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Project Summary

National Surface Water Survey, Western Lake Survey–Phase I (Synoptic Chemistry), Field Operations Report

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The Western Lake Survey-Phase I was conducted during Fall, 1985. This Survey is a component of the National Surface Water Survey of the Environmental Protection Agency and is designed to characterize the chemistry of waters which are susceptible to acidic deposition and which are in the United States.

Five subregions in the West and Northwest were identified for lake sampling: the Sierra Nevada and Klamath Mountains (California, Nevada); the Cascade and Olympic Mountains (Oregon, Washington); the northern Rocky Mountains (Oregon, Idaho, Montana); the central Rocky Mountains (Montana, Wyoming, Utah); and the southern Rocky Mountains (Wyoming, Colorado, New Mexico). To facilitate sampling, field stations were established in each of the subregions. A total of 757 lakes were sampled between September 11 and November 5, 1985. The lakes were sampled either by helicopter crews or by ground crews. To determine the comparability of data, 45 lakes were sampled by both methods.

Water samples were delivered to mobile laboratories at each field station, where some analyses were conducted. The samples were processed into aliquots which were preserved and shipped to contract analytical laboratories for further analysis.

All sampling was completed within the scheduled sampling windows, and the safety record of the Survey was excellent.

This Project Summary was developed by EPA's Environmental Monitoring Systems Laboratory, Las Vegas, NV, to announce key findings of the research project that is fully documented in a separate report of the same title (see Project Report ordering information at back).

Introduction

The Western Lake Survey–Phase I (WLS–I), part of the National Surface Water Survey of the Environmental Protection Agency, was conducted during Fall, 1985. WLS–I was designed to characterize the present chemistry of lakes in areas of the western United States at risk from acidic depositon. WLS–I is a counterpart to the Eastern Lake Survey–Phase I (ELS–I), completed in Fall, 1984.

Five target subregions were delineated for WLS–I on the basis of climatic, geologic, and edaphic similarities. These subregions were (1) the Sierra Nevada and Klamath Mountains of California and Nevada; (2) the Cascade and Olympic Mountains of Oregon and Washington; (3) the northern Rocky Mountains of Montana, Idaho, and northeastern Oregon; (4) the central Rocky Mountains of Montana, Wyoming, and Utah; and (5) the southern Rocky Mountains of Wyoming, Colorado, and New Mexico. Lakes within these subregions were selected randomly by using statistically-based procedures.

Field sampling and laboratory operations were conducted from temporary

field stations established in each of the subregions. Sampling took place between September 11 and November 5, 1985. Nearly half of the lakes sampled were in wilderness areas where motorized vehicles are prohibited. These lakes were sampled by ground crews. Lakes outside wilderness areas were sampled by helicopter crews, as had been done for ELS-I. To determine the comparability of results from both methods, a group of lakes was designated for sampling by both helicopter and ground crews.

Laboratories at each field station made determinations of labile constituents and processed bulk samples into aliquots that were preserved and shipped to contract analytical laboratories for further analysis.

Field Operations

Planning for WLS-I involved selecting sites for field stations, developing sampling protocols for ground crews, training field personnel, and procuring equipment and supplies. Coordination among the Environmental Monitoring Systems Laboratory (EMSL) of the Environmental Protection Agency (EPA) and Lockheed Engineering and Management Services Company, Inc., both in Las Vegas, Nevada, the Environmental Research Laboratory of the EPA in Corvallis, Oregon, and the Forest Service was essential to all aspects of Survey planning.

Field station sites were selected for each subregion on the basis of suitability for helicopter and field laboratory operations, availability of express courier and charter aircraft services, and proximity to the majority of lakes targeted for sampling. When a group of target lakes was beyond normal helicopter sampling range (about 150 miles), a remote base site was established, and samples were sent to the field laboratory by charter plane.

All field personnel were thoroughly trained in proper equipment and instrument operations, collection and measurement procedures, sample handling, data reporting, quality assurance practices, and safety.

At each field station, an EPA base coordinator had responsibility for overall operations; a Forest Service field manager coordinated ground sampling operations. In addition, each field station was staffed by 6 to 15 ground crews, 1 or 2 helicopter crews, an EPA duty officer who assisted the base coordinator, and the laboratory crew. A logistics coordinator was responsible for disbursing equipment and supplies to the ground sampling crews. Field laboratory crew and helicopter sampling crew responsibilities were identical to those in ELS-I. Overall WLS-I field operations were coordinated through a communications center operated by Lockheed-EMSCO in Las Vegas.

Field Sampling Operations

Sampling requirements for WLS-I were similar to those for ELS-I. After verifying the identity of the lake, the location judged by the samplers to be in the deepest part of the lake was chosen as the sample site. Thermal stratification status was determined, and if the lake was stratified, it was re-scheduled for a later visit. Water samples collected from each lake included a 4-L bulk sample and two 60-mL syringe samples. These were collected by using a Van Dorn sampler modified so that syringe samples could be taken without atmospheric contact. A 125-mL sample for nitrate and sulfate was collected and was immediately preserved with $HgCl_2$ at all the lakes which were sampled by ground crews and only at calibration study lakes which were sampled by helicopter crews. All water samples were stored in coolers at about 4°C for transport to the field laboratory.

Helicopters capable of prolonged high-altitude flying, equipped with floats, were used to reach the lakes. Field protocols and equipment were similar to those used for ELS-I: site depth was measured with a depth sounder mounted on the helicopter, lake transparency was measured using a Secchi disk, and *in situ* pH, temperature, and conductance were measured by using Hydrolab units.

Forest Service sampling crews hiked or used pack teams to travel to wilderness-area lakes and used rafts to reach the lake sample sites. Protocols for lakes accessed by ground crews were designed to follow helicopter sampling protocols as closely as possible. The types of data collected were similar, but direct-reading instruments were not used. Depth was measured by using a sounding line, temperature was measured with a telethermometer, and pH was measured by using indicator strips. Conductance was not measured by ground crews.

Blank and duplicate quality assurance (QA) samples were collected by all sampling crews according to a QA plan. Field observations and *in situ* measurements were recorded on multi-copy forms. Copies of each form were sent to the QA group at Lockheed-EMSCO for verification that all information was properly recorded and to Oak Ridge National Laboratory for entry into the WLS-I database.

Field Laboratory Operations

The field laboratories used during WLS-I were the same ones that had been used for ELS-I. Laboratory procedures were similar to those followed during ELS-I. Survey specifications required that samples be processed as soon as possible after collection. At the field laboratory, the bulk samples were subdivided into aliquots which were preserved and were shipped within 24 hours of processing to contract analytical laboratories for detailed analyses. Dissolved inorganic carbon (DIC), pH, true color, and turbidity were determined at the field laboratories because of concerns about the stability of these parameters. The syringe samples were used for field laboratory measurement of DIC and pH, and aliquots of the bulk sample were used for color and turbidity determinations.

Results

Sampling at all five field stations was completed on schedule, with 757 (83 percent) sampled. Most of the lakes that could not be sampled were frozen, stratified, too shallow, or had hazardous conditions that precluded sampling. Forty-five of the 50 lakes designated as calibration study lakes were sampled by both ground and helicopter crews. The calibration study lakes that were not sampled were frozen or too shallow. Important observations and recommendations, based on experience gained during the Western Lake Survey, are presented in this report for consideration by other investigators.

This report was submitted in partial fulfillment of Contract No. 68-03-3249 by Lockheed Engineering and Management Services Company, Inc., under the sponsorship of the U.S. Environmental Protection Agency. This report covers a period from February 1985 to December 1985, and work was completed as of December 1986.

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***Wesley L. Kinney** is the EPA Project Officer (see below).*
The complete report, entitled "National Surface Water Survey, Western Lake Survey—Phase I (Synoptic Chemistry) Field Operations Report," (Order No. PB 87-182 630/AS; Cost: $11.95, subject to change) will be available only from:

National Technical Information Service
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