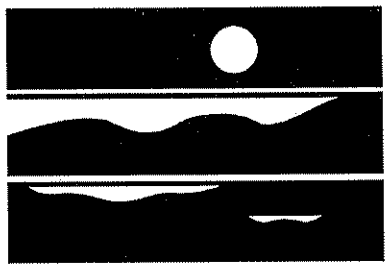

Washington Water Power Company
Kettle Falls Generator Station
Class II Inspection

April 1996

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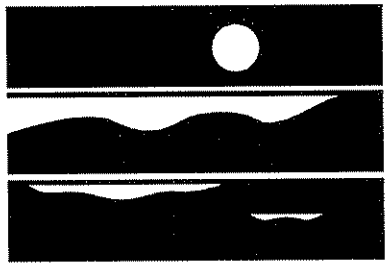

Washington Water Power Company
Kettle Falls Generator Station
Class II Inspection

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by
Guy Hoyle-Dodson

Environmental Investigations and Laboratory Services Program
Olympia, Washington 98504-7710

April 1996

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Abstract

A Class II Inspection was conducted August 21-23, 1995 at the Washington Water Power Company Kettle Falls Generator Station (Kettle Falls), located on the Columbia River's Lake Roosevelt near Kettle Falls in Stevens County, Washington. The inspection investigated the Kettle Falls combined process wastewater and cooling water treatment system.

Visual inspection discovered a substantial algae bloom in the retention basin. General chemistry results identified oxygen demand parameter increases across the basin and suggest that these increases were the result of the algae bloom. It is recommended that Kettle Falls take steps to reduce algae growth in the retention basins. Kettle Falls totalizer result was 92% of NPDES monthly average permit limit, and investigation of the totalizer measurements by Ecology doppler flowmeter estimated that effluent flows exceeded that limit. Kettle Falls should recalibrate their meter to ensure accuracy and evaluate whether future flows will remain within the permit limit.

Although inspection effluent temperatures exceeded permit daily average limits, dilution zone modeling indicated that these temperatures would be reduced to ambient temperatures at the edge of the chronic dilution zone. Several organic compounds were identified as possible contaminants in the plant cooling water, and it is recommended that Kettle Falls identify and if possible eliminate the source of these compounds.

Four metals were detected in the whole effluent in concentrations that exceeded the State chronic water quality criteria, but dilution zone modeling suggests that these should be reduced to well below criteria at the edge of the chronic dilution zone. Bioassays detected no effluent toxicity. Split samples results found significant differences between Ecology and Kettle Falls effluent samples, and it is recommended that Kettle Falls review sampling and holding procedures to ensure representative samples. A sludge sample collected from the bottom of the Kettle Falls south settling basin had high metal concentrations. Subsequent to the inspection (late 1995) Kettle Falls conducted a designation of a sludge sample under the provisions of the dangerous waste regulations indicating that it was not a dangerous waste and not subject to landfill disposal restrictions. Periodic monitoring of the sludge is recommended to ensure it does not pose a toxic hazard as a landfill leachate.

Summary

Flow Measurement

Ecology Polysonics doppler flowmeter flow measurements and Kettle Falls totalizer flow measurements produced a relative percent difference approaching 13%. Estimated effluent flow during the inspection was 0.147 to 0.167 MGD.

Process Wastewater Treatment System Operation

A severe algae bloom in the retention basin suggests that Kettle Falls was not operating the treatment system at optimal efficiency.

General Chemistry

Ecology identified increases in five-day biochemical oxygen demand (BOD_5), chemical oxygen demand (COD), and total organic carbon (TOC) across the settling basin and this is likely attributed to algae growth. Alkalinity and hardness also increased. Total suspended solids (TSS) had a relative percent removal efficiency of greater than 100%, but averaged less than 1% of total solids (TS). Additional TSS was likely created by algae growth in the retention basin, removed by the secondary clarifier, and returned to the settling basins. This removal is not reflected in overall TSS removal efficiencies. Relative percent removal efficiencies for TS and total non-volatile solids (TNVS) were less than 4% across the system, indicating minimal overall solids removal across the retention basin and the clarifier. Nitrification appeared to be taking place in the retention basin with ammonia nitrogen reduction approaching 138%. Conductivity, total kjeldahl nitrogen (TKN), nitrite & nitrate nitrogen (NO_2&NO_3-N), and total phosphorous were also reduced.

NPDES Permit Comparisons

Estimated 24-hour effluent flows determined by Ecology Polysonics doppler flowmeter exceeded the daily average permit limit but was within the permit daily maximum. Kettle Falls totalizer flow results were 93% of the daily average permit limit. There was some uncertainty about the accuracy of the Ecology measurement, but the difference between the two results was not considered significant. The Kettle Falls result was close enough to the permit limit to warrant caution and Kettle Falls should ensure that future flows do not exceed the limit. One Ecology temperature result (72° F) exceeded the daily average permit limit. An estimation of temperature dilution in the receiving water suggests that plume temperature should be reduced to ambient temperatures at the edge of the chronic mixing zone, which would be less than the permit limit.

TSS, oil & grease, chlorine and pH were all less than corresponding permit limits. Polychlorinated biphenyl compounds (PCBs) results were below analytical detection limits. Several priority pollutant organic compounds and metals were detected in the effluent, but none were explicitly identified as resulting from additives to the plant cooling water. The permit limits effluent discharge of such cooling water additives to zero concentration. Several compounds, chloroform, naphthalene, and di-n-butyl Phthalate were identified in both the cooling tower discharge and the effluent, the latter at concentrations of 0.89 µg/L, 2.3 µg/L , and 2.7 µg/L respectively. Although not identified in the list of cooling water additives supplied by Kettle Falls, their presence in the cooling tower effluent suggests that cooling water is the source. These concentrations might be attributed to contaminants in cooling water additives or to heat exchanger leakage from the boilers.

Detected Organics and Priority Pollutants

Volatile organic and BNA compounds were found in concentrations that did not exceed State water quality criteria for receiving waters. Four metal concentrations in the whole effluent exceeded the state chronic water quality criteria. Dilution with the receiving water is estimated to reduce these concentration to below criteria at the edge of the chronic dilution zone.

Bioassays

Multiple acute and chronic bioassays detected no toxicity in the effluent.

Split Samples

A Wilcoxon non-parametric signed ranks test found significant difference between Ecology samples and Kettle Falls samples. The largest differences were for COD, BOD_5, and TKN. Conflicting results found for TOC, COD, and BOD_5 may indicate flawed sampling or holding procedures on the part of Kettle Falls.

Sludge

A composite sludge sample was collected from the south settling basin. The south basin was in use during the reconnaissance in April, but had been drained since July 5, 1995 leaving exposed dry sludge on the basin's bottom. It was reported that this sludge would be disposed of in the local county landfill. Thirteen metals were detected in the sample. The combined concentration of arsenic, cadmium, chromium, copper, lead, and zinc was sufficiently high to raise concerns about toxicity in landfill leachate. Cadmium and lead concentrations were each greater than 20 times the dangerous waste thresholds cited in the Ecology dangerous waste regulations. Late in 1995 and subsequent to this preliminary

finding, Kettle Falls performed a designation of a sludge sample taken from the basin. It was determined that the sludge sample was not a dangerous waste and was not subject to landfill disposal restrictions.

Recommendations

Process Wastewater Treatment System

- Kettle Falls should investigate and, if feasible, eliminate algae growth in the retention basin.
- Kettle Falls should recalibrate the effluent totalizer and exercise caution to ensure that future effluent flows do not exceed the permitted limit.
- Kettle Falls should investigate and, if feasible, eliminate the origin of organics in the plant cooling water.
- Kettle Falls should review effluent sampling and holding procedures to ensure a representative sample for analysis.

Sludge

- Metals concentrations and sludge physical characteristics should be periodically monitored by Kettle Falls to ensure that these properties remain stable and that the sludge will not create a toxic landfill leachate.

Introduction

A Class II Inspection was conducted at the Washington Water Power Company Kettle Falls Generator Station (Kettle Falls), on August 21-23, 1995. Guy Hoyle-Dodson and Steve Golding, environmental engineers for the Washington State Department of Ecology (Ecology) Toxics Investigations Section, conducted the inspection. Pat Hallinan, permit coordinator for Ecology's Eastern Regional Office, provided background information and assisted with the inspection design. John Pitman, plant chemist, represented Kettle Falls and provided technical information and on-site assistance. Jim Thompson, auxiliary plant operator, also assisted on-site.

Wastewater generated at the Kettle Falls facility is primarily cooling tower blowdown, with smaller amounts of boiler process water, demineralizer washwater, and wastewater from the plant's drainage collection system. The treated wastewater is discharged into the Columbia River Lake Roosevelt reservoir. The plant discharge is regulated under NPDES permit No. WA 004521-7 issued July 22, 1988. The permit's expiration date is July 22, 1993. The plant is operating under an administrative extension until a new permit is issued, sometime in 1996.

The Department of Ecology initiated the inspection to assess permit compliance and to aid permit reissuance. The inspection was unannounced. Specific objectives of the inspection included the following:

- Assess NPDES permit compliance by analysis of influent and effluent permit parameter results in conjunction with a determination of plant flow
- Assess wastewater toxicity by comparing priority pollutant concentrations to EPA and Washington State water quality criteria
- Assess wastewater toxicity with effluent bioassays
- Evaluate treatment plant performance
- Assess the Kettle Falls self-monitoring program through sample splits and independent laboratory analysis

Setting

Generator Plant Operation

The Kettle Falls facility is located in Stevens County, approximately three miles west of the town of Kettle Falls in northeastern Washington. It is situated on the east shore of the Lake Roosevelt reservoir (*Figure 1*). Washington Water Power Company operates a waste wood-fired steam boiler at the facility with a turbine driven electrical generator. Total generator capacity is approximately 46 megawatts. Waste wood is provided from the regions wood products industries, and includes such materials as sawdust, bark, and chips. The boilers burn 60 to 70 tons of waste material an hour over a total of 250 to 300 days a year (Pitman, 1995). Electrical generation is seasonal, dependent on economic competition from regional hydroelectric facilities, whose operations are in turn dependent on reservoir impoundment levels. During the wet winter season the Kettle Falls facility is typically shut down. Permit effluent limitations are based on criteria established by the Columbia River's classification as a Class AA surface water at this location. (Ecology, 1992).

Generator Plant Wastewater Production

The generator station produces wastewater from several sources: cooling water from the facility's cooling tower, boiler blowdown bled from the boiler pressure vessel, boiler feed demineralizer washwater, and plant drainage wastewater. Sanitary wastes are handled on-site, and do not contribute to the facility's Columbia River discharge. Stormwater runoff from plant grounds and the hog fuel pile is collected and discharged separately from the wastewater treatment system. Sludge is collected from several places within the treatment system and is trucked to the county landfill.

Cooling tower water contains chlorine, phosphate, and polymers to control biological growth and scaling. Boiler blowdown contain ammonia, a breakdown product of hydrazine added as a corrosive inhibitor. Demineralizer washwater is pH neutralized prior to discharge to the treatment system. Oil is introduced to the treatment system mainly from machine shop and other plant drains, although some may also be contributed from non-contact cooling water. It was suggested by the plant chemist that previously reported elevated concentrations of mercury could originate from contaminated acids used in the neutralization process (Pitman, 1995). He also suggested that zinc concentrations may originate from zinc anodes.

Generator Station Wastewater Treatment System

The generator plant's wastewater treatment system consists of three main sections; a stormwater runoff system, a sanitary sewage treatment system, and a process water treatment system. (*Figure 2*). An average of 14,000 gal/day of stormwater runoff is collected from plant grounds, treated by an oil & grease interceptor, and discharged to natural drainage. Approximately 1,200 gal/day of sanitary sewage is treated in an underground septic tank and discharged to a drain field. A maximum of 72,000 gal/day from boiler blowdown, neutralized demineralizer washwater, and plant drain wastewater is discharged to the head of the wastewater treatment system. A maximum of 126,000 gal/day of cooling tower wastewater is added further downstream within the treatment system. The final discharge is largely recirculated cooling water with smaller amounts of treated process water. Total discharge ranges from 0.12 to 0.23 MGD.

The process water treatment system (PWTS) consists of two alternating settling basins, single large retention basin, secondary clarifier, and submerged discharge diffuser. A magnetic inductive flowmeter located in the line preceding the secondary clarifier records effluent flows. Flows from boiler process water, demineralizer washwater, and plant drain wastewater undergo initial sedimentation in a single settling basin. During the inspection the south settling basin had been drained and the north basin was receiving all process wastewater. Supernatant from the settling basin flows to the retention basin, where it is mixed with cooling water overflow from the cooling towers. Treatment in the retention basin is assumed to be negligible, although there may be minor biological degradation of nutrients and the potential for small increases of BOD from algae growth.

Wastewater from the retention basin is pumped to the secondary clarifier for additional sedimentation, primarily of cooling water solids. Supernatant from the clarifier is pumped to the receiving water via an 8-inch diameter buried steel pipe. Sludge from the clarifier is pumped to a primary settling basin, which is periodically drained and bottom accumulations removed. Final effluent discharge is through two 24-inch length, 8-inch diameter diffusers each with approximately 17 3/4-inch wide longitudinal slots evenly spaced around the diffuser's circumference. The discharge structure is elevated 3 feet above the river bottom, approximately 20 feet from the shore, and aligned parallel with the flow of the current.

Procedures

Ecology set up compositors and collected composite samples from the Kettle Falls wastewater treatment system at three locations (Figure 2 and Appendix A):

- flow from the settling basin, prior to discharge to the retention basin
- flow from the cooling tower, also prior to discharge to the retention basin
- flow from the secondary clarifier, prior to the final discharge to the receiving water

The effluent sample was collected from one leg of a T-valve splitter on the same line used by Kettle Falls to collect their effluent composite sample. Composite samples were collected using Ecology ISCO composite samplers with equal volumes of the sample collected every 30 minutes over a 24-hour period. To verify laboratory consistency, Ecology split a duplicate sample from the effluent composite sample and had it analyzed for most of the same parameters as the effluent analysis. A transfer blank from the effluent compositor was taken to establish baseline sampling conditions.

Pairs of grab samples were collected at the same locations as the composite samples. One sample was collected in the morning and one in the afternoon. A single grab sample was taken from the receiving water, upstream of the discharge. A grab-composite sample of dried sludge taken from various locations within the drained north settling basin was collected and analyzed for metal, PCB, and several general chemistry parameters. Several bioassay sample grabs were also collected from the effluent .

Kettle Falls personnel collected one composite sample using their own compositor from the final effluent. Kettle Falls effluent sample location was the same as Ecology's effluent sample location, using the other leg of a T-valve splitter place on the effluent sample line. Ecology and Kettle Falls effluent composite samples were each split between Ecology and Kettle Falls for analysis by each respective laboratory. Kettle Falls also took one grab sample of settling basin effluent for analysis of oil & grease. The location of the Kettle Falls oil & grease sample was downstream of the Ecology oil & grease sample, at the settling basin discharge into the retention basin. Parameters analyzed, samples collected, and schedules appear in Appendix B.

Samples designated for Ecology analysis were delivered to personnel from the Ecology's Manchester Laboratory. Chain-of-custody procedures were observed throughout the inspection. Analytical procedures and laboratories performing the analyses are summarized in Appendix C.

Quality Assurance/Quality Control (QA/QC) discussions are included in Appendix D.

Results And Discussion

Flow Measurement

Kettle Falls takes totalizer flow measurements using an magnetic inductive flowmeter located in a line preceding the secondary clarifier. Flow for August 22, estimated from approximately 23 hours of totalizer measurements, was 0.147 MGD. Losses across the secondary clarifier are not considered for the purposes of NPDES permit compliance.

Ecology performed independent verification of wastewater flow measurement during the inspection using a Polysonics Ultrasonic doppler flowmeter. Flow measurements were taken through a 6.065-inch inner diameter pipe carrying effluent from the retention basin to the secondary clarifier. This section of pipe was the only exposed segment available for the doppler measurement, and although upstream of the Kettle Falls meter, flow was assumed to be comparable. There are also some flow losses across the secondary clarifier due to sludge, but it was determined that these losses would be small compared to the total flow. A malfunction of the instrument's internal power supply limited the collection of flow data to approximately 4.5 hours, from which a 24-hour flow was extrapolated. The effluent flow estimated for August 22 was 0.164 MGD. Relative percent difference between Ecology and Kettle Falls flow measurements approached 13%. Considering inherent variability in instrument precision and differences in measurement protocols, this discrepancy is likely not significant.

Plant Operation and Maintenance

Only one operational deficiency was observed during the inspection. A severe algae bloom was observed in the retention basin and could contribute to increased BOD_5 in the effluent. Although BOD_5 is not a parameter of particular concern in the effluent and is not included in the NPDES permit, such algae growth would reduce overall treatment efficiency.

General Chemistry

Ecology general chemistry analysis results are shown in Table 1. Ecology BOD_5, COD, and TOC concentrations exhibited relative percent increases across the treatment system of 38%, 26% and 16% respectively (*Table 2*). In contrast, Kettle Falls results showed substantial relative percent decreases in BOD_5 and COD. Ecology duplicate analysis found close agreement between Ecology results for BOD_5 and TOC, but a COD duplicate was not performed. Since changes in BOD_5, TOC, and COD are often closely correlated it is likely that the Ecology result for COD is reliable. This conclusion is supported by the observance of a algae bloom in the retention basin, which would be expected to increase BOD_5 and COD in the effluent.

Total suspended solids (TSS) was 2 mg/L from the settling basin and 13 mg/L from the cooling tower, with a combined weighted concentration of 7 mg/L. Total solids (TS) for these flows were 2,240 mg/L and 2,180 mg/L respectively for a weighted average of 2,212 mg/L. Relative percent removal efficiencies were less than 4% for TS and total non-volatile solids (TNVS). Relative percent decreases for TSS and Total Non-Volatile Suspended Solids (TNVSS) were 111% and 95% respectively. Conductivity results revealed a relative percent decrease of 24% and alkalinity and hardness results produced relative increases of 43% and 16 % respectively. These results would appear to indicate that the major constituent in the wastewater was dissolved, and that limited influent suspended solids removal occurred across the retention basin and secondary clarifier.

A large portion of the suspended solids actually removed by the secondary clarifier likely resulted from solids created by algae and bacterial growth in the retention basin, and this removal is not reflected in treatment system removal efficiencies. It is surmised that algae growth must be significant, if it is to account for both BOD_5 increases and suspended solids removal across the clarifier. Although effluent discharges for BOD_5 and TSS are small, algae growth is an unnecessary contributor to treatment system loads. Kettle Falls should investigate and, if practical, eliminate this growth in the retention basin. Decreasing detention time in the retention basin may be one expedient means of reducing algae growth.

Retention basin influent total kjeldahl nitrogen (TKN), ammonia nitrogen and nitrate&nitrite nitrogen (NO_2&NO_3-N) were 2.8 mg/L, 1.3 mg/L, and 2.1 mg/l respectively. The percent contribution of ammonia nitrogen from the cooling tower wastewater was less than 0.05%. Relative percent reduction across the system was greatest for ammonia nitrogen, approaching 138%. Nitrification appeared to be taking place in the retention basin, although the amount of ammonia nitrogen reduced was relatively minor. Relative percent reduction in NO_2&NO_3-N was 8%, indicating minor denitrification. TKN results produced a relative percent reduction of 22% and total phosphorous results displayed a relative increase of 17%.

NPDES Permit Comparisons

Ecology Polysonics doppler fowmeter results (0.164 MGD) exceeded the permit daily average limit (0.158 MGD), but was within the daily maximum (Table 3). This flow measurement was only an estimate, since a full 24-hour totalizer reading could not be obtained. Kettle Falls estimated 24-hour totalizer measurement (0.147 MGD) was within the daily average permit flow limit, and may be more representative. Because of the ambiguity in Ecology's evaluation of the Kettle Falls totalizer and since its total daily flow evaluated by the Kettle Falls instrument was about 93% of the permitted daily average limit, caution should be used to ensure that monthly averages do not exceed the permit limit. Calibration of the Kettle Falls totalizer on a regular basis is advised.

One Ecology effluent temperature result (72° F) did exceed the permitted daily average by close to 3%, but was well within the daily maximum. Temperature dilution in the receiving water was estimated using the EPA PLUMES dilution zone modeling software (EPA 1994). Calculations were based upon the seasonally high ambient temperatures measured during the inspection, and used the receiving waters 7Q10 flow (7-day minimum average flow in a 10-year period) as calculated by Weibull distributed frequency factor analysis in WQHYDRO (Aroner, 1995). Due to the unusual structure and orientation of the Kettle Falls diffuser, the port configuration was particularly difficult to model and a number of port configurations were employed.

The orientation of the port also required that plume width at the beginning of the far field be manually adjusted. A plume width equal to the width of the discharge pipe was adopted, since repeated trials found this width produced maximum dilution. All port configurations used in the model projected that the plume temperature would be reduced to ambient temperature at the edge of the chronic zone. The PLUMES setup with the most conservative result is given in appendix E. The chronic dilution zone is defined by permit as having a length that is 300 feet downstream from the centerline of the outfall pipe and a width of 400 feet or 25% of the river width, whichever is less. The permit does not specifically allow a dilution zone for daily average, but modeling indicates that at the edge of the chronic dilution zone plume temperatures should not exceed daily average limits.

Compositor TSS concentrations (2 mg/L) were well within both the permit daily average and daily maximum limits (*Table 3*). Ecology oil & grease, polychlorinated biphenyl compounds (PCBs), and chlorine concentrations were less than the respective analytical detection limits. The Kettle Falls permit limits to zero discharge all chemical agents added for cooling system maintenance which may contain any of the 126 priority pollutants. Ecology results from priority pollutant analyses identified eight organic compounds and six metals in the effluent. Several organic compounds were detected in both the cooling water tower effluent and the final effluent. Chloroform, naphthalene, and di-n-butyl phthalate were detected in the cooling water tower effluent at 0.61 µg/L, 3.1 µg/L , and 0.15 µg/L respectively. They were detected in the final effluent at 0.89 µg/L , 2.3 µg/L , and 2.7 µg/L respectively. A list of cooling water additives submitted by Kettle Falls includes none of the compounds detected in either the cooling water tower effluent or the final effluent.

It is possible that contaminants in cooling water additives or heat exchanger leakage may be the source of one or more of the effluent concentrations, but this cannot be confirmed by inspection results. There is sufficient uncertainty about the source of these detected compounds in the final effluent to warrant further investigation, and Kettle Falls should conduct additional analyses of both the cooling water and cooling water additives to determine the origin of these contaminates.

Detected Organics and Priority Pollutants

Table 4 summarizes concentrations of organics detected with priority pollutant scans, and also summarizes priority pollutant metals. Appendix F contains results of all targeted organic compounds and metals results. Tentatively identified compounds are presented in appendix G. A glossary is included in appendix H.

Concentrations of VOAs, BNAs, and metals were detected in the Kettle Falls effluent (*Table 4*). Five VOAs and 14 BNAs were detected in either the Ecology effluent sample or the Ecology effluent duplicate. No organic compound exceeded water quality criteria for receiving waters, although di-n-butyl phthalate concentration (2.6-2.7 µg/L) was approximately 90% of the chronic criteria. Six metals were detected in the effluent. The Ecology final effluent results for cadmium (0.73 µg/L), copper (11 µg/L), lead (4.9 µg/L), and mercury (0.11 µg/L) all exceeded the State chronic water quality criteria (Ecology, 1992). Dilution zone analysis using the same procedures described in evaluating temperature dilution suggests that all effluent metals concentrations would be reduced to below the corresponding water quality criteria at the edge of the chronic dilution zone. Dilution model setups for the most conservative copper and mercury results are given in appendix E.

Bioassays

Effluent bioassays did not detect toxicity in either of two acute or two chronic tests (Table 5). The *Daphnia magna* 48-hour survival test, fathead minnow (*Pimephales promelas*) 96-hour survival test, *Ceriodaphnia dubia* 7-day survival and reproduction test, and fathead minnow (*Pimephales promelas*) 7-day survival and growth test all exhibit a survival LC_{50}, NOEC, and LOEC either equal to or greater than 100%. Reproduction for *Ceriodaphnia dubia* produced a NOEC and LOEC greater than or equal to 100%. Growth for the fathead minnow also produced a NOEC and LOEC greater than or equal to 100%.

Split Samples

A Wilcoxon nonparametric signed ranks test was performed on Ecology lab results for Kettle Falls and Ecology effluent samples (Table 6). The test found significant difference between the two sample sets at a critical level of 0.05. Relative percent differences (RPD) between five out of nine sets of paired data were greater than the interpolated variation in interlaboratory precision estimated for the laboratory procedures of those analyses. TKN, BOD_5, and COD analyses produced RPDs between samples of 75%, 108%, and 189% respectively, 2.5 to 8.5 times that of maximum precision variation. TOC, TSS, Total-P, and NO_2&NO_3-N produced RPDs of less than 10%, all well within ranges of accepted precision variation. The cause of the conflicting results for TOC, COD, and BOD_5 is unknown, but could indicate analytical error . Alternatively, the results may indicate a

depletion of biologically active organic carbon in the Kettle Falls samples due to flawed sampling or holding procedures. Kettle Falls should review sampling and holding procedures to ensure a representative sample. Relative percent difference between the Ecology and Kettle Falls lab analyses for oil & grease and TSS were 108% and 14% respectively. Since Kettle Falls detection limit for oil & grease was lower than Ecology's this difference is likely not significant. The difference in TSS is far less than the variability of precision for the analytical method at those concentrations.

Sludge

The composite sludge sample was collected during the inspection from the South settling basin, which had been drained the previous month. The South basin was in use until July 5, 1995 when influent flow was switched to the North basin. The plant chemist reported in a letter sent to the permit manager that this basin was only in service during the plant's annual summer shutdowns, and that the material found on the basin bottom was probably an accumulation of miscellaneous wash downs of the plant from more than one year (Pitman, 1996). He also suggested that during the summer outage the preheater hoppers were washed out and may have contributed to the material build up, and that the sludge would be a combination of large particle char ash and scale that builds up on the tubes. It should be noted that the south basin was in use during the April reconnaissance, during which time the plant was in full operation. It is unclear just how long the south settling basin was in service previous to the April reconnaissance, but it must be presumed that it was used at least until July 5 switch date, including periods of plant operation. It must be concluded that at least part of the material accumulated on the South settling basin bottom came from process water suspended solids.

The sludge sample's percent solids was 88.8%, with percent volatiles 14.1% of the total (Table 1). TOC comprised somewhat more than 8% of the total dry weight. Thirteen metals were detected in the sludge sample (Table 4). The combined concentration of arsenic (50.2 mg/Kg-dry wt.), cadmium (150 mg/Kg-dry wt.), chromium (26.6 mg/Kg-dry wt.), copper (413 mg/Kg-dry wt.), lead (226 mg/Kg-dry wt.), and zinc (2140 mg/Kg-dry wt.) was sufficiently high to warrant concerns about potential toxicity in landfill leachate. Cadmium and lead concentrations, when converted to a volumetric concentrations, exceeded 20 times the dangerous waste thresholds as cited in WAC 173-303-090 of the Dangerous Waste Regulations (Ecology, 1995). This screening criteria recommends that such wastes be designated by test methods set forth in WAC 173-303-110 (Davies, 1996).

Subsequent to this preliminary finding, Kettle Falls performed such a designation of a sludge sample taken from the basin late in 1995 (Hallinan, 1996). It was determined that the sludge was not a dangerous waste and was not subject to land disposal restrictions. Since the physical characteristics of the sludge may vary dependent on a variety of factors, including the nature and scope of miscellaneous wash downs of plant components, Kettle Falls should periodically monitor the sludge to ensure that it does not pose a toxic hazard as a landfill leachate.

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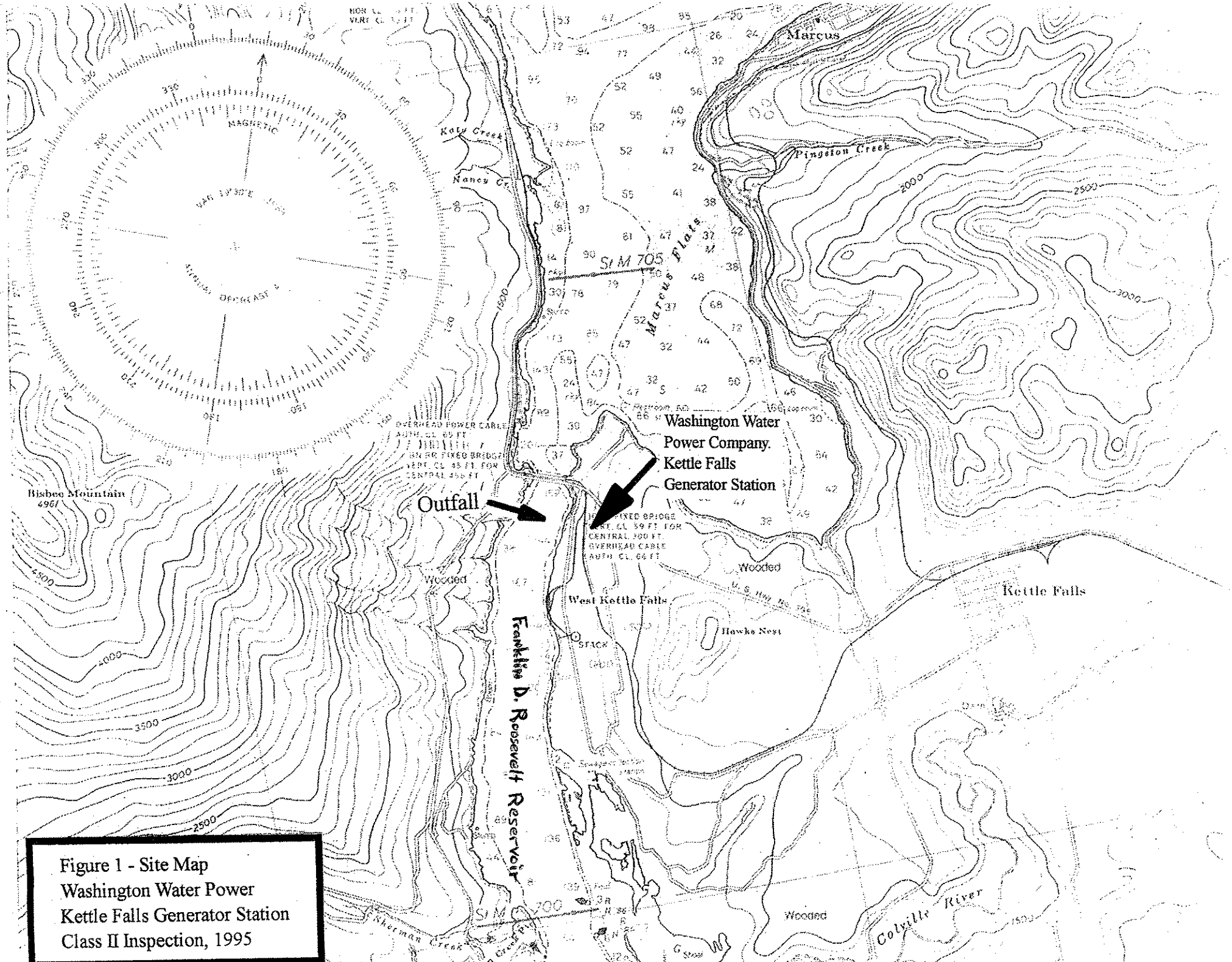

Figure 1 - Site Map
Washington Water Power
Kettle Falls Generator Station
Class II Inspection, 1995

Figure 2 - Process Schematic
Washington Water Power Kettle Falls
Generator Station Wastewater Treatment Plant
Class II Inspection, 1995

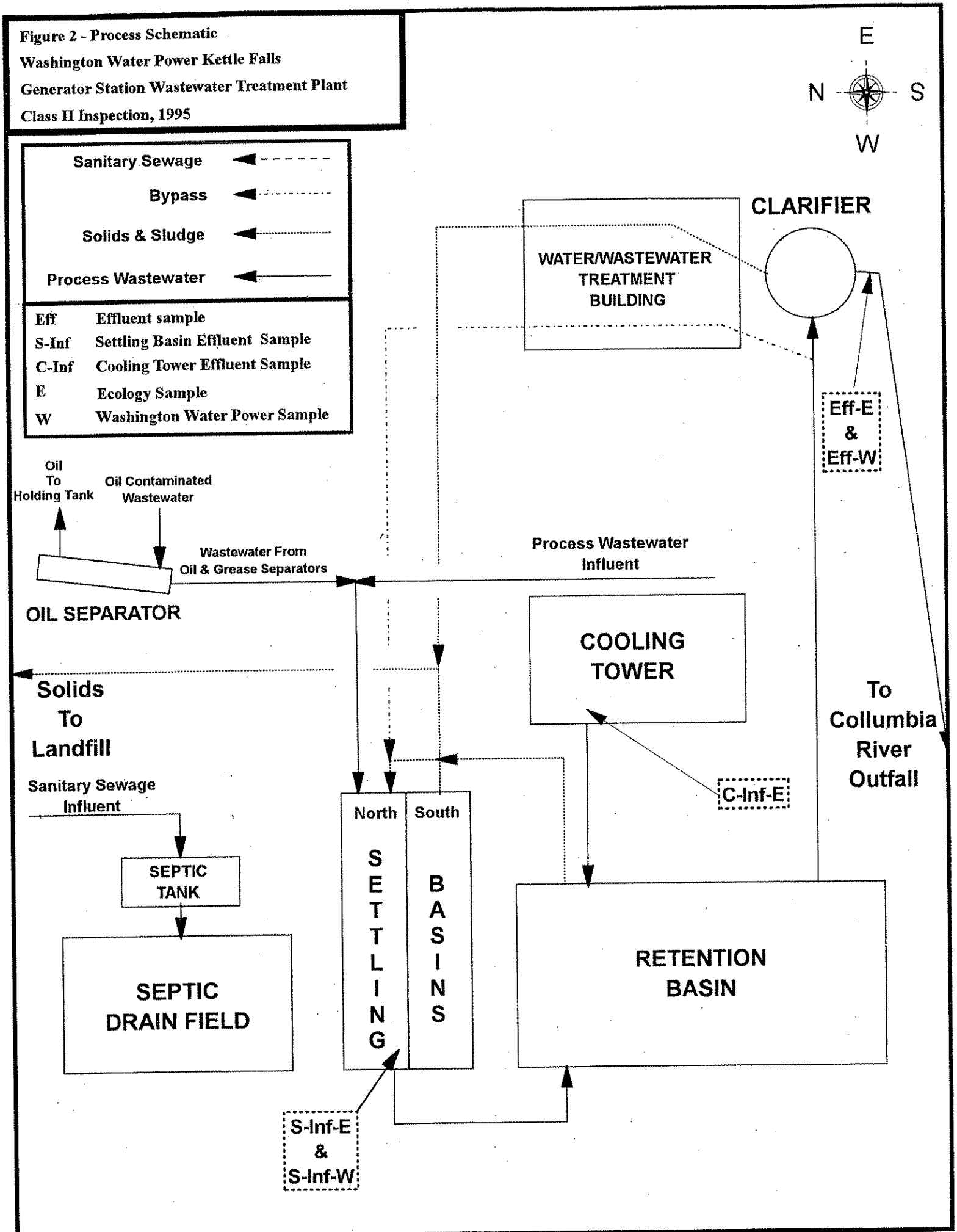

Table 1 - General Chemistry Results- Kettle Falls Washington Water Power Generating Station , July 1995.

Parameter	Location:	S-Inf-E-1	S-Inf-E-2	S-Inf-E	SSludge	C-Ef-E-1	C-Ef-E-2	C-Ef-E
	Type:	grab	grab	comp	grab-comp	grab	grab	comp
	Date:	8/22	8/22	8/22-23	8/22	8/22	8/22	8/22-23
	Time:	1000	1440	0815	1420	0820	1400	0800-0800
	Lab Log #:	348230	348231	348232	348233	348234	348235	348236
GENERAL CHEMISTRY								
Conductivity (umhos/cm)		3800	3140	3400		2060	2210	2160
Alkalinity (mg/L CaCO3)				10 U				317
Hardness (mg/L CaCO3)				807				1330
SOLIDS								
TS (mg/L)				2240				2180
TNVS (mg/L)				1950				1850
TSS (mg/L)		2	2	2		11	13.5	13
TNVSS (mg/L)				1 U				5
% Solids					88.8			
% Volatile Solids					14.1			
OXYGEN DEMAND PARAMETERS								
BOD5 (mg/L)				5				9
COD (mg/L)				12				50
TOC (water mg/L)		9.2	8.9	9.5	9.2	12.2	13.5	14.9
NUTRIENTS								
Total Kjeldahl Nitrogen (TKN) (mg/L)				3.3				2.1
NH3-N (mg/L)				2.29				0.01
NO2+NO3-N (mg/L)				1.3				3.16
Total-P (mg/L)				0.905				1.5
MISCELLANEOUS								
Oil and Grease (mg/L)		1 U				2.8 J	2.5 J	
FIELD OBSERVATIONS								
Temperature ° C		20.2	22.8			22.3	25.3	
Temp-cooled ° C				4.1				3.7
pH		2.39	2.62	2.36		8.61	8.65	8.74
Conductivity (umhos/cm)		3930	3180	3920		2120	2270	2310
Chlorine (mg/L)			<0.1			<0.1	<0.1	

S-Inf	Influent into Settling Basin	grab	Grab sample
C-Ef	Cooling Tower effluent into Settling Basin	comp	Composite sample
SSludge	Settling Basin Sludge	grab-comp	Grab-composite sample
E	Ecology Sample	J	The analyte was positively identified. The associated numerical result is an estimate.
		U	The analyte was not detected at or above the reported result.

Table 1 - General Chemistry Results- Kettle Falls Washington Water Power Generating Station , July 1995.

Parameter	Location:	Ef-E-1	Ef-E-2	Ef-E	Transblk	Ef-W	Ef-Bio	Duplicate	River
	Type:	grab	grab	comp	grab	comp	grab-comp	comp	grab
	Date:	8/22	8/22	8/22-23	8/21	8/22-23	8/22	8/22-23	8/22
	Time:	0910	1425	0800-0800	0720	0800-0800	0930&142	0800-0800	1335
	Lab Log #:	348237	348238	348239	348240	348241	348242	348243	348244
GENERAL CHEMISTRY									
Conductivity (umhos/cm)		2220	2220	2220	2.85	2210	2230	2220	
Alkalinity (mg/L CaCO3)				233		233		233	
Hardness (mg/L CaCO3)				1230		1210	1210	1220	60.2
SOLIDS									
TS (mg/L)				2180				2190	
TNVS (mg/L)				1850				1840	
TSS (mg/L)		9	2	2	1 U	2	5	2	2
TNVSS (mg/L)				1				1 U	
% Solids									
% Volatile Solids									
OXYGEN DEMAND PARAMETERS									
BOD5 (mg/L)				10		3 U		11	
COD (mg/L)				38		1			
TOC (water mg/L)		13		14.1	34.3	13.4		14	
NUTRIENTS									
Total Kjeldahl Nitrogen (TKN) (mg/L)				2.2		1		2.2	
NH3-N (mg/L)				0.228		0.207		0.228	
NO2+NO3-N (mg/L)				1.99		2.05		2.03	
Total-P (mg/L)				1.39		1.39		1.51	
MISCELLANEOUS									
Oil and Grease (mg/L)		3.2 J	3 J						
FIELD OBSERVATIONS									
Temperature ° C		20.3	22						18.1
Temp-cooled ° C				3.7		5.4		3.7	
pH		7.55	7.67	8.74		7.84		8.74	7.8
Conductivity (umhos/cm)		2310	2290	2310		2310		2310	132
Chlorine (mg/L)		<0.1	<0.1						

Ef	Effluent sample	E	Ecology sample
Transblk	Transfer blank from effluent sample	W	Washington Water Power Company sample
Ef-Bio	Effluent bioassay grab-composite	J	The analyte was positively identified. The associated numerical result is an estimate.
Duplicate	Duplicate composite split sample	U	The analyte was not detected at or above the reported result.
River	Columbis River - receiving water		

Table 2 - Percent Reduction Results - Kettle Falls Washington Water Power Generating Station , July 1995.

Parameter	Location:	S-Inf-E	C-Ef-E	Combined Conc. Of	Ef-E	Ecology Relative	Duplicate	Average	Ecology Average Relative	Ef-W	Kettle Falls Relative
	Type:	comp	comp	Settling Basin Effluent	comp	Percent Decrease From	comp	Of	Percent Decrease From	comp	Percent Decrease From
	Date:	8/22-23	8/22-23	&	8/22-23	Retention Pond Influent	8/22-23	Eff-E	Retention Pond Influent	8/22-23	Retention Pond Influent
	Time:	0800-080	0800-0800	Cooling Water Effluent	0800-0800	To	0800-0800	&	To	0800-0800	To
	Lab Log #:	348232	348236	(Flow Weighted*)	348239	Clarifier Effluent	348243	Duplicate	Clarifier Effluent	348241	Clarifier Effluent
GENERAL CHEMISTRY											
Conductivity (umhos/cm)		3400	2160	2,833	2220	24%	2220	2220	24%	2210	25%
Alkalinity (mg/L CaCO3)		10 U	317	150	233	-43%	233	233	-43%	233	-43%
Hardness (mg/L CaCO3)		807	1330	1,046	1230	-16%	1220	1,225	-16%	1210	-15%
SOLIDS											
TS (mg/L)		2240	2180	2,212	2180	1%	2190	2,185	1%		
TNVS (mg/L)		1950	1850	1,904	1850	3%	1840	1,845	3%		
TSS (mg/L)		2	13	7	2	111%	2	2	111%	2	111%
TNVSS (mg/L)		1 U	5	3	1	95%	1	1	95%		
OXYGEN DEMAND PARAMETERS											
BOD5 (mg/L)		5	9	7	10	-38%	11	11	-42%	3 U	78%
COD (mg/L)		12	50	29	38	-26%				1	187%
TOC (water mg/L)		9.5	14.9	12.0	14.1	-16%	14	14	-16%	13.4	-11%
NUTRIENTS											
Total Kjeldahl Nitrogen (mg/L)		3.3	2.1	2.8	2.2	22%	2.2	2.2	22%	1	93%
NH3-N (mg/L)		2.29	0.01	1.25	0.228	138%	0.228	0.228	138%	0.207	143%
NO2+NO3-N (mg/L)		1.3	3.16	2.1	1.99	8%	2.03	2.01	7%	2.05	5%
Total-P (mg/L)		0.905	1.5	1.2	1.39	-17%	1.51	1.5	-21%	1.39	-17%
FIELD OBSERVATIONS											
Conductivity (umhos/cm)		3920	2310	3,184	2310	32%	2310	2310	32%	2310	32%

S-Inf	Influent into Settling Basin	comp	Composite sample
C-Ef	Cooling Tower effluent into Settling Basin	U	The analyte was not detected at or above the reported result.
Ef	Efluent sample	*	Percent of total flow for each source established by historic data then applied to measured flow.
Duplicate	Duplicate composite split sample		
E	Ecology Sample		
W	Washington Water Power Company sample		

Table 3 - NPDES Limits Inspection Results - Kettle Falls Washington Water Power Generating Station , July 1995.

Parameter	NPDES Permit Effluent Limits			Ecology Grab	Ecology Composites			Kettle Falls Composite	Ecology Grabs			
	Daily Average	Daily Maximum	Location:	S-Inf-E-1	C-Ef-E	Ef-E	Duplicate	Ef-W	C-Ef-E-1	C-Ef-E-2	Ef-E-1	Ef-E-2
			Type:	grab	comp	comp	comp	comp	grab	grab	grab	grab
			Date:	8/22	8/22-23	8/22-23	8/22-23	8/22-23	8/22	8/22	8/22	8/22
			Time:	1000	0800-0800	0800-0800	0800-0800	0800-0800	0820	1400	0910	1425
			Lab Log #:	348230	348236	348239	348243	348241	348234	348235	348237	348238
Flow												
(MGD)	0.158	0.233				0.164 *		0.147 **				
Effluent Temp												
Permit Limit (° F)	70	90										
Whole Effluent (° F)											69	72
Estimated Dilution Temp (Edge Chronic Zone - ° F)											65 #	65 #
Effluent TSS												
Concentration (mg/L)	30	100				2	2	2			9	2
Oil & Grease¥												
Concentration (mg/L)	210	380		1 U								
Effluent pH												
(S.U.)	6.0 < pH < 9.0					8.74	8.74	7.84			7.55	7.67
Chlorine (Free)												
Concentration (mg/L)	0.2	0.5									<0.1	<0.1
PCBs	No Discharge				ND	ND						
Priority Pollutants¤												
Detected	No Discharge											
Carbon Disulfide											0.12 J	0.1 J
Chloroform									0.61 J	0.57 J	0.84 J	0.89 J
Toluene										0.07 J	0.1 J	
Naphthalene									3.1		2.3	0.84 J
Ethyl Ether											1.1	1.2
Isophorone					1.1							
Diethyl Phthalate						1.3	1.5	0.18				
Di-n-Butyl Phthalate					0.15 J	2.6	2.7	0.078				
Butylbenzyl Phthalate						0.44	0.42	0.26				
Di-n-Octyl Phthalate								0.049				
Dimethyl Phthalate								0.14				
Arsenic						6.8 P	6.6 P	8.2 P				
Cadmium						0.73 J	0.47 J	0.52 J				
Copper						11 P	11 P	12 P				
Lead						4.9 J						
Mercury (Total)						0.11 J	0.061 J	0.066 J				
Zinc						15 P	13 P	16 P				

C	Cooling Tower effluent into Settling Basin
Duplicate	Duplicate composite split sample.
E	Ecology 4-hour composite sample
W	Shell 4-hour composite sample
Ef	Effluent sample
comp	Composite sample
grab	Ecology grab sample.
ND	No Detect

J	The analyte was positively identified. The associated numerical result is an estimate.
P	The analyte was detected above the instrument detection limit but below the established minimum quantitation limit.
*	24-hour flow derived from Ecology Polysonic doppler flow meter reading taken over 4.37 hour period.
**	24-hour flow derived from Washington Water Power totalizer reading over 23.3 hour period.
¤	Chemicals added for cooling tower maintenance that contain any of the 126 priority pollutants.
¥	Sample is after the oil separator, prior to the retention pond.
#	Based on 3PLUMES dilution zone model with upper & lower 7Q10 flows calculated at a 95% confidence interval. Multiple port configurations were analyzed and ambient temperature was assumed non-stratified based on historical data.

Table 4 - Detected VOA,BNA, and Metals Scan Results - Kettle Falls Washington Water Power Generating Station , July 1995.

Parameter/Location:	C-Ef-E-1	C-Ef-E-2	Ef-E-1	Ef-E-2	Ecology Water Quality Criteria Summary	
Type:	grab	grab	grab	grab	Acute Fresh	Chronic Fresh
Date:	8/22	8/22	8/22	8/22		
Time:	0820	1400	0910	1425		
Lab Log#:	348234	348235	348237	348238		
VOA Compounds	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
Carbon Disulfide			0.12 J	0.1 J		
Chloroform	0.61 J	0.57 J	0.84 J	0.89 J	28,900 *	1,240 *
Bromodichloromethane	0.1 J				11,000 *(a)	
Toluene		0.07 J	0.1 J		17,500 *	
Naphthalene	3.1		2.3	0.84 J	2,300 *	620 *
Ethyl Ether			1.1	1.2		

Partameter/Location:	C-Ef-E	Eff-E	Ef-W	Duplicate	Ecology Water Quality Criteria Summary	
Type:	comp	comp	comp	comp	Acute Fresh	Chronic Fresh
Date:	8/22-23	8/22-23	8/22-23	8/22-23		
Time:	0800-0800	0800-0800	0800-0800	0800-0800		
Lab Log#:	348236	348239	348241	348243		
BNA Compounds	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
Isophorone	1.1				117,000 *	
Diethyl Phthalate		1.3	0.18	1.5	940 *(i)	3 *(i)
Di-n-Butyl Phthalate	0.15 J	2.6	0.078 J	2.7	940 *(i)	3 *(i)
Butylbenzyl Phthalate		0.44	0.26	0.42	940 *(i)	3 *(i)
Bis(2-Ethylhexyl)Phthalate	12				940 *(i)	3 *(i)
Di-n-Octyl Phthalate				0.049 J	940 *(i)	3 *(i)
Dimethyl Phthalate				0.14 J	940 *(i)	3 *(i)
Ethanol, 1-(2-Butoxyethoxy)-‡		0.78 NJ	61 NJ	25 NJ		
Triphenyl Phosphate‡		0.43 NJ				
Benzenemethanol, .alpha.,.alpha.,4-trime ‡		0.31 NJ				
Benzothiazole ‡		0.51 NJ		0.62 NJ		
Ethanol, 2-(2-Butoxyethoxy)-, Acetate ‡		23 NJ	0.59 NJ	0.43 NJ		
Ethanol, 2-Butoxy-, Phosphate (3:1) ‡		1 NJ	1.1 NJ	1.1 NJ		
Furan, 2,5-diethyltetrahydro- ‡		0.4 NJ				
Propanoic Acid, 2-Methyl-, 2,2-Dimethyl-1-(2-Hydroxy-1 ‡		0.69 NJ		0.85 NJ		

C-Ef	Cooling Tower effluent into Settling Basin	J	The analyte was positively identified. The associated numerical result is an estimate.	‡ Tentatively Identified.
Ef	Efluent sample	N	The spike sample recovery was not within control limits.	
E	Ecology Sample	Duplicate	Duplicate composite split sample.	
W	Washington Water Power Company sample	a	Total Halomethanes	
grab	Grab sample	i	Total Phthalate Esters	
*	Insufficient data to develop criteria. Value presented is the LOEL - Lowest Observed Effect Level.			

Table 4 (Cont.) - Kettle Falls Washington Water Power Generating Station , July 1995.

Partameter	Location:	S-Inf-E	Eff-E	Ef-W	Duplicate	Ecology Water Quality Criteria Summary		SSludge
	Type:	comp	comp	comp	comp			grab-comp
	Date:	8/22-23	8/22-23	8/22-23	8/22-23	Acute	Chronic	8/22
	Time:	0815	0800-0800	0800-080	0800-080	Fresh	Fresh	1420
	Lab Log#:	348232	348239	348241	348243			348233
Metals ++		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/Kg - dry wt.
Hardness =	60.2							
Antimony						9,000 *	1,600 *	4.7 J
Arsenic		5.3 P	6.8 P	8.2 P	6.6 P			50.2
	Pentavalent					850 *	48 *	
	Trivalent					360	190	
Beryllium						130 *	5.3 *	0.56 P
Cadmium		1.36 N	0.73 J	0.52 J	0.47 J	1.9 +	0.7 +	150
Chromium	Total Recoverable							26.8 N
	Hexavalent					16	11	
	Trivalent					1,146 +	137 +	
Copper		15 P	11 P	12 P	11 P	9 +	7 +	413
Lead		3 J	4.9 J			29 +	1.1 +	226
Mercury (Total)		0.38 J	0.11 J	0.066 J	0.061 J	2.4	0.012	0.212 N
Nickel						877 +	97 +	17.7 N
Selenium						20	5.0	0.70 J
Silver						0.9 +	0.12	15.7 J
Thallium						1,400 *	40 *	3.5 J
Zinc		44.4 P	15 P	16 P	13 P	68 +	61 +	2140

S-Inf	Influent into Settling Basin	J	The analyte was positively identified. The associated numerical result is an estimate.
C-Ef	Cooling Tower effluent into Settling Basin	N	The spike sample recovery was not within control limits.
SSludge	Settling Basin Sludge	P	The analyte was detected above the instrument detection limit, but below the established minimum quantitation limit.
E	Ecology Sample		
W	Washington Water Power Company sample	comp	Composite sample
Transblk	Transfer blank from effluent sample	grab	Grab sample
++	Metals are total recoverable unless otherwise noted.	Duplicate	Duplicate composite split sample
+	Hardness dependent criteria (100 mg/L used).		
*	Insufficient data to develop criteria. Value presented is the LOEL - Lowest Observed Effect Level.		

Table 5 - Effluent Bioassay Results - Kettle Falls Washington Water Power Generating Station , July 1995.

NOTE: tests were run on secondary clarifier effluent (Ef-Bio: Lab Log #348242)

Daphnia magna - 48-hour survival test

(Daphnia magna)

Sample	Number Tested *		Percent Survival
Control	20		100
6.25 % Effluent	20		100
12.5 % Effluent	20		100
25 % Effluent	20		100
50 % Effluent	20		100
100 % Effluent	20		100

Survival
LC50 > 100 % effluent
LOEC > 100 % effluent
NOEC = 100 % effluent

* 4 replicates of 5 organisms

Fathead Minnow - 96-hour survival test

(Pimephales promelas)

Sample	Number Tested *		Percent Survival
Control	40		95
6.25 % Effluent	40		97.5
12.5 % Effluent	40		95
25 % Effluent	40		100
50 % Effluent	40		100
100 % Effluent	40		95

Survival
LC50 > 100 % effluent
LOEC > 100 % effluent
NOEC = 100 % effluent

* 4 replicates of 10 organisms

Ceriodaphnia dubia - 7-day survival and reproduction test

(Ceriodaphnia dubia)

Sample	Number Tested		Percent Survival	Mean # Young per Original Female
Control	10		100	8.7
6.25 % Effluent	10		100	11.5
12.5 % Effluent	10		90	5.6
25 % Effluent	10		90	8.2
50 % Effluent	10		90	13.2
100 % Effluent	10		80	6
			Survival	Reproduction*
			LC50 > 100% effluent	
			NOEC = 100% effluent	NOEC = 100 % effluent
			LOEC > 100% effluent	LOEC > 100% effluent

* Due to the presence of 50% males in the control, the statistical power of the test was not acceptable based on EPA criteria, but since the test is not required by permit the results have been accepted as valid for screening purposes.

NOEC No observable effects concentration

LOEC Lowest observable effects concentration

LC50 Lethal concentration for 50% of the organisms

Table 5 - Effluent Bioassay Results - Kettle Falls Washington Water Power Generating Station , July 1995.

NOTE: tests were run on secondary clarifier effluent (Ef-Bio: Lab Log #348242)

Fathead Minnow - 7 day survival and growth test

(Pimephales promelas)

Sample	Number Tested *	Percent Survival	Average Dry Weight per Fish (mg)
Control	40	92.5	0.36
6.25 % Effluent	40	97.5	0.35
12.5 % Effluent	40	100	0.34
25 % Effluent	40	75.0	0.46
50 % Effluent	40	100	0.39
100 % Effluent	40	100	0.39

	Survival	Growth
LC50	> 100 % effluent	
LOEC	> 100 % effluent	LOEC > 100 % effluent
NOEC	= 100 % effluent	NOEC = 100 % effluent

* four replicates of 10 organisms

NOEC No observable effects concentration

LOEC Lowest observable effects concentration

LC50 Lethal concentration for 50% of the organisms

Table 6 - Split Sample Result Comparison - Kettle Falls Washington Water Power Generating Station, July 1995

Parameter		Location:	Eff-E	Eff-W	S-Inf-E-1
		Type:	E-comp	KF-comp	grab
		Date:	08/22-23	08/22-23	08/22-23
		Time:	0800-0800	0800-0800	1000
		Lab Log #:	348239	348241	348230
General Chemistry	**Laboratory**				
Oil & Grease (mg/L)	Ecology				1 U
	Kettle Falls				0.3 *
Effluent TSS (mg/L)	Ecology		2	2	
	Kettle Falls		2.3	2.3	
Effluent BOD5 (mg/L)	Ecology		10	3	
Chemical Oxygen Deman (mg/L)	Ecology		38	1	
TOC (mg/L)	Ecology		14.1	13.4	
TKN (mg/L)	Ecology		2.2	1	
Ammonia Nitrogen (mg/L)	Ecology		0.228	0.207	
NO_2+NO_3-N (mg/L)	Ecology		1.99	2.05	
Total-P (mg/L)	Ecology		1.39	1.39	
pH	Ecology		8.74	7.84	

E	Ecology sample
KF	Kettle Falls sample
grab	grab sample
Comp	Composite sample
EFF-E	Ecology effluent sample
EF-W	Kettle Falls effluent sample

U	The analyte was not detected at or above the reported result.
S-Inf	Effluent from settling basin, taken at at the channel carrying outflow from that basin
*	Kettle Falls sample taken at approximately the same time as the Ecology sample, but sample location was at the overflow from settling basin into the retention pond.

Appendices

Appendix A - Sampling Stations Descriptions - Washington Water Power Company Kettle Falls Generator Station, 1995

S-Inf-E-#	Ecology grab sample of Kettle Falls in-plant wastewater collected from the channel draining the settling basin. Collected 08/22/95 in both A.M. and P.M.
S-Inf-E	Ecology 24-hour composite sample of Kettle Falls in-plant wastewater collected from the channel draining the settling basin. Collected 08/22-23/95
SSludge	Grab-composite of accumulate bottom sludge recently exposed due to draining the south settling basin.
C-Ef -E-#	Ecology grab sample of Kettle Falls non-contact cooling water collected at the overflow from the cooling tower. Collected 08/22/95 in both A.M. and P.M.
C-Ef-E	Ecology 24-hour composite sample of Kettle Falls non-contact cooling water collected at the overflow from the cooling tower. Collected 08/22-23/95
Ef-E-#	Ecology grab sample of Kettle Falls effluent wastewater collected from a splitter valve sampling the secondary clarifier supernatant. Collected 08/22/95 in both A.M. and P.M.
Ef-E	Ecology 24-hour composite sample of Kettle Falls effluent wastewater collected from a splitter valve sampling the secondary clarifier supernatant. Collected 10/22-23/95
Transblk	Ecology grab sample of effluent compositor rinse. - Collected 08/21/95.
Ef-W	Washington Water Power Company (Kettle Falls Generator Station) 24-hour composite sample of Kettle Falls effluent wastewater collected from a splitter valve sampling the secondary clarifier supernatant. Collected 10/22-23/95
Ef-Bio	Ecology grab sample of Kettle Falls effluent wastewater collected from a splitter valve sampling the secondary clarifier supernatant. - Collected 08/22/95 in both the A.M. and the P.M..
Duplicate	Ecology split of 24-hour composite sample of Kettle Falls effluent wastewater collected from a splitter valve sampling the secondary clarifier supernatant. Collected 10/22-23/95
River	Ecology grab sample of receiving water collected from the shore of the Columbia River Lake Roosevelt reservoir 100 feet above the outfall structure. - Collected 10/6/94.

Appendix B - Sampling Schedule - Kettle Falls Washington Water Power Generating Station , July 1995.

Parameter	Location:	S-Inf-E-1	S-Inf-E-2	S-Inf-E	SSludge	C-Ef-E-1	C-Ef-E-2	C-Ef-E
	Type:	grab	grab	comp	grab-comp	grab	grab	comp
	Date:	8/22	8/22	8/22-23	8/22	8/22	8/22	8/22-23
	Time:	1000	1440	0815	1420	0820	1400	0800-0800
	Lab Log #:	348230	348231	348232	348233	348234	348235	348236
GENERAL CHEMISTRY								
Conductivity		E	E	E		E	E	E
Alkalinity				E				E
Hardness				E				E
SOLIDS								
TS				E				E
TNVS				E				E
TSS		E	E	E		E	E	E
TNVSS				E				E
% Solids					E			
% Volatile Solids					E			
OXYGEN DEMAND PARAMETERS								
BOD5				E				E
COD				E				E
TOC (water)		E	E	E	E	E	E	E
NUTRIENTS								
Total Kjeldahl Nitrogen (TKN)				E				E
NH3-N				E				E
NO2+NO3-N				E				E
Total-P				E				E
MISCELLANEOUS								
Oil and Grease (water)		EW	E			E	E	
ORGANICS								
VOC (water)						E	E	
BNAs (water)								E
PCB (water) - Chlorinated								E
METALS								
PP Metals (water)				E				
PP Metals (water - spike, dupe)								
BIOASSAYS								
Daphnia magna (acute)								
Ceriodaphnia (chronic)								
Fathead Minnow (acute)								
Fathead Minnow (chronic)								
FIELD OBSERVATIONS								
Temperature		E	E			E	E	
Temp-cooled				E				E
pH		E	E	E		E	E	E
Conductivity		E	E	E		E	E	E
Chlorine		E	E			E	E	

S-Inf	Influent into Settling Basin	grab	Grab sample	E	Ecology Sample & analysis
C-Ef	Cooling Tower effluent into Settling Basin	comp	Composite sample	W	Washington Water Power Company sample & analysis
SSludge	Settling Basin Sludge	grab-comp	Grab-composite sample		

Appendix B (Cont.) - Sampling Schedule - Kettle Falls Washington Water Power Generating Station , July 1995.

Parameter	Location:	Ef-E-1	Ef-E-2	Eff-E	Transblk	Ef-W	Ef-Bio	Duplicate	River
	Type:	grab	grab	comp	grab	comp	grab-comp	comp	grab
	Date:	8/22	8/22	8/22-23	8/21	8/22-23	8/22	8/22-23	8/22
	Time:	0910	1425	0800-0800	0720	0800-0800	0930&1425	0800-0800	1335
	Lab Log #:	348237	348238	348239	348240	348241	348242	348243	348244
GENERAL CHEMISTRY									
Conductivity		E	E	E	E	E	E	E	
Alkalinity				E		E		E	
Hardness				E		E		E	E
SOLIDS									
TS				E				E	
TNVS				E				E	
TSS		E	E	EW	E	EW	E	E	E
TNVSS				E				E	
% Solids									
% Volatile Solids									
OXYGEN DEMAND PARAMETERS									
BOD5				E		E		E	
COD				E		E		E	
TOC (water)				E	E	E		E	
NUTRIENTS									
Total Kjeldahl Nitrogen (TKN)				E		E		E	
NH3-N				E		E		E	
NO2+NO3-N				E		E		E	
Total-P				E		E		E	
MISCELLANEOUS									
Oil and Grease (water)		E	E						
ORGANICS									
VOC (water)		E	E						
BNAs (water)				E		E		E	
PCB (water) - Chlorinated				E	E	E		E	
METALS									
PP Metals (water)				E	E	E		E	
PP Metals (water - spike, dupe)				E					
BIOASSAYS									
Daphnia magna (acute)							E		
Ceriodaphnia (chronic)							E		
Fathead Minnow (acute)							E		
Fathead Minnow (chronic)							E		
FIELD OBSERVATIONS									
Temperature		E	E						E
Temp-cooled				E		E	E	E	
pH		E	E	E		E	E	E	E
Conductivity		E	E	E		E	E	E	E
Chlorine		E	E						

Ef	Effluent sample	Duplicate	Duplicate composite split sample	E	Ecology sample & analysis
Transblk	Transfer blank from effluent sample	River	Columbis River - receiving water	W	Washington Water Power Company sample & analysis
Ef-Bio	Effluent bioassay grab-composite				

Appendix C - Analytical Methods - Kettle Falls Washington Water Power Generating Station , July 1995.

Parameter	MANCHESTER METHODS	APHA METHODS	LAB USED
GENERAL CHEMISTRY			
Conductivity	EPA, Revised 1983: 120.1	APHA, 1989: 2510A.	Ecology Manchester Lab
Alkalinity	EPA, Revised 1983: 310.1	APHA, 1989: 2320B.	Ecology Manchester Lab
Hardness	EPA, Revised 1983: 130.2	APHA, 1989: 2340C.	Ecology Manchester Lab
SOLIDS			
TS	EPA, Revised 1983: 160.3	APHA, 1989: 2540E.	Ecology Manchester Lab
TNVS	EPA, Revised 1983: 160.3	APHA, 1989: 2540D.	Ecology Manchester Lab
TSS	EPA, Revised 1983: 160.2	APHA, 1989: 2540D&E.	Ecology Manchester Lab
TNVSS	EPA, Revised 1983: 160.2	EPA, Revised 1983: 160.2	Ecology Manchester Lab
% Solids	APHA-AWWA-WPCF 1989: 2540G	APHA, 1992: 2540G.	Ecology Manchester Lab
% Volatile Solids	EPA, Revised 1983: 160.4	APHA, 1992: 2540E.	Ecology Manchester Lab
OXYGEN DEMAND PARAMETERS			
BOD5	EPA, Revised 1983: 405.1	APHA, 1989: 5210B.	Ecology Manchester Lab
COD	EPA, Revised 1983: 410.1	APHA, 1989: 5220B.	Ecology Manchester Lab
TOC (water)	EPA, Revised 1983: 415.1	APHA, 1989: 5310B.	Ecology Manchester Lab
NUTRIENTS			
Total Kjeldahl Nitrogen (TKN)	EPA, Revised 1983: 350.3	APHA, 1992: 4500-NorgC.	Ecology Manchester Lab
NH3-N	EPA, Revised 1983: 350.1	APHA, 1989: 4500-NH3D.	Ecology Manchester Lab
NO2+NO3-N	EPA, Revised 1983: 353.2	APHA, 1989: 4500-NO3F.	Ecology Manchester Lab
Total-P	EPA, Revised 1983: 365.3	APHA, 1989: 4500-PF.	Ecology Manchester Lab
MISCELLANEOUS			
Oil and Grease (water)	EPA, Revised 1983: 413.1	APHA, 1989: 5520B.	Ecology Manchester Lab
ORGANICS			
VOC (water)	EPA, 1986: 8260	APHA, 1989: 6	Ecology Manchester Lab
BNAs (water)	EPA, 1986: 8270	APHA, 1989: 6410B.	Ecology Manchester Lab
PCB (water) - Chlorinated	EPA, 1986: 8080	APHA, 1989: 6630C.	Ecology Manchester Lab
METALS			
PP Metals (water)	EPA, Revised 1983: 200-299	APHA, 1989: 3000-3500*.	Ecology Manchester Lab
PP Metals (water - spike, dupe)	EPA, Revised 1983: 200-299	APHA, 1989: 3000-3500*.	Ecology Manchester Lab
BIOASSAYS			
Daphnia magna (acute)	EPA 1985	APHA, 1989: 8711B&C	Parametrix, Inc.
Ceriodaphnia (chronic)	EPA 1989: 1002.0	N.A.	Parametrix, Inc.
Fathead Minnow (acute)	EPA 1989: 1000.0	APHA, 1989: 8910B&C	Parametrix, Inc.
Fathead Minnow (chronic)	EPA 1989:1000	N.A.	Parametrix, Inc.

METHOD BIBLIOGRAPHY:

APHA-AWWA-WPCF, 1989. Standard Methods for the Exanination of Water and Wastewater, 17th Edition.

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

EPA, 1985. Methods for Measuring the Acute Toxicity of Effluents to Freshwater and Marine Organisms. EPA/600/4-85/013.

EPA, 1986: SW846. Test Methods for Evaluating Solid Waste Physical/Chemical Methods, SW-846, 3rd. ed.,November, 1986.

EPA, 1989. Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving waters to Freshwater Organisms.

Appendix D - Quality Assurance/Quality Control - Washington Water Power Kettle Falls Generator Station, 1994

Priority Pollutant Metal Cleaning Procedures for Wastewater Collection Equipment.

1. Wash with laboratory detergent
2. Rinse several times with tap water
3. Rinse with 10% HNO_3 solution
4. Rinse three (3) times with distilled/deionized water
5. Rinse with high purity acetone
6. Rinse with high purity Hexane
7. Allow to dry and seal with aluminum foil

Specific QA/QC Discussions

A transfer blank was submitted for metals analysis to establish baseline sampling conditions. Sampling quality assurance included ultra cleaning (priority pollutant cleaning) of sampling equipment to remove trace priority pollutant contaminates. Sampling in the field followed all protocols for holding times, preservation, and chain-of-custody set forth in the Manchester Environmental Laboratory Lab Users Manual (Ecology, 1994).

Laboratory QA/QC, including holding times, check standards, matrix spike and duplicate spike sample analyses, surrogate recoveries, and precision data were, with a few exceptions, within appropriate ranges. Initial calibration verification standards and continuing calibration standards were within relevant control limits. Procedural blanks were predominantly free from contamination. For bioassays the conduct of testing, responses to positive and negative controls, and water quality data were all appropriate. Qualifiers are included in the data table where appropriate. The following are specific concerns:

1. Kjeldahl Nitrogen was detected in the blank at concentrations less than five times that detected in the samples. Therefore, the analyte is most likely native to the samples, and the contribution of Kjeldahl Nitrogen due to laboratory contamination is negligible. No qualifiers were required for this condition.

2. Low levels of certain target volatile and semi-volatile compounds were detected in laboratory blanks. The EPA five times rule was applied to all target compounds that were found in the blank. If the concentrations of the compounds in the samples are greater than or equal to five times the concentration of the compounds in the associated method blank, they are considered native to the sample. Any target compounds not within acceptable QC limits for both percent recovery and Relative Percent Differences (RPD) have been qualified with a "J" to indicate that the result is an estimate.

3. Two semi-volatile compounds, aniline and benzoic acid, had less than 10% recoveries and the data from these samples was given the "REJ" qualifier to indicate that these samples had been rejected.

4. For the chlorinated Pesticides/PCB analysis insufficient sample was provided to permit matrix spikes, so organic free water was spiked and analyzed with the samples. Interferences prevented determining the recovery of the PCB-1242.

5. Water sample spike recoveries for cadmium, lead, mercury, selenium, silver, and thallium were outside the CLP acceptance limits. The results of those analytes with levels below ten time the detection limit and still detected were qualified with "J" as estimates. Those analytes with results above this level or not detected are qualified with "N".

6. Sludge sample spike recoveries for antimony, chromium, nickel, selenium, silver, and thallium were low and the results of these elements should be considered to have low bias. The mercury spike was slightly above the control limits and may have a small high bias. Spike recoveries for those compounds outside the CLP acceptance limits with levels below ten times the detection limit and still detected are qualified with "J" as estimates. Those analytes with results above this level or not detected are qualified with "N". Since the Relative Percent Difference (RPD) for silver was outside the CLP acceptance window for duplicate analysis, it is qualified with "J" as an estimate, due to poor precision.

7. Evaluation of reproductive data for the *Ceriodaphnia dubia* Test of Survival and Reproduction was confounded by the number of males determined to be present at the termination of testing. This brought into question the test's statistical power acceptability. Based on the criteria that 60% of the surviving females should produce their third brood by test termination, with an average of at least 15 young per female the test was found to be valid. Further, based on consultations with Randy Marshall of the Department of Ecology's Water Quality program it was determined that the Agency's statistical power requirement for NPDES bioassays does not apply because this test is not a required bioassay in the Kettle Falls WWP NPDES permit. Therefore statistical power of the reproduction data was not evaluated and the bioassay has been accepted as a valid test.

Appendix E - PLUMES Setup and Results for Most Conservative Case

```
Jan 24, 1996,  15:54: 3  ERL-N PROGRAM PLUMES, Ed 3, 3/11/94  Case:  5 of  7
Title   KF Temp - min 7Q10 at lower 95% - P=3/L=4'/2r=16.2"/s=16     nonlinear
tot flow   # ports      portflow      spacing  effl sal  effl temp     far inc  far dis
0.006440      3         0.002147     0.4064     0.0       22.3         10      103.0
port dep  port dia    plume dia     total vel     horiz vel    vertl vel   asp coeff    print frq
10.67     0.4115      0.3214        0.02646       0.02646      0.000       0.10         100
port elev ver angle   cont coef  effl den   poll conc  decay       Froude #   Roberts F
0.9144       0.0        0.61     -2.23533      22.3        0         0.5031     0.001961
hor angle  red space     p amb den      p current   far dif   far vel    K:vel/cur   Stratif #
0.01       0.00007093  -1.35958       0.07994    0.0003    0.07994    0.3310      0.000
depth     current       density       salinity   temp    amb conc     N (freq)       red grav.
0.0       0.07994       -1.35958          0       18.1      18.1         0.000          0.008608
11.59     0.07994       -1.35958          0       18.1      18.1       buoy flux      puff-ther
                                                                       0.2605         0.1297
                                                                       jet-plume      jet-cross
                                                                       0.1522         0.09428
                                                                       plu-cross      jet-strat
                                                                       0.03617
                                                                       plu-strat

                                                                       hor dis>=

CORMIX1 flow category algorithm is turned off.
 0 day-1, 0.000 hr-1, 0.000 t90hr.                          0 to large day-1 range
Help: F1.  Quit: <esc>.  Configuration:ARCP0.  FILE: KFTLO95A.VAR;

                              RSB
                Written by Philip J. W. Roberts (12/12/89, 4/22/93)
                  (Adapted by Walter E. Frick (1/12/92, 5/6/93))

 Case:  5: KF Temp - min 7Q10 at lower 95% - P=3/L=4'/2r=16.2"/s=16

 Lengthscale ratios are: s/lb =   0.19 lm/lb =   0.04
 Froude number, u3/b =            3.75
 Jet Froude number, Fj =          0.5

 Rise height to top of wastefield, ze =  10.7 m
 Wastefield submergence below surface =   0.0 m    PLUME SURFACES
 Wastefield thickness, he =              8.7 m
 Height to level of cmax, zm =           8.2 m
 Length of initial mixing region, xi =   54.0 m

 Minimum dilution,      Sm =   20.4
 Flux-average dilution, Sfa =  23.4 ( 1.15 x Sm)
 Roberts Fr. # < 0.1 (aspiration dominated), no avg. flux dilution formed
FARFIELD CALCULATION (based on Brooks, 1960, see guide)

Input wastefield width: .2032

Farfield dispersion based on wastefield width of     0.2032m
  --4/3 Power Law--   -Const Eddy Diff-
     conc  dilution     conc   dilution      distance        Time
                                               m          sec        hrs
    18.23     32.2     18.25      28.1       60.00      74.43       0.0
    18.17     62.6     18.21      38.8       70.00      199.5       0.1
    18.14     99.6     18.19      47.4       80.00      324.6       0.1
    18.13    142.0     18.18      54.7       90.00      449.7       0.1
    18.12    189.1     18.17      61.2       100.0      574.8       0.2
    18.12    204.1     18.17      63.0       103.0      612.3       0.2
```

Appendix E - PLUMES Setup and Results for Most Conservative Case

```
Jan 25, 1996, 16:12:40  ERL-N PROGRAM PLUMES, Ed 3, 3/11/94  Case:  5 of  7
Title   KF Cu - min 7Q10 at lower 95% - P=3/L=4'/2r=16.2"/s=16      nonlinear
tot flow      # ports  port flow     spacing  effl sal  effl temp     far inc  far dis
0.006440         3     0.002147     0.4064     0.0        22.3         10      103.0
port dep   port dia  plume dia   total vel   horiz vel     vertl vel  asp coeff   print frq
10.67      0.4115    0.3214      0.02646     0.02646        0.000       0.10       100
port elev     ver angle     cont coef     effl den   poll conc     decay  Froude  # Roberts F
0.9144            0.0         0.61        -2.23533       4.9          0     0.5031  0.001961
hor angle     red space     p amb den     p current     far dif   far vel  K:vel/cur     Stratif #
0.01          0.00007093   -1.35958      0.07994       0.0003    0.07994    0.3310      0.000
depth     current       density       salinity      temp      amb conc     N (freq) red grav.
0.0       0.07994       -1.35958         0          18.1         0       0.000  0.008608
11.59     0.07994       -1.35958         0          18.1         0       buoy flux puff-ther
                                                                         0.2605    0.1297
                                                                         jet-plume jet-cross
                                                                         0.1522    0.09428
                                                                         plu-cross jet-strat
                                                                              0.03617
                                                                         plu-strat

                                                                             hor dis>=

CORMIX1 flow category algorithm is turned off.
 0                                                    0.0 to any  range
Help: F1.  Quit: <esc>.  Configuration:ARCP0.  FILE: KFTLO95A.VAR;

                              RSB
                 Written by Philip J. W. Roberts (12/12/89, 4/22/93)
                   (Adapted by Walter E. Frick (1/12/92, 5/6/93))

 Case:  5: KF Cu - min 7Q10 at lower 95% - P=3/L=4'/2r=16.2"/s=16

 Lengthscale ratios are: s/lb =   0.19 lm/lb =   0.04
 Froude number, u3/b =            3.75
 Jet Froude number, Fj =          0.5

 Rise height to top of wastefield, ze =  10.7 m
 Wastefield submergence below surface =   0.0 m    PLUME SURFACES
 Wastefield thickness, he =                8.7 m
 Height to level of cmax, zm =              8.2 m
 Length of initial mixing region, xi =    54.0 m

 Minimum dilution,       Sm =    20.4
 Flux-average dilution, Sfa =    23.4 ( 1.15 x Sm)
 Roberts Fr. # < 0.1 (aspiration dominated), no avg. flux dilution formed
FARFIELD CALCULATION (based on Brooks, 1960, see guide)

Input wastefield width: .2032

Farfield dispersion based on wastefield width of     0.2032m
  --4/3 Power Law--   -Const Eddy Diff-

    conc     dilution     conc     dilution    distance        Time
                                                  m          sec    hrs
   0.1521      32.2      0.1747       28.1      60.00       74.43    0.0
  0.07831      62.6      0.1263       38.8      70.00       199.5    0.1
  0.04920      99.6      0.1034       47.4      80.00       324.6    0.1
  0.03451     142.0      0.08956      54.7      90.00       449.7    0.1
  0.02591     189.1      0.08010      61.2     100.0        574.8    0.2
  0.02400     204.1      0.07780      63.0     103.0        612.3    0.2
```

Appendix E - PLUMES Setup and Results for Most Conservative Case

```
Jan 26, 1996,  11:18:15  ERL-N PROGRAM PLUMES, Ed 3, 3/11/94  Case:  5 of  7
Title   KF Hg - min 7Q10 at lower 95% - P=3/L=4'/2r=16.2"/s=16      nonlinear
tot flow       # ports   port flow      spacing   effl sal   effl temp      far inc   far dis
0.006440          3     0.002147      0.4064      0.0        22.3          10        103.0
port dep  port dia  plume dia     total vel  horiz vel       vertl vel      asp coeff     print frq
10.67     0.4115    0.3214        0.02646   0.02646           0.000        0.10            100
port elev   ver angle       cont coef      effl den       poll conc      decay     Froude    # Roberts F
0.9144        0.0             0.61        -2.23533          0.11          0       0.5031      0.001961
hor angle    red space    p amb den     p current     far dif    far vel    K:vel/cur  Stratif #
0.01        0.00007093    -1.35958      0.07994      0.0003    0.07994     0.3310     0.000
depth          current        density        salinity   temp       amb conc       N (freq)  red grav.
0.0            0.07994        -1.35958          0       18.1          0           0.000     0.008608
11.59          0.07994        -1.35958          0       18.1          0           buoy flux puff-ther
                                                                                  0.2605    0.1297
                                                                                  jet-plume jet-cross
                                                                                  0.1522    0.09428
                                                                                  plu-cross jet-strat
                                                                                  0.03617
                                                                                  plu-strat

                                                                                  hor dis>=

CORMIX1 flow category algorithm is turned off.
 0.10                                                    0.0 to 0.5  range
Help: F1.  Quit: <esc>.  Configuration:ARCP0.  FILE: KFTLO95A.VAR;

                        RSB
          Written by Philip J. W. Roberts (12/12/89, 4/22/93)
           (Adapted by Walter E. Frick (1/12/92, 5/6/93))

 Case:  5: KF Hg - min 7Q10 at lower 95% - P=3/L=4'/2r=16.2"/s=16

 Lengthscale ratios are: s/lb =   0.19 lm/lb =   0.04
 Froude number, u3/b =            3.75
 Jet Froude number, Fj =          0.5

 Rise height to top of wastefield, ze =  10.7 m
 Wastefield submergence below surface =   0.0 m    PLUME SURFACES
 Wastefield thickness, he =               8.7 m
 Height to level of cmax, zm =            8.2 m
 Length of initial mixing region, xi =   54.0 m

 Minimum dilution,      Sm =    20.4
 Flux-average dilution, Sfa =   23.4 ( 1.15 x Sm)
 Roberts Fr. # < 0.1 (aspiration dominated), no avg. flux dilution formed
FARFIELD CALCULATION (based on Brooks, 1960, see guide)

Input wastefield width: .2032

Farfield dispersion based on wastefield width of    0.2032m
  --4/3 Power Law--   -Const Eddy Diff-
    conc      dilution      conc    dilution  distance        Time
                                                 m          sec     hrs
 0.003414      32.2       0.003921     28.1     60.00       74.43    0.0
 0.001758      62.6       0.002836     38.8     70.00       199.5    0.1
 0.001104      99.6       0.002321     47.4     80.00       324.6    0.1
0.0007746     142.0       0.002011     54.7     90.00       449.7    0.1
0.0005816     189.1       0.001798     61.2     100.0       574.8    0.2
0.0005389     204.1       0.001746     63.0     103.0       612.3    0.2
```

Appendix F - VOA,BNA, Pesticide/PCB and Metals Scan Results - Kettle Falls Washington Water Power Generating Station , July 1995.

Parameters Location:	C-Ef-E-1	C-Ef-E-2	Ef-E-1	Ef-E-2
Type:	grab	grab	grab	grab
Date:	8/22	8/22	8/22	8/22
Time:	0820	1400	0910	1425
Lab Log#:	348234	348235	348237	348238
VOA Compounds	µg/L	µg/L	µg/L	µg/L
Chloromethane	1 U	1 U	1 U	1 U
Dichlorodifluoromethane	1 U	1 U	1 U	1 UJ
Bromomethane	1 U	1 U	1 U	1 UJ
Vinyl Chloride	1 U	1 U	1 U	1 U
Chloroethane	1 U	1 U	1 U	1 UJ
Trichlorofluoromethane	1 U	1 U	1 U	1 U
Methylene Chloride	1 U	1 U	1 U	1 UJ
Acetone	4 UJ	4 UJ	4 UJ	4 UJ
Carbon Disulfide	2 U	2 U	0.12 J	0.1 J
1,1-Dichloroethene	1 U	1 U	1 U	1 UJ
1,1-Dichloroethane	1 U	1 U	1 U	1 UJ
trans-1,2-Dichloroethene	1 U	1 U	1 U	1 U
cis-1,2-Dichloroethene	1 U	1 U	1 U	1 UJ
2,2-Dichloropropane	1 U	1 U	1 U	1 U
Bromochloromethane	1 U	1 U	1 U	1 U
Chloroform	0.61 J	0.57 J	0.84 J	0.89 J
1,2-Dichloroethane	1 U	1 U	1 U	1 U
2-Butanone (MEK)	1 U	1 U	1 U	1 UJ
1,1,1-Trichloroethane	1 U	1 U	1 U	1 U
Carbon Tetrachloride	1 U	1 U	1 U	1 U
1,1-Dichloropropene	1 U	1 U	1 U	1 U
Bromodichloromethane	0.095 J	1 U	1 U	1 U
1,2-Dichloropropane	1 U	1 U	1 U	1 UJ
Dibromomethane	1 U	1 U	1 U	1 U
trans-1,3-Dichloropropene	0.94 U	0.94 U	0.94 U	0.94 U
Trichloroethene	1 U	1 U	1 U	1 UJ
Dibromochloromethane	1 U	1 U	1 U	1 U
1,2-Dibromoethane (EDB)	1 U	1 U	1 U	1 U
1,1,2-Trichloroethane	1 U	1 U	1 U	1 UJ

C-Ef	Cooling Tower effluent into Settling Basin	J	The analyte was positively identified. The associated numerical result is an estimate.
Ef	Effluent sample	U	The analyte was not detected at or above the reported result.
E	Ecology Sample	UJ	The analyte was not detected at or above the reported estimated result.
grab	Grab sample		

Appendix F (cont'd) - Kettle Falls Washington Water Power Generating Station , July 1995..

Parameters Location:	C-Ef-E-1	C-Ef-E-2	Ef-E-1	Ef-E-2
Type:	grab	grab	grab	grab
Date:	8/22	8/22	8/22	8/22
Time:	0820	1400	0910	1425
Lab Log#:	348234	348235	348237	348238
VOA Compounds	µg/L	µg/L	µg/L	µg/L
1,3-Dichloropropane	1 U	1 U	1 U	1 U
Benzene	1 U	1 U	1 U	1 UJ
cis-1,3-Dichloropropene	1.1 U	1.1 U	1.1 U	1.1 U
Bromoform	1 U	1 U	1 U	1 U
2-Hexanone	1 U	1 U	1 U	1 U
4-Methyl-2-Pentanone (MIBK)	2 U	2 U	2 U	2 UJ
Tetrachloroethene	1 U	1 U	1 U	1 UJ
1,1,2,2-Tetrachloroethane	1 U	1 U	1 U	1 U
1,1,1,2-Tetrachloroethane	1 U	1 U	1 U	1 U
Toluene	1 U	0.07 J	0.1 J	0.1 UJ
Chlorobenzene	1 U	1 U	1 U	1 U
Ethylbenzene	1 U	1 U	1 U	1 U
Styrene (Ethenylbenzene)	1 U	1 U	1 U	1 UJ
Bromobenzene	1 U	1 U	1 U	1 UJ
1,2,3-Trichloropropane	1 U	1 U	1 U	1 U
2-Chlorotoluene	1 U	1 U	1 U	1 UJ
4-Chlorotoluene	1 U	1 U	1 U	1 UJ
Total Xylenes	3 U	3 U	3 U	3 U
1,2,4-Trimethylbenzene	1 U	1 U	1 U	1 UJ
tert-Butylbenzene	1 U	1 U	1 U	1 UJ
1,3,5-Trimethylbenzene	1 U	1 U	1 U	1 UJ
sec-Butylbenzene	1 U	1 U	1 U	1 U
p-Isopropyltoluene	1 U	1 U	1 U	1 U
1,2-Dibromo-3-Chloropropane (DBCP)	1 U	1 U	1 U	1 UJ
1,2,3-Trichlorobenzene	2 U	2 U	2 U	2 UJ
Isopropylbenzene	1 U	1 U	1 U	1 UJ
1,4-Dichlorobenzene	1 U	1 U	1 U	1 U
1,2-Dichlorobenzene	1 U	1 U	1 U	1 UJ
1,2,4-Trichlorobenzene	1 U	1 U	1 U	1 U
Naphthalene	3.1	1 UJ	2.3	0.84 J

C-Ef	Cooling Tower effluent into Settling Basin
Ef	Efluent sample
E	Ecology Sample
grab	Grab sample

J	The analyte was positively identified. The associated numerical result is an estimate.
U	The analyte was not detected at or above the reported result.
UJ	The analyte was not detected at or above the reported estimated result.

Appendix F (cont'd) - Kettle Falls Washington Water Power Generating Station , July 1995..

Parameters Location:	C-Ef-E-1	C-Ef-E-2	Ef-E-1	Ef-E-2
Type:	grab	grab	grab	grab
Date:	8/22	8/22	8/22	8/22
Time:	0820	1400	0910	1425
Lab Log#:	348234	348235	348237	348238
VOA Compounds	µg/L	µg/L	µg/L	µg/L
Hexachlorobutadiene	1 UJ	1 UJ	1 UJ	1 UJ
o-Xylene	1 U	1 U	1 U	1 U
1,3-Dichlorobenzene	1 U	1 U	1 U	1 UJ
m&p-Xylene	2 U	2 U	2 U	2 U
1,1-Dichloropropanone	1 U	1 U	1 U	1 UJ
1-Chlorobutane	1 U	1 U	1 U	1 UJ
2-Methyoxy-2-Methylpropane	1 U	1 U	1 U	1 U
Acrylonitrile	80 U	80 U	80 U	80 U
Allyl Chloride	1 U	1 U	1 U	1 UJ
Chloroacetonitrile	REJ	REJ	REJ	REJ
Ethyl Ether	1 U	1 U	1.1	1.2
Ethylmethacrylate	1 U	1 U	1 U	1 UJ
Hexachloroethane	1 U	1 U	1 U	1 UJ
Iodomethane	1 U	1 U	1 U	1 UJ
Methyacrilonitrile	1 U	1 U	1 U	1 U
Methyl acrylate	1 U	1 U	1 U	1 U
Methyl Methacrylate	1 U	1 U	1 U	1 U
n-Butylbenzene	1 U	1 U	1 U	1 U
n-Propylbenzene	1 U	1 U	1 U	1 UJ
Nitrobenzene	10 UJ	10 UJ	10 UJ	10 UJ
Pentachloroethane	2 U	2 U	2 U	2 UJ
Propane, 2-Nitro-	1 U	1 U	1 U	1 UJ
Propionitrile	REJ	REJ	REJ	REJ
Tetrahydrofuran	1 U	1 U	1 U	1 UJ
Trans-1,4-Dichloro-2-butene	1 U	1 U	1 U	1 UJ

C-Ef	Cooling Tower effluent into Settling Basin
Ef	Efluent sample
E	Ecology Sample
grab	Grab sample

J	The analyte was positively identified. The associated numerical result is an estimate.
U	The analyte was not detected at or above the reported result.
UJ	The analyte was not detected at or above the reported estimated result.

Appendix F (cont'd) - Kettle Falls Washington Water Power Generating Station , July 1995..

Partameter Location:	C-Ef-E	Ef-E	Ef-W	Duplicate
Type:	comp	comp	comp	comp
Date:	8/22-23	8/22-23	8/22-23	8/22-23
Time:	0800-0800	0800-0800	0800-0800	0800-0800
Lab Log#:	348236	348239	348241	348243
BNA Compounds	µg/L	µg/L	µg/L	µg/L
Benzo(a)Pyrene	0.26 U	0.36 U	0.15 U	0.19 U
2,4-Dinitrophenol	11 U	15 U	5.9 U	7.6 U
Dibenzo(a,h)Anthracene	0.26 U	0.36 U	0.15 U	0.19 U
Benzo(a)Anthracene	0.26 U	0.36 U	0.15 U	0.19 U
4-Chloro-3-Methylphenol	0.26 U	0.36 U	0.15 U	0.19 U
Aniline	REJ	REJ	REJ	REJ
Benzoic Acid	REJ	REJ	REJ	REJ
Hexachloroethane	0.26 UJ	0.36 UJ	0.15 UJ	0.19 UJ
Hexachlorocyclopentadiene	1.3 UJ	1.8 UJ	0.74 UJ	0.95 UJ
Isophorone	1.1	0.36 U	0.15 U	0.19 U
Acenaphthene	0.26 U	0.36 U	0.15 U	0.19 U
Diethyl Phthalate	0.26 UJ	1.3	0.18	1.5
Di-n-Butyl Phthalate	0.15 J	2.6	0.078 J	2.7
Phenanthrene	0.26 U	0.36 U	0.15 U	0.19 U
Butylbenzyl Phthalate	0.26 U	0.44	0.26	0.42
N-Nitrosodiphenylamine	0.26 U	0.36 U	0.15 U	0.19 U
Fluorene	0.26 U	0.36 U	0.15 U	0.19 U
Carbazole	0.26 U	0.36 U	0.15 U	0.19 U
Hexachlorobutadiene	0.26 UJ	0.36 UJ	0.15 UJ	0.19 UJ
Pentachlorophenol	1.3 U	1.8 U	0.74 U	0.95 U
2,4,6-Trichlorophenol	0.26 U	0.36 U	0.15 U	0.19 U
2-Nitroaniline	0.26 U	0.36 U	0.15 U	0.19 U
2-Nitrophenol	0.26 U	0.36 U	0.15 U	0.19 U
Naphthalene	0.26 U	0.36 U	0.15 U	0.19 U
2-Methylnaphthalene	0.26 U	0.36 U	0.15 U	0.19 U
2-Chloronaphthalene	0.26 U	0.36 U	0.15 U	0.19 U
3,3'-Dichlorobenzidine	0.52 U	0.73 U	0.3 U	0.38 U
Benzidine	0.26 UJ	0.36 UJ	0.15 UJ	0.19 UJ
2-Methylphenol	0.26 U	0.36 U	0.15 U	0.19 U
1,2-Dichlorobenzene	0.26 UJ	0.36 UJ	0.15 UJ	0.19 UJ

C-Ef	Cooling Tower effluent into Settling Basin	Duplicate	Duplicate composite split sample.
Ef	Effluent sample	J	The analyte was positively identified. The associated numerical result is an estimate.
E	Ecology sample	U	The analyte was not detected at or above the reported result.
W	Washington Water Power Company sample	UJ	The analyte was not detected at or above the reported estimated result.
comp	Composite sample	REJ	The data are unusable for all purposes.

Partameter Location:	C-Ef-E	Ef-E	Ef-W	Duplicate
Type:	comp	comp	comp	comp
Date:	8/22-23	8/22-23	8/22-23	8/22-23
Time:	0800-0800	0800-0800	0800-0800	0800-0800
Lab Log#:	348236	348239	348241	348243
BNA Compounds	µg/L	µg/L	µg/L	µg/L
2,4,5-Trichlorophenol	0.26 U	0.36 U	0.15 U	0.19 U
Nitrobenzene	0.26 UJ	0.36 UJ	0.15 UJ	0.19 UJ
1,2-Dichlorobenzene	0.26 UJ	0.36 UJ	0.15 UJ	0.19 UJ
2,4,5-Trichlorophenol	0.26 U	0.36 U	0.15 U	0.19 U
Nitrobenzene	0.26 UJ	0.36 UJ	0.15 UJ	0.19 UJ
3-Nitroaniline	0.26 U	0.36 U	0.15 U	0.19 U
4-Nitroaniline	0.26 U	0.36 U	0.15 U	0.19 U
4-Nitrophenol	0.52 U	0.73 U	0.3 U	0.38 U
Benzyl Alcohol	0.26 U	0.36 U	0.15 U	0.19 U
4-Bromophenyl Phenylether	0.26 U	0.36 U	0.15 U	0.19 U
2,4-Dimethylphenol	0.26 U	0.36 U	0.15 U	0.19 U
4-Methylphenol	0.26 U	0.36 U	0.15 U	0.19 U
1,4-Dichlorobenzene	0.26 UJ	0.36 UJ	0.15 UJ	0.19 UJ
4-Chloroaniline	0.26 UJ	0.36 UJ	0.15 UJ	0.19 UJ
Phenol	0.26 U	0.36 U	0.15 U	0.19 U
Pyridine	0.26 UJ	0.36 UJ	0.15 UJ	0.19 UJ
Bis(2-Chloroethyl)Ether	0.26 U	0.36 U	0.15 U	0.19 U
Bis(2-Chloroethoxy)Methane	0.26 U	0.36 U	0.15 U	0.19 U
Bis(2-Ethylhexyl)Phthalate	12	0.96 UJ	0.15 UJ	1 UJ
Di-n-Octyl Phthalate	0.26 U	0.36 U	0.15 U	0.049 J
Hexachlorobenzene	0.26 UJ	0.36 UJ	0.15 UJ	0.19 UJ
Anthracene	0.26 U	0.36 U	0.15 U	0.19 U
1,2,4-Trichlorobenzene	0.26 UJ	0.36 UJ	0.15 UJ	0.19 UJ
2,4-Dichlorophenol	0.26 U	0.36 U	0.15 U	0.19 U
2,4-Dinitrotoluene	0.52 U	0.73 U	0.3 U	0.38 U
Pyrene	0.26 U	0.36 U	0.15 U	0.19 U
Dimethyl Phthalate	0.26 U	0.36 U	0.15 U	0.14 J
Dibenzofuran	0.26 U	0.36 U	0.15 U	0.19 U
Benzo(g,h,i)Perylene	0.26 U	0.36 U	0.15 U	0.19 U
Indeno(1,2,3-cd)Pyrene	0.26 U	0.36 U	0.15 U	0.19 U

C-Ef	Cooling Tower effluent into Settling Basin
Ef	Effluent sample
E	Ecology sample
W	Washington Water Power Company sample
comp	Composite sample

Duplicate	Duplicate composite split sample.
J	The analyte was positively identified. The associated numerical result is an estimate.
U	The analyte was not detected at or above the reported result.
UJ	The analyte was not detected at or above the reported estimated result.
REJ	The data are unusable for all purposes.

Partameter Location:	C-Ef-E	Ef-E	Ef-W	Duplicate
Type:	comp	comp	comp	comp
Date:	8/22-23	8/22-23	8/22-23	8/22-23
Time:	0800-0800	0800-0800	0800-0800	0800-0800
Lab Log#:	348236	348239	348241	348243
BNA Compounds	µg/L	µg/L	µg/L	µg/L
Benzo(b)Fluoranthene	0.26 U	0.36 U	0.15 U	0.19 U
Fluoranthene	0.26 U	0.36 U	0.15 U	0.19 U
Benzo(k)Fluoranthene	0.26 U	0.36 U	0.15 U	0.19 U
Acenaphthylene	0.26 U	0.36 U	0.15 U	0.19 U
Chrysene	0.26 U	0.36 U	0.15 U	0.19 U
4,6-Dinitro-2-Methylphenol	2.6 U	3.6 U	1.5 U	1.9 U
1,3-Dichlorobenzene	0.26 UJ	0.36 UJ	0.15 UJ	0.19 UJ
2,6-Dinitrotoluene	0.52 UJ	0.73 UJ	0.3 UJ	0.38 UJ
N-Nitroso-di-n-Propylamine	0.26 UJ	0.36 UJ	0.15 UJ	0.19 UJ
4-Chlorophenyl Phenylether	0.26 U	0.36 U	0.15 U	0.19 U
2-Chlorophenol	0.26 U	0.36 U	0.15 U	0.19 U
Bis(2-Chloroisopropyl)Ether	0.26 UJ	0.36 UJ	0.15 UJ	0.19 UJ
Retene	NAF	NAF	NAF	NAF
3B-Coprostanol	NAF	NAF	NAF	NAF
Caffeine	280 NJ	NAF	NAF	NAF
Ethanol, 1-(2-Butoxyethoxy)-	0.26 U	0.78 NJ	61 NJ	25 NJ
Hydrazine, 1,2-Diphenyl-	0.52 UJ	0.36 U	0.15 U	0.19 U
N-Nitrosodimethylamine	NAF	0.73 UJ	0.3 UJ	0.38 UJ
Triphenyl Phosphate		0.43 NJ		
Benzenemethanol, .alpha.,.alpha.,4-trime		0.31 NJ		
Benzothiazole		0.51 NJ		0.62 NJ
Ethanol, 2-(2-Butoxyethoxy)-, Acetate		23 NJ	0.59 NJ	0.43 NJ
Ethanol, 2-Butoxy-, Phosphate (3:1)		1 NJ	1.1 NJ	1.1 NJ
Furan, 2,5-diethyltetrahydro-		0.4 NJ		
Propanoic Acid, 2-Methyl-, 2,2-Dimethyl-1-(2-Hydroxy-1		0.69 NJ		0.85 NJ
Cyclohexasiloxane, Dodecamethyl-			0.53 NJ	
Cholesterol				0.39 NJ

C-Ef	Cooling Tower effluent into Settling Basin	Duplicate	Duplicate composite split sample.
Ef	Effluent sample	J	The analyte was positively identified. The associated numerical result is an estimate.
E	Ecology sample	U	The analyte was not detected at or above the reported result.
W	Washington Water Power Company sample	UJ	The analyte was not detected at or above the reported estimated result.
comp	Composite sample	REJ	The data are unusable for all purposes.

Appendix F (cont'd) - Kettle Falls Washington Water Power Generating Station , July 1995..

Partameter Location:	SSludge	C-Ef-E	Eff-E	Transblk
Type:	grab-comp	comp	comp	grab
Date:	8/22	8/22-23	8/22-23	8/21
Time:	1420	0800-0800	0800-0800	0720
Lab Log#:	348233	348236	348239	348240
PCB Compounds	µg/kg - dry wt.	µg/L	µg/L	µg/L
PCB - 1016	51 U	0.07 U	0.091 U	0.066 U
PCB - 1221	51 U	0.07 U	0.091 U	0.066 U
PCB - 1232	51 U	0.07 U	0.091 U	0.066 U
PCB - 1242	51 U	0.07 U	0.091 U	0.066 U
PCB - 1248	51 U	0.07 U	0.091 U	0.066 U
PCB - 1254	51 U	0.07 U	0.091 U	0.066 U
PCB - 1260	51 U	0.07 U	0.091 U	0.066 U

Partameter Location:	S-Inf-E	SSludge	Eff-E	Transblk	Ef-W	Duplicate
Type:	comp	grab-comp	comp	grab	comp	comp
Date:	8/22-23	8/22	8/22-23	8/21	8/22-23	8/22-23
Time:	0815	1420	0800-0800	0720	0800-0800	0800-0800
Lab Log#:	348232	348233	348239	348240	348241	348243
Metals ++	µg/L	mg/Kg - dry wt.	µg/L	µg/L	µg/L	µg/L
Antimony	30 U	4.7 J	30 U	30 U	30 U	30 U
Arsenic	5.3 P	50.2	6.8 P	1.5 U	8.2 P	6.6 P
Beryllium	1 U	0.56 P	1 U	1 U	1 U	1 U
Cadmium	1.36 N	150	0.73 J	0.27 J	0.52 J	0.47 J
Chromium	5 U	26.8 N	5 U	5 U	5 U	5 U
Copper	15 P	413	11 P	4 U	12 P	11 P
Lead	3 J	226	4.9 J	1.2 J	1 U	1 U
Mercury (Total)	0.38 J	0.212 N	0.11 J	0.05 UJ	0.066 J	0.061 J
Nickel	10 U	17.7 N	10 U	10 U	10 U	10 U
Selenium	2 UN	0.70 J	2 UN	2 UN	2 UN	2 UN
Silver	0.5 UN	15.7 J	0.5 UN	0.5 UN	0.5 UN	0.5 UN
Thallium	2.5 UN	3.5 J	2.5 UN	2.5 UN	2.5 UN	2.5 UN
Zinc	44.4 P	2140	15 P	4.8 P	16 P	13 P

S-Inf	Influent into Settling Basin	J	The analyte was positively identified. The associated numerical result is an estimate.
C-Ef	Cooling Tower effluent into Settling Basin	N	The spike sample recovery was not within control limits.
SSludge	Settling Basin Sludge	P	The analyte was detected above the instrument detection limit but below the established minimum quantitation limit.
E	Ecology Sample	U	The analyte was not detected at or above the reported result.
W	Washington Water Power Company sample	UJ	The analyte was not detected at or above the reported estimated result.
Transblk	Transfer blank from effluent sample	UN	The analyte was not detected and the sample spike recovery was not within detection limits.
Duplicate	Duplicate composite split sample	comp	Composite sample
++	Metals are total recoverable unless otherwise noted.	grab	Grab sample

Appendix G - Tentatively Identified Compounds - Washington Water Power Company
Kettle Falls Generator Station, 1995

C-INF-E
comp
8/22-23/95
0800-0800
348235

BNA/Pesticides

Parameter	Value	Qualifier	Units
Unknown 01	0.72	NJ	ug/L
Unknown 02	0.33	NJ	ug/L
Unknown 03	2.3	NJ	ug/L
Unknown 04	0.19	NJ	ug/L
Unknown 05	0.87	NJ	ug/L
Unknown 06	7	NJ	ug/L
Unknown 07	0.39	NJ	ug/L
Unknown 08	0.49	NJ	ug/L
Unknown 09	1.1	NJ	ug/L
Unknown 10	0.3	NJ	ug/L

NJ There is evidence that the analyte is present. The associated numerical result is an estimate.

Ef-E
comp
8/22-23/95
0800-0800
348239

BNA/Pesticides

Parameter	Value	Qualifier	Units
Unknown 01	0.56	NJ	ug/L
Unknown 02	1	NJ	ug/L
Unknown 03	0.34	NJ	ug/L
Unknown 04	0.37	NJ	ug/L
Unknown 05	0.75	NJ	ug/L
Unknown 06	0.37	NJ	ug/L
Unknown 07	0.33	NJ	ug/L
Unknown 08	0.33	NJ	ug/L
Unknown 09	0.32	NJ	ug/L

NJ There is evidence that the analyte is present. The associated numerical result is an estimate.

Appendix G (cont.) - Tentatively Identified Compounds - Washington Water Power Company
Kettle Falls Generator Station, 1995

Ef-W
comp
8/22-23/95
0800-0800
348241

BNA/Pesticides

Parameter	Value	Qualifier	Units
Unknown 01	0.42	NJ	ug/L
Unknown 02	0.45	NJ	ug/L
Unknown 03	0.6	NJ	ug/L
Unknown 04	0.51	NJ	ug/L
Unknown 05	0.82	NJ	ug/L
Unknown 06	0.48	NJ	ug/L
Unknown 07	0.62	NJ	ug/L
Unknown 08	0.57	NJ	ug/L
Unknown 09	0.54	NJ	ug/L
Unknown 10	0.61	NJ	ug/L
Unknown 11	0.74	NJ	ug/L
Unknown 12	0.97	NJ	ug/L
Unknown 13	0.83	NJ	ug/L
Unknown 14	0.87	NJ	ug/L
Unknown 15	0.74	NJ	ug/L
Unknown 16	0.64	NJ	ug/L

NJ There is evidence that the analyte is present. The associated numerical result is an estimate.

Duplicate
comp
8/22-23/95
0800-0800
348243

BNA/Pesticides

Parameter	Value	Qualifier	Units
PAH unknown 01	0.36	NJ	ug/L
Unknown 10	0.65	NJ	ug/L
Unknown 02	0.92	NJ	ug/L
Unknown 03	0.57	NJ	ug/L
Unknown 04	0.36	NJ	ug/L
Unknown 05	0.9	NJ	ug/L
Unknown 06	0.37	NJ	ug/L
Unknown 07	0.38	NJ	ug/L
Unknown 08	0.35	NJ	ug/L
Unknown 09	0.41	NJ	ug/L
Unknown 10	0.44	NJ	ug/L
Unknown 11	0.42	NJ	ug/L
Unknown 12	0.42	NJ	ug/L

NJ There is evidence that the analyte is present. The associated numerical result is an estimate.

Appendix H - GLOSSARY - Washington Water Power Company
Kettle Falls Generator Station, 1994

BOD_5	Five Day Biological Oxygen Demand
$CaCO_3$	Calcium Carbonate
CLP	Contract Laboratory Program
CVAA	Cold Vapor Atomic Absorption
D.O.	Dissolved Oxygen
EPA	Environmental Protection Agency
kg	kilogram (1×10^3 grams)
L	Liter (1×10^3 milliliters)
lbs/day	Pounds per Day
LOD	Limit of Detection
m^3	Cubic meter (1×10^3 liters)
MF	Membrane Filter
mg	milligram (1×10^{-3} grams)
MGD	Million Gallons per Day
mL	Milliliter (1×10^{-3} liters)
NH_3	AmmoniaNPDES National Pollutant Discharge Elimination System
PCB	Polychlorinated Biphenyls
pH	Hydrogen Ion Concentration
PO_4	Phosphate
PP	Priority Pollutant
ppm	Parts per million (1×10^{-6} kg/L, 1 mg/L, or 1 mg/kg)
ppt	Parts per thousand (1×10^{-3} kg/L, 1 g/L, or 1 g/kg)
QA/QC	Quality Assurance/Quality Control
RPD	Relative Percent Difference
STP	Sewage Treatment Plant
TIC	Total Inorganic Carbon or Tentatively Identified Compound
TKN	Total Kjeldahl Nitrogen
TMDL	Total maximum daily Load
TNVS	Total Non-Volatile Solids
TNVSS	Total Non-Volatile Suspended Solids
TOC	Total Organic Carbon
TP	Total Phosphorous
TS	Total Solids
TSS	Total Suspended Solids
TVS	Total Volatile Solids
ug	Microgram (1×10^{-6} grams)
ug/L	Micrograms per Liter
VOA	Volatile Organic Analysis
VOC	Volatile Organic Carbon