

# **QUARTERLY PROGRESS REPORT**

**PACIFIC NORTHWEST  
WATER LABORATORY  
CORVALLIS, OREGON**

**JULY 1—SEPTEMBER 30, 1971**

**ENVIRONMENTAL PROTECTION AGENCY**

ENVIRONMENTAL PROTECTION AGENCY  
NATIONAL ENVIRONMENTAL RESEARCH CENTER  
200 S.W. 35th STREET  
CORVALLIS, OREGON 97330



PACIFIC NORTHWEST WATER LABORATORY

QUARTERLY REPORT

July 1 through September 31, 1971

Environmental Protection Agency  
National Environmental Research Center  
200 S.W. 35th Street  
Corvallis, Oregon 97330

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## NATIONAL THERMAL POLLUTION RESEARCH PROGRAM

PPB 1613

### Status of Projects and Significant Accomplishments

#### Work Plan ZBA: Improvement in Evaporative Cooling Methods

Dr. Garton is continuing literature survey and in-house research on constituents, effects, and control of cooling tower blowdown. Laboratory experiments are being conducted and initial results have been obtained for effects of constituents in cooling tower blowdown on algae, using Selenastrum capricornutum, and for fish using juvenile steelhead for test organisms.

#### Work Plan ZFD: Heat Transport and Behavior in Large Hydrologic Systems

Meteorological and stream data collected during the 1969 study on the Little Deschutes River were analyzed to determine the evaporative heat loss. Energy budget computations failed to provide accurate evaporation rates due to insufficient information on stream travel time and inadequate stream temperature measurements. The final report for this project is being prepared.

#### Work Plan ZFF: Engineering and Cost Aspects of Heat Dissipation

Environmental thermal testing of a simulated reflective particle pond was completed. Draft of a working paper covering the reflective pond investigation has been prepared.

Work Plan ZFC: Heat Transport and Behavior in the Mixing Zone

A comprehensive workbook on mixing zone problems was initiated early this summer. The objective is to compile results of in-house, grant, contract, and outside sources into computer programs and readily usable charts for the prediction of plume trajectory and temperature for cooling water discharges. The book will be published in two parts. The first part will be devoted to submerged outfalls and the second part to surface discharges.

The first part is sixty percent complete. All charts and correlation plots for no-current and stratified ambient conditions for single or multiple diffuser outfalls have been completed. Experimental data on crossflow and co-flow jets in ambient currents are available for developing the remaining portion of the first part. Analytical methods are being explored to fill the gap between crossflow and co-flow discharges to complete the picture.

Plans are made for providing experimental data to check these analytical models. A towing channel designed for this purpose is now nearly completed. Assembly of the parts will begin within two weeks at the Fluid Dynamics Laboratory, Pacific Northwest Water Laboratory.

Work Plan ZFI: Advanced Power Generation

Inactive.

Work Plan ZFD: Heat Transport and Behavior in Large Hydrologic Systems

"Heat and Water Vapor Exchange between Water Surface and Atmosphere," Cornell University, 16130 DIP, has been printed and two-hundred copies received by NTPRP.

"Controlling Thermal Pollution in Small Streams," 16130 FOK, Oregon State University is continuing.

Work Plan ZFJ: Beneficial Uses of Heated Water

The 1970 Annual Report of our grant with Eugene Water and Electric Board, 16130 EIK, "Thermal Water Demonstration Project," was received. Request for grant continuation was reviewed and continued support highly recommended as the more productive phases of the project are forthcoming.

Consulting Services

Work Plan ZFL: Consultation and Advisory Services

Mr. Christianson attended a meeting in Washington, D.C., for technical review of work done under the Industrial Waste Studies Program. A summary presentation was given on the Steam Generation-Power Industry category. Comments and suggestions were offered by the review group, which consisted of consultants and numerous EPA personnel. Work progressed throughout the quarter on the draft final report and reference guides covering this industrial category.

Assistance was provided Region VII in their evaluation of Union Electric's proposed Rush Island power plant. Mississippi

River temperature records were analyzed by Rainwater and Christianson to determine critical periods with respect to anticipated operational and discharge characteristics of the plant. Suggestions were made to enable compliance with water quality standards.

Dr. Tichenor presented testimony on the cost of alternative cooling systems for thermal power plants near Lake Michigan at two public hearings: Wisconsin Department of Natural Resources, Madison, Wisconsin, August 13, and Indiana Stream Pollution Control Board, Indianapolis, Indiana, August 23.

Mr. Rainwater presented testimony in the form of a Statement before the State Water Resources Control Board of California regarding water temperature standards for the State.

Information was provided the Assistant Administrator for Research and Monitoring on EPA-AEC relationships in thermal research and Mr. Rainwater traveled to Washington, D.C., to attend a meeting between EPA staff and representatives of AEC regarding future thermal research activities and designation of R&D responsibilities -- EPA and AEC.

Mr. Rainwater provided the Temperature Standards Work Group with comments on New York State water quality standards, thermal criteria.

Information was provided all EPA regions on the subject, "Environmental Impact of Nuclear Power Plants," in connection with the July 23, 1971, decision of the U.S. Court of Appeals of the District of Columbia, in the case of the Calvert Cliff's Coordinating Committee vs the Atomic Energy Commission.

Mr. Rainwater and Dr. Tichenor met with staff of the Division of Meteorology, Air Pollution Research, EPA, Research Triangle Park, North Carolina, to coordinate air and water research relative to electric power generation. Four interfaces and/or areas of potential coordination were identified and personal contacts established.

#### Reports, Papers, and Presentations

1. Dr. Shirazi attended the Annual Specialty Conference of ASCE Hydraulic's Division, held at Iowa Institute of Hydraulic Research. While there he met with Dr. McQuivey, USGS, to discuss the final report of the EPA-USGS cooperative study.

2. Mr. Rainwater presented a paper, "Recent Developments in Thermal Waste Control," to the Intersociety Energy Conversion Conference, Boston, Massachusetts, August 3-6, 1971.

3. Larry Winiarski completed the final draft of a working paper covering the Reflective Pond investigation.

4. Dr. Shirazi was a guest speaker at a meeting of the Willamette Chapter of ASME. The subject of his talk was dry cooling towers. With cooperation from the Training Branch of the Laboratory, he arranged for a tour of the Pacific Northwest Water Laboratory.

5. Dr. Shirazi submitted a paper, "Dry Cooling Towers for Steam Electric Power Plants in Arid Regions," for presentation at the Sixth Conference of the International Association on Water Pollution Research to be held in Jerusalem, Israel, June 1972.



Plans for Second Quarter, FY 1972

Work Plan ZBA: Improvement in Evaporative Cooling Methods

Continue work on toxicity of blowdown from cooling towers. Dr. Garton will be preparing a paper on the subject for presentation to American Institute of Chemical Engineers, Dallas, Texas, February 1972.

Work Plan ZFL: Consultation and Advisory Services

Complete work on Reference Guide and final report on steam generation for Industrial Waste Studies Program.

Work Plan ZFC: Heat Transport and Behavior in Mixing Zone

Continue analytical phase of workbook on mixing zones. Shakedown equipment and instrumentation for flume studies.

## NATIONAL COASTAL POLLUTION RESEARCH PROGRAM

PPB 1607

### Status of Projects and Significant Accomplishments

#### Work Plan DBH: Estuarine and Ocean Outfalls

Selection of Safe Sites for Discharge. A draft of a report on oceanographic sampling methods in nearshore waters was completed. The report relates coastal oceanographic effects to the fate of marine discharges.

Two two-dimensional models of current structure were run with an eye to evaluating their efficacy in coastal pollution problems. For a small grid (5x10) approximately one minute of CDC 3300 (CPU plus print) is required to simulate one hour of 'real' time with a 1 1/2 minute time step. The results of such purely numerical experimentation and the input requirements of the models will be incorporated as a part of a larger report on coastal oceanography.

ERTS Study. A joint proposal (EPA and Bendix Corporation) on utilization of the Earth Resources Technology Satellite (ERTS) (NASA) in coastal oceanography was submitted to NASA for consideration. At this writing no awards have been announced.

#### Work Plan ZAH: PCB, Biocides, and Other Persistent Organic Compound

##### Distributions and Fates in Coastal Waters

A Finnegan gas chromatograph/mass spectrometer (GC/MS) has been delivered. An organic chemist was hired and attended GC/MS operationa

training courses at San Jose, Athens, and Cincinnati. Current efforts are centered around setting up lab facilities to conduct research on persistence, accumulation, and distribution of harmful organics in the marine environment.

Work Plan XAA: Barge Dump Disposal of Wastes in Ocean and Coastal Waters

A polarographic system is being assembled to analyze for extremely low concentrations of lead and other materials in ocean and coastal waters.

Analysis of other trace materials (Hg, Cd, Se, As) continues by computer-based analysis of Ge(Li) spectra taken by a multichannel Pulse Height Analyzer (PHA) available to the Program at the Radiation Center of Oregon State University approximately 2 to 3 days per month.

Work Plan ZAI: Mercury, Cadmium, Arsenic, and Other Heavy Metal Distributions and Fates in Coastal Waters

A mercury uptake estimation experiment was conducted using radioactive mercury in the environmental simulator at the Marine Science Center, Newport, Oregon. The subjects during a ten-day exposure to  $0.1 \mu\text{g m Hg (Hg}^{203}\text{)}/\text{gm water}$  in a 25 l tank were algae, oysters, clams, and Dungeness crabs; preliminary results indicate that the algae and/or bacteria took up Hg rapidly.

Grant and Contract Research

Work Plan DBH: Estuarine and Ocean Outfalls

16070 FJV: Coastal Pollution: Literature Search, Indexing and Abstracting. At monthly intervals abstracts of papers relevant

to coastal pollution are submitted by the grantee (Pollution Abstracts, Inc.) to the Water Resources Scientific Information Center, and to headquarters, NCPRP. WRSIC publishes the abstracts in its twice-monthly publication, Selected Water Resources Abstracts, and NCPRP, upon receipt of the abstracts, forwards copies to laboratories and regional offices of EPA for immediate use.

16070 DGY: Dispersion in Hydrologic and Coastal Environments. The grantee has begun writing the final report for this project. This is expected to be finished during the next quarter. The reports received during the quarter prepared by the grantee and his staff are listed under "Reports, Papers and Presentations."

Work Plan XCF: Tidal Flats Influence on Estuarine Water Quality

16070 DGO: Tidal Flats in Estuarine Water Quality Analysis. Laboratory studies were continued at Oregon State University in order to better understand sulfate reduction. The results indicate a more rapid decomposition of organics than had previously been anticipated. Field measurements of sulfate profiles within the deposits will be conducted during the next grant period. In addition, the use of S-35 to better measure sulfate reduction over a short period of time is being investigated.

Work Plan XAA: Barge Dump Disposal of Wastes in Ocean and Coastal Waters

16070 EKZ: Oxidation of Organic Matter in the Seabed. The University of Washington continues its work on the second year of the grant. The grantee made two more cruises to Puget Sound to

increase its coverage to 36 stations. The additional stations close to population centers of Seattle and Tacoma did not show higher rates of oxygen uptake than previous stations, but intertidal stations at the mouth of the Snohomish River in Everett had rates of uptake as high as four times the highest rates ever measured in Puget Sound. Dr. Pamatmat, the principal investigator, will go back to this location in two weeks to repeat the measurements at the same stations and go farther up the river for in situ measurements on the riverbed. The long-term laboratory experiment on organic matter oxidation was begun recently.

#### Proposals Sought

Mr. Gil Jaffe, Director of the National Oceanographic Instrumentation Center, visited the Program Chief to discuss a proposal for the NOIC to evaluate equipment and instruments designed for coastal pollution measurements. The grant would cover basically two activities:

1. direct laboratory or field evaluation of specific items of equipment recommended for study by our program, and
2. collaboration between NOIC and NCPRP staffs on evaluation of research and demonstration projects awarded to a third party.

#### Consulting Services

##### Work Plan ZAR: Technical Consultation on Coastal Pollution Problems

1. Dispersal of Reserve Mining Taconite Tailings Waste in Lake Superior. Actual field work commenced on July 26. Four current

meter stations were established and sediment traps set up at two positions. Equipment was forwarded to the Duluth site for use in investigating turbid water areas. Primary measurements utilized horizontal and vertical transmissometer transects, backed up with dye traces and water samples.

Official assignment of the responsibility to NCPRP for conduct of the Lake Superior taconite tracing study (under the Great Lakes Region) was received September 14. Four employees were subsequently deployed for temporary duty in the Lake Superior area, two to remain until the completion of the study. A Coulter counter was taken to the site to analyze samples immediately after receipt, and a one-week cruise on the Coast Guard Cutter WOODRUSH provided samples for study. An investigation to determine resuspension of settled tailings fines began in our laboratory, and we initiated a review of the basic data and computations used by Reserve Mining to estimate the volume of their waste in the delta and on the bottom of the lake. Recent studies have concentrated on tracing the layer of turbid water near the bottom of the lake. Proprietary transmissometers performed very poorly during the field studies. The sediment traps built especially for this study performed very well.

In addition to field measurements on tailings transport, detailed analytical work on noxious trace elements (Cd, As, Se, Hg) is being conducted by neutron activation analysis at Corvallis.

2. Three conductivity meters were loaned to the Oregon Institute of Marine Biology (of the University of Oregon) in Charleston for its work in Coos Bay.

3. At the request of the Biological Methods Manual Committee, the Program Chief prepared a critique of the bioassay section of the proposed manual. A staff member attended a three-day meeting in Denver for the purpose of reviewing the final draft.

4. Chief, Chemical and Biological Oceanography, attended a second meeting in Washington, D.C., of the committee to prepare a request for proposals on the "Fate and Persistence of Oil in Marine Waters." The draft RFP was later reviewed by NCPRP personnel and extensive revisions made for the final form.

5. Mr. Vic McCauley, EPA headquarters, requested an outline of our capabilities for analysis of marine samples. He was provided a list of parameters which can be routinely analyzed in our laboratory and a list of specialized equipment and analytical capabilities which are not routinely employed for marine analysis, but which can be used for special purposes.

6. Program Chief attended the Summer Study on the Environmental Quality Program of the International Decade of Ocean Exploration at Durham, New Hampshire. The study was organized by the National Scientific Committee on Oceanography with the endorsement of the Ocean Affairs Board.

#### Reports, Papers and Presentations

1. "Applications of Some Numerical Models to Pacific Northwest Estuaries," by R. J. Callaway, was published in the Proceedings, 1971 Technical Conference on Estuaries of the Pacific Northwest, Circular #42, Engineering Experiment Station, Oregon State University, pp. 29-97.

2. Dr. Baumgartner presented a paper entitled, "Capabilities and Limitations of Models as Estuarine Pollution Control Techniques," at the 7th Annual Conference and Exposition of the Marine Technology Society meeting in Washington, D.C., August 1971.

3. A report by Baumgartner, D. J., M. H. Feldman, and Carl L. Gibbons, "A Procedure for Tracing of Kraft Mill Effluent from an Ocean Outfall by Constituent Fluorescence," was published in Water Research, Volume 5, Number 8, pp. 533-544.

4. Papers from grant 16070 DGY, Cal Tech:

Sullivan, Paul J., "Some Data on the Distance-neighbour Function for Relative Diffusion"

Ditmars, John D., "Mixing of Density Stratified Impoundments with Buoyant Jets"

List, E. J., "Laminar Momentum Jets in a Stratified Fluid"

Sullivan, Paul J., "The Penetration of a Density Interface by Heavy Vortex Rings"

Cederwall, Klas, "A Float Diffusion Study" and "Buoyant Slot Jets into Stagnant or Flowing Environments"

Okoye, Josephat K., "Characteristics of Transverse Mixing in Open Channel Flows"

#### Plans for Second Quarter, FY 1972

#### Work Plan DBH: Estuarine and Ocean Outfalls

Work will continue on the evaluation of numerical models of drift flow. A small example area will be chosen for illustration, as well as several idealized cases. Evaluation of self-contained,



submerged tide recorders for offshore work will be initiated. These instruments are required in order to properly specify the incoming tidal wave in the model.

Work Plan ZAH: PCB, Biocides, and Other Persistent Organic Compound  
Distributions and Fates in Coastal Waters

We will continue setting up lab facilities and begin study of transport, accumulation, and interchange mechanisms. Initial investigations will be made to determine present general levels of PCB, DDT, DDE, and other persistent organics in the marine environment.

Work Plan ZAR: Technical Consultation on Coastal Pollution Problems

The Lake Superior taconite tracing study will be completed and the data from the study presented at the Lake Superior enforcement conference.

General

The Director, National Environmental Research Center, requested a list of research programs which would expand the scope of our program's studies, or which are directed to studies of other elements of the environment as air pollution. Program Chief suggested future studies on:

1. pollution interference with pheromone identification by marine organisms;
2. development of autopsy and biopsy procedures for marine fish, shellfish, and marine birds;
3. demonstration of available marine bioassay tests to prevent the discharge of unsatisfactory treated wastes;

4. ecosystem assessment techniques;
5. deep sea disposal of continental wastes;
6. effects of accumulated pollutants in the Gulf of Mexico;
7. air-sea interchange in major coastal pollution problem areas;
8. health aspects of municipal sewage discharge in coastal regions;
9. establishment of case studies group;
10. remote sensing; and
11. a concentrated program to solve the pollution problem in the New York Bight.

Presidential interns in science and engineering, sponsored by the National Science Foundation, were requested for future studies on:

1. behavior and fate of mercury compounds in the marine environment;
2. behavior of pesticides and other persistent chlorinated hydrocarbons in the marine environment; and
3. case studies of causes of pollution in New York Harbor and research needs to effect recovery of water quality.

Work Plan ZCJ: A Comparative Study of Eutrophication in Two  
Recreational Mountain Lakes

Limnological studies were continued on Diamond Lake on a monthly basis. Carbon-14 primary productivity measurements were made at the deep hole location at two-week intervals. The lake is decidedly eutrophic, with dissolved oxygen values less than 2 mg/l and significantly increased levels of dissolved phosphorus and ammonia in the hypolimnion. Extensive littoral weed growth was observed. A dense diatom bloom occurred in early June, followed later in the summer by heavy growths of blue-green algae. Very dense populations of zooplankton, predominantly Daphnia, were sampled in July. The bottom fauna is dominated by midge larvae. The regular sampling program was terminated the last week of September owing to the onset of winter at that elevation. Seven groundwater observation wells were installed at various locations around the lake. Some intermittent sampling of the lake is planned for the winter months.

The Waldo Lake groundwater study was resumed in July. Water levels in the observation wells were low, indicating no discharge to the lake. Residual rhodamine dye (injected last year into the septic field) was found at a number of wells, demonstrating poor flushing characteristics of the aquifer and suggesting that local buildup of septic tank effluents may be occurring.

A limnological survey of Waldo Lake proper was made in August, following the procedures observed during the past two years. It is intended to so survey the lake during August of each year for some time to come.

Work Plan ZCH: New Methods for the Removal and/or Inactivation of  
Nutrients in Lakes

At Cline's Pond, monitoring of the sodium aluminate inactivation experiment continued. An Anabaena bloom of short duration was followed by return of pH values to about 7 and increase of Secchi disc transparency to 1.4 m. Dissolved oxygen below 1.5 m is quite low. Review of the data indicates lower total phosphorus, chlorophyll a, dissolved iron, dissolved manganese, ammonia, and total Kjeldahl nitrogen than during pretreatment years. The water transparency and pH have been more stable than in previous years. The large Daphnia and tadpole populations which appeared in past years have not appeared.

Phosphorus in Shagawa Lake sediments is being studied using various leaching solutions including ammonium chloride, sodium bicarbonate, ammonium acetate, and dilute sulfuric-hydrochloric acid.

Eighteen lakes throughout Oregon were visited as part of a survey to locate further potential study sites. Water samples were taken for characterization and evaluation of each lake. A report will be completed during the next quarter.

Work Plan ZBP: Lake Restoration

The established sampling program at the Shagawa Lake Project was continued throughout the quarter. Concentrations of ortho and total phosphorus and Chlorophyll a during July of this year were generally the same as those during the corresponding time last year at Shagawa Lake. Unlike previous years, the Aphanizomenon bloom

has not yet developed this summer. Recording flow gages are now in operation in "Stinky Ditch," the secondary treatment plant outfall, and the raw wastewater by-pass ahead of the treatment plant. Automatic samplers are also in operation at the latter two positions.

Development of a mathematical model for Shagawa Lake has continued.

#### Other Activities

Arnold Gahler attended the national meetings of the American Chemical Society on September 13-17.

Charles Powers attended an EPA-sponsored meeting in Rochester, NY, September 8, concerning EPA participation in the International Field Year--Great Lakes.

Kenneth Malueg attended a meeting at the EPA Regional Office, Atlanta, to discuss plans for the restoration of Lake Apopka. Earlier he visited lake restoration sites in Sweden.

#### Publications and Presentations

Donald Schults presented a seminar on lake restoration to the Corps of Engineers at Walla Walla, Washington.

#### Grant and Contract Research

The following research grant and contract proposals were reviewed.

1. "The Control of Predominating Algal Species"
2. "Septic Tanks and Lake Eutrophication"
3. "Study of the Interaction between the Blue-Green Alga, Plectonema boryanum, and its Cyanophage"

4. "Feasibility of Eutrophication Control in Lake Arlington by Reducing Nutrient Input"
5. "Removal of Algae from Eutrophic Lakes and Oxidation Ponds by Polymer-Aided Centrifugation"
6. "Algal Nuisance Control by Aeration"
7. "Restoration of Lake Lansing, Meridian Township, Ingham County, Michigan"
8. "The Nutritional Ecology of Nuisance Aquatic Plants"

#### Plans for Second Quarter, FY 1972

##### Physiological Control

- Conduct training course in algal assays.
- Continue nationwide algal assay lake survey.
- Continue Snake and Columbia River system assay study.
- Complete fall quarter Shagawa Lake assay series.
- Conduct regular seasonal assays on Cascade and coastal lakes.

##### Technology Development

- Complete data analysis and write reports for Cline's Pond and Diamond Lake projects. Continue routine monitoring of Cline's Pond.
- Conduct further nutrient exchange studies on Diamond Lake sediments.
- Complete report on groundwater studies at Waldo Lake, and on the survey of new study sites.
- Participate in IFYGL - Lake Ontario planning.

Lake Restoration

Begin construction of AWT plant at Ely, Minnesota.

Continue existing projects.

## NATIONAL WASTE TREATMENT RESEARCH PROGRAM

### FOOD WASTES RESEARCH - PPB 1206

#### Status of Projects and Significant Accomplishments

##### Work Plan ZAQ: Technical Consultation and Data Dissemination

The Second National Symposium on Food Processing Wastes proceedings was reproduced and dissemination was initiated.

At the request of the Seattle Regional Office, Mr. Dostal consulted with EPA Regional personnel and personnel from Oregon's Department of Environmental Quality on potato processing and waste treatment.

Mr. Dostal met with key members of the National Canners Association (NCA) and discussed both ongoing and needed research in the fruit and vegetable area.

A full-scale waste treatment system, first of its kind on a salmon cannery, was visited by Mr. Boydston and Mr. Dostal.

##### Work Plan FGF: Grant Monitoring

Mr. Dostal and Mr. Thompson visited Del Monte Corporation's Plant No. 3 in San Jose, California, (Grant 12060 HFY) and NCA's laboratory in Berkeley, California (Grants 12060 PAV and 12060 EDK).

Widmer's Wine Cellars, Inc. in Naples, New York, (Grant 12060 EUZ) was visited by Mr. Taylor and Kent Cheese Co. in Kent, Illinois, (Grant 12060 EKQ) was visited by Mr. Cochrane. Corn Products Co. in Pekin, Illinois, (Grant 12060 DPE) and American Distilling Co. in Pekin (Grant 12060 FLL) were visited by Mr. Taylor and Mr. Cochrane.



Messrs. Dostal, Burm, and Taylor spent a week in EPA Headquarters assisting in a review meeting on the industrial "Reference Guides". Prior to the meeting a "Reference Guide" was developed internally for the Beet Sugar Processing industry.

Two new grants were awarded:

12060 HCW, Anheuser, Busch, Inc., Houston, Texas

Project Officer - R. Hiller

12060 HPC, California Department of Agriculture Wine Advisory Board, Fresno, California

Project Officer - D. W. Taylor

The following grant proposals and preproposals were received during the quarter:

1. Seafoods processing wastewater characterization.
2. Rum distillery waste treatment by anaerobic digestion.
3. The development and operation of an acid whey fermentation, demonstration pilot plant.
4. Reduction of waste flow and organic load from the blanching process in vegetable canning.
5. Zero-effluent cane cleaner.
6. Treatment of total wastes from wet milling industry and development of economical water reuse techniques.
7. Technological survey, wastewater and sludge reclamation/reuse in the frozen food industry.
8. Waste treatment facilities for Gold Seal Vineyards.

Work Plan GJJ: New and Improved Treatment Processes for Food Processing Wastes

The full-scale anaerobic trickling filters which treat starch plant waste at United Centennial Mills, Spokane, Washington, were monitored until August 20 at which time an explosion and fire in the processing plant halted production. On September 15 the processing plant was placed into operation. BOD and COD removals declined to about 60 percent prior to the explosion. This was probably due to the large amount of suspended solids in the influent stream, over 2,000 mg/l.

Work Plan GKI: Secondary Treatment Processes for Highly Seasonal Wastes

A pilot RBC unit containing 30 discs, two feet in diameter, was started on a waste made from dehydrated potato granules. The artificial waste is being used so that the hydraulic and organic loadings can be varied independently. Initially the hydraulic loading was set at 0.25 gpd/sq ft with a COD concentration of 1000 mg/l. Thus far, periodic sloughing of the biomass has resulted in wide removal ranges for both SS and COD, from 30 to 90 percent.

Grant and Contract Research

The current status of monitored grants is described below. These grants are in the process of being assigned to work plans.

1. 12060 EUZ: Winery Wastewater - Characterization and Treatment. Most of the mechanical problems have been taken care of and the post-construction studies are being initiated.

2. 12060 EKQ: Kent Cheese Company - Waste Treatment Facility. Post-construction studies are about 80 percent complete. Effluent BOD has been in the 20 to 40 mg/l range with percentage reductions consistently over 95.

3. 12060 FLL: Activated Sludge: Bio-Disc Treatment of Distilling Wastes. Construction has been completed and the post-construction studies are just being initiated.

4. 12060 EHS: Cannery Waste Treatment by Lagoons and Oxidation Ditch. The final report has been revised and retyped for submittal.

5. 12060 EHV: Aerobic Secondary Treatment of Potato Processing Wastes with Mechanical Aeration. The final audit has not been done.

6. 12060 DSI: State-of-the-art, Sugarbeet Processing Waste Treatment. Following revision, the final report was submitted for reproduction.

7. 12060 ECF: Water Pollution Abatement in the United States Seafood Industry--State-of-the-art. Will be completed after a final audit.

8. 11060 EZR: Complete Aerobic Treatment of Combined Domestic and Industrial Wastes with Mechanical Aeration. The final report was submitted last quarter and is awaiting reproduction.

9. 12060 EIG: Full-scale Demonstration and Evaluation of Potato Dry and Wet Caustic Peeling Processes. The project was extended so that data could be collected during the first half of the 1971-72 processing season.

10. WP-01486-01: Status and Research Needs for Potato Waste Waters. Grant still not officially terminated.

11. 12060 FAD: Aerobic Treatment of Fruit Processing Wastes. Questions raised by final audit have not been settled.

12. WPD 93-04-68: Anaerobic-Aerobic Sugar Beet Waste Treatment. Final report has been revised and is currently being typed

13. 12060 DXL: Reduction of Salt Content of Food Processing Liquid Waste Effluent. Final report has been reproduced and distribution has started.

14. 12060 EDK: Production and Disposal Practices for Liquid Wastes from Canning and Freezing Fruits and Vegetables. Final report is being revised.

15. 12060 EHT: Use of Fungi Imperfecti in Waste Control. Still waiting for an appendix of data.

16. 12060 EDZ: Pilot Plant Installation for Use of Fungi Imperfecti on Vegetable Wastes. Revised final report is being typed.

17. 12060 FAK: Concentration of Sugar Beet Wastes for Economic Treatment with Biological Systems. Revised final report is being typed.

18. 12060 FQE: Dry Caustic Peeling of Tree Fruit to Reduce Liquid Waste Volume and Strength. Final report submitted last quarter to Project Reports System for reproduction.

19. 11060 FJQ: Pollution Abatement and By-Product Recovery in Shellfish and Fisheries Processing - Phase I. Final report submitted to Headquarters.

20. 12060 EGU: State-of-the-art of Dairy Plant Wastes and Waste-Treatment Systems. Draft of final report being revised.
21. 12060 FDR: Disposal of Rum Distillery Wastes. Termination of project underway.
22. 12060 ESY: Improvement of Treatment of Food Industry Waste. Final report still being revised.
23. 12060 EZP: Cannery Waste Treatment by the Kehr Activated Sludge Process. Project not officially terminated.
24. WPRD 151-01-68: Integrated Treatment of Liquid Wastes from Food Canning Operations. Final report is being distributed.
25. 12060 EHU: Reconditioning and Reuse of Food Processing Brines. Final report has been reproduced and is being distributed.
26. 12060 DQV: Removal and Recovery of Fatty Materials from Edible Fat and Oil Refinery Effluents. Second draft of final report reviewed.
27. 12060 DEQ: Elimination of Pollution by the Utilization of Protein Concentrates (Dried Whey) from Milk Residues of Cheese Making. Status still unknown.
28. 12060 DPE: Treatment of Wastes from the Wet Milling Industry. Post-construction studies just initiated.
29. 12060 DSB: Demonstration of a Full-Scale Waste Treatment System for a Cannery. Final report submitted to Headquarters.
30. 12060 EAE: Evaluation of Controlled Temperature and Forced Aeration in Trickling Filter Treatment of Food Canning Waste Waters. Final report is being reproduced.

31. 12060 DXF: Development and Demonstration of an Ultrafiltration Plant for the Abatement of Pollution from Cottage Cheese Whey. Final report is being reproduced.

32. 12060 FJK: Acid Emulsion Breaking - Activated Sludge for Bakery Waste. Construction completed.

33. 12060 ESC: Separation, Dewatering and Disposal of Sugarbeet Transport Water Solids. No activity until next beet sugar "campaign" starts.

34. 12060 FUR: Membrane Separation of Soybean Whey for Product Recovery and Waste Treatment. Testing continues.

35. 12060 FTC: State-of-the-art Study of Water Pollution Control from the Beverage Industry. About 75 percent of the work has been completed and the termination date was extended to September 1, 1971.

36. 11060 DLF: Tertiary Treatment of Combined Domestic-Industrial Wastes. Post-construction studies ended in August. Data analysis and final report preparation are underway.

37. 11060 DJB: Controlled Treatment of Combined Potato Processing - Municipal Wastes by Anaerobic Fermentation, Aerobic Stabilization Process. Construction of facilities nearing completion.

38. 11060 DUJ: Dynamic Process Development for Biological Treatment of Whey Bearing Wastes. Final report still being revised.

39. 11060 ENF: Vermont Cheese Industry Pollution Abatement. Project has not been initiated.

40. 12060 PAV: Low Water Volume Enzyme Deactivation of Vegetables Before Preservation. Blanching runs have been done on asparagus, peas, snap beans, corn, and beets. Thus far, the results from the hot air blancher look very promising. The finished products will be evaluated after a six-month holding period for vitamin and mineral content.

41. 12060 HFY: Dry Caustic Peeling of Clingstone Peaches on a Commercial Scale. The full-scale (15 ton per hour) "dry caustic" peeling line was operated on clingstone peaches until September 24. Peeling was satisfactory and the peel solids were kept out of the liquid wastestream. Water use in the rinsing was about 1 gpm per ton of fruit as compared to 11 gpm per ton of fruit on the conventional line.

42. 12060 FRW: Water and Waste Management in Sweet Potato Processing. The existing processing equipment and methods are being evaluated for water usage and waste discharges prior to implementing changes.

43. 12060 HCW: Submerged Combustion Evaporation System for Concentration of Brewery Spent Grain Liquors. A submerged combustion evaporation will be evaluated on its ability to concentrate spent grain liquor from screening and pressing operations. Following concentration the material will be dried with other grain, resulting in a salable by-product.

44. 12060 HPC: Pilot Scale Treatment of Wine Stillage. Both activated sludge and anaerobic trickling filter pilot plants will

be operated on brandy stillage to develop design criteria and cost estimates.

#### Consulting Services

Listed under work plan ZAQ.

#### Reports, Papers and Presentations

Listed under work plan ZAQ.

#### Plans for Second Quarter, FY 1972

1. Continue grant monitoring.
2. Monitor full-scale anaerobic filters.
3. Continue work on development of effluent standards.
4. Continue operation of RBC pilot plant.

PAPER AND FOREST INDUSTRIES RESEARCH - 1204, 1210, 1301

#### Status of Projects and Significant Accomplishments

##### Work Plan GJG: Technical Consultation and Data Dissemination

Continued major efforts in this area concerned time spent on Section 13 permit activities; aid to the Regional Office at Seattle on waste discharge requirements for Scott Paper in Everett, Wash., and to the Chicago Regional Office. Mr. Scott attended the Standards Development meeting in Washington, D.C.

##### Work Plan FCK: Coliform and Solids Removal from Aerated Lagoon

#### Effluent

This project has been completed and the data are being consolidated for presentation at an AIChE meeting in Dallas, Texas. Efforts



were made to determine the effect of adding polymers and flocculants to aerated lagoon effluent to reduce waste concentrations in pulp and paper plant discharges.

Dr. Knittel and a student assistant have joined the staff to work on fecal coliform problems associated with pulp and paper wastes. Their activities have centered on establishing a microbiological laboratory and starting culture techniques.

#### Work Plan GJH: Suspended Solids Removal by Mechanical Means

Construction has been completed on this field project at Crown-Zellerbach's Lebanon mill. A test program has been set up and the initial phase of treating settled waste in the aeration basin has begun. Samples are now being taken and data collected on the microscreen treatment of raw wastes. During the quarter a failure of the side-hill screen prompted the installation of a tube settler for use on the unsettled primary wastewater. Bob Shankland and John Ruppertsberger are expending a majority of their time on this project.

#### Work Plan ZBI: Series Biological Treatment of Pulp and Paper Wastes

A bench scale multiple unit activated sludge treatment plant has been set up to study treatment of sulfite pulping wastewater. After startup operation certain modifications have been made to obtain dependable results with the fibrous wastes. Supplementary trials are being conducted with a synthetic sulfite waste using dried SWL and acetic acid.

Work Plan ZAX: Pollutational Aspects of Bark Leachate

The lysimeter collection of bark leachate has started again with the fall rains. This project has studied leachate from four different bark types over a full year period. Sampling will be continued through the second winter.

Work Plan FCD: Grant and Contract Monitoring

Grant applications and research proposals reviewed during the quarter related to the following subjects:

1. Fate of Nitrogen Fertilizers in Forest Soil: Conversions, Movement, and Losses.
2. Effects of Fire on Lakes in a Natural Forest Ecosystem.
3. Evaluation of Effect of Various Biological Treatment Processes on Colored Organisms in Pulp and Paper Wastewaters.
4. Development of a Process Control Computer System for a Modern Pulp and Paper Mill Wastewater Treatment Plant.
5. Organic Compounds in Pulp Mill Lagoon Discharge.
6. A Test Method for Volatile Component Stripping of Wastewater in Cooling Towers.
7. Factors Affecting Slime Accumulation in Hardboard Mill Effluents.
8. Analysis of Organic Compounds in Pulp Industry Wastewater.
9. Summary Review of Recovery of Chemicals from Kraft, Sulfite, and NSSC Pulping and Treatment of Waste Materials.

### Grant and Contract Research

Current status on grants monitored by Paper and Forest Industries Research personnel.

1. 12040 DBD: Color and Mineral removal from Kraft Bleach Wastes. In the final year of the program examining the use of various ion exchange resins.

2. 12040 DEH: Studies of Low Molecular Weight Lignin Sulfonates. At the completion of the last year of this seven year project, isolation and characterization of certain fractions of sulfonates have been accomplished. An extension of time has been allowed for the final report.

3. 12040 DLQ: Slime Growth Evaluation of Treated Pulp Mill Wastes. Now in the final report preparation for this investigation which has shown that biologically treated pulp mill waste will not support slime growths as well as untreated waste.

4. 12040 EEK: Treatment of Selected Internal Kraft Mill Wastes in Cooling Towers. BOD of condensates can be reduced and cooling water recycled reducing mill pollution load and water needs. Report has been completed and is awaiting publication.

5. 12040 EEL: In-Plant Treatment of Dilute Wastes of the Pulping Industry. The project has completed the fifth and final application of reverse osmosis to unit process streams in the pulp and paper industry. Report is being prepared.

6. 12040 EFC: Pollution Abatement by Fiber Modification. Final report approved for publication. Laboratory study of strengthening paper fibers by the addition of waste lignin sulfonates.

7. 12040 ELW: Aerated Lagoon Treatment of Sulfite Pulping Effluent. The final report has been approved for publication.

8. 12040 EMY: Evaluation of Role of High Rate Trickling Filters and Aeration Devices Separately and in Combination for the Advanced Biological Treatment of Integrated Kraft Pulp and Paper Mill Effluents. The final report is being published.

9. 12040 ESV: A Demonstration Plant Evaluation of Four Methods for Pulp and Paper Mill Sludge Utilization and Disposal. Separate burning and log fuel addition burning studies continue. Soil assimilation studies continue.

10. 12040 EXQ: Steam Stripping of Kraft Pulp Mill Effluent Streams. Progress has continued to the end of the third and final year. A time extension has been given for project completion and write up.

11. 12040 FKS: Steam Stripping and Rectification of Kraft Mill Condensates and Black Liquors for Pollution Control and By-Product Recovery. Program alteration and plant design completed.

12. 12040 FUB: Closure of Water Use Loop in NSSC Pulp and Paper-board Mill Utilizing Reverse Osmosis as a Unit Operation. Phase I pilot operations completed. Report in preparation. Hold period of 3 months on decision for commercial plant. Project alteration includes emphasis on recycle rather than R.O. treatment.

13. 12040 GQD: Coliform Growth and Control in Aerated Stabilization Basin. A cooperative study will determine controlling factors of coliform growth in aerated basins treating weak spent

sulfite liquor and paper machine white water. Study initiated this quarter.

14. 12040 HDU: Mercury Recovery from Sediments and Sludges. Six mercury recovery techniques will be evaluated for treatment of sediments, process sludges, and liquid wastestreams. The optimum process will be used on a chlor-alkali plant effluent. Study initiated this quarter.

15. 12100 EBG: Influence of Log Rafting on Water Quality. Currently working on a four month extension, studies have shown the effect of log handling and storage in water; a survey of practice has been completed for the Northwest.

16. 13010 EGA: Studies on Effects of Watershed Practices on Streams. This study of logging methods has been completed and the final report submitted for publication.

#### Plans for Second Quarter, FY 1972

1. Continue R&D grant and contract monitoring and review.
2. Provide, on request, consulting services to Headquarters, regional offices, and states.
3. Continue with in-house project work.
4. Initiate work on hardboard wastewater treatment.

## CONSOLIDATED LABORATORY SERVICES PROGRAM

### Status of Projects and Significant Accomplishments

#### General

Final pieces of hardware for field gas chromatograph were received during the last week of this quarter. Assembly and field evaluation are programmed for the next quarter.

The new SHAVES bookkeeping and bench sheet production program is functioning efficiently. Scheduling of people for production line operation has been simplified. The weekly summary alerts the staff where resources must be applied to most efficiently handle the samples.

Five people have left through resignation, retirement, or transfer. They have been replaced by three new employees and a returning temporary. Optimum productivity continued during personnel changeover.

The analytical load peaked in the month of September, which is a change from previous years where the peak was attained in the month of August. Indications are that the load will continue to increase through the next quarter.

#### Automated Analytical Systems

A dual sampling probe has been installed on the Technicon II pump in the Technicon II system. This dual probe provides the capability to program spiked samples and test samples into the system.

### Atomic Absorption Spectrophotometry

Minor problems still continue to occur with atomic absorption spectrophotometric analysis. Instrument response is sluggish after measurement of high level of constituent. Restandardization is a necessity after a high concentration has been aspirated through the flame zone.

Problems occasionally arise when the dissolved concentration of metal is greater than the total concentration. Studies are being made to determine the source of this problem.

### Specialized Analysis

PBI (Pearl Benson Index), arsenic, selenium, total solids, dissolved solids, and suspended solids analyses have occupied the attention of the specialized group this quarter. Some problems have been encountered in the analysis of selenium in saline waters. Analyses of selenium by neutron activation analysis have been performed to check on colorimetric procedures.

### Analysis of Carbon

Particulates exiting from the total carbon furnace and the inorganic carbon furnace have been plugging the switching valve in the Beckman 915 system. A simple modification consisting of installation of a micron filter on the exits of both furnaces has solved the problem of clogging in the switching valve. This modification has resulted in less downtime of the instrument.

The quartz tubes for the inorganic furnace and the total carbon furnace are being fabricated locally from a purchased supply of

quartz tubing. The cost saving is appreciable over purchasing commercial quartz combustion tubes.

Work continues to be done with the Oceanography International Carbon System. A technician is being trained to permit for more flexibility in the use of this system.

#### Kjeldahl Analysis

The backlog is once again beginning to increase in the Kjeldahl section. Efforts are being made to reduce this backlog.

#### Computer Services

The Computer Services section concerned itself with thermal pollution modeling, analysis of data from neutron activation analysis system, and assistance to Eutrophication in reduction of algal assay data. A small amount of effort was given to the ecological modeling of Lake Shagawa -- Ely, Minnesota.

#### Biology

A number of sampling trips was conducted for the Waste Treatment Research Program. Routine samples were also analyzed for the Eutrophication Research Program.

#### Microbiology

The pollution surveillance program had the only input of routine samples for microbiological analysis.

#### Areas of Concern

Planning and priorities still continue to be a source of concern especially with the changing pattern of peak loads.



Reports and Papers

None.

Plans for Second Quarter, FY 1972

1. Continue efforts to reduce turnaround time and backlog in the laboratory.
2. Test in the laboratory the CO<sub>2</sub>, N<sub>2</sub>, O<sub>2</sub> gas analyzer and then field test it.
3. Resubmit paper on oil pollution.
4. Complete paper on SHAVES.
5. Continue efforts to produce the report on analysis of total carbon, inorganic carbon, and particulate inorganic carbon, and, also, particulate organic carbon.