples – ARCO, April 1991

| Location: | INF-1 | | INF-2 | | TF-EF-1 | | TF-EF-2 | | STRM-3 | | EF-1 | | EF-2 | |
|------------------|---------|--------|---------|---------|---------|--------|---------|--------|---------|--------|---------|--------|---------|--------|
| Type: | Grab | | Grab | | Grab | | Grab | | Grab | | Grab | | Grab | |
| Date: | 4/9 | | 4/9 | | 4/9 | | 4/9 | | 4/9 | | 4/9 | | 4/9 | |
| Time: | 1155 | | 1605 | | 1225 | | 1510 | | 1705 | | 1055 | | 1440 | |
| Lab: | Ecology | ARCO * | Ecology | ARCO * | Ecology | ARCO * | Ecology | ARCO * | Ecology | ARCO * | Ecology | ARCO * | Ecology | ARCO * |
| VOA Compounds | (ug/L) | (ug/L) | (ug/L) | (ug/L) | (ug/L) | (ug/L) | (ug/L) | (ug/L) | (ug/L) | (ug/L) | (ug/L) | (ug/L) | (ug/L) | (ug/L) |
| Acetone | 500 U | 1100 | 2500 U | 1100 | 500 U | 760 J | 2500 U | 1200 | 10 U | 4 J | 10 U | 10 U | 10 U | 10 U |
| 2-Butanone (MEK) | 500 U | 1000 U | 17000 | 1000 U | 500 U | 1000 U | 2500 U | 1000 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Benzene | 14000 D | 9100 | 28000 | 19000 | 4700 | 3300 | 10000 | 8400 | 11 | 7 | 5 U | 5 U | 5 U | 5 U |
| Toluene | 20000 D | 14000 | 77000 D | 47000 D | 7400 | 4900 | 24000 | 19000 | 29 | 37 | 4 J | 3 J | 5 U | 2 J |
| Ethylbenzene | 1800 | 1100 | 16000 | 5500 | 590 | 410 J | 2500 | 1900 | 4 J | 2 J | 5 U | 5 U | 5 U | 5 U |
| Total Xylenes | 12000 D | 5300 | 83000 D | 27000 | 6700 | 2600 | 21000 | 11000 | 51 | 23 | 5 U | 2 J | 5 U | 1 J |

| Location: | INF-3 | | TF-EF-3 | | STRM-3 | | EF-3 | |
|----------------------------|---------|--------|---------|--------|---------|--------|---------|--------|
| Type: | Comp | | Comp | | Grab | | Comp | |
| Date: | 4/9 | | 4/9 | | 4/9 | | 4/9 | |
| Time: | *** | | *** | | 1705 | | *** | |
| Lab: | Ecology | ARCO * | Ecology | ARCO * | Ecology | ARCO * | Ecology | ARCO * |
| BNA Compounds | (ug/L) | (ug/L) | (ug/L) | (ug/L) | (ug/L) | (ug/L) | (ug/L) | (ug/L) |
| Phenol | 1900 D | 2000 D | 1000 D | 1500 D | 10 U | 10 U | 10 U | 3 J |
| Benzyl Alcohol | 100 U | 34 | 100 U | 40 | 10 U | 10 U | 10 U | 10 U |
| 2-Methylphenol | 1000 D | 1000 D | 770 D | 960 D | 10 U | 10 U | 10 U | 10 U |
| 4-Methylphenol | 540 D | 1200 D | 400 D | 1000 D | 10 U | 10 U | 10 U | 2 J |
| 2,4-Dimethylphenol | 980 D | 990 D | 920 D | 990 D | 10 U | 10 U | 10 U | 10 U |
| Naphthalene | 530 D | 520 D | 250 D | 250 | 10 U | 10 U | 10 U | 10 U |
| 2-Methylnaphthalene | 510 D | 520 D | 320 D | 310 | 10 U | 10 U | 10 U | 10 U |
| Dibenzofuran | 100 U | 18 | 100 U | 18 J | 10 U | 10 U | 10 U | 10 U |
| Fluorene | 33 DJ | 28 | 26 DJ | 28 | 10 U | 10 U | 10 U | 10 U |
| Phenanthrene | 66 DJ | 31 | 56 DJ | 32 | 10 U | 10 U | 10 U | 10 U |
| Pyrene | 100 U | 4 J | 100 U | 7 J | 10 U | 10 U | 10 U | 10 U |
| Chrysene | 100 U | 4 J | 100 U | 6 J | 10 U | 10 U | 10 U | 10 U |
| Bis(2-Ethylhexyl)Phthalate | 100 U | 2 J | 100 U | 20 U | 10 U | 10 U | 6 J | 10 U |
| Pesticides/PCBs | | | | | | | | |
| Endrin | 0.10 U | 0.09 | 0.10 U | 0.12 U | | | | |
| 4,4'-DDE | 0.10 U | 0.04 U | 0.10 U | 0.15 | | | | |

INF Influent sample
 TF-EF Trickling filter effluent sample
 STRM Stormwater sample
 EF Final effluent sample
 * ARCO analysis by contract lab (ENSR, 1991)
 *** Composite samples were collected from midnight to midnight

U The analyte was not detected at or above the reported result.
 J The analyte was positively identified. The associated numerical result is an estimate.
 D The result was derived from an analysis of a sample that required a secondary dilution
☐ Compound detected

Table 7 – Metals Scan Results – ARCO, April 1991

| | Location: Trns Blk | INF-3 | TF-EF-3 | STRM-3 | EF-1 | EF-2 | EF-3 | EF-ARCO | SED-1 | SED-2 |
|-----------------------|---------------------|---------|----------------|----------------|----------------|----------------|---------|---------|-----------|-----------|
| | Type: Grab | Comp | Comp | Grab | Grab | Grab | Comp | Comp | Bkgd | Edge Dil |
| | Date: 4/8 | 4/9 | 4/9 | 4/9 | 4/9 | 4/9 | 4/9 | 4/9 | 4/16 | 4/16 |
| | Time: 1545 | *** | *** | 1705 | 1055 | 1440 | *** | *** | 1520-1630 | 1730-1845 |
| | Lab Log#: 158130 | 158133 | 158136 | 158139 | 158140 | 158141 | 158142 | 158144 | 168145 | 168146 |
| | Laboratory: Ecology | Ecology | ARCO + Ecology | ARCO + Ecology | ARCO + Ecology | ARCO + Ecology | Ecology | Ecology | Ecology | Ecology |
| Metals* | (ug/L) | (ug/L) | (ug/L) | (ug/L) | (ug/L) | (ug/L) | (ug/L) | (ug/L) | (ug/L) | (mg/Kg**) |
| Antimony | 60 U | 60 U | 40 U | 60 U | 40 U | 60 U | 40 U | 60 U | 40 U | 60 U |
| Arsenic | 1 U | 100 U | 4.0 U | 100 U | 4.0 U | 10 U | 3.6 | 100 U | 2.4 | 100 U |
| Beryllium | 5 U | 5 U | 4.1 | 5 U | 4.7 | 5 U | 1.0 U | 5 U | 1.2 | 5 U |
| Cadmium | 5 U | 104 | 5.0 U | 6 U | 5.0 U | 5 U | 5.0 U | 58 | 5.0 U | 66 |
| Chromium | 10 U | 590 | 623 | 780 | 615 | 60 | 20.1 | 60 | 54 | 60 |
| Chromium (Total) | 10 U | 530 | 530 | 700 | 280 | 60 | 40 | 50 | 50 U | 70 |
| Chromium (Hexavalent) | 5 | 121 | 20 U | 173 | 20 U | 22 | 20 U | 19 | 20 U | 18 |
| Copper | 25 U | 25 U | 14.9 | 25 U | 14.9 | 25 U | 17.3 | 25 U | 5.0 U | 25 U |
| Copper – Dissolved | 5 U | 20 | 5.2 | 17 | 5.0 U | 5 U | 7.3 | 12 | 5.5 | 5 U |
| Lead | 5 U | 6 | 19.5 | 8 | 22.4 | 8 | 6.8 | 5 U | 3.0 U | 5 U |
| Mercury | 0.2 U | 0.9 | 0.20 U | 0.4 | 0.25 | 0.2 U | 0.20 U | 0.2 U | 0.20 U | 0.7 |
| Nickel | 5 U | 167 | 200 | 187 | 213 | 48 | 36.4 | 74 | 81.8 | 72 |
| Selenium | 5 NU | 50 NU | 192 | 50 NU | 193 | 5 NU | 3.5 | 50 NU | 119 | 50 NU |
| Silver | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Thallium | 10 U | 10 | 11.8 | 10 U | 10.5 | 10 U | 2.0 U | 10 U | 10 U | 10 U |
| Zinc | 20 U | 330 | 359 | 400 | 385 | 170 | 167 | 70 | 65.4 | 110 |

Trns Blk Transfer blank
 INF Influent sample
 TF-EF Trickling filter effluent sample
 STRM Stormwater sample
 EF Final effluent sample
 SED Marine sediment sample
 * Total Recoverable Metals unless otherwise noted
 ** Total Metals based on dry weight
 *** Composite samples were collected from midnight to midnight
 U The analyte was not detected at or above the reported result.
 N Spiked sample recovery not within control limits
 + Total Cr and Hex Cr were analyzed by the in-house or contract lab typically doing the analysis.
 Other ARCO analysis by contract lab (ENSR, 1991).
 ++ ARCO result – 20 U

Table 8 – Comparison of Effluent Metals Concentrations to EPA Water Quality Criteria – ARCO, April 1991.

| Metals* | Location: | | | EPA Water Quality Criteria (EPA, 1986) | | | |
|-----------------------|------------------|---------|---------|--|----------|----------|---------|
| | EF-3 | EF-ARCO | | Fresh | Fresh | Marine | Marine |
| | Type: Comp | Comp | | Acute | Chronic | Acute | Chronic |
| | Date: 4/9 | 4/9 | | | | | |
| | Time: *** | *** | | | | | |
| | Lab Log#: 158142 | 158144 | | | | | |
| Laboratory: | Ecology | ARCO + | Ecology | | | | |
| | (ug/L) | (ug/L) | (ug/L) | (ug/L) | (ug/L) | (ug/L) | (ug/L) |
| Antimony | 60 U | 40 U | 60 U | 9,000 ** | 1,600 ** | – | – |
| Arsenic | 100 U | 2.4 | 100 U | 360 | 190 | 69 | 36 |
| Beryllium | 5 U | 1.2 | 5 U | 130 ** | 5.3 ** | – | – |
| Cadmium | 58 | 5.0 U | 66 | 7.1 ++ | 1.7 ++ | 43 | 9.3 |
| Chromium (Total) | 50 | | 70 | | | | |
| Chromium (Trivalent) | | | | 2,700 ++ | 320 ++ | – | – |
| Chromium (Hexavalent) | 19 | | 18 | 16 | 11 | 1,100 | 50 |
| Copper | 25 U | 5.0 U | 25 U | 29 ++ | 19 ++ | 2.9 | – |
| Copper – Dissolved | 12 | 5.5 | | | | | |
| Lead | 5 U | 3.0 U | 5 U | 160 ++ | 6.3 ++ | 140 | 5.6 |
| Mercury | 0.2 U | 0.20 U | 0.7 | 2.4 | 0.012 | 2.1 | 0.025 |
| Nickel | 74 | 81.8 | 72 | 2200 ++ | 250 ++ | 75 | 8.3 |
| Selenium | 50 NU | 119 | 50 NU | 260 | 35 | 410 | 54 |
| Silver | 10 U | 10 U | 10 U | 10 ++ | 0.12 | 2.3 | – |
| Thallium | 10 U | 10 U | 10 U | 1,400 ** | 40 ** | 2,130 ** | – |
| Zinc | 70 | 65.4 | 110 | 183 ++ | 166 ++ | 95 | 86 |

EF Final effluent sample

* Total Recoverable Metals unless otherwise indicated

** Insufficient data to develop criteria. Value presented is LOEL – Lowest Observed Effects Level.

*** Composite samples were collected from midnight to midnight

☐ Concentration exceeds one or more water quality criteria.

U The analyte was not detected at or above the reported result.

N Spiked sample recovery not within control limits

– Data not available to develop criterion

+ Total Cr and Hex Cr were analyzed by the in-house or contract lab typically doing the analysis. Other ARCO analysis by contract lab (ENSR, 1991).

++ Hardness dependent criterion. Based on hardness of 170 mg/L CaCO₃

Table 9 - Ecology Laboratory General Chemistry Results - ARCO, April 1991.

| Location: | Trns Blk | Inf-1 | Inf-2 | Inf-3 | Tf-ef-1 | Tf-ef-2 | Tf-ef-3 | Strm-3 | Ef-1 | Ef-2 | Ef-3 | Ef-4 | Ef-arco | Sed-1 | Sed-2 |
|------------------------------------|----------|--------|--------|--------|---------|---------|---------|--------|--------|--------|--------|---------|----------|-----------|-----------|
| Type: | Grab | Grab | Grab | Comp | Grab | Grab | Comp | Grab | Grab | Grab | Comp | Gr-comp | Comp | Bkgrd | Edge Dil |
| Date: | 4/8 | 4/9 | 4/9 | 4/9 | 4/9 | 4/9 | 4/9 | 4/9 | 4/9 | 4/9 | 4/9 | 4/9 | 4/9 | 4/16 | 4/16 |
| Time: | 1545 | 1155 | 1605 | *** | 1225 | 1510 | *** | 1705 | 1055 | 1440 | *** | ** | *** | 1520-1630 | 1730-1845 |
| Lab Log #: | 158130 | 158131 | 158132 | 158133 | 158134 | 158135 | 158136 | 158139 | 158140 | 158141 | 158142 | 158143 | 158144 | 168145 | 168146 |
| LABORATORY ANALYSIS | | | | | | | | | | | | | | | |
| Conductivity (umhos/cm) | | | | 7620 | | | | 7440 | 439 | | 5480 | 5530 | 5510 | | |
| Alkalinity (mg/L CaCO3) | | | | 420 | | | | 374 | 38.5 | | 322 | | 321 | | |
| Hardness (mg/L CaCO3) | | | | 156 | | | | 154 | 50.4 | | 170 | 162 | 168 | | |
| TS (mg/L) | | | | 5930 | | | | 5650 | 394 | | 4070 | | 4090 | | |
| TNVS (mg/L) | | | | 5680 | | | | 5370 | 316 | | 3870 | | 3830 | | |
| TSS (mg/L) | | | | 34 | | | | 97 | 60 | | 14 | 13 | 18 | | |
| TNVSS (mg/L) | | | | 22 | | | | 44 | 63 | | 12 | | 26 | | |
| % Solids | | | | | | | | | | | | | | 67.0 | 58.5 |
| % Volatile Solids | | | | | | | | | | | | | | 2.6 | 4.3 |
| BOD5 (mg/L) | | | | 220 | | | | 220 | < 10 | | < 10 | | < 10 | | |
| COD (mg/L) | | | | 420 | | | | 330 | 35 | | 50 | | 53 | | |
| TOC (mg/L) | | | | 124 | | | | 122 | 15.1 | | 22.5 | | 24.8 | | |
| TOC (% dr wt) | | | | | | | | | | | | | | 0.65 | 1.3 |
| NH3-N (mg/L) | | | | 3.47 | | | | 4.7 | 1.72 | | 5.57 | | 0.046 | | |
| NO2+NO3-N (mg/L) | | | | 0.673 | | | | 0.273 | 0.341 | | 0.103 | | 0.103 | | |
| Phosphorous - Total (mg/L) | | | | 2.72J | | | | 2.27J | 0.209J | | 0.525J | | 0.499J | | |
| Oil and Grease (mg/L) | | 32 | 19 | | 30 | 26 | | | < 1 | 1.6 | < 1 | | | 104 | 80 |
| Oil and Grease (mg/Kg - wet wt) | | | | | | | | | | | | | | | |
| F-Coliform MF (#/100 mL) | | | | | | | | | 6H | 17H | | | | | |
| F-Coliform MPN (#/100 mL) | | | | | | | | | < 20 H | 40 H | | | | | |
| Cyanide (total - ug/L) | < 5 | 828 | 699 | 640 | 843 | 853 | 567 | < 5 | 8 | 13 | 8 | | | | |
| Cyanide (wk & dis - ug/L) | < 5 | 559 | 371 | 428 | 510 | 430 | 406 | < 5 | < 5 | < 5 | < 5 | | | 0.054 J | 0.048 J |
| Cyanide (total mg/Kg - wet wt) | | | | | | | | | | | | | | 0.040 J | 0.037 J |
| Cyanide (wk & dis mg/Kg - wet wt) | | | | | | | | | | | | | | | |
| Phenolics - Total (mg/L) | < 0.005J | | | 5.91J | | | | 3.88J | 0.013J | | 0.015J | | < 0.005J | < 0.10 J | < 0.10 J |
| Phenolics - Total (mg/Kg - wet wt) | | | | | | | | | | | | | | | |
| Grain Size (%) | | | | | | | | | | | | | | | |
| gravel (+10 mesh) | | | | | | | | | | | | | | 0 | 3 |
| sand (20-230 mesh) | | | | | | | | | | | | | | 71 | 57 |
| silt (5-8 phi) | | | | | | | | | | | | | | 21 | 28 |
| clay (9-12 phi) | | | | | | | | | | | | | | 8 | 12 |
| FIELD OBSERVATIONS | | | | | | | | | | | | | | | |
| Temperature (C) | | 28.0 | 30.6 | | 29.3 | 29.7 | | 11.1 | 15.7 | 16.3 | | | | | |
| Temperature - cooled (C) | | | | 3.2 | | | 4.8 | | | | 3.2 | | | | |
| pH | | 7.9 | 7.6 | 9.2 | 7.6 | 7.6 | 8.8 | 7.7 | 8.1 | 8.0 | 8.3 | | | | |
| Conductivity (umhos/cm) | | 6900 | 5870 | 6510 | 6640 | 6900 | 6170 | 380 | 4840 | 5170 | 5010 | | | | |
| Sulfide (mg/L) | | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | | | | |
| Chlorine (mg/L) | | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | | | | |

Trns Blk - Transfer blank
 Inf - Influent sample
 Tf-ef - Trickling filter effluent sample
 Strm - Stormwater sample
 Ef - Final effluent sample

Sed - Marine sediment sample
 Gr-comp - grab composite sample
 Comp - composite sample
 Ef-arco - composite sample collected by ARCO

*** Composite samples were collected from midnight to midnight
 ** Equal volumes collected with the 1055 and 1440 grab samples
 J - The analyte was positively identified. The associated numerical result is an estimate.
 H - Exceeded holding time requirements

Table 10 – Organic Compound Removal by the Trickling Filter – ARCO, April 1991

| | | | | | | | |
|------------------------------|--|---------|---------|---------|---------|---------|---------|
| Location: | | INF-1 | TF-EF-1 | | INF-2 | TF-EF-2 | |
| Type: | | Grab | Grab | | Grab | Grab | |
| Date: | | 4/9 | 4/9 | | 4/9 | 4/9 | |
| Time: | | 1155 | 1225 | | 1605 | 1510 | |
| Lab Log#: | | 158131 | 158134 | | 158132 | 158135 | |
| | | | | Percent | | | Percent |
| VOA Compounds | | (ug/L) | (ug/L) | Removal | (ug/L) | (ug/L) | Removal |
| (Group) | | | | | | | |
| 2-Butanone (MEK) | | 500 U | 500 U | | 17000 | 2500 U | 85 |
| Benzene | | 14000 D | 4700 | 66 | 28000 | 10000 | 64 |
| Toluene | | 20000 D | 7400 | 63 | 77000 D | 24000 | 69 |
| Ethylbenzene | | 1800 | 590 | 67 | 16000 | 2500 | 84 |
| Total Xylenes | | 12000 D | 6700 | 44 | 83000 D | 21000 | 75 |
| | | | | | | | |
| Location: | | INF-3 | TF-EF-3 | | | | |
| Type: | | Comp | Comp | | | | |
| Date: | | 4/9 | 4/9 | | | | |
| Time: | | *** | *** | | | | |
| Lab Log#: | | 158133 | 158136 | | | | |
| | | | | Percent | | | |
| BNA Compounds | | (ug/L) | (ug/L) | Removal | | | |
| Phenol | | 1900 D | 1000 D | 47 | | | |
| 2-Methylphenol | | 1000 D | 770 D | 23 | | | |
| 4-Methylphenol | | 540 D | 400 D | 26 | | | |
| 2,4-Dimethylphenol | | 980 D | 920 D | 6 | | | |
| n Naphthalene | | 530 D | 250 D | 53 | | | |
| 2-Methylnaphthalene | | 510 D | 320 D | 37 | | | |
| n Fluorene | | 33 DJ | 26 DJ | 21 | | | |
| n Phenanthrene | | 66 DJ | 56 DJ | 15 | | | |
| i Bis(2-Ethylhexyl)Phthalate | | 100 U | 100 U | | | | |

INF Influent sample
 TF-EF Trickling filter effluent sample
 *** Composite samples were collected from midnight to midnight
 U The analyte was not detected at or above the reported result
 D The result was derived from an analysis of a sample that required a secondary dilution
 J The analyte was positively identified. The associated numerical result is an estimate
 * Insufficient data to develop criteria. Value presented is the LOEL-Lowest Observed Effects Level.
 i Total Phthalate Esters
 n Total Polynuclear Aromatic Hydrocarbons

Table 11 – Ecology Sediment Bioassay Results – ARCO, April 1991

Echinoderm Larvae – 96 hour survival and development test
(*Strongylocentrotus purpuratus*)

| Sample | Percent Survival * | Percent Normal Development * |
|-------------------|--------------------|------------------------------|
| Control | 99.4 | 87.4 |
| Sed-1 (168145) | 0.5 | 0 |
| Sed-2 (168146) | 0.7 | 0 |

* Based on average of 5 replicate analyses

Amphipod – 10 day survival test
(*Rheopoxynius abronius*)

| Sample | Number Tested + | Percent Survival | Survival per replicate * | Total Emergence Events per replicate * |
|-------------------|-----------------|------------------|--------------------------|--|
| Control | 100 | 93 | 18.6 (+/- 1.1) | 9.6 (+/- 4.0) |
| Sed-1 (168145) | 100 | 81 | 16.2 (+/- 2.2) | 12.2 (+/- 8.6) |
| Sed-2 (168146) | 100 | 53 ** | 10.6 (+/- 2.5)** | 18.2 (+/- 15.9) |

+ five replicates of 20 organisms per replicate

* Mean (standard deviation)

** Results significantly different ($p < 0.05$) than control

Sed-1 Background
Sed-2 Edge Dilution

Table 12 – Comparison of Ecology and ARCO Sediment Bioassay Results – ARCO, April, 1991

| Species | Test Duration | End Point | RESULTS | | | |
|-------------------|---------------|------------------------|-----------------|--------|-------------------|--------|
| | | | SED-1 bckgrd | | SED-2 edge dil | |
| | | | Ecology | ARCO + | Ecology | ARCO + |
| Echinoderm Larvae | | | | | | |
| survival | 96 hr | % survival | 0.5% | - | 0.7% | - |
| development | 96 hr | % normal | 0% | - | 0% | - |
| Amphipod | | | | | | |
| survival | 10 day | % survival | 81% | ** | 53% | ** |
| emergence | 10 day | total emergence events | 12.2(+/-8.6)* | *** | 18.2(+/-15.9)* | *** |

* Mean(+/- standard deviation) per replicate – 20 organisms per replicate

** ARCO numbering different – survival ranged from 92–94% in the sediments tested

*** ARCO numbering different – emergence ranged from 2.4–4.2 events in the sediments tested

- Not analyzed

+ ARCO analysis by contract lab (ENSR, 1991)

Table 13 – Comparison of Ecology and ARCO Sediment Results with Marine Sediment Criteria – ARCO, April 1991

| Location: Type: Date: Time: Lab: | SED-1 Bkgrd 4/16 1520-1630 | | | | SED-2 Edge Dil 4/16 1730-1845 | | | | Marine Sediment Standards (a) |
|--|-------------------------------------|-------------|----------------|-------------|--|-------------|----------------|-------------|----------------------------------|
| | Ecology | | ARCO * | | Ecology | | ARCO * | | |
| | (ug/Kg dry wt) | (mg/Kg TOC) | (ug/Kg dry wt) | (mg/Kg TOC) | (ug/Kg dry wt) | (mg/Kg TOC) | (ug/Kg dry wt) | (mg/Kg TOC) | |
| Percent solids | 67.0 | | 73.1 | | 58.5 | | 62.7 | | |
| Percent volatile solids | 2.6 | | 0.61 | | 4.3 | | 1.3 | | |
| TOC (percent dry wt basis) | 0.65 | | 0.68 | | 1.3 | | 2.0 | | |
| VOA Compounds | | | | | | | | | |
| | (ug/Kg dry wt) | (mg/Kg TOC) | (ug/Kg dry wt) | (mg/Kg TOC) | (ug/Kg dry wt) | (mg/Kg TOC) | (ug/Kg dry wt) | (mg/Kg TOC) | (mg/Kg TOC) |
| Acetone | 15 U | 2.3 U | 15 U | 2.2 U | 17 U | 1.3 U | 9 J | 0.5 J | - |
| 1,1,1-Trichloroethane | 8 J | 1.2 J | 7 U | 1.0 U | 11 J | 0.8 J | 8 U | 0.4 U | - |
| Toluene | 68 | 10 | 7 U | 1.0 U | 8 U | 0.6 U | 8 U | 0.4 U | - |
| Ethylbenzene | 92 | 14 | 7 U | 1.0 U | 8 U | 0.6 U | 8 U | 0.4 U | - |
| Total Xylenes | 520 | 80 | 7 U | 1.0 U | 8 U | 0.6 U | 8 U | 0.4 U | - |
| BNA Compounds | | | | | | | | | |
| | (ug/Kg dry wt) | (mg/Kg TOC) | (ug/Kg dry wt) | (mg/Kg TOC) | (ug/Kg dry wt) | (mg/Kg TOC) | (ug/Kg dry wt) | (mg/Kg TOC) | (mg/Kg TOC) |
| Acenaphthene | 110 J | 17 J | 980 U | 144 U | 1100 U | 85 U | 1100 U | 55 U | 16 |
| Phenanthrene | 610 J | 94 J | 980 U | 144 U | 1100 U | 85 U | 210 J | 11 J | 100 |
| Anthracene | 190 J | 29 J | 980 U | 144 U | 1100 U | 85 U | 1100 U | 55 U | 220 |
| Fluoranthene | 550 J | 85 J | 980 U | 144 U | 1100 U | 85 U | 220 J | 11 J | 160 |
| Pyrene | 560 J | 86 J | 980 U | 144 U | 1100 U | 85 U | 170 J | 8.5 J | 1000 |
| Benzo(a)Anthracene | 210 J | 32 J | 980 U | 144 U | 1100 U | 85 U | 1100 U | 55 U | 110 |
| Chrysene | 170 J | 26 J | 980 U | 144 U | 1100 U | 85 U | 1100 U | 55 U | 110 |
| Benzo(b)Fluoranthene | 170 J | 26 J | 980 U | 144 U | 1100 U | 85 U | 1100 U | 55 U | 230 (b) |
| Benzo(k)Fluoranthene | 130 J | 20 J | 980 U | 144 U | 1100 U | 85 U | 1100 U | 55 U | 230 (b) |
| Benzo(a)Pyrene | 170 J | 26 J | 980 U | 144 U | 1100 U | 85 U | 1100 U | 55 U | 99 |
| Bis(2-Ethylhexyl)Phthalate | 980 U | 151 U | 120 J | 18 J | 1100 U | 85 U | 720 J | 36 J | 47 |
| Metals | | | | | | | | | |
| | (mg/Kg dry wt) | | (mg/Kg dry wt) | | (mg/Kg dry wt) | | (mg/Kg dry wt) | | (mg/Kg dry wt) |
| Antimony | 2.3 U | | 10.6 U | | 2.9 U | | 8.6 U | | - |
| Arsenic | 1.3 | | 3.6 | | 1.9 | | 3.9 | | 57 |
| Beryllium | 0.19 U | | 0.44 | | 0.24 U | | 0.81 | | - |
| Cadmium | 3.2 | | 1.3 U | | 2.8 | | 1.1 U | | 5.1 |
| Chromium | 18 | | 17.7 | | 21 | | 23.2 | | 260 |
| Copper | 7.3 | | 10.7 | | 9.3 | | 15.0 | | 390 |
| Lead | 0.31 | | 3.7 | | 2.5 | | 5.4 | | 450 |
| Mercury | 0.014 | | 0.14 U | | 0.1 U | | 0.15 U | | 0.41 |
| Nickel | 14 | | 19.9 | | 16 | | 25.0 | | - |
| Selenium | 0.19 U | | 0.61 U | | 0.24 U | | 0.88 U | | - |
| Silver | 0.38 | | 2.6 U | | 0.48 U | | 2.1 U | | 6.1 |
| Thallium | 0.38 U | | 0.40 U | | 0.38 U | | 0.59 U | | - |
| Zinc | 32 | | 33.7 | | 42 | | 48.2 | | 410 |

(a) Listed in Table 1 (Ecology, 1991)

U The analyte was not detected at or above the reported result.

J The analyte was positively identified. The associated numerical result is an estimate.

- No standard

(b) Standard listed is for Total Benzofluoranthenes, i.e., sum of the concentrations of the b, j, and k isomers

Exceeds sediment standard

* ARCO analysis by contract lab (ENSR, 1991)

APPENDICES

Appendix A - Sampling Station Locations - ARCO, April 1991.

Influent (Inf) - influent to the secondary treatment system collected at the outlet of the API separator.

The composite sampler intakes were positioned just upstream of the API effluent weir above the afterbay. The sample strainers were suspended approximately one foot below the water surface.

The grab samples were collected as the water fell over the weir into the afterbay. Brian Lynch collected the grab samples under Ecology supervision. Brian collected the samples wearing a respirator.

Trickling filter effluent (Tf-ef) - effluent from the trickling filter.

The composite sample was collected from the wetwell which collected flow from the trickling filter underdrains. The sample strainers were suspended approximately 1.5 feet below the water surface.

Grab samples were collected from the discharge of the water pumped through the ARCO in line monitoring meters.

Stormwater Lagoon discharge (Strm) - flow from the stormwater retention lagoon.

The sample was collected from the vault just downstream of the lagoon outlet and upstream of the sanitary package plant input. The samples were collected using an ARCO weighted frame "thief" sampler. A clean bottle was inserted for sample collection and the sampler tripping mechanism was not used. Most stormwater lagoon water was being routed through the secondary treatment system during the inspection. Stormwater flow to the final settling pond was the result of a leaky valve at the stormwater retention pond outlet.

Effluent (Ef) - wastewater treatment plant final effluent.

The samples were collected from outfall line taps in the effluent pump house. The grab samples were taken from the tap usually used by ARCO for grab sample collection.

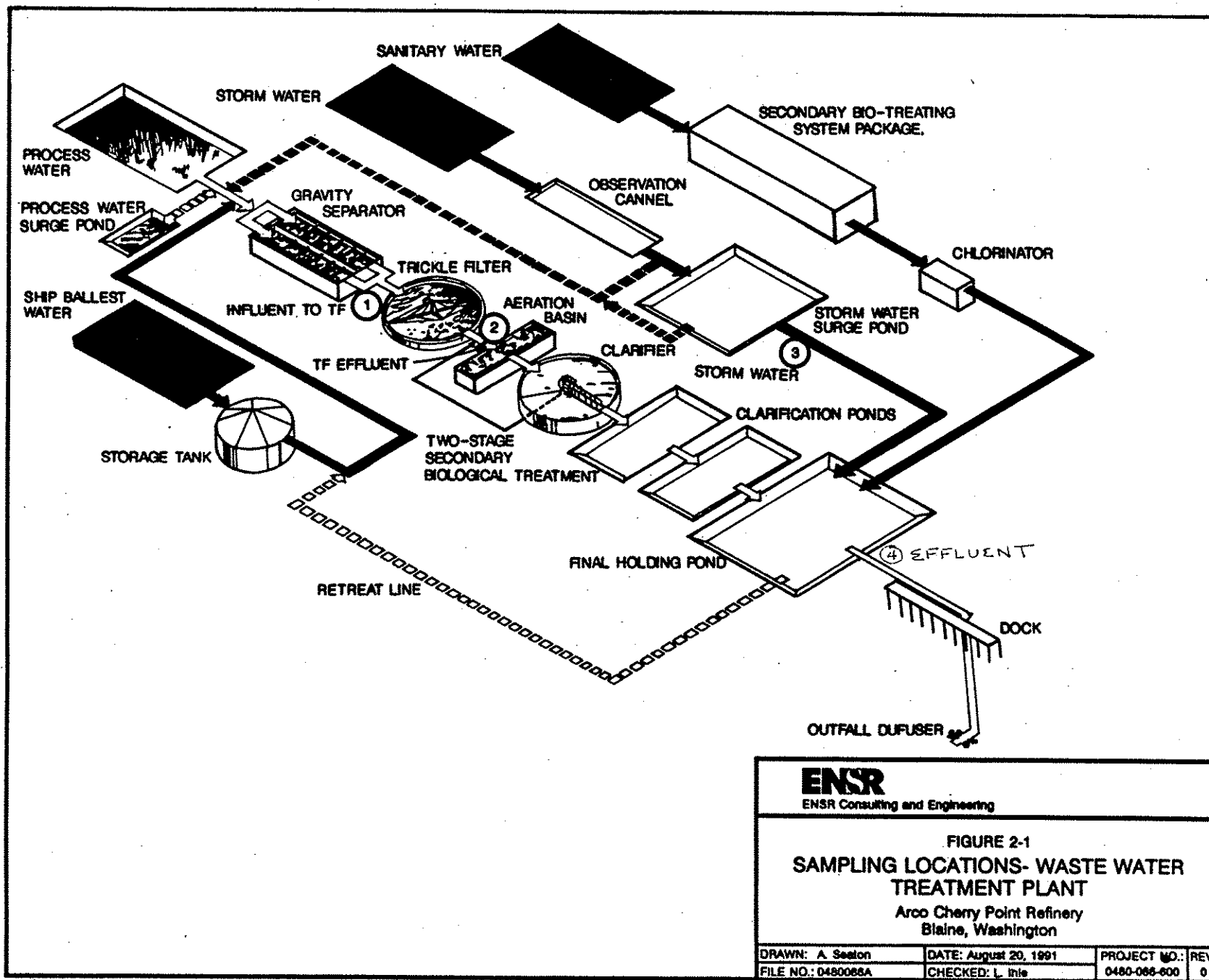
The composite sample was collected from a tap about ten feet from the grab tap. A priority pollutant cleaned stainless steel bucket placed underneath the tap and kept continuously overflowing and well mixed. The sampling tubes were suspended at approximately mid-depth of the bucket.

Sediment (Sed) - receiving water sediments collected in the vicinity of the ARCO outfall.

Sed-1 - Background sample - Sediment was collected approximately 1200 feet north of the diffuser. The sample was collected within 15 yards of a marker buoy set up by the ARCO consultant (Ardea Enterprises, Inc.). (approximate Lat 48N,51',51": Long 122W,45',36")

Sed-2 - Edge Dilution - Sample was collected approximately 225 feet SSE of the diffuser. The sample was collected between the second and third pilings SE of the outfall, just to the east of the catwalk. (approximate Lat 48N,51',36": Long 122W,45',24")

Sed-3 - At Diffuser - Sample could not be collected. Location was by the ARCO dock near the diffuser. Three sampler casts resulted in shells, a large rope, and a hose. (Lat 48N,51',39": Long 122W,45',26")



Appendix B – Sampling Schedule and Parameters Analyzed – ARCO, April 1991.

| Location: | Trns Blk | Inf-1 | Inf-2 | Inf-3 | Tf-ef-1 | Tf-ef-2 | Tf-ef-3 | Strm-3 | Ef-1 | Ef-2 | Ef-3 | Ef-4 | Ef-arco | Sed-1 | Sed-2 |
|-------------------------------------|----------|--------|--------|--------|---------|---------|---------|--------|--------|--------|--------|--------|---------|-----------|-----------|
| Type: | | Grab | Grab | Comp | Grab | Grab | Comp | Grab | Grab | Grab | Comp | H-Comp | Comp | Bkgd | Edge Dil |
| Date: | 4/8 | 4/9 | 4/9 | 4/9 | 4/9 | 4/9 | 4/9 | 4/9 | 4/9 | 4/9 | 4/9 | 4/9 | 4/9 | 4/16 | 4/16 |
| Time: | 1545 | 1155 | 1605 | *** | 1225 | 1510 | *** | 1705 | 1055 | 1440 | *** | *** | *** | 1520-1630 | 1730-1845 |
| Lab Log #: | 158130 | 158131 | 158132 | 158133 | 158134 | 158135 | 158136 | 158139 | 158140 | 158141 | 158142 | 158143 | 158144 | 168145 | 168146 |
| GENERAL CHEMISTRY | | | | | | | | | | | | | | | |
| Conductivity | | | | E | | | E | E | | | E | E | E | | |
| Alkalinity | | | | E | | | E | E | | | E | E | E | | |
| Hardness | | | | E | | | E | E | | | E | E | E | | |
| TS | | | | E | | | E | E | | | E | E | E | | |
| TNVS | | | | E | | | E | E | | | E | E | E | | |
| TSS | | | | EA | | | EA | EA | | | EA | E | EA | | |
| TNVSS | | | | E | | | E | E | | | E | | E | | |
| % Solids | | | | | | | | | | | | | | E | E |
| % Volatile Solids | | | | | | | | | | | | | | E | E |
| BOD5 | | | | EA | | | EA | EA | | | EA | | EA | | |
| COD | | | | EA | | | EA | EA | | | EA | | EA | | |
| TOC (water) | | | | E | | | E | E | | | E | | E | | |
| TOC (soil) | | | | | | | | | | | | | | E | E |
| NH3-N | | | | EA | | | EA | EA | | | EA | | EA | | |
| NO2+NO3-N | | | | E | | | E | E | | | E | | E | | |
| Phosphorous - Total | | | | E | | | E | E | | | E | | E | | |
| Oil and Grease (water) | | EA | EA | | EA | EA | | EA | EA | EA | | | | E | E |
| Oil and Grease (sediment) | | | | | | | | | | | | | | | |
| F-Coliform MF | | | | | | | | | EA | EA | | | | | |
| F-Coliform MPN | | | | | | | | | E | E | | | | | |
| Grain Size | | | | | | | | | | | | | | E | E |
| Cyanide total | | E | E | E | E | E | E | E | E | E | E | | | | |
| Cyanide (wk & dis) | | E | E | E | E | E | E | E | E | E | E | | | | |
| Cyanide (total wet wt) | | | | | | | | | | | | | | E | E |
| Cyanide (wk & dis wet wt) | | | | | | | | | | | | | | E | E |
| ORGANICS | | | | | | | | | | | | | | | |
| VOC (water) | E | E | E | | E | E | | E | E | E | | | | | |
| VOC (soil) | | | | | | | | | | | | | | E | E |
| BNAs (water) | | | | E | | | E | E | | | E | | | E | E |
| BNAs (soil) | | | | | | | | | | | | | | E | E |
| Pest/PCB (water) | E | | | E | | | E | E | | | E | | | E | E |
| Pest/PCB (soil) | | | | | | | | | | | | | | | |
| Phenolics Total(water) | E | | | EA | | | EA | EA | | | EA | | EA | | |
| Phenolics Total(soil) | | | | | | | | | | | | | | E | E |
| METALS | | | | | | | | | | | | | | | |
| PP Metals | E | | | E | | | E | E | | | E | | E | E | E |
| Soluble Cu | E | | | E | | | E | E | | | E | | | | |
| Total chromium | E | | | EA | | | EA | EA | | | EA | | EA | | |
| Hexavalent chromium | E | | | EA | | | EA | EA | EA | EA | EA | | EA | | |
| BIOASSAYS | | | | | | | | | | | | | | | |
| Salmonid (acute 65%) | | | | | | | | | | | | | | E | |
| Salmonid (acute 100%) | | | | | | | | | | | | | | E | |
| Daphnia magna (acute) | | | | | | | | | | | | | | E | |
| Bivalve Larvae (chronic) | | | | | | | | | | | | | | E | |
| Fathead Minnow (acute) | | | | | | | | | | | | | | E | |
| Sheepshead Minnow (chronic) | | | | | | | | | | | | | | E | |
| Echinoderm sperm cell fertilization | | | | | | | | | | | | | | E | |
| Echinoderm larvae (solid) | | | | | | | | | | | | | | | |
| Amphipod (solid acute) | | | | | | | | | | | | | | E | E |
| FIELD OBSERVATIONS | | | | | | | | | | | | | | | |
| Temp | | EA * | EA * | E | EA * | EA * | E | E | EA * | EA * | E | | | | |
| pH | | E | EA * | E | EA * | EA * | E | E | EA * | EA * | E | | | | |
| Conductivity | | E | E | E | E | E | E | E | E | E | E | | | | |
| Sulfide | | EA | EA | E | EA | EA | E | EA | EA | EA | E | | | | |
| Chlorine | | E | E | E | E | E | E | E | EA | EA | E | | | | |

Trns Blk Transfer Blank
 Inf Influent sample
 Tf-ef Trickling filter effluent sample
 Strm Stormwater sample
 Ef Final Effluent sample
 Sed Sediment sample

E Samples analyzed by Ecology – split taken by ARCO for analysis by their consultant (ENSR)
 EA Sample analyzed by Ecology and ARCO – ARCO analysis conducted by ARCO laboratory
 * ARCO measurement taken from continuous monitoring device
 ** Chronic renewal test, samples collected April 8, 10, and 12
 *** Composite samples were collected from midnight to midnight
 *+ Equal volumes collected with the 1055 and 1440 grab samples

Appendix C – Ecology Analytical Methods and Laboratories – ARCO, April 1991

| Parameter | Method Used for Ecology Analysis | Laboratory Performing Analysis |
|-------------------------------------|----------------------------------|--------------------------------|
| GENERAL CHEMISTRY | | |
| Conductivity | EPA, 1979: 120.1 | Ecology |
| Alkalinity | EPA, 1979: 310.1 | Ecology |
| Hardness | EPA, 1979: 130.2 | Ecology |
| TS | EPA, 1979: 160.3 | Ecology |
| TNVS | EPA, 1979: 160.4 | Ecology |
| TSS | EPA, 1979: 160.2 | Ecology |
| TNVSS | EPA, 1979: 160.4 | Ecology |
| % Solids | EPA, 1979: 160.3 | Amtest |
| % Volatile Solids | EPA, 1979: 160.4 | Amtest |
| BOD5 | EPA, 1979: 405.1 | Amtest |
| COD | EPA, 1979: 410.1 | Amtest |
| TOC (water) | EPA, 1979: 415.2 | Ecology |
| TOC (soil) | EPA, 1986a | Amtest |
| NH3-N | EPA, 1979: 350.1 | Amtest |
| NO2+NO3-N | EPA, 1979: 353.2 | Amtest |
| Phosphorous - Total | EPA, 1979: 365.3 | Amtest |
| Oil and Grease | EPA, 1979: 413.1 | Amtest |
| F-Coliform MF | APHA, 1989: 9222D | Ecology |
| F-Coliform MPN | APHA, 1989: 9221C | Ecology |
| Grain Size | EPA, 1986a | Soil Technology |
| Cyanide total | EPA, 1979: 335.2mod | Amtest |
| Cyanide (wk & dis) | APHA, 1989: 4500-CN I. | Amtest |
| Cyanide (total dry wt) | EPA, 1979: 335.2mod | Amtest |
| Cyanide (wk & dis dry wt) | APHA, 1989: 4500-CN I. | Amtest |
| ORGANICS | | |
| VOC (water) | EPA, 1984: 624 | Weyerhaeuser |
| VOC (soil) | EPA, 1986b: 8240 | Weyerhaeuser |
| BNAs (water) | EPA, 1984: 625 | Weyerhaeuser |
| BNAs (soil) | EPA, 1986b: 8270 | Weyerhaeuser |
| Pest/PCB (water) | EPA, 1984: 608 | Weyerhaeuser |
| Pest/PCB (soil) | EPA, 1986b: 8080 | Weyerhaeuser |
| Phenolics Total | EPA, 1979: 420.2 | Amtest |
| METALS | | |
| PP Metals | EPA, 1979: 200 | Sound Analytical Services |
| Soluble Cu | EPA, 1979: 200 | Sound Analytical Services |
| Hexavalent chromium | EPA, 1979: 200 | Sound Analytical Services |
| BIOASSAYS | | |
| Salmonid (acute 65%) | Ecology, 1981 | Ecology |
| Salmonid (acute 100%) | Ecology, 1981 | Ecology |
| Daphnia magna (acute) | EPA, 1985 | Ecology |
| Bivalve Larvae (chronic) | ASTM, 1989 | Northwestern Aquatic Sciences |
| Fathead Minnow (acute) | EPA, 1985 | Ecology |
| Sheepshead Minnow (chronic) | EPA, 1987 | International Technology Corp. |
| Echinoderm sperm cell fertilization | Dinnel, 1987 | ERC Environmental |
| Echinoderm larvae (solid) | EPA, 1990 | ERC Environmental |
| Amphipod (solid acute) | EPA, 1986a | Northwestern Aquatic Sciences |

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Appendix D - Cleaning for Priority Pollutant Sampling and Field Transfer Blank Procedures - ARCO, April 1991.

PRIORITY POLLUTANT SAMPLING EQUIPMENT CLEANING PROCEDURES

1. Wash with laboratory detergent.
2. Rinse several times with tap water.
3. Rinse with 10% HNO₃ solution.
4. Rinse three (3) times with distilled/deionized water.
5. Rinse with high purity methylene chloride.
6. Rinse with high purity acetone.
7. Allow to dry and seal with aluminum foil.

FIELD TRANSFER BLANK PROCEDURE

1. Pour organic free water directly into appropriate bottles for parameters to be analyzed from grab samples (VOA).
2. Run approximately 1L of organic free water through a compositor and discard.
3. Run approximately 6L of organic free water through the same compositor and put the water into appropriate bottles for parameters to be analyzed from composite samples (BNA, Pesticide/PCB, cyanide, phenolics, and metals).

Appendix E – VOA, BNA, and Pesticide/PCB Scan Results – ARCO, April 1991

| | | | | | | | | | | |
|-----------|-----------|--------|--------|---------|---------|--------|--------|--------|-----------|-----------|
| Location: | TRNS BLNK | INF-1 | INF-2 | TF-EF-1 | TF-EF-2 | STRM-3 | EF-1 | EF-2 | SED-1 | SED-2 |
| Type: | Grab | Grab | Grab | Grab | Grab | Grab | Grab | Grab | Bkgd | Edge dil |
| Date: | 4/8 | 4/9 | 4/9 | 4/9 | 4/9 | 4/9 | 4/9 | 4/9 | 4/16 | 4/16 |
| Time: | 1545 | 1155 | 1605 | 1225 | 1510 | 1705 | 1055 | 1440 | 1520-1630 | 1730-1845 |
| Lab Log#: | 158130 | 158131 | 158132 | 158134 | 158135 | 158139 | 158140 | 158141 | 168145 | 168146 |

| (Group) | VOA Compounds | (ug/L) | (ug/L) | (ug/L) | (ug/L) | (ug/L) | (ug/L) | (ug/L) | (ug/L) | (ug/Kg*) | (ug/Kg*) |
|---------|-----------------------------|--------|--------|---------|---------|--------|--------|--------|--------|----------|----------|
| a | Chloromethane | 10 U | 500 U | 2500 U | 500 U | 2500 U | 10 U | 10 U | 10 U | 15 U | 17 U |
| a | Bromomethane | 10 U | 500 U | 2500 U | 500 U | 2500 U | 10 U | 10 U | 10 U | 15 U | 17 U |
| a | Methylene Chloride | 5 U | 250 U | 1300 U | 250 U | 1300 U | 5 U | 5 U | 5 U | 8 U | 8 U |
| a | Chloroform | 5 U | 250 U | 1300 U | 250 U | 1300 U | 5 U | 5 U | 5 U | 8 U | 8 U |
| a | Carbon Tetrachloride | 5 U | 250 U | 1300 U | 250 U | 1300 U | 5 U | 5 U | 5 U | 8 U | 8 U |
| a | Bromodichloromethane | 5 U | 250 U | 1300 U | 250 U | 1300 U | 5 U | 5 U | 5 U | 8 U | 8 U |
| a | Dibromochloromethane | 5 U | 250 U | 1300 U | 250 U | 1300 U | 5 U | 5 U | 5 U | 8 U | 8 U |
| a | Bromoform | 5 U | 250 U | 1300 U | 250 U | 1300 U | 5 U | 5 U | 5 U | 8 U | 8 U |
| | Chloroethane | 10 U | 500 U | 2500 U | 500 U | 2500 U | 10 U | 10 U | 10 U | 15 U | 17 U |
| | Vinyl Chloride | 10 U | 500 U | 2500 U | 500 U | 2500 U | 10 U | 10 U | 10 U | 15 U | 17 U |
| | 1,1-Dichloroethane | 5 U | 250 U | 1300 U | 250 U | 1300 U | 5 U | 5 U | 5 U | 8 U | 8 U |
| | 1,2-Dichloroethane | 5 U | 250 U | 1300 U | 250 U | 1300 U | 5 U | 5 U | 5 U | 8 U | 8 U |
| b | 1,1-Dichloroethene | 5 U | 250 U | 1300 U | 250 U | 1300 U | 5 U | 5 U | 5 U | 8 U | 8 U |
| b | 1,2-Dichloroethene (total) | 5 U | 250 U | 1300 U | 250 U | 1300 U | 5 U | 5 U | 5 U | 8 U | 8 U |
| c | 1,1,1-Trichloroethane | ++ | 5 U | 250 U | 1300 U | 250 U | 5 U | 5 U | 5 U | 8 J | 11 J |
| c | 1,1,2-Trichloroethane | 5 U | 250 U | 1300 U | 250 U | 1300 U | 5 U | 5 U | 5 U | 8 U | 8 U |
| | Trichloroethene | 5 U | 250 U | 1300 U | 250 U | 1300 U | 5 U | 5 U | 5 U | 8 U | 8 U |
| f | 1,1,2,2-Tetrachloroethane | 5 U | 250 U | 1300 U | 250 U | 1300 U | 5 U | 5 U | 5 U | 8 U | 8 U |
| | Tetrachloroethene | 5 U | 250 U | 1300 U | 250 U | 1300 U | 5 U | 5 U | 5 U | 8 U | 8 U |
| d | 1,2-Dichloropropane | 5 U | 250 U | 1300 U | 250 U | 1300 U | 5 U | 5 U | 5 U | 8 U | 8 U |
| e | cis-1,3-Dichloropropene | 5 U | 250 U | 1300 U | 250 U | 1300 U | 5 U | 5 U | 5 U | 8 U | 8 U |
| e | trans-1,3-Dichloropropene | 5 U | 250 U | 1300 U | 250 U | 1300 U | 5 U | 5 U | 5 U | 8 U | 8 U |
| | Acetone | 10 U | 500 U | 2500 U | 500 U | 2500 U | 10 U | 10 U | 10 U | 15 U | 17 U |
| | 2-Butanone (MEK) | ++ | 10 U | 500 U | 17000 U | 500 U | 10 U | 10 U | 10 U | 15 U | 17 U |
| | 4-Methyl-2-Pentanone (MIBK) | 10 U | 500 U | 2500 U | 500 U | 2500 U | 10 U | 10 U | 10 U | 15 U | 17 U |
| | 2-Hexanone | 10 U | 500 U | 2500 U | 500 U | 2500 U | 10 U | 10 U | 10 U | 15 U | 17 U |
| | Vinyl Acetate | 10 U | 500 U | 2500 U | 500 U | 2500 U | 10 U | 10 U | 10 U | 15 U | 17 U |
| | Carbon Disulfide | 5 U | 250 U | 1300 U | 250 U | 1300 U | 5 U | 5 U | 5 U | 8 U | 8 U |
| | Benzene | ++ | 5 U | 14000 D | 28000 | 4700 | 11 | 5 U | 5 U | 8 U | 8 U |
| | Toluene | ++ | 5 U | 20000 D | 77000 D | 7400 | 29 | 4 J | 5 U | 68 | 8 U |
| | Ethylbenzene | ++ | 5 U | 1800 | 16000 | 590 | 4 J | 5 U | 5 U | 92 | 8 U |
| | Styrene | 5 U | 250 U | 1300 U | 250 U | 1300 U | 5 U | 5 U | 5 U | 8 U | 8 U |
| | Total Xylenes | ++ | 5 U | 12000 D | 83000 D | 6700 | 51 | 5 U | 5 U | 520 | 8 U |
| g | Chlorobenzene | 5 U | 250 U | 1300 U | 250 U | 1300 U | 5 U | 5 U | 5 U | 8 U | 8 U |

TRNS BLNK Transfer blank

INF Influent sample

TF-EF Trickling filter effluent sample

STRM Stormwater sample

EF Final effluent sample

SED Marine sediment sample

U The analyte was not detected at or above the reported result.

J The analyte was positively identified. The associated numerical result is an estimate.

D The result was derived from an analysis of a sample that required a secondary dilution.

++ Compound detected in one or more samples

* Dry weight basis

a Total Halomethanes

b Total Dichloroethenes

c Total Trichloroethanes

d Total Dichloropropanes

e Total Dichloropropenes

f Total Tetrachloroethanes

g Total Chlorinated Benzenes (excluding Dichlorobenzenes)

Appendix E (cont'd) – VOA, BNA, and Pesticide/PCB Scan Results – ARCO, April 1991

| | | | | | | |
|-----------|--------|---------|--------|--------|-----------|-----------|
| Location: | INF-3 | TF-EF-3 | STRM-3 | EF-3 | SED-1 | SED-2 |
| Type: | Comp | Comp | Grab | Comp | Bkgd | Edge dil |
| Date: | 4/9 | 4/9 | 4/9 | 4/9 | 4/16 | 4/16 |
| Time: | *** | *** | 1705 | *** | 1520-1630 | 1730-1845 |
| Lab Log#: | 158133 | 158136 | 158139 | 158142 | 168145 | 168146 |

| (Group) | BNA Compounds | (ug/L) | (ug/L) | (ug/L) | (ug/L) | (ug/Kg*) | (ug/Kg*) |
|---------|-----------------------------|--------|--------|--------|--------|----------|----------|
| | Hexachloroethane | 100 U | 100 U | 10 U | 10 U | 980 U | 1100 U |
| | Hexachlorobutadiene | 100 U | 100 U | 10 U | 10 U | 980 U | 1100 U |
| | Hexachlorocyclopentadiene | 100 U | 100 U | 10 U | 10 U | 980 U | 1100 U |
| j | Bis(2-Chloroethyl)Ether | 100 U | 100 U | 10 U | 10 U | 980 U | 1100 U |
| j | Bis(2-Chloroisopropyl)Ether | 100 U | 100 U | 10 U | 10 U | 980 U | 1100 U |
| j | Bis(2-Chloroethoxy)Methane | 100 U | 100 U | 10 U | 10 U | 980 U | 1100 U |
| k | N-Nitroso-di-n-Propylamine | 100 U | 100 U | 10 U | 10 U | 980 U | 1100 U |
| k | N-Nitrosodiphenylamine | 100 U | 100 U | 10 U | 10 U | 980 U | 1100 U |
| | Isophorone | 100 U | 100 U | 10 U | 10 U | 980 U | 1100 U |
| n | Naphthalene | 530 D | 250 D | 10 U | 10 U | 980 U | 1100 U |
| | 2-Methylnaphthalene | 510 D | 320 D | 10 U | 10 U | 980 U | 1100 U |
| n | Acenaphthylene | 100 U | 100 U | 10 U | 10 U | 980 U | 1100 U |
| n | Acenaphthene | 100 U | 100 U | 10 U | 10 U | 110 J | 1100 U |
| n | Fluorene | 33 DJ | 26 DJ | 10 U | 10 U | 980 U | 1100 U |
| n | Phenanthrene | 66 DJ | 56 DJ | 10 U | 10 U | 610 J | 1100 U |
| n | Anthracene | 100 U | 100 U | 10 U | 10 U | 190 J | 1100 U |
| n | Fluoranthene | 100 U | 100 U | 10 U | 10 U | 550 J | 1100 U |
| n | Pyrene | 100 U | 100 U | 10 U | 10 U | 560 J | 1100 U |
| n | Benzo(a)Anthracene | 100 U | 100 U | 10 U | 10 U | 210 J | 1100 U |
| n | Chrysene | 100 U | 100 U | 10 U | 10 U | 170 J | 1100 U |
| n | Benzo(b)Fluoranthene | 100 U | 100 U | 10 U | 10 U | 170 J | 1100 U |
| n | Benzo(k)Fluoranthene | 100 U | 100 U | 10 U | 10 U | 130 J | 1100 U |
| n | Benzo(a)Pyrene | 100 U | 100 U | 10 U | 10 U | 170 J | 1100 U |
| n | Indeno(1,2,3-cd)Pyrene | 100 U | 100 U | 10 U | 10 U | 980 U | 1100 U |
| n | Dibenzo(a,h)Anthracene | 100 U | 100 U | 10 U | 10 U | 980 U | 1100 U |
| n | Benzo(g,h,i)Perylene | 100 U | 100 U | 10 U | 10 U | 980 U | 1100 U |
| h | 1,2-Dichlorobenzene | 100 U | 100 U | 10 U | 10 U | 980 U | 1100 U |
| h | 1,3-Dichlorobenzene | 100 U | 100 U | 10 U | 10 U | 980 U | 1100 U |
| h | 1,4-Dichlorobenzene | 100 U | 100 U | 10 U | 10 U | 980 U | 1100 U |
| g | 1,2,4-Trichlorobenzene | 100 U | 100 U | 10 U | 10 U | 980 U | 1100 U |
| g | Hexachlorobenzene | 100 U | 100 U | 10 U | 10 U | 980 U | 1100 U |
| m | 2-Chloronaphthalene | 100 U | 100 U | 10 U | 10 U | 980 U | 1100 U |
| i | Dimethyl Phthalate | 100 U | 100 U | 10 U | 10 U | 980 U | 1100 U |
| i | Diethyl Phthalate | 100 U | 100 U | 10 U | 10 U | 980 U | 1100 U |
| i | Di-n-Butyl Phthalate | 100 U | 100 U | 10 U | 10 U | 980 U | 1100 U |
| i | Butylbenzyl Phthalate | 100 U | 100 U | 10 U | 10 U | 980 U | 1100 U |
| i | Bis(2-Ethylhexyl)Phthalate | 100 U | 100 U | 10 U | 6 J | 980 U | 1100 U |
| i | Di-n-Octyl Phthalate | 100 U | 100 U | 10 U | 10 U | 980 U | 1100 U |
| | Nitrobenzene | 100 U | 100 U | 10 U | 10 U | 980 U | 1100 U |
| o | 2,4-Dinitrotoluene | 100 U | 100 U | 10 U | 10 U | 980 U | 1100 U |
| o | 2,6-Dinitrotoluene | 100 U | 100 U | 10 U | 10 U | 980 U | 1100 U |
| | 3,3'-Dichlorobenzidine | 200 U | 200 U | 20 U | 20 U | 2000 U | 2200 U |
| | Phenol | 1900 D | 1000 D | 10 U | 10 U | 980 U | 1100 U |
| | 2-Methylphenol | 1000 D | 770 D | 10 U | 10 U | 980 U | 1100 U |
| | 4-Methylphenol | 540 D | 400 D | 10 U | 10 U | 980 U | 1100 U |
| | 2,4-Dimethylphenol | 980 D | 920 D | 10 U | 10 U | 980 U | 1100 U |
| l | 2-Nitrophenol | 100 U | 100 U | 10 U | 10 U | 980 U | 1100 U |
| l | 4-Nitrophenol | 500 U | 500 U | 50 U | 50 U | 4800 U | 5300 U |
| l | 2,4-Dinitrophenol | 500 U | 500 U | 50 U | 50 U | 4800 U | 5300 U |
| l | 4,6-Dinitro-2-Methylphenol | 500 U | 500 U | 50 U | 50 U | 4800 U | 5300 U |
| | 2-Chlorophenol | 100 U | 100 U | 10 U | 10 U | 980 U | 1100 U |
| | 2,4-Dichlorophenol | 100 U | 100 U | 10 U | 10 U | 980 U | 1100 U |
| | 4-Chloro-3-Methylphenol | 100 U | 100 U | 10 U | 10 U | 980 U | 1100 U |
| | 2,4,5-Trichlorophenol | 500 U | 500 U | 50 U | 50 U | 4800 U | 5300 U |
| | 2,4,6-Trichlorophenol | 100 U | 100 U | 10 U | 10 U | 980 U | 1100 U |
| | Pentachlorophenol | 500 U | 500 U | 50 U | 50 U | 4800 U | 5300 U |
| p | 4-Chlorophenyl Phenylether | 100 U | 100 U | 10 U | 10 U | 980 U | 1100 U |
| p | 4-Bromophenyl Phenylether | 100 U | 100 U | 10 U | 10 U | 980 U | 1100 U |

Appendix E (cont'd) – VOA, BNA, and Pesticide/PCB Scan Results – ARCO, April 1991

| | | | | | | | |
|-----------|-----------|--------|---------|--------|--------|-----------|-----------|
| Location: | TRNS BLNK | INF-3 | TF-EF-3 | STRM-3 | EF-3 | SED-1 | SED-2 |
| Type: | Grab | Comp | Comp | Grab | Comp | Bkgrd | Edge dil |
| Date: | 4/8 | 4/9 | 4/9 | 4/9 | 4/9 | 4/16 | 4/16 |
| Time: | 1545 | *** | *** | 1705 | *** | 1520-1630 | 1730-1845 |
| Lab Log#: | 158130 | 158133 | 158136 | 158139 | 158142 | 168145 | 168146 |

| (Group) | BNA Compounds | (ug/L) | (ug/L) | (ug/L) | (ug/L) | (ug/Kg*) | (ug/Kg*) |
|---------|---------------------------|---------|---------|---------|---------|----------|----------|
| | 2-Nitroaniline | 500 U | 500 U | 50 U | 50 U | 4800 U | 5300 U |
| | 3-Nitroaniline | 500 U | 500 U | 50 U | 50 U | 4800 U | 5300 U |
| | 4-Nitroaniline | 500 U | 500 U | 50 U | 50 U | 4800 U | 5300 U |
| | 4-Chloroaniline | 100 U | 100 U | 10 U | 10 U | 980 U | 1100 U |
| | Benzyl Alcohol | 100 U | 100 U | 10 U | 10 U | 980 U | 1100 U |
| | Benzoic Acid | 500 U | 500 U | 50 U | 50 U | 4800 U | 5300 U |
| | Dibenzofuran | 100 U | 100 U | 10 U | 10 U | 980 U | 1100 U |
| | <u>Pest/PCB Compounds</u> | | | | | | |
| | Aldrin | 0.050 U | 0.050 U | 0.050 U | 0.050 U | 24 U | 27 U |
| | Dieldrin | 0.10 U | 0.10 U | 0.10 U | 0.10 U | 48 U | 55 U |
| v | alpha-Chlordane | 0.50 U | 0.50 U | 0.50 U | 0.50 U | 240 U | 270 U |
| v | gamma-Chlordane | 0.50 U | 0.50 U | 0.50 U | 0.50 U | 240 U | 270 U |
| s | Endosulfan I | 0.050 U | 0.050 U | 0.050 U | 0.050 U | 24 U | 27 U |
| s | Endosulfan II | 0.10 U | 0.10 U | 0.10 U | 0.10 U | 48 U | 55 U |
| s | Endosulfan Sulfate | 0.10 U | 0.10 U | 0.10 U | 0.10 U | 48 U | 55 U |
| t | Endrin | 0.10 U | 0.10 U | 0.10 U | 0.10 U | 48 U | 55 U |
| t | Endrin Ketone | 0.10 U | 0.10 U | 0.10 U | 0.10 U | 48 U | 55 U |
| r | Heptachlor | 0.050 U | 0.050 U | 0.050 U | 0.050 U | 24 U | 27 U |
| r | Heptachlor Epoxide | 0.050 U | 0.050 U | 0.050 U | 0.050 U | 24 U | 27 U |
| q | alpha-BHC | 0.050 U | 0.050 U | 0.050 U | 0.050 U | 24 U | 27 U |
| q | beta-BHC | 0.050 U | 0.050 U | 0.050 U | 0.050 U | 24 U | 27 U |
| q | delta-BHC | 0.050 U | 0.050 U | 0.050 U | 0.050 U | 24 U | 27 U |
| q | gamma-BHC (Lindane) | 0.050 U | 0.050 U | 0.050 U | 0.050 U | 24 U | 27 U |
| u | 4,4'-DDT | 0.10 U | 0.10 U | 0.10 U | 0.10 U | 48 U | 55 U |
| u | 4,4'-DDE | 0.10 U | 0.10 U | 0.10 U | 0.10 U | 48 U | 55 U |
| u | 4,4'-DDD | 0.10 U | 0.10 U | 0.10 U | 0.10 U | 48 U | 55 U |
| | Toxaphene | 1.0 U | 1.0 U | 1.0 U | 1.0 U | 480 U | 550 U |
| | Methoxychlor | 0.50 U | 0.50 U | 0.50 U | 0.50 U | 240 U | 270 U |
| w | Aroclor-1016 | 0.50 U | 0.50 U | 0.50 U | 0.50 U | 240 U | 270 U |
| w | Aroclor-1221 | 0.50 U | 0.50 U | 0.50 U | 0.50 U | 240 U | 270 U |
| w | Aroclor-1232 | 0.50 U | 0.50 U | 0.50 U | 0.50 U | 240 U | 270 U |
| w | Aroclor-1242 | 0.50 U | 0.50 U | 0.50 U | 0.50 U | 240 U | 270 U |
| w | Aroclor-1248 | 0.50 U | 0.50 U | 0.50 U | 0.50 U | 240 U | 270 U |
| w | Aroclor-1254 | 1.0 U | 1.0 U | 1.0 U | 1.0 U | 480 U | 550 U |
| w | Aroclor-1260 | 1.0 U | 1.0 U | 1.0 U | 1.0 U | 480 U | 550 U |

TRNS BLNK Transfer blank

INF Influent sample

TF-EF Trickling filter effluent sample

STRM Stormwater sample

EF Final effluent sample

SED Marine sediment sample

* Dry weight basis

*** Composite samples collected from midnight to midnight

++ compound detected in one or more samples

U The analyte was not detected at or above the reported result.

J The analyte was positively identified. The associated numerical result is an estimate.

D The result was derived from an analysis of a sample that required a secondary dilution

h Total Dichlorobenzenes

i Total Phthalate Esters

j Total Chloroalkyl Ethers

k Total Nitrosamines

l Total Nitrophenols

m Total Chlorinated Naphthalenes

n Total Polynuclear Aromatic Hydrocarbons

o Total Dinitrotoluenes

p Total Haloethers

q Total BHCs

r Heptachlor

s Endosulfan

t Endrin

u DDT plus metabolites

v Total Chlordane

w Total Aroclors (PCBs)

Appendix F – VOA, BNA, and Pesticide/PCB Tentatively Identified
Compounds (TICs) – ARCO, April 1991

TICs are noted on the attached lab data sheets. The EPA sample numbers on the data sheets correspond to the log lab numbers noted below.

| | | | | | | | | |
|-----------|-----------|--------|--------|---------|---------|--------|--------|--------|
| Location: | TRNS BLNK | INF-1 | INF-2 | TF-EF-1 | TF-EF-2 | STRM-3 | EF-1 | EF-2 |
| Type: | Grab | Grab | Grab | Grab | Grab | Grab | Grab | Grab |
| Date: | 4/8 | 4/9 | 4/9 | 4/9 | 4/9 | 4/9 | 4/9 | 4/9 |
| Time: | 1545 | 1155 | 1605 | 1225 | 1510 | 1705 | 1055 | 1440 |
| Lab Log#: | ** | 158131 | 158132 | 158134 | 158135 | 158139 | 158140 | 158141 |

| | | | | | | |
|-----------|--------|---------|--------|--------|-----------|-----------|
| Location: | INF-3 | TF-EF-3 | STRM-3 | EF-3 | SED-1 | SED-2 |
| Type: | Comp | Comp | Grab | Comp | Bkgd | Edge dil |
| Date: | 4/9 | 4/9 | 4/9 | 4/9 | 4/16 | 4/16 |
| Time: | *** | *** | 1705 | *** | 1520-1630 | 1730-1845 |
| Lab Log#: | 158133 | 158136 | 158139 | 158142 | 168145 | 168146 |

TRNS BLNK Transfer blank
INF Influent sample
TF-EF Trickling filter effluent sample
STRM Stormwater sample
EF Final effluent sample
SED Marine sediment sample
JN There is evidence the analyte is present. The associated numerical value is an estimate.
*** Composite samples collected from midnight to midnight

1E
VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

158131

Lab Name: WEYERHAEUSER

Contract: 046-5751

Lab Code: WEYER

Case No.: 5432

SAS No.:

SDG No.: 158130

Matrix: (soil/water) WATER

Lab Sample ID: 69454

Sample wt/vol: 0.10 (g/mL) ML

Lab File ID: B4844

Level: (low/med) LOW

Date Received: 04/11/91

% Moisture: not dec.

Date Analyzed: 04/21/91

Column (pack/cap) CAP

Dilution Factor: ~~10~~ 50.
6.6416

Number TICs found: 3

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

| CAS NUMBER | COMPOUND NAME | RT | EST. CONC. | Q |
|----------------------|---|------------------|----------------|---------------|
| 1. 120923 | Cyclopentanone | 7.57 | 300 | JN |
| 2. 541059 | Cyclotrisiloxane, hexamethyl | 16.49 | 250 | BJ |
| 3. 611143 | Benzene, 1-ethyl-2-methyl- | 25.61 | 1100 | JN |

1E
VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

158131DL

Lab Name: WEYERHAEUSER

Contract: 046-5751

Lab Code: WEYER

Case No.: 5432

SAS No.:

SDG No.: 158130

Matrix: (soil/water) WATER

Lab Sample ID: 69454DL

Sample wt/vol: 0.020 (g/mL) ML

Lab File ID: B4890

Level: (low/med) LOW

Date Received: 04/11/91

% Moisture: not dec.

Date Analyzed: 04/23/91

Column (pack/cap) CAP

Dilution Factor: ~~10~~ 250,
6.6.91

Number TICs found: 2

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

| CAS NUMBER | COMPOUND NAME | RT | EST. CONC. | Q |
|----------------------|---|------------------|------------------|---------------|
| 1. 541059 | Cyclotrisiloxane, hexamethyl | 16.22 | 25000 | BJ |
| 2. | Unknown | 26.27 | 8500 | JN |

1E
VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

158132

Lab Name: WEYERHAEUSER

Contract: 046-5751

Lab Code: WEYER

Case No.: 5432

SAS No.:

SDG No.: 158130

Matrix: (soil/water) WATER

Lab Sample ID: 69455

Sample wt/vol: 0.020 (g/mL) ML

Lab File ID: B4845

Level: (low/med) LOW

Date Received: 04/11/91

% Moisture: not dec.

Date Analyzed: 04/21/91

Column (pack/cap) CAP

Dilution Factor: ~~1.0~~ 250
6.6.91

Number TICs found: 10

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

| CAS NUMBER | COMPOUND NAME | RT | EST. CONC. | Q |
|------------|------------------------------|-------|------------|----|
| 1. 107835 | Pentane, 2-methyl- | 4.08 | 3500 | JN |
| 2. | Unknown | 7.58 | 6500 | JN |
| 3. | Unknown hydrocarbon | 12.74 | 1500 | JN |
| 4. 111659 | Octane | 14.79 | 1500 | JN |
| 5. 541059 | Cyclotrisiloxane, hexamethyl | 16.49 | 5500 | BJ |
| 6. 103651 | Benzene, propyl- | 25.17 | 4800 | JN |
| 7. 611143 | Benzene, 1-ethyl-2-methyl- | 25.64 | 18000 | JN |
| 8. 108678 | Benzene, 1,3,5-trimethyl- | 26.02 | 7300 | JN |
| 9. | Unknown | 26.47 | 1300 | JN |
| 10. 611143 | Benzene, 1-ethyl-2-methyl- | 26.76 | 4800 | JN |

1E
VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

158132DL

Lab Name: WEYERHAEUSER

Contract: 046-5751

Lab Code: WEYER

Case No.: 5432

SAS No.:

SDG No.: 158130

Matrix: (soil/water) WATER

Lab Sample ID: 69455DL

Sample wt/vol: 0.004 (g/mL) ML

Lab File ID: B4891

Level: (low/med) LOW

Date Received: 04/11/91

% Moisture: not dec.

Date Analyzed: 04/23/91

Column (pack/cap) CAP

Dilution Factor: 100 1250

6m 6.41

Number TICs found: 3

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

| CAS NUMBER | COMPOUND NAME | RT | EST. CONC. | Q |
|----------------------|---|------------------|------------------|---------------|
| 1. 541059 | Cyclotrisiloxane, hexamethyl | 16.22 | 61000 | BJ |
| 2. 620144 | Benzene, 1-ethyl-3-methyl- | 25.37 | 10000 | JN |
| 3. | Unknown | 26.27 | 26000 | JN |

1E
VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

158135

Lab Name: WEYERHAEUSER

Contract: 046-5751

Lab Code: WEYER

Case No.: 5432

SAS No.:

SDG No.: 158130

Matrix: (soil/water) WATER

Lab Sample ID: 69458

Sample wt/vol: 0.020 (g/mL) ML

Lab File ID: B4847

Level: (low/med) LOW

Date Received: 04/11/91

% Moisture: not dec.

Date Analyzed: 04/21/91

Column (pack/cap) CAP

Dilution Factor: ~~10~~ 250.

6.6-9.6m

Number TICs found: 3

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

| CAS NUMBER | COMPOUND NAME | RT | EST. CONC. | Q |
|----------------------|---|------------------|------------------|---------------|
| 1. 541059 | Cyclotrisiloxane, hexamethyl | 16.47 | 12000 | BJ |
| 2. 620144 | Benzene, 1-ethyl-3-methyl- | 25.59 | 1800 | J <i>h</i> |
| 3. | Unknown | 26.47 | 6300 | J <i>h</i> |

1E
VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

158139

Lab Name: WEYERHAEUSER

Contract: 046-5751

Lab Code: WEYER

Case No.: 5432

SAS No.:

SDG No.: 158130

Matrix: (soil/water) WATER

Lab Sample ID: 69460

Sample wt/vol: 5.0 (g/mL) ML

Lab File ID: B4829

Level: (low/med) LOW

Date Received: 04/11/91

% Moisture: not dec.

Date Analyzed: 04/18/91

Column (pack/cap) CAP

Dilution Factor: 1.0

Number TICs found: 2

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

| CAS NUMBER | COMPOUND NAME | RT | EST. CONC. | Q |
|----------------------|---|------------------|----------------|----------------|
| 1. 541059 | Cyclotrisiloxane, hexamethyl | 16.57 | 9.0 | J |
| 2. | UNKNOWN | 26.67 | 6.0 | J _u |

1E
VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

158141

Lab Name: WEYERHAEUSER

Contract: 046-5751

Lab Code: WEYER

Case No.: 5432

SAS No.:

SDG No.: 158130

Matrix: (soil/water) WATER

Lab Sample ID: 69462

Sample wt/vol: 5.0 (g/mL) ML

Lab File ID: B4843

Level: (low/med) LOW

Date Received: 04/11/91

% Moisture: not dec.

Date Analyzed: 04/21/91

Column (pack/cap) CAP

Dilution Factor: 1.0

Number TICs found: 3

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

| CAS NUMBER | COMPOUND NAME | RT | EST. CONC. | Q |
|----------------------|--|------------------|---------------|---------------|
| 1. | Unknown | 4.53 | 6.0 | JN |
| 2. 541059 | Cyeloctrisiloxane, hexamethyl | 16.49 | 29 | BJ |
| 3. | Unknown | 26.51 | 12 | JN |

1F
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

158133DL

Lab Name: WEYERHAEUSER

Contract: MAGOON

Lab Code: WEYER

Case No.: 05432

SAS No.:

SDG No.: 69453

Matrix: (soil/water) WATER

Lab Sample ID: 69456DL

Sample wt/vol: 1000 (g/mL) ML

Lab File ID: BN0501D

Level: (low/med) LOW

Date Received: 04/11/91

% Moisture: not dec. dec.

Date Extracted: 04/12/91

Extraction: (SepF/Cont/Sonc) CONT

Date Analyzed: 05/02/91

GPC Cleanup: (Y/N) N pH:

Dilution Factor: 10

Number TICs found: 21

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

| CAS NUMBER | COMPOUND NAME | RT | EST. CONC. | Q |
|----------------|------------------------------|-------|------------|----|
| 1. 100-41-4 | BENZENE, ETHYL- | 5.53 | 1300 | JX |
| 2. 108-38-3 | BENZENE, 1,3-DIMETHYL- | 5.72 | 4600 | JX |
| 3. 95-47-6 | BENZENE, 1,2-DIMETHYL- | 6.17 | 2100 | JX |
| 4. 611-14-3 | BENZENE, 1-ETHYL-2-METHYL- | 7.55 | 1300 | JX |
| 5. 95-63-6 | BENZENE, 1,2,4-TRIMETHYL- | 7.68 | 720 | JX |
| 6. 526-73-8 | BENZENE, 1,2,3-TRIMETHYL- | 8.23 | 1700 | JX |
| 7. 124-18-5 | DECANE | 8.30 | 420 | JX |
| 8. 2870-04-4 | BENZENE, 2-ETHYL-1,3-DIMETHY | 9.55 | 1200 | JX |
| 9. 62016-37-9 | OCTANE, 2,4,6-TRIMETHYL- | 10.37 | 580 | JX |
| 10. 17301-32-5 | UNDECANE, 4,7-DIMETHYL- | 12.34 | 610 | JX |
| 11. 62108-21-8 | DECANE, 6-ETHYL-2-METHYL- | 14.20 | 1000 | JX |
| 12. | UNKNOWN | 15.95 | 950 | JX |
| 13. | UNKNOWN | 17.60 | 930 | JX |
| 14. 544-76-3 | HEXADECANE | 19.19 | 780 | JX |
| 15. 629-78-7 | HEPTADECANE | 20.67 | 680 | JX |
| 16. 54105-67-8 | HEPTADECANE, 2,6-DIMETHYL- | 20.75 | 440 | JX |
| 17. | UNKNOWN | 22.20 | 290 | JX |
| 18. | UNKNOWN | 23.42 | 500 | JX |
| 19. | UNKNOWN | 24.70 | 1700 | JX |
| 20. | UNKNOWN | 25.94 | 1100 | JX |
| 21. 629-97-0 | DOCOSANE | 27.11 | 630 | JX |

1F
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

158136DL

Lab Name: WEYERHAEUSER

Contract: MAGOON

Lab Code: WEYER

Case No.: 05432

SAS No.:

SDG No.: 69453

Matrix: (soil/water) WATER

Lab Sample ID: 69459DL

Sample wt/vol: 1000 (g/mL) ML

Lab File ID: BN0501E

Level: (low/med) LOW

Date Received: 04/11/91

% Moisture: not dec. dec.

Date Extracted: 04/12/91

Extraction: (SepF/Cont/Sonc) CONT

Date Analyzed: 05/02/91

GPC Cleanup: (Y/N) N pH:

Dilution Factor: 10

Number TICs found: 21

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

| CAS NUMBER | COMPOUND NAME | RT | EST. CONC. | Q |
|----------------|-----------------------------|-------|------------|-------|
| 1. 100-41-4 | BENZENE, ETHYL- | 5.52 | 360 | JX JN |
| 2. 108-38-3 | BENZENE, 1,3-DIMETHYL- | 5.68 | 2000 | JX |
| 3. 95-47-6 | BENZENE, 1,2-DIMETHYL- | 6.13 | 890 | JX |
| 4. 611-14-3 | BENZENE, 1-ETHYL-2-METHYL- | 7.55 | 700 | JX |
| 5. 526-73-8 | BENZENE, 1,2,3-TRIMETHYL- | 8.22 | 830 | JX |
| 6. 124-18-5 | DECANE | 8.30 | 310 | JX |
| 7. 62016-37-9 | OCTANE, 2,4,6-TRIMETHYL- | 10.37 | 680 | JX |
| 8. | UNKNOWN | 11.54 | 290 | JX |
| 9. | UNKNOWN | 12.34 | 550 | JX |
| 10. 62108-21-8 | DECANE, 6-ETHYL-2-METHYL- | 14.19 | 940 | JX |
| 11. | UNKNOWN | 15.95 | 910 | JX |
| 12. 62238-13-5 | DECANE, 2,3,7-TRIMETHYL- | 16.99 | 320 | JX |
| 13. | UNKNOWN | 17.60 | 640 | JX |
| 14. 544-76-3 | HEXADECANE | 19.17 | 680 | JX |
| 15. 36475-50-0 | TETRADECANAL, O-METHYLOXIME | 20.65 | 610 | JX |
| 16. 54105-67-8 | HEPTADECANE, 2,6-DIMETHYL- | 20.75 | 430 | JX |
| 17. | UNKNOWN | 22.20 | 250 | JX |
| 18. | UNKNOWN | 23.42 | 430 | JX |
| 19. | UNKNOWN | 24.70 | 1600 | JX |
| 20. | UNKNOWN | 25.94 | 1100 | JX |
| 21. 629-97-0 | DOCOSANE | 27.11 | 630 | JX |

1F
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

158142

Lab Name: WEYERHAEUSER

Contract: MAGOON

Lab Code: WEYER

Case No.: 05432

SAS No.:

SDG No.: 69453

Matrix: (soil/water) WATER

Lab Sample ID: 69463

Sample wt/vol: 1000 (g/mL) ML

Lab File ID: 2BN10419E

Level: (low/med) LOW

Date Received: 04/11/91

% Moisture: not dec. dec.

Date Extracted: 04/12/91

Extraction: (SepF/Cont/Sonc) CONT

Date Analyzed: 04/19/91

GPC Cleanup: (Y/N) N pH:

Dilution Factor: 1.0

Number TICs found: 3

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

| CAS NUMBER | COMPOUND NAME | RT | EST. CONC. | Q |
|-------------|------------------------------|-------|------------|-------|
| 1. | UNKNOWN | 10.30 | 18 | JX JW |
| 2. | UNKNOWN | 15.50 | 16 | JX |
| 3. 112-50-5 | ETHANOL, 2-[2-(2-ETHOXYETHOX | 19.82 | 5.8 | JX ↓ |

1E
VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

Lab Name: WEYERHAEUSER Contract: 046-5751 168145

Lab Code: WEYER Case No.: 5500 SAS No.: _____ SDG No.: 168145

Matrix: (soil/water) SOIL Lab Sample ID: 69954

Sample wt/vol: 5.0 (g/mL) G Lab File ID: A7709

Level: (low/med) LOW Date Received: 04/19/91

% Moisture: not dec. 34 Date Analyzed: 04/22/91

Column (pack/cap) CAP Dilution Factor: 1.0

Number TICs found: 10

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/KG

| CAS NUMBER | COMPOUND NAME | RT | EST. CONC. | Q |
|-------------|-----------------------------|-------|------------|----|
| 1. 108872 | Cyclohexane, methyl- | 7.83 | 88 | JN |
| 2. 592278 | Heptane, 2-methyl- | 9.97 | 120 | J |
| 3. 589811 | Heptane, 3-methyl- | 10.37 | 83 | J |
| 4. 111659 | Octane | 11.77 | 89 | J |
| 5. 926829 | Heptane, 3,5-dimethyl- | 13.82 | 82 | J |
| 6. 52896874 | Heptane, 4-(1-methylethyl)- | 20.92 | 83 | J |
| 7. 103651 | Benzene, propyl- | 21.42 | 59 | J |
| 8. 611143 | Benzene, 1-ethyl-2-methyl- | 21.90 | 80 | J |
| 9. 526738 | Benzene, 1,2,3-trimethyl- | 22.29 | 48 | J |
| 10. 124185 | Decane | 22.99 | 110 | J |

1E
VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

| | | |
|---|--------------------------------|------------------------|
| Lab Name: <u>WEYERHAEUSER</u> | Contract: <u>046-5751</u> | 168146 |
| Lab Code: <u>WEYER</u> | Case No.: <u>5500</u> | SAS No.: _____ |
| | | SDG No.: <u>168145</u> |
| Matrix: (soil/water) <u>SOIL</u> | Lab Sample ID: <u>69955</u> | |
| Sample wt/vol: <u>5.0</u> (g/mL) <u>G</u> | Lab File ID: <u>A7710</u> | |
| Level: (low/med) <u>LOW</u> | Date Received: <u>04/19/91</u> | |
| % Moisture: not dec. <u>41</u> | Date Analyzed: <u>04/23/91</u> | |
| Column (pack/cap) <u>CAP</u> | Dilution Factor: <u>1.0</u> | |

Number TICs found: 1

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/KG

| CAS NUMBER | COMPOUND NAME | RT | EST. CONC. | Q |
|------------|------------------------------|------|------------|----|
| 1. 76131 | Ethane, 1,1,2-trichloro-1,2, | 2.32 | 340 | JN |

1F
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

Lab Name: WEYERHAEUSER

Contract: MAGOON

69954
168145

Lab Code: WEYER

Case No.: 05500

SAS No.:

SDG No.: 69954

Matrix: (soil/water) SOIL

Lab Sample ID: 168145

Sample wt/vol: 30.6 (g/mL) G

Lab File ID: 2BN10515L

Level: (low/med) LOW

Date Received: 04/19/91

% Moisture: not dec. 34 dec.

Date Extracted: 05/02/91

Extraction: (SepF/Cont/Sonc) SONC

Date Analyzed: 05/16/91

GPC Cleanup: (Y/N) Y pH: 7.0

DILUTION FACTOR: 1.0

Number TICs found: 7

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/KG

| CAS NUMBER | COMPOUND NAME | RT | EST. CONC. | Q |
|---------------|--------------------------|-------|------------|----------|
| 1. | UNKNOWN | 5.15 | 49000 | JX JW Sm |
| 2. 100-52-7 | BENZALDEHYDE (ACN) (DOT) | 7.58 | 540 | JX |
| 3. 10544-50-0 | SULFUR, MOL. (S8) | 25.62 | 760 | JX |
| 4. | UNKNOWN | 27.02 | 690 | JX |
| 5. | UNKNOWN | 29.09 | 4400 | JX |
| 6. | UNKNOWN | 33.29 | 5100 | JX |
| 7. 57-88-5 | CHOLESTEROL | 36.61 | 1100 | JX |

1F
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

Lab Name: WEYERHAEUSER

Contract: MAGOON

69955-
168146

Lab Code: WEYER

Case No.: 05500

SAS No.:

SDG No.: 69954

Matrix: (soil/water) SOIL

Lab Sample ID: 168146

Sample wt/vol: 30.8 (g/mL) G

Lab File ID: 2BN10508N

Level: (low/med) LOW

Date Received: 04/19/91

% Moisture: not dec. 41 dec.

Date Extracted: 05/02/91

Extraction: (SepF/Cont/Sonc) SONC

Date Analyzed: 05/09/91

GPC Cleanup: (Y/N) Y pH: 7.3

DILUTION FACTOR: 1.0

Number TICs found: 6

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/KG

| CAS NUMBER | COMPOUND NAME | RT | EST. CONC. | Q |
|---------------|-------------------|-------|------------|----|
| 1. | UNKNOWN | 22.92 | 620 | JX |
| 2. 10544-50-0 | SULFUR, MOL. (S8) | 24.17 | 1100 | JX |
| 3. | UNKNOWN | 25.77 | 560 | JX |
| 4. | UNKNOWN | 27.81 | 7000 | JX |
| 5. | UNKNOWN | 31.96 | 5100 | JX |
| 6. | UNKNOWN | 35.17 | 1100 | JX |