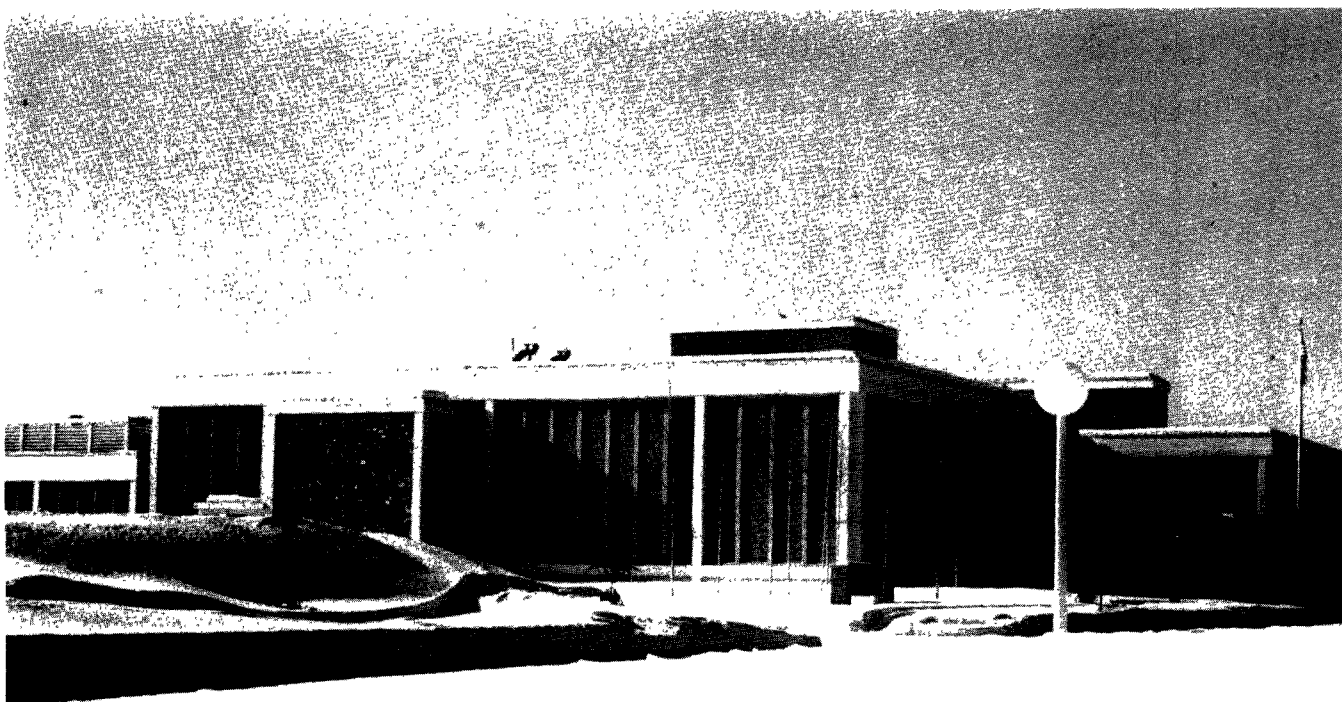


UNITED STATES DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
ALASKA WATER LABORATORY



QUARTERLY RESEARCH REPORT

OCTOBER 1 - DECEMBER 31, 1970

ALASKA WATER LABORATORY
College, Alaska 99701

ALASKA VILLAGE DEMONSTRATION PROJECT

PROJECT: 1610 GGR

Objectives:

To plan and construct in one or more Alaskan villages, projects to provide a central safe water supply and waste disposal facility in conjunction with community laundry and bathing facilities and a community health education program to help assure continued beneficial use of the projects.

Work Completed Second Quarter FY 1971:

Preliminary meetings on working agreements with USPHS Division of Indian Health and State of Alaska Department of Health and Welfare have been held, resulting in preliminary drafts of letters of agreement. A mutually acceptable draft describing working arrangements with the Indian Health Service, Alaska Area Native Health Service, was forwarded to headquarters of both agencies for completion and signature by appropriate officers.

With consideration of input from several sources, a description of the project as a general conception was drafted and used in an announcement in the "Business Commerce Daily," requesting qualifications and statement of concept by interested bidders on an R & D contract.

Informal contracts with several field agencies and with Alaska Native representatives have been made. Information gained in this way helped to formulate the project concept to date. There have also been some informal contacts with industry representatives to discuss possible approaches to technology of the project.

The selection process for identifying probable locations for projects has progressed to the point that there are about a dozen where a high degree of confidence in project success can be expected. Final selections will come from this group.

Work Plan Third Quarter FY 1971:

Project staff will attend a meeting of an association of village presidents and will present an explanation of the project to them. It is hoped they will concur in the present concept, recommend villages for selection and also designate appropriate individuals for working directly with the project staff on detailed decisions as the project moves along. This participation by village residents and area natives is absolutely necessary to the ultimate success of the project.

Qualified bidders will be selected from respondents to the aforementioned announcement and proposals for an R & D contract will be invited from a few. The usual contracting procedure will be followed in implementing the project contract. This will be done by Headquarters research and procurement staff.

Field visits to villages will be made to obtain detailed information necessary to make a final selection and provide design data to an eventual contractor. A final selection for a first project location will be recommended to the Director, Process Research and Development, after that time.

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COLD CLIMATE RESEARCH

PROJECT: 16100 GHG - LOW TEMPERATURE DISINFECTION

Objectives:

1. Determine effectiveness of chemical disinfection of low temperature waste water treatment plants.
2. Develop disinfection design criteria for low temperature system.
3. Demonstrate application of low temperature design criteria.

Work Completed Second Quarter FY 1971:

A chlorination system for treating effluent from the Eielson Pilot Plant facility was installed and is being placed in operation. The system consists of a tank, in which a hypochlorite solution is mixed, and two pumps (one spare) for metering the solution into the extended aeration effluent line. This line feeds into a common effluent line for all the pilot facilities which, in turn, feeds into a holding pond. Approximately 6 hours of contact time is provided in the pond before draining into the receiving lake.

Work Plan Third Quarter FY 1971:

1. Complete startup of the Eielson chlorination system.
2. Continue to develop a comprehensive investigation and demonstration program for development of low temperature disinfection design criteria.

PROJECT: 16100 GGS - APPLICATION OF ADVANCED WASTE TREATMENT TO NORTH SLOPE

Objectives:

1. Establish water use patterns for remote location operations and determine the feasibility of reducing water requirements.
2. Determine the effectiveness of small scale tertiary package plants and demonstrate their capabilities under remote site operating conditions.

Work Completed Second Quarter FY 1971:

Evaluation of the two tertiary treatment plants at Toolik Lake and Deadhorse on the North Slope continued. The two plants consist of a moving paper filter apparatus which filters the raw sewage and sludge generated in the system; chemical coagulation; upflow clarification; and two stage carbon filtration and adsorption. The two systems, which were

supplied by Met-Pro Corporation, were designed for a population of 300-400 people but are only being loaded at 2-5% of capacity. Limited grab sample analyses have indicated the Toolik Lake system is operating fairly well at the low loadings with effluent BOD's and solids ranging from 46 to 78 and 69 to 111 respectively. Results from the Deadhorse system have been less satisfactory. Data are from samples taken during startup, however, and the system has been shut down occasionally with the waste going directly to a stabilization lagoon. Because of the low level of activity on the North Slope and the uncertainty about when activity will increase, the level of effort which will be expended on this project is not known. A trip to the Slope during the third quarter to inspect the systems is expected.

Work Plan Third Quarter FY 1971:

1. Conduct field trips to existing advanced waste treatment systems on North Slope to evaluate their performance.
2. Discuss with industry problems related to advanced waste treatment application to the North Slope and other remote sites.

PROJECT: 16100 FHC - COLD REGIONS EXTENDED AERATION DESIGN CRITERIA

Objective:

Development of adequate design criteria for application of extended aeration in Alaska.

Work Completed Second Quarter FY 1971:

The contract for construction of two extended aeration units at the Eielson Air Force Base pilot facility was completed and buildup of activated sludge in the systems begun. The aeration chambers are of approximately 15,000 gal. capacity each and are exposed to the atmosphere. Solid separation is provided by a horizontal flow clarifier for one unit and settling tubes (inclined at 60°) developed by the Neptune Microfloc Co. for the other. The clarifiers are provided with air lift sludge return and are enclosed in an insulated unheated A-frame cover. The units will be operated under wintertime conditions to gather cold temperature information on the extended aeration process and to demonstrate the feasibility of using exposed aeration chambers in Alaska.

Operation of laboratory reactors for the constant temperature studies were delayed during startup of the extended aeration systems.

Work Plan Third Quarter FY 1971:

1. Develop operation data related to extended aeration systems operated with a minimum of environmental protection.

2. Continue constant temperature room studies to determine causes of sludge separation problems.

3. Continue Ft. Yukon and Northway lagoon studies.

PROJECT: 16100 FHD - DESIGN CRITERIA FOR ALASKA SEWAGE LAGOONS

Objectives:

A. To establish design criteria for the aerated lagoon waste treatment process in Alaska, and to evaluate parameters and contribution to effluent quality, power and maintenance costs, and reliability.

B. To demonstrate the feasibility of waste stabilization lagoon application in Alaska, particularly utilizing winter storage and summer treatment capabilities. To develop design criteria and investigate materials utilization and other design factors to minimize costs.

Work Completed Second Quarter FY 1971:

A. The aerated lagoon at the Eielson A.F.B. pilot facility was changed from a 6 cell system to a 4 cell system with detention times of 6.5, 7.2, 7.3, and 9.0 days respectively in each cell. The change was accomplished by cutting holes in the baffles between cells 1 and 2 and between cells 3 and 4, under the old configuration, and mixing the contents with pumps. The lagoon is back in operation and is being monitored. A leak has been discovered, however, and an attempt will be made next quarter to determine its location so that data obtained from each of the cells may be adjusted accordingly. Evaluation of a new air gun type diffuser system installed in the Northway aerated lagoon also began this quarter. The diffuser provides an air lift pump type action and has had extensive use in Canada.

B. The contract for modification of the Eielson A.F.B. pilot facility to include a facultative lagoon system was completed. Two cells were provided with 3 day detention in the first cell and 200 day or total winter storage in the second cell. The feed system for the lagoon, which will be installed by Alaska Water Laboratory personnel, has not been completed. The lagoon has also developed a leak and is not expected to be placed in operation until spring when the system can be pumped down and repaired.

Work Plan Third Quarter FY 1971:

A. Aerated Lagoon:

1. Continue evaluation of Northway Aerated lagoon with aeration system modifications.

2. Participate with the Corps of Engineers and Fort Greely Arctic Testing Facility in modification of an existing aerated lagoon system to demonstrate the capabilities of open aeration devices.

B. Facultative Lagoons:

Continue evaluation of the Fort Yukon lagoon system.

PROJECT: 16100 FHE - DISSOLVED OXYGEN DEPLETION AND ALASKA WATER RESOURCES

Objectives:

A. The role of microorganisms in D.O. depletion at low water temperatures.

1. To determine the metabolic activity of the natural population of microorganisms in sub-Arctic river water in a system which simulates river conditions as nearly as possible.

2. Assess the role of nutrients in metabolic activity of microorganisms at low temperatures.

B. D.O. sampling technique for Arctic operations.

To determine the method of collecting and transporting D.O. samples in BOD bottles which will minimize icing problems and provide the most valid sample.

C. Winter baseline D.O. conditions.

1. Establish baseline conditions for waters of the major drainages.

2. Determine the D.O. levels of ground water to establish the oxygen content of the water that rivers receive under ice cover.

Work Completed Second Quarter FY 1971:

A. The effect of velocity on the rate of D.O. depletion with polluted river water has been completed at 0° and 5°C. Similar work is in progress with unpolluted river water at 0°C. The results thus far indicate that being in motion significantly decreases the elapsed time to reduce the D.O. from saturation to 0 mg/liter as compared to stationary systems with both polluted and unpolluted river water. The velocity in the dynamic system has an effect on the rate of depletion particularly in samples of unpolluted water. These studies are being conducted with an amino acid mixture as the substrate and there are significant changes in the bacterial population in the presence of this substrate. Initially there are 10^3 - 10^4 bacteria present in the river which are capable of growth on membrane filters at 0° or 5°C on the medium being used. After the D.O. has been depleted the population has increased to 10^6 in the stationary system and 10^7 in the dynamic system. Based on gross colony morphology, only a small portion of the initial population is capable of competing successfully and the number of morphological types present when the D.O. is depleted is much reduced.

B. Experimental sampling techniques for dissolved oxygen are being investigated. Van Doren bottles, air filled BOD bottles and nitrogen filled BOD bottles were compared under severe cold temperatures as low as -34°F. Presently nitrogen filled BOD bottles appear to be the best method under arctic and low dissolved oxygen conditions. Devices utilizing tubes or spring mechanisms quickly freeze at subzero temperatures resulting in air entrainment.

C. Project field work began in October with initiation of a systematic sampling program to investigate the dissolved oxygen concentrations of the Chatanika, Salcha and Chena Rivers. Simultaneously, samples were collected to be analyzed for pH, conductivity and alkalinity. Air temperature also was recorded.

Range of Values for Chemical and Physical
Parameters for October through December, 1970

<u>Parameter</u>	<u>Chena River</u>	<u>Salcha River</u>	<u>Chatanika River</u>
Dissolved Oxygen mg/l	13.4-3.2	11.9-7.5	13.3-8.8
Conductivity umhos/cm	170-240	135-170	140-165
pH	5.1-7.6	5.8-7.4	6.6-7.5
Alkalinity mg/l	60-94	49-56	44-48
Air Temperature °C	-44 to -10°		

Work Plan Third Quarter FY 1971:

A. The effects of velocity on the rate of D.O. depletion will continue at a very low pace because the major investigator will be on leave for several weeks.

B. The methods which have given the best field results will be compared to the standard method in a laboratory study.

C. Field work will continue next quarter with extended field trips along the road system and into the outlying areas.

PROJECT: 16100 GHG - BASELINE CONDITIONS OF ARCTIC NORTH SLOPE

Objectives:

Provide baseline water quality information on the Sagavanirktok System and the immediate industrial region of the developing oil field.

Work Completed Second Quarter FY 1971:

Efforts on this project were directed toward completing the final biological analyses that have been delayed. Laboratory analyses of

chemical, physical data and microbiological data has been finished. Little correlation or reporting has been initiated.

Work Plan Third Quarter FY 1971:

It is hoped that all analyses will be completed in this interval. The first draft will be completed in this period.

PROJECT: 16100 GGT - FATE AND EFFECT OF OIL SPILLS ON ARCTIC RIVERS

Objectives:

Develop an understanding of the rate of movement and ultimate fate of petroleum spilled on and under the ice of ice covered rivers.

Establish the toxicity of spilled hydrocarbons to the aquatic communities of ice covered streams.

Work Completed Second Quarter FY 1971:

No activity.

Work Plan Third Quarter FY 1971:

Continue work on a master plan to develop a project defining needs and objectives to establish the fate and effects of oil spills under cold climates.

PROJECT: 16100 FHB - BACTERIA CONTAMINATION OF ALASKA WATERS

Objectives:

The objectives of this study of the Tanana River, from its confluence with the Chena River to its confluence with the Yukon River, are as follows:

1. To determine the rate of reduction in numbers of fecal indicator bacteria.
2. To determine changes in the chemical parameters which are associated with domestic wastes.
3. To establish the time required for a water mass to travel from the mouth of the Chena River to the mouth of the Tanana River.

Work Completed Second Quarter FY 1971:

Final write-up of the results for publication has been nearly completed.

Work Plan Third Quarter FY 1971:

Write-up of results for publication will be completed and the material should be in the hands of the printer before the end of the quarter.

PROJECT: 16100 GOI - GRAVEL REMOVAL PRACTICES ON ARCTIC NORTH SLOPE AND
WATER QUALITY CHANGES FROM ROAD BUILDING

Objectives:

1. Ascertain the nature and degree of damage that activities associated with gravel removal and road construction have on the aquatic ecosystem in sub-Arctic and Arctic Alaska.
2. Develop guidelines to be used by operators and resource managers to permit orderly removal of gravel and permit road construction without damage to aquatic life and water quality.

Work Completed Second Quarter FY 1971:

An advanced draft of the manuscript entitled "Industrial Waste Guide for Road Construction and Maintenance in Alaska" was returned by outside reviewers and is being revised.

Two working papers were published, (1) "Land Related Problems Associated with TAPS Construction and Operation," and (2) "Impact of Road Construction on Water Quality Management."

Work Plan Third Quarter FY 1971:

Continue literature review and development of study plan for the gravel removal project.

Complete revision of road construction guidelines; have it printed.

GRANTS AND CONTRACTS

PROJECT 16100 EOM - "Baseline Water Quality Study of the Alaskan Arctic Estuarine Development," Institute of Marine Science, University of Alaska, Dr. Patrick J. Kinney.

Initially efforts were made to familiarize the investigators with the study area. Three field parties monitored the study area from the west limit of the Colville delta to Beechey Point to the east and from the barrier islands inland about 125 miles up the Colville River. Segments of the project in which data have been collected include:

1. Current surveys by surface drifters and direct measurements inside the barrier islands.
2. Temperature, salinity, nutrient and trace metal distributions in the river, delta and lagoon complex.
3. Primary productivity from the headwaters of the Colville River to the barrier islands.
4. Bottom and suspended sediment sampling, sizing and mineralogy from the river delta out to the continental shelf.
5. Biological sampling, with emphasis on benthic fauna, in the delta out to the barrier islands.

PROJECT 16100 FWQ - "Investigations on Possible Effects of Crude Oil on Aquatic Organisms." Department of Biological Sciences, University of Alaska, Dr. James E. Morrow.

The overall objective of this project is to investigate the physical and physiological effects of various doses of oil pollution on salmon at the minimum, maximum and mean water temperatures in the Central Alaskan fisheries areas.

Equipment delivery was much slower than anticipated and some was found to be faulty. However, delivery is now complete and the faulty components have been repaired or replaced. Experimental work started in late November with adaptation of Coho Parr to a salinity of approximately 30‰. Initial results in the oil toxicity studies indicated that there are blood chemistry and behavioral differences between fish exposed to the oil and the control fish.

PROJECT 16100 FXJ - "North Slope Application of Advanced Waste Treatment and Partial Water Reuse." Wagley Inc., William A.D. Johnson.

Wagley Inc., was awarded \$71,080.00 in June 1970 for purchase of an advanced waste treatment system, an incinerator and associated laboratory monitoring equipment under a demonstration grant from the F.W.Q.A. The waste treatment system has been installed at the Wagley-Deadhorse camp on the North Slope and a very limited evaluation performed to date (see Application of Advanced Waste Treatment for the North Slope project). Little effort has been expended because of the slow-down of activity on the North Slope. The project agreement does include a provision for canceling the contract if active technical evaluation is not initiated by April 1, 1971. This action may become necessary since the system is presently loaded at 2-5% of capacity which will not permit proper evaluation. Prospects for increased activity on the North Slope are slight at this time.

PROJECT 16100 EXH - "Water Pollution Control in Cold Climates - A Symposium," Institute of Water Resources, University of Alaska, Dr. R. Sage Murphy.

The Symposium, which was held July 22-24, 1970, at the University of Alaska, attracted over 150 participants from 12 different countries. The 20 papers that were presented have been edited and are now being typed and prepared for publication under a single hardbound volume.

PROPOSALS REVIEWED

"Unsolicited Proposal to Demonstrate the Use of Gas Turbine Waste Heat and Sewage Treatment in Ski and Recreation Areas," Turbine Energy Company, Bellevue, Washington.

"Preliminary Design and Preparation of Specifications for a Community Sanitary Facility Utilizing a Catalytic Combustor," International Research and Technology Corp., Washington, D.C.

"Sewage Disposal and Waste Water Renovation System," American Machine and Foundry Company, AMF-CUNO Division, Meriden, Connecticut.

CONSOLIDATED LABORATORY SERVICES

Primary emphasis this quarter has been on catching up the large backlog of analyses present at the end of the last quarter (October 1). This has been accomplished for chemical analyses; however, there is still a backlog of several months of bottom fauna sorting and classification. Since we have only one Biological Technician, this work will proceed slowly.

Results of chemical analysis and bottom fauna collections were transmitted to Alaska Operations Office in December. Although all STORET data coding has been completed on these data, we await new and revised station coding before transmittal and inclusion in STORET.

Chemical analysis of samples collected for the Bering River Coal Field Study is completed; bottom fauna has yet to be sorted or identified.

Bottom mud samples collected from the Ketchikan and Sitka pulp mill areas, and other areas in Southeast Alaska used for commercial log storage, were analyzed for total phosphate, nitrogen, and carbon.

Analyses were completed on samples collected from the Petersburg Experimental Forest Refertilization Study.

Analysis of samples collected from the Eielson experimental sewage treatment plant continued throughout the quarter on a weekly basis. Beginning in January, additional samples will be collected so that sampling frequency becomes three times per week.

A method of detecting leaks in the Eielson system, using potassium as a tracer, is being developed and will be tried in early January.

During the last week of December 1970, a serious leak was detected in the main sewer drain which drains the south side of the building. It is anticipated that we will have to replace the entire 40 feet of drain line and all fittings, which have been destroyed by continuous chemical attack from laboratory drainage.

The glass distilled water system is being re-evaluated for possible upgrading, since it is no longer able to provide sufficient volume for our use. A study is being made with possible acquisition of new equipment in mind.

Quality control in the Laboratory is undergoing serious changes. We are developing cumulative-summation charts for all routine analyses and additional spike and sample runs are being made.

PUBLICATIONS AND PRESENTATIONS

Dr. Ronald C. Gordon, Research Microbiologist at the Alaska Water Laboratory, presented a paper at the Alaska Water Management Association meeting in October. It was entitled, "Monitoring the Sanitary Bacteriological Quality of Potable Water Supplies."

Mr. Ernst W. Mueller, Chief, Consolidated Laboratory Services, presented a seminar entitled "The Chena River-A Study in Pollution Ecology," at the University of Alaska's Geophysical Institute on December 17, 1970.

Mr. Mueller also held a discussion of local pollution problems to the Students for Environmental Action Club at Lathrop High School in Fairbanks.

PUBLIC RELATIONS

The following Alaska Water Laboratory reports were requested and mailed out this quarter:

"Biological Waste Treatment in the Far North" - 97

"Ecological Changes in the Chena River" - 5

"Effects of Placer Mining on Water Quality in Alaska" - 6

"Effects of Large Scale Forest Fires on Water Quality in Interior Alaska" - 5

There were 174 copies of "Clean Water for the 70's" mailed out.

The Laboratory mailed 1301 miscellaneous public information pamphlets which were requested.

The FWQA movie, "The Gifts," was shown ten times by the Borough school district and the University of Alaska.

VISITORS

The following persons visited the Alaska Water Laboratory during this quarter:

Mr. Edmund Grant, FWQA Assistant Commissioner for Administration, Washington, D.C.

Mr. Ray Jung, FWQA Facilities Management Office, Washington, D.C.

Mr. Patrick O'Brien, GAO Auditor, Seattle, Washington

TRAINING

Mrs. Ruth McFadden, Chemist, attended the Civil Service course "Introduction to Supervision," held in Juneau, Alaska, November 16-20, 1970.

Mrs. Carolyn McClintock, Secretary to the Director, attended the Civil Service course "Writing Effective Letters," held in Fairbanks, Alaska, December 17-18, 1970.