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Field Procedures for The Uranium Hydrogeochemical and Stream Sediment Reconnaissance as Used by The Los Alamos Scientific Laboratory

Robert R. Sharp, Jr.
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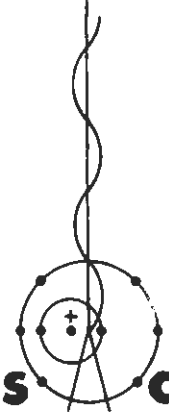

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FOR IMMEDIATE RELEASE
May 11, 1978

DOE ISSUES HYDROGEOCHEMICAL AND STREAM SEDIMENT RECONNAISSANCE FIELD PROCEDURES REPORT

The Grand Junction, Colorado, Office, U. S. Department of Energy (DOE), has issued a report entitled "Field Procedures for the Uranium Hydrogeochemical and Stream Sediment Reconnaissance as Used by The Los Alamos Scientific Laboratory," as part of the National Uranium Resource Evaluation (NURE).

The report, by Robert R. Sharp, Jr., and Paul L. Aamodt, of Los Alamos Scientific Laboratory (LASL), Los Alamos, New Mexico, presents sampling procedures used in reconnaissance surveys in the Rocky Mountain states and Alaska. There are descriptions of preparation for sampling, selection of sample sites, and field procedures. The instruments used are described and illustrated, and the field data form is shown, with coding instructions.

NURE is a program of DOE's Grand Junction Office to compile geologic and other information with which to assess the magnitude and distribution of uranium resources and to determine areas favorable for the occurrence of uranium in the United States. LASL, operated for DOE's Albuquerque Operations Office by the University of California, is responsible for completing a water and stream-sediment survey of the Rocky Mountain states and Alaska.

The 64-page report, GJBX-68(78), [LASL No. 7054-M], dated April 1978, will be placed on open file at the following places:

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FOR

THE URANIUM HYDROGEOCHEMICAL AND STREAM SEDIMENT RECONNAISSANCE

AS USED BY

THE LOS ALAMOS SCIENTIFIC LABORATORY

by

Robert R. Sharp, Jr., and Paul L. Aamodt

ABSTRACT

This manual of field procedures is prepared to aid personnel involved in the field sampling of natural waters and waterborne sediment for the Los Alamos Scientific Laboratory (LASL) as part of the US Department of Energy (DOE) Hydrogeochemical and Stream Sediment Reconnaissance (HSSR) of the National Uranium Resource Evaluation (NURE) program. It presents the procedural guidelines to be followed by all contractors, contractor employees, and others who collect, treat, or otherwise handle samples taken for the LASL as part of the HSSR program.

Part I relates to all sampling in the conterminous states of the US for which the LASL is responsible to the DOE for carrying out the HSSR work. Part II describes procedures to be followed for HSSR work, using helicopter support, in the state of Alaska.

The objective of the manual is to insure that consistent techniques are used throughout the survey. If any procedure is unclear or cannot be followed, telephone collect to Group G-5, LASL, (505) 667-7590, for further instructions. No variations in the specific procedures should be made without prior approval of the LASL.

PART I

SAMPLING PROCEDURES FOR THE CONTERMINOUS LASL STATES

INTRODUCTION

The field sampling operations in the conterminous states of the US for which the Los Alamos Scientific Laboratory (LASL) is responsible are typically carried out using four-wheel-drive vehicles or other ground transportation. Use of the equipment supplied and the procedures required by the LASL and described in this manual will provide accurate measurements and properly treated samples from each site.

I. PREPARATIONS PRIOR TO LEAVING FOR THE FIELD

Before personnel leave for the field, all necessary materials should be inventoried and cleaned. The electronic equipment should be calibrated and all batteries checked. Listed below are the essential items needed by a one- or two-person sampling crew for taking and treating water and sediment samples at 100 sites according to the LASL contract specifications.

A. Equipment Inventory

Item Description	Quantity	Required Condition
Field-sampling case	1	Clean, dry
Water sample vials (25-mℓ)	100	New, washed
Reactor vials (rabbits) (41-mℓ)	100	New, washed
Sediment-sample bags	100	New, unopened
Pressure filtration kit:	1	Clean, complete
Syringes	2	Clean
Filter heads	30	Washed, dried, preloaded
Filter papers	200	New
Vacuum filtration kit (optional):	1	Clean, complete
Hand vacuum pump	1	Clean, operational
Reservoir and base	1	Clean, dry
Flask with tubing	1	Clean, dry
Filter papers	200	New
Conductivity meter with range extender	1	Clean, operational
Scintillometer	1	Clean, operational

pH kit:	1	Clean, complete
pH meter	1	Clean, calibrated
Probe	1	Clean
Spare probe	1	New
Buffered solution	1 btl	Fresh
pH paper (for backup if meter fails)	1 pkg	Multirange, new, sealed
Thermometers	2	Clean, shielded
Acid dropper-bottles	2	Filled with 8M HNO_3, double wrapped
Deionized water rinse bottle	1	Filled, plus extra 1/2 gal deionized water
Prenumbered data forms	100	Sequentially numbered, clean, wrapped
Unnumbered data forms	10	Clean, wrapped
Field maps	As needed	Sample locations marked
Marking pens, pencils	As needed	Usable
Paper towels	As needed	Clean, dry
Spare batteries	2 of each type	New
Plastic 500-mℓ beaker	1	Clean, dry
Wide-mouth 8-oz bottles	3	Clean, dry
Polyethylene sediment scoop	1	Clean, dry
DOE I.D. cards	1 per person	As provided by the LASL

NOTE: Items may be substituted, added, or deleted from this list at the option of the LASL.

The field instrument case (Fig. 1) supplied by the LASL is a suitcase lined with foam padding and having movable dividers inside. It can hold all electronic equipment and most other items needed to sample approximately 10 locations. The additional sample vials, rabbits, data forms, maps, and other required materials and equipment can be carried separately but they must always be kept clean, orderly, and secure.

The field sampling case must be emptied and cleaned each day. If dust or dirt has accumulated on the foam liner, clean it thoroughly with a brush or damp cloth and air-dry it.

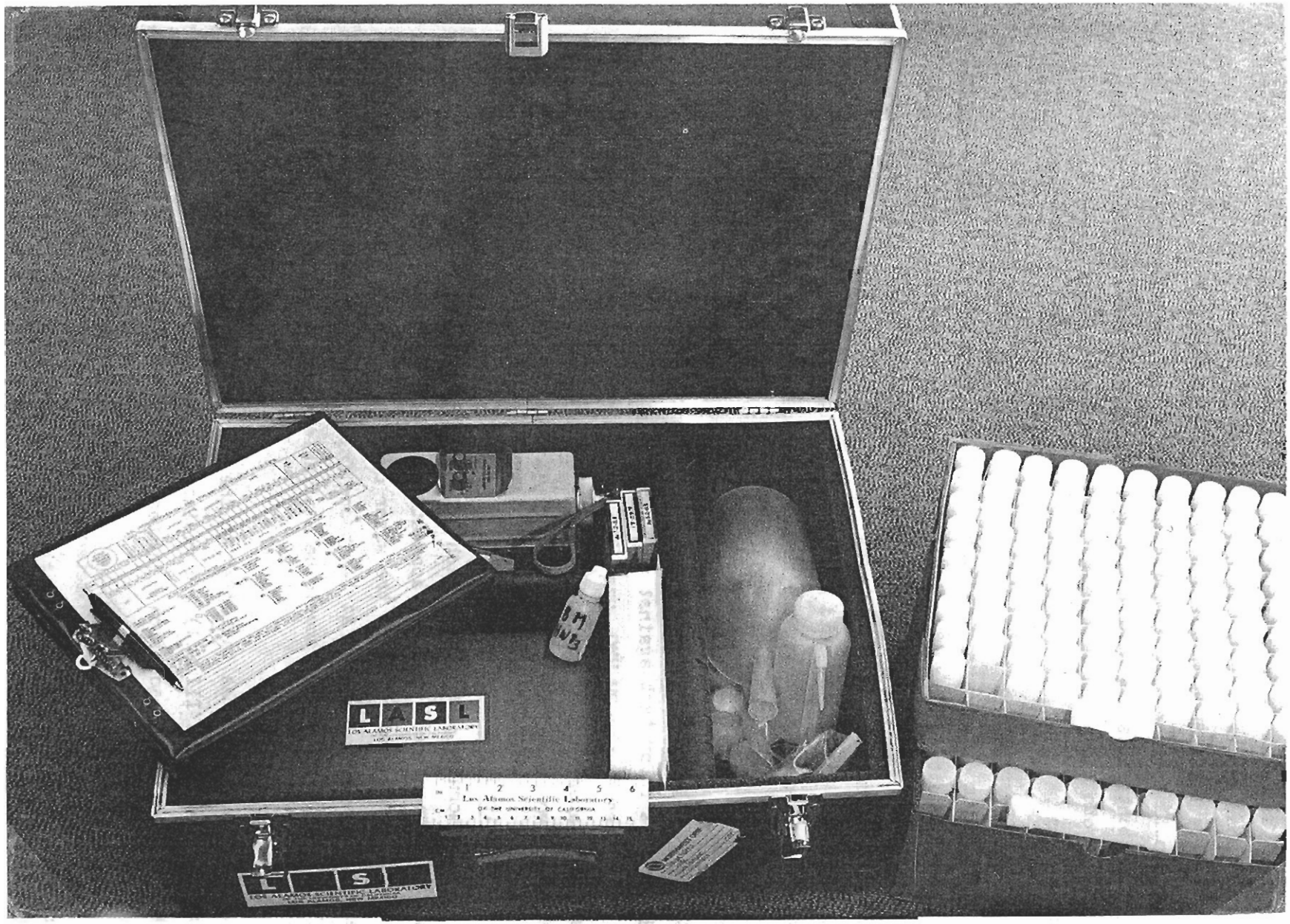

Fig. 1. Field sampling case and equipment.

B. Sample Vials and Bags

Set aside an adequate supply of new sample containers, both 25-mℓ and 41-mℓ sizes, and new, sealed sample bags for each day's collection. The vials provided by the LASL have already been washed and closed, so should not be opened until they are to be filled in the field. Keep and carry them in their shipping containers. If only a few are needed at a remote site, the necessary vials of both sizes can be carried in new, clean, tightly closed sediment-sample bags.

C. Acid Preparation

Fill the dropper-bottles, which are used to acidify the water samples, with 8-molar nitric acid (8M HNO_3). To prepare the 8M HNO_3, combine equal parts of the 16M reagent-grade acid (supplied by the LASL) with LASL-furnished deionized water (1 pt 16M HNO_3 plus 1 pt deionized H_2O yields 1 qt of 8M HNO_3). NEVER dilute the acid by pouring the deionized water into the concentrated acid--a strong and hazardous chemical reaction may result.

A 25-mℓ bottleful of 8M HNO_3 will acidify approximately 50 sample vials (enough for 25 sites). Take two acid bottles (one a spare) into the field each day. Always store them inside one or more securely closed plastic bags or jars to protect against accidental leakage.

To prepare the 2M HNO_3 used for washing the filter apparatus (as described later in III.B.1), add 1 part 16M HNO_3 to 7 parts deionized H_2O (1 pt 16M HNO_3 plus 7 pt deionized H_2O yields 1 gal 2M HNO_3).

D. Deionized Water

Each morning, refill the wash bottles with the LASL-furnished deionized water used to rinse the filter apparatus and instruments, taking special care to avoid any contamination of the water or of the bottles when they are being opened, closed, or stored. At least one full wash bottle plus an extra half-gallon of deionized water should be available for each day's work.

E. Equipment Check

Each day, test the batteries in the conductivity meter, pH meter, and scintillometer (Sec. III.D.1) and replace any weak batteries. Make sure that each bottle of buffer solution supplied with the pH meter is at least two-thirds full.

Calibrate the regular pH meter electrode in the buffer solution at the start of each day, and calibrate the spare electrode at least once each week.

After each calibration, rinse electrodes thoroughly with deionized water, cap them, and return them to the instrument case. Make sure that the small, plastic range extender for the conductivity meter is attached to the meter or is stored in the field case.

Test the hand-operated vacuum pump by operating it while holding a finger over its intake end. If the suction is weak, check the relief valve to be sure that it is properly seated.

Prepare sufficient preloaded filter holders (and spare filter papers) for the day's sampling. Normally, one filter will suffice for each sample (two vials). Two or three filter papers may be required when sampling turbid waters, therefore several spares should be available.

F. Data Forms and Maps

Include one data form (Fig. 2 and Appendix) for each site to be sampled, plus several spares. Take the LASL-furnished field maps (and any supplemental copies) required for each day's work, which are premarked with the sample-site locations, and store them in the instrument case or other suitable container. Be sure that each field map that will be needed is included. The field maps can be folded neatly and carried in a large plastic bag to protect them from the elements. Spare pens and pencils for marking maps and data forms can be carried in the instrument case.

The LASL will normally supply three kinds of map for each contract area in the conterminous states:

- One unmarked 2° topographic map sheet of the entire area covered by the premarked field maps. Each night, make a precise plot of the locations actually sampled, along with their corresponding location numbers, on the MASTER FIELD MAP of the entire area (do NOT fold any of the master maps).

- One unmarked 7-1/2' or 15' topographic map sheet for each area covered by an identical premarked field map. Each night, make a precise plot of each location actually sampled, along with its corresponding location number, on these MASTER FIELD MAPS.

- Three premarked 7-1/2' or 15' topographic map sheets (one premarked original and two xerox copies). These maps are to be used by the field crew members for accurate location of sample sites in the field.

II. SELECTION OF SAMPLE SITES

The primary objective in sample-site selection is to obtain samples that most accurately represent the surface water, groundwater, and/or water-

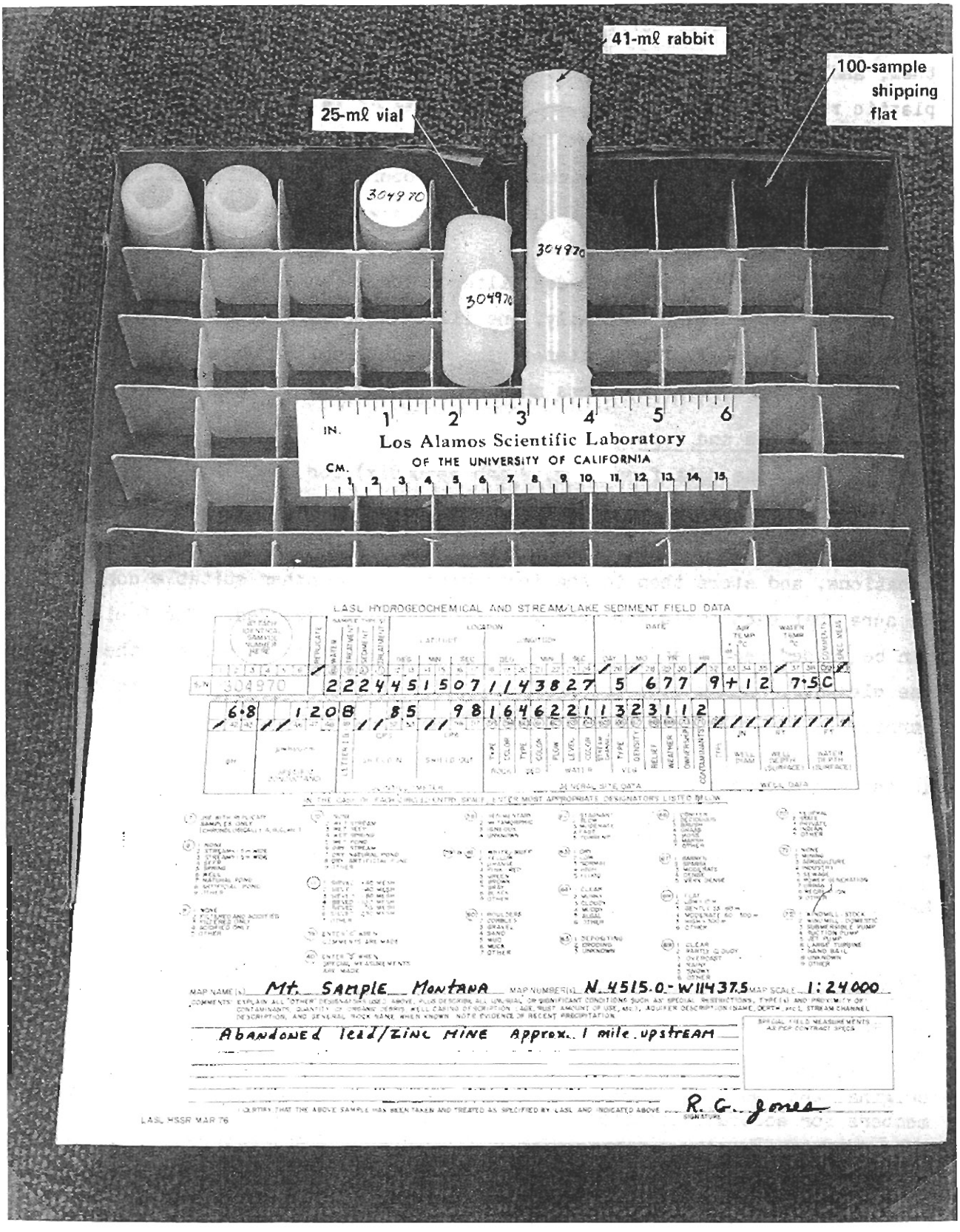

Fig. 2. Sample containers, shipping flat, and properly filled-out field data form.

transported bottom sediment of the areas sampled. Specific sample sites are premarked on the field maps supplied by the LASL, as indicated above.

The sample density will be about 1 per 10 km^2 (or 1 per 4 mi^2). The ratio of groundwater samples to surface water samples and of wet to dry stream-sediment samples will vary, depending on geography and other factors. The number of different source types, for both water and sediment samples, should be minimized to the extent possible within each survey area. Whenever possible, the sources will be determined in advance by the LASL. When an alternate location is required, briefly explain on the field map why the original premarked site could not be sampled.

Always respect a landowner's property and wishes: obtain permission for access, respect any restrictions, follow any special routes, and always be courteous and careful. There should be absolutely no littering, and sample sites, gates, and land must be left as found.

A. Surface Water Sites

Collect water and stream-transported bottom sediment from every surface water site sampled. Select stream sites where each sample will represent a relatively small drainage area (approximately 10 km^2). Where two tributaries join, choose sample sites on each tributary above the stream junction, so that each is representative of its separate drainage area. Where a small tributary joins a large river, sample the tributary and not the river. Sample the tributaries at least 50 to 100 m upstream from their confluence with a main stream. Because each sample should be representative of at least several square kilometers, very small drainages normally will not be sampled. Where a stream is crossed by a road or trail, the sample site must be upstream beyond the range of road or vehicle contamination.

When sampling surface waters having discernible water movement, move upstream after rinsing the equipment in order to obtain a clean sample. If there is no obvious flow, do the initial rinsing at least 10 m (if possible) away from the sampling spot. Collect wet bottom sediment in shallow water, following the guidelines for sediment collection given below and in Sec. III.C.

B. Groundwater Sites

At spring sites, take the water sample from freely moving water, preferably as far from the shore and as close to the source as possible. Avoid stagnant water if mobile water is available. Year-round springs are

preferable to wet-weather seeps because the latter usually represent very shallow drainage.

The wells to be sampled commonly will be designated in advance on the maps provided by the LASL. Regularly used wells with known depth and geologic data are preferred to those not recently pumped or of unknown depth. Before collecting water from a working well, pump the well continuously for at least 3 to 4 min until the water runs clean. Sample the water as close as possible to the well head. Describe the well piping in the Comments on the field data form. If a designated well cannot be sampled or is otherwise undesirable, try to find a satisfactory well or other water source as close as possible to the originally specified site.

C. Sediment-Sample Sites

Wet sediment is to be collected from every surface water site. If there is no water, collect dry sediment from designated intermittent stream beds. Sediment samples will not be collected at water well sites.

Always collect a composite sample (described in the next paragraph) and include only fine-grained, organic-rich, water-transported material. Collect enough sediment so that sufficient fine material will remain after drying and sieving to fill a 25-mℓ vial (use standard mixing and quartering techniques described in Sec. III.C.3 to split samples having more than 25 mℓ of the -100 mesh fraction). Vials less than three-fourths full (approximately 18 mℓ) of processed sediment are considered incomplete, and a penalty will be assessed the contractor for all such samples. Unless otherwise specified, discard all remaining sediment coarser than -100 mesh.

At springs, seeps, and streams, collect uncontaminated, fine-grained, water-borne wet sediment. Each organic-rich sediment sample should be a composite of roughly equal portions from three underwater locations within approximately 30 m (100 ft) of the designated site. Avoid collecting wind-blown, disturbed, or contaminated material.

III. FIELD PROCEDURES

The normal procedure is to carry the sampling kit to the designated location and complete the sampling there. If the temperature is near or above 35°C (95°F), do the sampling in the shade if possible. When the temperature is below 0°C (32°F), you may follow the cold-weather procedure described in

Sec. IV. The routine sampling procedures and equipment operation are described in detail below.

A. Temperature Measurement

As soon as the field kit is set up on level ground close to the sampling site, remove one thermometer and hang it in the shade. Immerse the second thermometer in the source water downstream from the water collection point. Allow several minutes for both thermometers to equilibrate before reading them.

One factor affecting the accuracy of the temperature reading is the length of time needed for the thermometer to equilibrate with the water or air around it--a thermometer at room temperature may require as long as 6 min to equilibrate in water. If the water is stagnant, gently stir the immersed thermometer to hasten equilibration.

Also, heating or cooling can occur between the time the thermometer is removed from the water and the time it is read. On a warm or windy day, heat from the air or evaporation of any water on the glass can change the temperature rapidly. Read the thermometer quickly after removing it from the water. The thermometer measuring air temperature must be adequately ventilated and shaded and must be protected from heat sources, including body heat, when a reading is taken.

B. Water Collection and Treatment

Water samples being collected and treated must be representative of the source and not contaminated by anything used in their collection. Only the material dissolved in water is desired; consequently, all water samples must be filtered and acidified, whether from streams, springs, or wells.

1. Syringe Filter Unit Procedures. The Millipore 50-mℓ syringe filter system (Fig. 3) is a quick and convenient method of filtering nearly all waters. Because murky or muddy waters can rapidly clog the small filter surface (25-mm diam), several filters (or the vacuum filter unit described in Sec. III.B.2) may have to be used.

Before entering the field, load the Millipore filter holders by unscrewing the two halves of a thoroughly cleansed (see next paragraph) filter holder, inserting the white silicone gasket into the funnel-shaped half so that it seats on the supporting lip, inserting a fresh filter (the white paper) so that it lies over the gasket, and screwing the two halves back together. Check to see that the filter and gasket are properly seated.

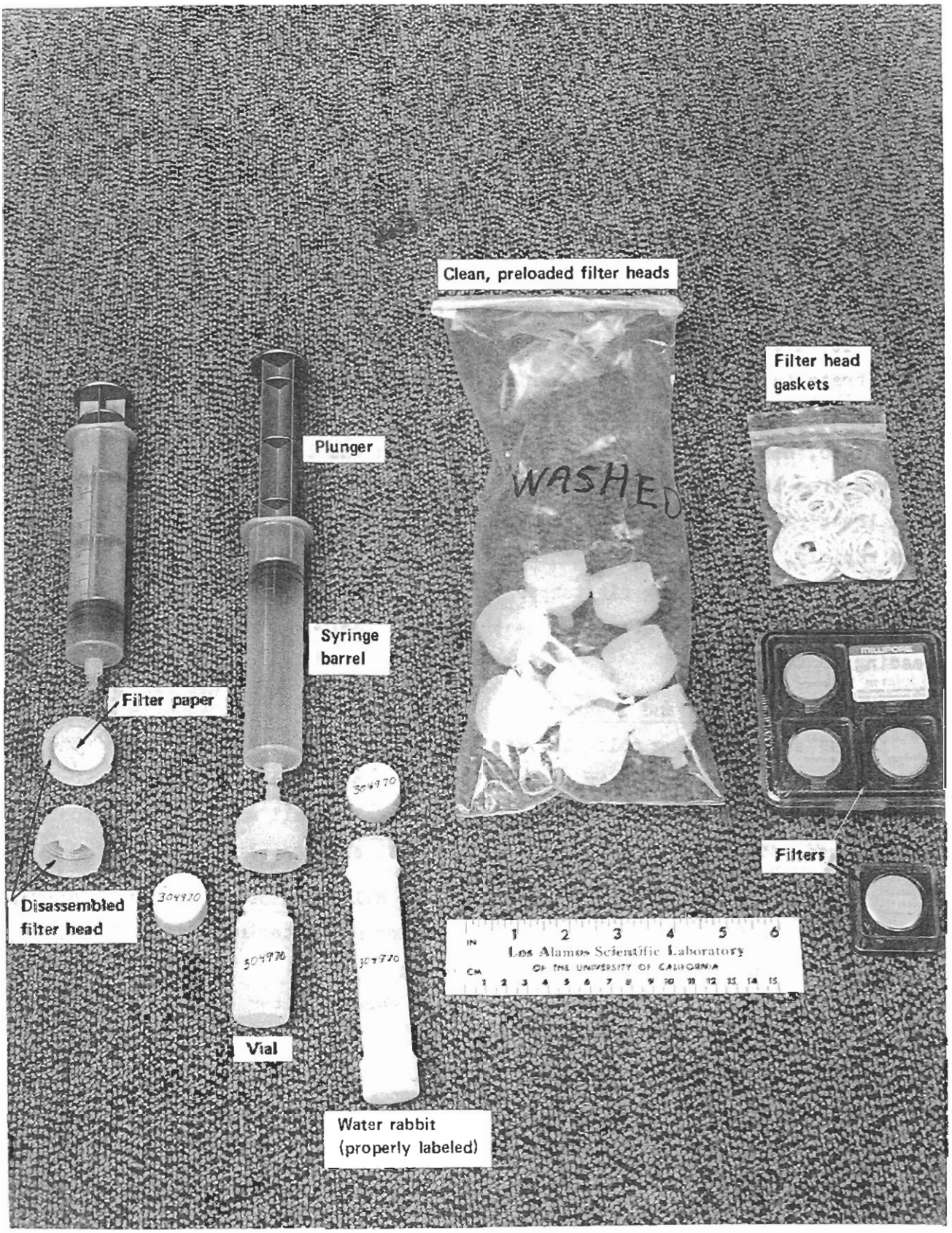

Fig. 3. Pressure filtration assembly.

Before taking a sample, thoroughly rinse the syringe barrel and plunger in the water to be filtered so that any traces of previous sample water will be removed. After each use, remove the plunger from the syringe and rinse the barrel and plunger once with deionized water.

Fill the syringe by inserting it (without a filter holder) into the sample water, point first and with the plunger pushed down. When filling, hold the syringe at arm's length to avoid near-shore contamination. While the tip is submerged, pull out the plunger until a sufficient volume of water is sucked up into the barrel. Then insert the syringe tip into the tapered end of the filter holder until snug. Do not twist the filter holder when attaching it to the syringe because the tip is easily broken. Hold the sample container (or rabbit) vertically under the filter holder to catch the filtered water sample as the plunger is depressed.

If more than one syringe full of water must be filtered, the filter holder can be removed, the barrel refilled, the filter holder reattached, and filtration continued. Only if the first filter clogs will it be necessary to attach a fresh filter holder to obtain the required sample volume. Once a filter holder is used, it is extremely important that it be stored apart from the remaining clean ones so that it cannot be used again until it is thoroughly cleaned and reloaded.

Preloaded filter holders must be kept clean before use. They can be stored in a sealed plastic bag until needed. The whirl-top sample bags supplied by the LASL for collecting sediment are ideal for this use, but they should never be used more than once after the seal is broken.

After each use, the filter holders must be disassembled, and the used filters disposed. Then all unassembled holder components must be soaked for at least 15 min in a 2M HNO_3 bath, rinsed twice in deionized water, and air-dried before being used again. This operation can be performed each evening at the field base camp by using one or more clean plastic buckets to hold all used filter holders.

The acid bath can be used for as many as 30 washings, unless it becomes dirty earlier. When not in use, the acid bath should be kept covered in an out-of-the-way place for safety reasons as well as for protection from contamination. Preparation of the 2M HNO_3 wash solution is described in Sec. I.C.

2. Vacuum-Filter Unit Procedures. The parts of the vacuum filter unit are illustrated in Fig. 4. The vacuum pump is a relatively simple instrument, but an occasional source of trouble on some models is the vacuum relief valve under the front tip of the hand pump. The small red lever must be centered in its seat. Test this by holding a finger over the nozzle and operating the pump. If a strong vacuum does not develop, the relief valve is probably leaking. Try to correct it by jiggling the small red lever several times. If this fails, a replacement pump is needed.

Remove from the carrying case the large polyethylene beaker containing the water filter, remove the filter from the beaker, and set the beaker and plastic top reservoir of the filter assembly back into the case. Next, thoroughly rinse with deionized water the small glass beaker (or flask) and the lower half of the magnetic filter holder (with rubber stopper) and drain them. After the outside of the glass beaker (or flask) is wiped dry, insert the lower filter holder stopper, attach the vacuum hose, and set the unit upright in the carrying case.

Now, rinse the plastic top reservoir at least twice in the water to be sampled. Place a clean filter paper on the lower filter holder and carefully place over it the plastic filter reservoir with magnetic retainer. The magnetically retained reservoir is easier to assemble if you incline it so that one edge touches the magnet first, then pivot it upright over the filter paper.

Rinse the large plastic beaker three times with the water to be sampled, then pour 100 mℓ of water into the top reservoir and filter it into the small glass beaker (or flask). If the filter paper becomes plugged, remove the beaker (or flask) of filtered water, replace the filter, reassemble the unit, and resume filtering. After all water is filtered, disassemble the filter unit, remove the filter paper, rinse the unit in deionized water, and store it.

3. Acidification. For each sample, acidify one 25-mℓ vial and one 41-mℓ vial (both properly labeled) by adding 10 drops (0.5 mℓ) of 8M HNO_3. If the vacuum filter was used, remove the stopper from the small beaker (or flask) and pour the filtered water into each of the preacidified sample vials. If the syringe filter was used, the sample water can be filtered directly into the preacidified vials. Fill the vials to capacity so that as little air as possible remains, and cap each one tightly.

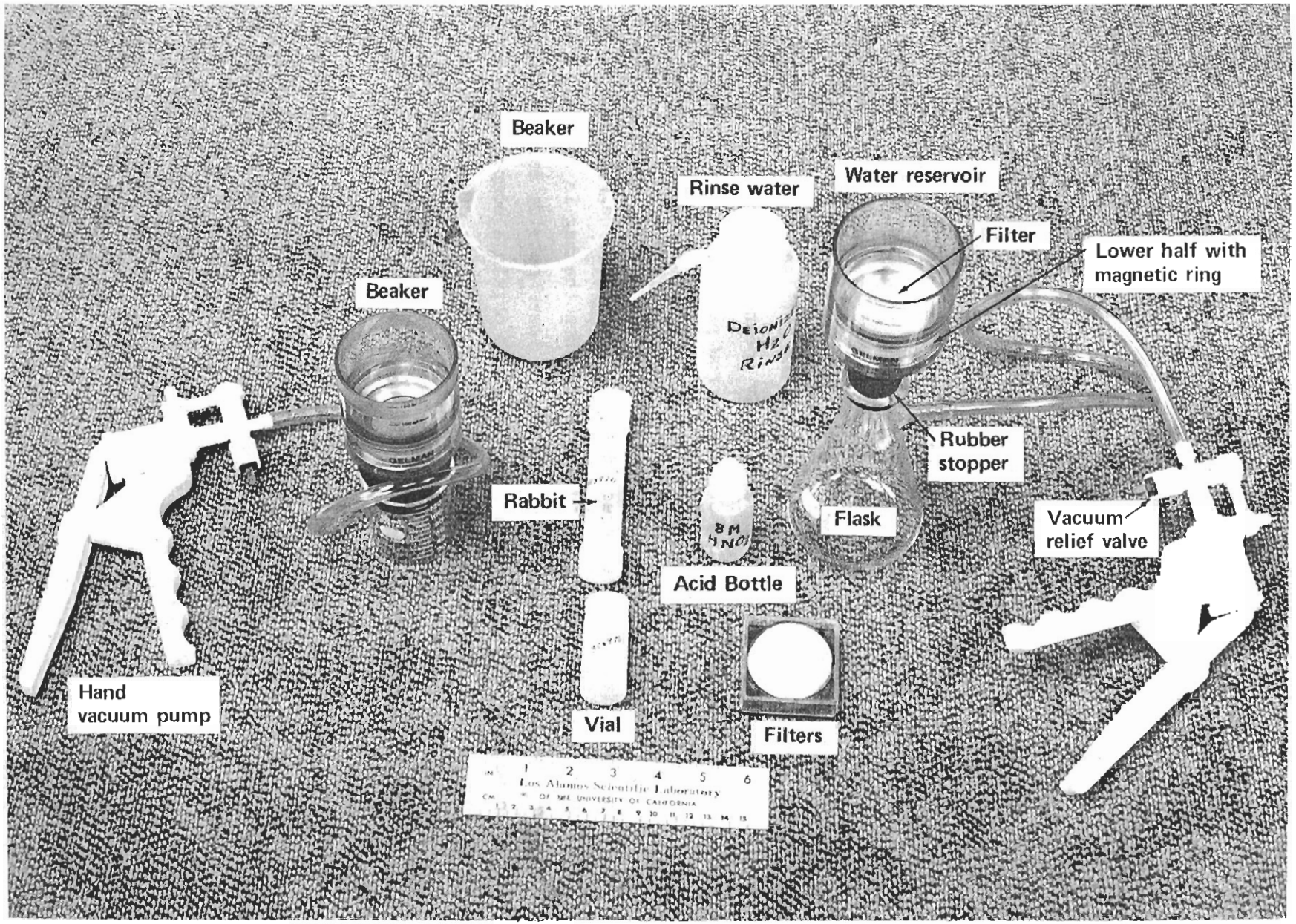

Fig. 4. Vacuum filtration assembly.

Take care when handling the 8M acid because it can burn the skin if it is not promptly washed off and it is extremely hazardous to the eyes. If acid spills or leaks onto the equipment, remove it by repeatedly flushing the equipment with water, being careful not to wet the inside electronics. Carry the acid dropper-bottles in securely wrapped plastic bags or in wide-mouthed, screw-top bottles to prevent damage in case the dropper top comes loose, and pack them away from the instruments to reduce the possibility of damage.

C. Sediment Collection and Treatment

The equipment and materials for collecting wet or dry sediment are shown in Fig. 5.

1. Wet Sediment. Collect the composite sediment sample (after the water samples have been taken) with the polyethylene scoop, which is rinsed first in the source water to remove any residue from previous samples. After scooping the sediment from the bottom, tilt the scoop to drain off excess water from the sample, and remove coarse gravel and pebbles by hand.

Place the fine, drained residue in a newly opened, polyethylene sample bag. Open the sample bag by tearing off the narrow perforated top, and spread the bag by pulling the two tabs on its top edge. Write the location number on the bag with a permanent-ink flow pen before adding the sediment sample. Near the top of the bag, place a prenumbered adhesive label from the appropriate data form (this label will be rolled out of sight when the bag is sealed). Place another label from the same data form on the lower outside half of the bag so it can be seen when the top is rolled up. To obtain a composite sample, include in each bag at least three separate scoopfuls of equal size. When the bag contains a sufficient quantity of composite sediment, drain off any excess water. Seal the bag by rolling the top down and twisting the yellow seal strip ends together.

At springs, the three locations at which the composite sediment sample is to be taken should be close to the water source or within a few meters of it. If a spring or seep covers a large area having no well-defined source point, space the three samplings evenly over the source area.

At stream sites, collect the sediment from the stream bottom at three locations as close as possible to a fast-moving part of the stream. At sites where the fast-moving current may preclude the collection of organic material, one or two of the three portions may be collected in slower flowing water that

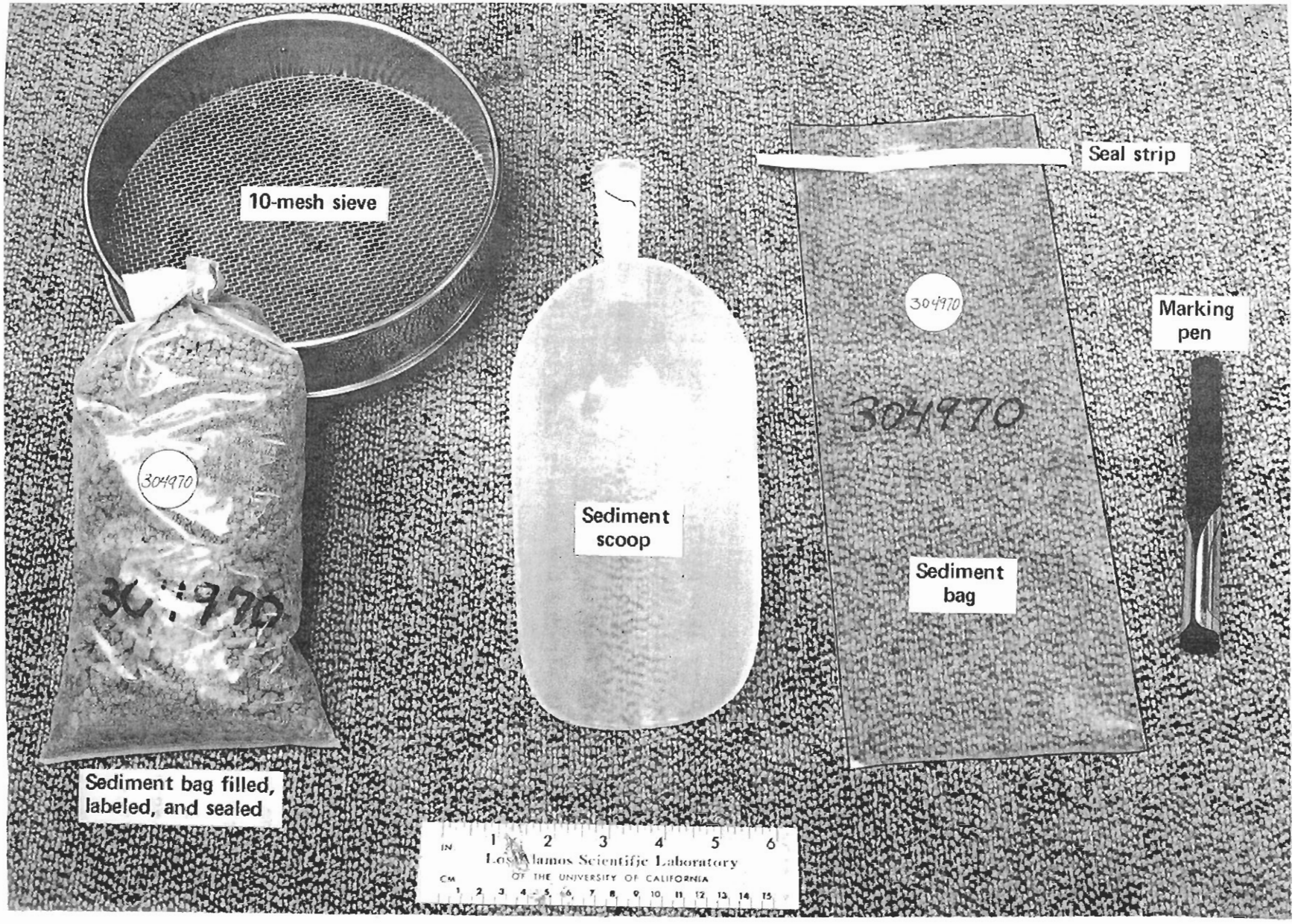

Fig. 5. Collecting equipment for wet or dry sediment.

includes organic material. Mud-bars in midstream and deposits on the inside of meander curves are commonly good sources of fine organic sediment, but take all samples from below the water level. In streams containing little sediment, it may be necessary to sample the fine material deposited underwater between and beneath cobbles.

Take the sample from as far offshore as possible to avoid contamination. Collect the wet bottom sediment in shallow water from three locations several meters apart, avoiding areas that have been disturbed. Include organic sediment in the sample whenever possible.

2. Dry Sediment. If the sediment to be sampled is dry, take extra care to avoid windblown material (remove it by scraping it away with the scoop). Very hard, dry sediment can be broken with a pick or shovel, but be careful to sample only that portion which has not been in contact with the tools. Break up any lumps before putting the sample into the bag. Seal and label the bag as described in Sec. III.C.1.

3. Drying and Sieving. Sediment samples are most conveniently processed at one central location--a laboratory, an available building, or a trailer. Dry all sediment samples thoroughly by placing them on new paper plates, clean porcelain dishes, or some other tray (previously determined to be acceptable to the LASL) and heating them at 100°C, or less, until dry. Sometimes it is convenient to partially air-dry the samples first, but be sure they do not become contaminated, spilled, or fractionated by the wind. The sample location numbers must stay with the samples throughout the drying process (usually they can be written on the drying plates).

After each sample is dry, break up the lumps without grinding the sample (the LASL will supply a mortar and pestle on request) and sieve to -100 mesh through stainless steel sieves (supplied by the LASL). Then place the -100 mesh fraction in a properly labeled 25-mℓ vial for shipment (vials less than three-fourths full of the -100 mesh material will be assessed a penalty). If, after a sample has been sieved, more than 25-mℓ (one full vial) of -100-mesh material is present, split the sieved material using the standard mixing and quartering technique described in the next paragraph, and then place the split(s) in the sample vial.

The standard method of mixing and quartering involves taking all of the -100-mesh fraction obtained, piling it up on a large, clean, impermeable paper

(a sheet of clean plastic will also work), spreading it out evenly in a large flat circle, and dividing it into quarters. Place one quarter in the sample vial. If the vial is not filled by this quarter, recombine the remaining three quarters (pile them up), spread the pile out, and quarter it again. Then place one of these quarters in the sample vial with the first. If the vial is still not full, repeat the procedure until the vial is full (25 mℓ).

After each sample has been processed, clean or discard the drying plates, clean the mortar and pestle (if used) and all sieves and pans, and throw away the paper or plastic sheets so that there will be no cross contamination. Paper plates can be used for drying only once, then must be discarded.

Discard the remaining coarse sediment (larger than 100 mesh) after each sample has been processed. Unless the LASL specifically requests otherwise, the contractor, his personnel, or others must not retain any portion of any sediment sample for any reason whatsoever.

D. Conductivity Measurement

The conductivity meter illustrated in Fig. 6 is easy to use. The most important concern is avoidance of contamination of the water sample. Just before each measurement rinse the meter cup with sample water to remove dust, dirt, or extraneous moisture. Do NOT immerse the meter to fill or rinse the meter cup!

1. Instrument Check. At the beginning of each day, check the instrument batteries by pressing the READ button and observing the glow-lamp visible through the small hole in the lower right corner of the meter face. If the lamp fails to glow when the button is pressed, replace the batteries in pairs, using regular 9-V transistor batteries (NEDA 1604, Eveready No. 216, Burgess 206, Mallory MI604, or equivalent). Do NOT use mercury or alkaline batteries.

Normally, the instrument will not need recalibration; however, if it is dropped or is suspected of giving erroneous readings, check it by taking comparison readings with another meter, using water from the same source. If the comparison readings differ by more than 10%, recalibrate the meter by filling the meter cup with fresh 0.01M KCl solution. Then adjust the calibration control (under the snap-out cap on the base plate) until the meter reads 1412 μmho/cm. If the meter still gives improper readings, return it to the LASL.

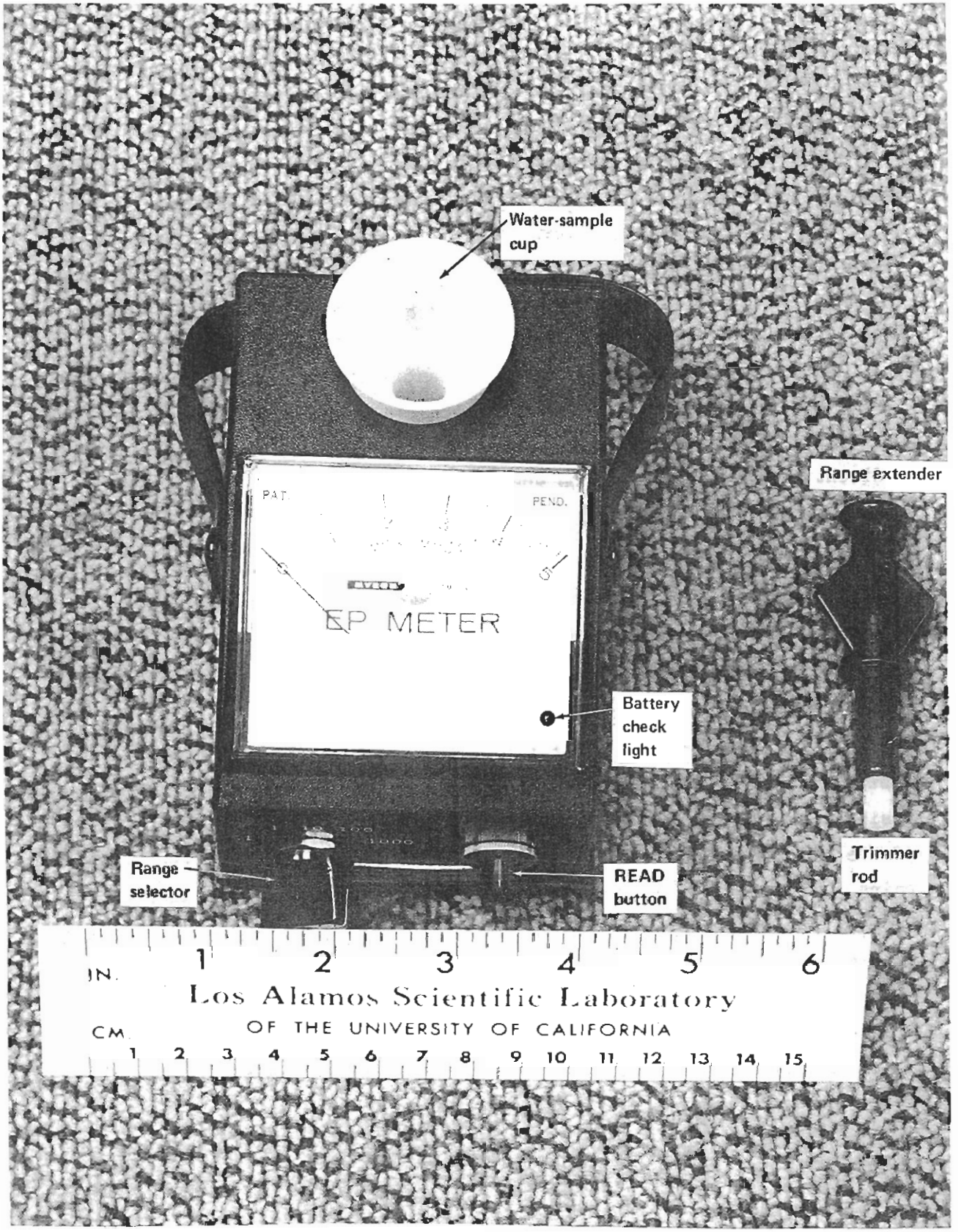

Fig. 6. Myron L conductivity meter with range-extender.

2. Reading the Instrument. To measure the conductivity of a water sample, first rinse the built-in white plastic cup three times with sample water. Then fill the cup with the sample water and press the READ button on the front of the meter. The meter needle will indicate the specific conductance in μmho/cm, corrected automatically to a reference temperature of 25°C. Set the RANGE selector switch to give the highest "on scale" reading; for example, if the needle points to 4.2, and the RANGE selector is set on 100, the specific conductance is 4.2 x 100 = 420, and 420 is recorded (right-justified) on the data form. If the needle points to less than 0.50, turn the RANGE selector to the next lower range. If the needle goes off-scale when the RANGE selector is set to 1000, use the range extender.

3. Range Extender. The range extender, see Fig. 6, is a small, plastic accessory that is inserted into the sample cup to increase the scale range by a factor of 10 (to a maximum of 50 000 μmho/cm). It is used whenever the reading is off-scale on the 1000 range (more than 5000 μmho/cm).

Thoroughly rinse the range extender with sample water, then insert it into the cup, pressing until the O-ring is firmly seated. Fill the cup with fresh sample water and read the meter in the normal manner, but multiply that reading by 10. For example, if the needle points to 2.75, with the RANGE selector switch on 1000 and the 10X range extender plugged in, the conductance is 2.75 x 1000 x 10 = 27 500 μmhos/cm. Samples of most natural waters can be measured without the range extender and when not in use it should be kept clean and wrapped in the carrying case. The range extender for each instrument is calibrated to that particular instrument, and they should always be kept together. If a range extender other than the one matched with a given instrument must be used, recalibrate the instrument and the substitute extender using the 0.01M KCl solution. Recalibrate the range extender by moving the white plug (trimmer rod) on the end of the extender in to lower the reading and out to increase the reading.

E. pH Measurement

When the pH of water is measured, the water should be as close to its natural (uncontaminated) condition as is reasonable. If sampling stream or pond water, try to measure its pH directly in the water at the site. If sampling well water, measure its pH in the large, plastic collection beaker.

For the pH measurement of most well samples, two water temperature measurements are necessary. Take the first in the source water and record it

on the field data form. For flowing wells, make this first measurement with the thermometer immersed in the water from the discharge pipe. If the discharge pipe is in sunlight or passes through a building, run the pump long enough for the discharge temperature to equilibrate with the well temperature. When measuring the pH of the sample water in a beaker, make another temperature reading in the beaker itself to adjust the pH meter TEMPERATURE control (this second water temperature is not recorded on the field data form).

The pH electrode is extremely fragile and must be handled carefully. The glass bulb on the electrode's tip is porous and must always be kept moist. Always adjust the meter TEMPERATURE compensation control to the temperature of the water being measured. Each morning check the pH-meter batteries and calibrate the instrument. Never turn the meter ON when the electrode is not in the buffer solution or the water sample.

1. KERNCO pH Meter. To check the batteries on this instrument (Fig. 7), plug the electrode cable into the jack located on the front panel of the meter and slide the BATTERY CHECK switch to the right. The meter needle should lie in, or to the right of, the colored band on the dial. If it does not, replace the batteries and check again. If the meter is bad, return it to the LASL.

To calibrate the KERNCO meter, remove the protective wetting cap from the electrode tip and immerse the electrode in pH 6.86 buffer solution. Turn the meter ON and adjust the CALIBRATE knob until the needle is on pH 6.86. Rinse the electrode in deionized water and gently shake it to remove excess water. Immerse the electrode in the 4.01 pH buffer and adjust the TEMPERATURE knob until the needle is on 4.01. If in calibration, the instrument is ready to use. Turn the meter OFF, rinse the electrode in deionized water, leaving it wet, and replace the protective wetting cap.

Each day, recalibrate the meter every 2 or 3 hours or whenever the CALIBRATE knob is moved or a reading is abnormally high or low. NOTE: Before taking a reading, always adjust the TEMPERATURE knob to the measured temperature of the water being tested. To keep the buffer solution clean, rinse the electrode with deionized water before each calibration. Replace the buffer solution at least every 2 weeks.

2. CORNING pH Meter. Check the battery for this instrument (Fig. 8), by turning the switch to ON and the CALIBRATE knob fully clockwise. The needle should swing to the blue section on the meter. If it does not, replace

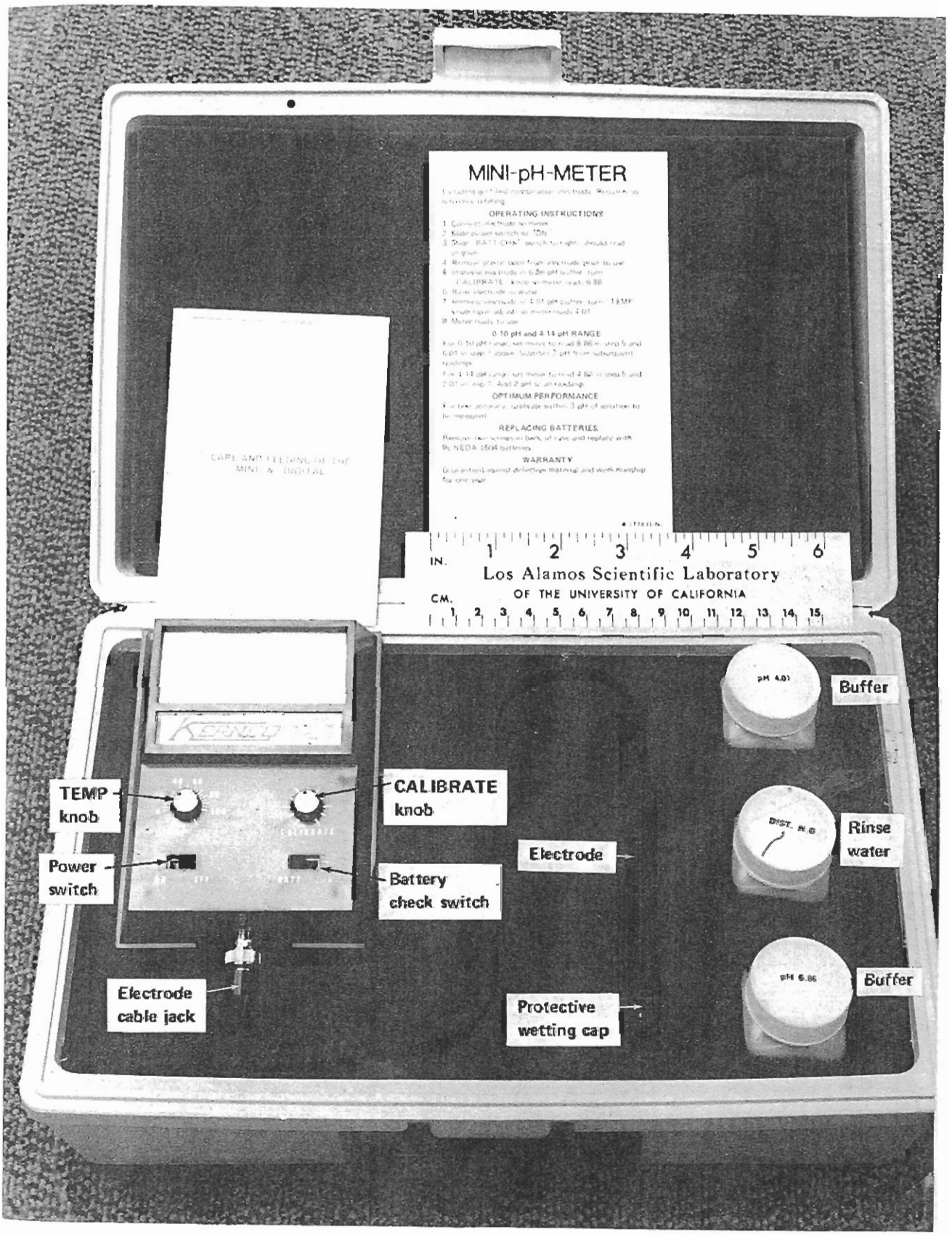

Fig. 7. Kernco pH meter and case.

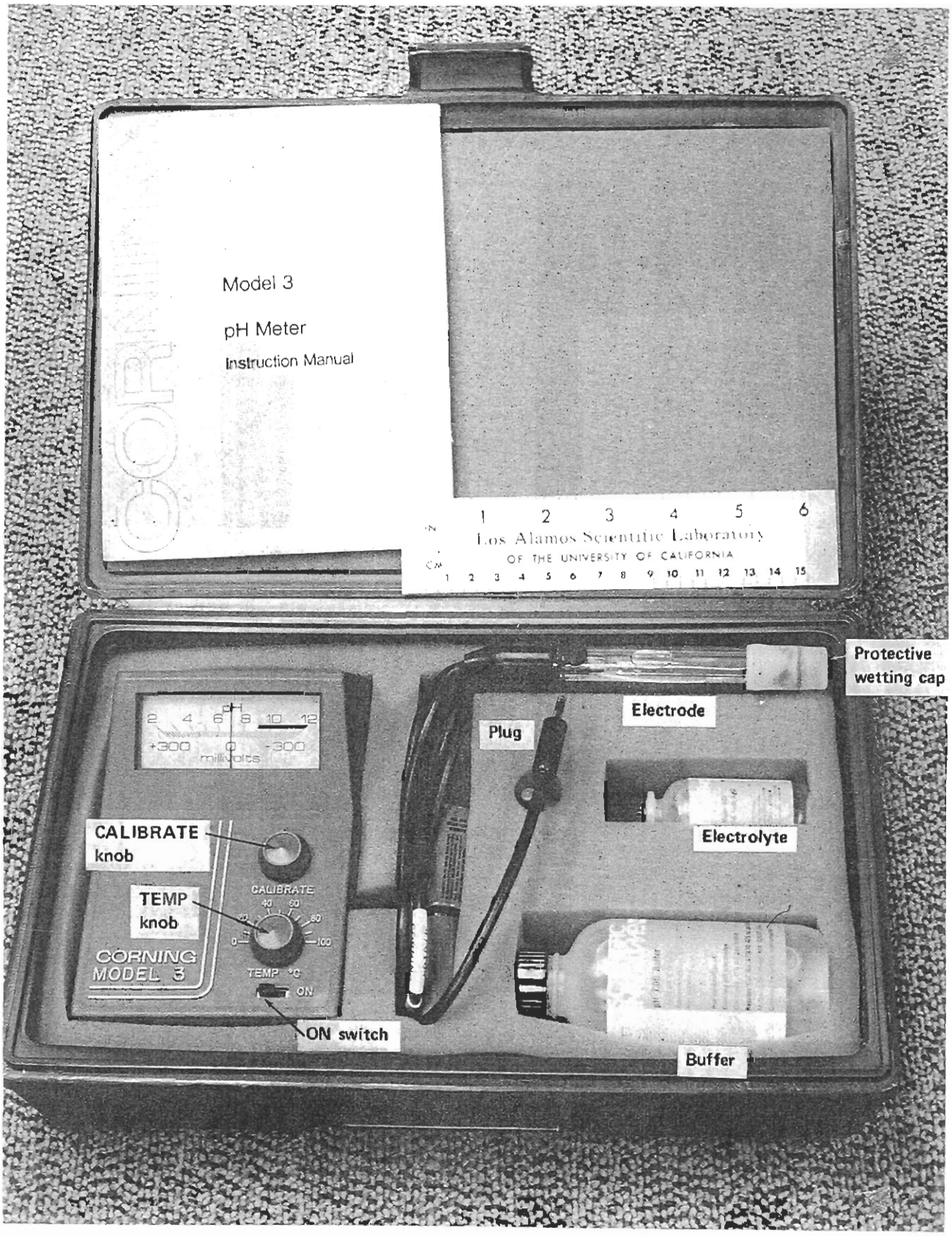

Fig. 8. Corning Model 3 pH meter and case.

both of the 9-V batteries and retest. If the needle still fails to reach the blue section, return the meter to the LASL. To calibrate the meter, plug the electrode cable into the right side of the meter, remove the protective wetting cap from the tip of the electrode, and lower it into the bottle of pH 7.0 buffer solution. With the TEMPERATURE knob set to the temperature of the buffer solution, turn the meter ON and turn the CALIBRATE knob so that the meter needle is exactly on pH 7.0. This calibration should be repeated several times daily. The CALIBRATE knob can be taped down to prevent unintentional movement, but then check to see that the meter still indicates a pH of 7.0 in the buffer solution. Turn the instrument OFF. Then rinse the electrode with deionized water, leaving the tip wet, and replace the protective wetting cap.

If the pH measurement is made directly in source water, simply turn the TEMPERATURE knob to the water temperature. Remove the cap from the electrode tip and rinse the electrode thoroughly by carefully swirling it in the sample water. Turn the meter ON, wait for the needle to stabilize (about 1 min), then read the pH directly. After reading the pH, turn the meter OFF and rinse the electrode with deionized water before covering it with the wetting cap.

If the pH measurement is made in a beaker of sample water, uncap the electrode, rinse it with deionized water, and remove any excess rinse water by gently shaking the electrode. Measure the temperature of the beaker water just before making the pH reading so that the TEMPERATURE knob can be properly set. Then immerse the electrode in the water and swirl it to wet the tip completely. Turn the meter ON and read the pH of the sample directly from the meter. After taking the reading, turn the meter OFF, rinse the electrode with deionized water, and put the wetting cap back on the tip.

F. Scintillometer Measurements

The scintillometer is used to measure the local gamma-ray activity at each sample site. The procedure for scintillimeter measurements requires two different readings. The first is made with the shield in place under the front of the detector, thereby blocking radiation from ground sources. The second reading, made with the shield retracted, measures all gamma rays passing through the detector. Together, the two readings allow calculation of the actual ground radioactivity at the spot.

1. Measurement Procedure. Place the scintillometer on a nearly horizontal, dry surface close to the sample site. Brush away loose debris

such as pebbles, twigs and leaves, or snow before taking the readings. If the sample site is at the bottom of a deep narrow canyon, place the scintillometer as far as possible from the canyon walls. In general, the scintillometer readings should be taken within 10 m (30 ft) of the sample site.

Before taking any readings, enter in column 49 of the field data form the single-character I.D. letter painted in red on the side or front of each scintillometer. Next, move the shield on the bottom of the instrument forward or inward to the SHIELD-IN position. Turn the RANGE or METER SCALE MULTIPLIER switch to the lowest range that gives an on-scale reading on the meter dial. Then read the meter in counts per second (CPS). If the meter needle fluctuates, take the average of the high and low values. Multiply the observed reading by the number on which the METER SCALE MULTIPLIER is set for the particular type of instrument as described in Sec. III.F.2.

After recording the SHIELD-IN reading, move the shield all the way back without moving the scintillometer; then make and record the SHIELD-OUT reading. If the instrument is moved accidentally between readings, repeat the SHIELD-IN reading.

2. Correct Reading of the Scintillometer. If a MOUNT SOPRIS unit is being used, correct reading is straightforward because the dial face has only a single scale (Fig. 9). Simply read the value to which the needle points (or the average value if the needle fluctuates) and multiply it by the number on which the METER SCALE MULTIPLIER is set. For example, if the meter reading is 60 and the METER SCALE MULTIPLIER switch is on 2, the measurement to be recorded on the data form is 120 CPS (60 x 2). Always turn the meter OFF after taking readings.

The calibration of Mount Sopris units should be checked at each sample site before use. The instrument must be on the ground in its normal operating position when the calibration check is made. Turn the right-hand OFF-CAL-TIME-CONSTANT switch to CAL and see whether the meter needle coincides with the CAL line (the 80 mark) on the dial. If the needle does not point to the CAL line, slowly adjust the CALIBRATE knob until it does. After checking the calibration, turn the OFF-CAL-TIME-CONSTANT switch to the "1" TIME CONSTANT position for general use. If the meter needle ever fluctuates too rapidly for accurate reading, turn the TIME CONSTANT switch to the next higher setting.

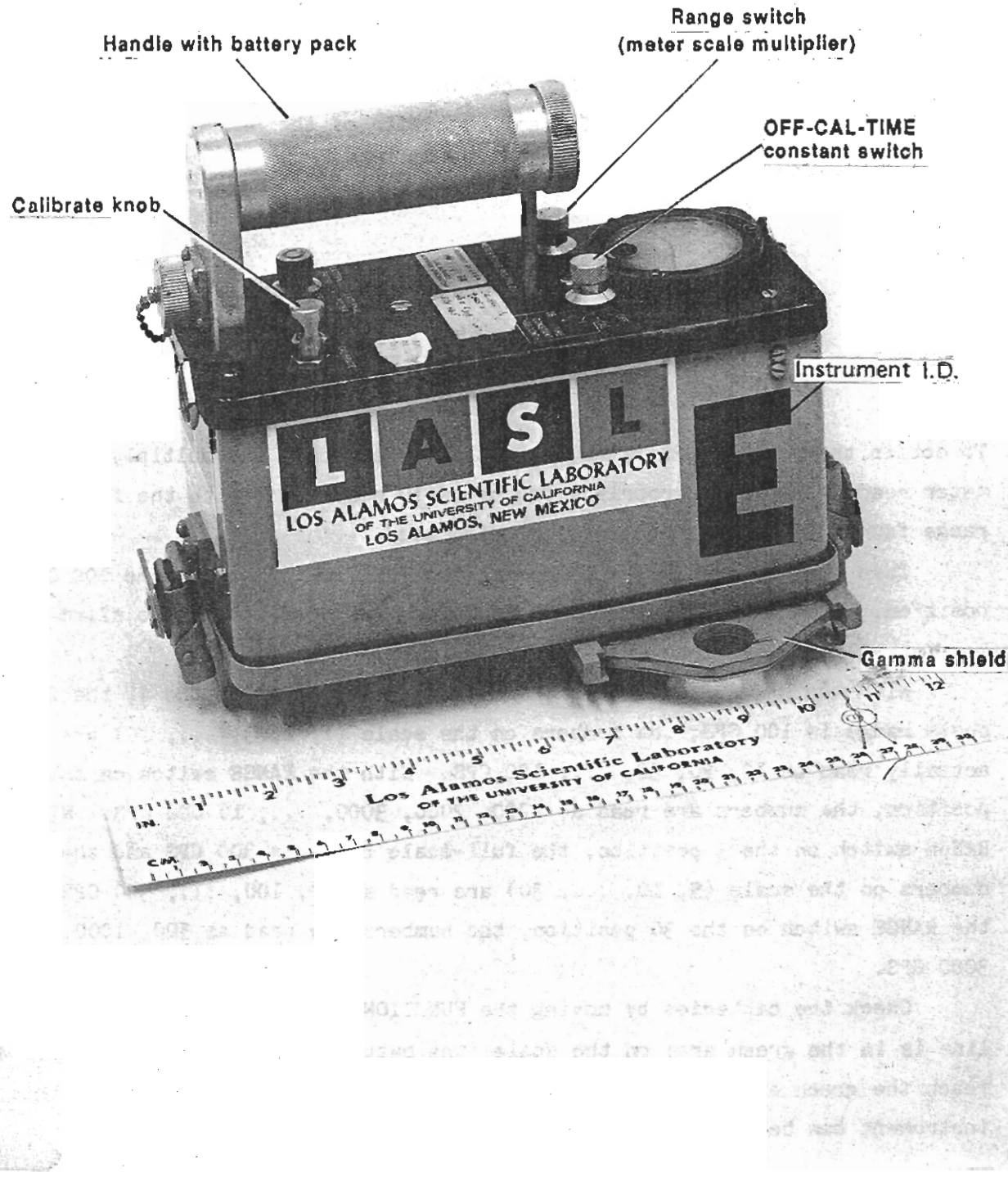

Fig. 9. Mount Sopris scintillometer.

The EXPLORANIUM scintillometer (Fig. 10) requires more care to give a correct reading because of the dual scales (0-10 on the outside of the dial and 0-30 on the inside) and because all the values on the RANGE switch must be multiplied by 100 to obtain the full-scale value for any particular RANGE setting. Use of the dual scale is simple enough if one remembers to read the inner scale (0-30) only when the RANGE switch is set on a value that incorporates a three (3 or 30) and to read the outer scale (0-10) only when the RANGE switch is set at a value that incorporates a one (1, 10, or 100).

The full-scale readings for each position of the RANGE switch are:

RANGE Switch Position	Full-Scale Reading (CPS)
1F	100
1	100
3	300
10	1 000
30	3 000
100	10 000

To obtain the correct CPS value, read the proper scale and multiply the actual meter reading by the appropriate factor of 10 consistent with the full-scale range for the RANGE switch position being used.

Turn the Exploranium ON by moving the FUNCTION switch to the 100 ON position. If the 75, 50, and 25 ON positions are used, the audio alarm may buzz at values lower than full-range.

With the RANGE switch on the 1F (fast) position or on the 1, the full scale range is 100 CPS; the numbers on the scale (1, 2, 3, ..., 10) are actually read as 10, 20, 30, ..., 100 CPS. With the RANGE switch on the 100 position, the numbers are read as 1000, 2000, 3000, ..., 10 000 CPS. With the RANGE switch on the 3 position, the full-scale range is 300 CPS and the numbers on the scale (5, 10, ..., 30) are read as 50, 100, ..., 300 CPS. With the RANGE switch on the 30 position, the numbers are read as 500, 1000, ..., 3000 CPS.

Check the batteries by moving the FUNCTION switch to BAT. If the needle line is in the green area on the scale, the batteries are good; if it does not reach the green area, replace the batteries. No calibration checks of this instrument can be done in the field.

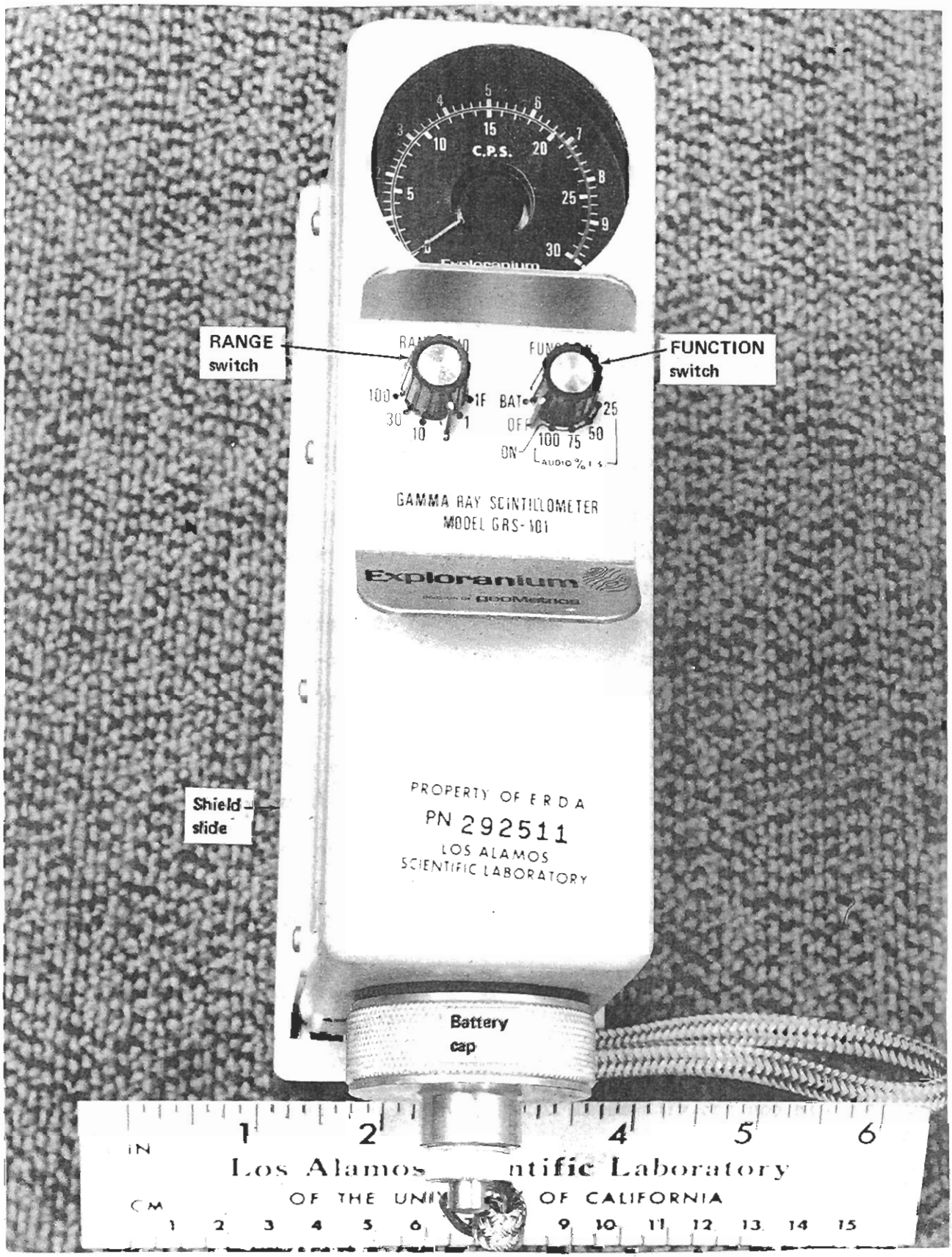

Fig. 10. Exploranium scintillometer.

G. Data Form Completion

Before leaving the sample location, fill in the site description on the data form according to the standard coding instructions provided in the Appendix. Make a final check to be sure that the correct sample location number LABELS are firmly affixed to the side and top of each vial and to the sediment sample bag. In addition, be certain that the location number has been written on the sediment bag with a permanent-ink flow pen.

H. Cleanup and Storage

Dry the water-filter apparatus and all other gear with clean towels and place them in the field kit. Be sure to remove carefully any soil or other debris adhering to the equipment.

IV. COLD WEATHER PROCEDURE

The main difference between the normal sampling procedure (always preferable if possible) and the cold-weather procedure is that in the cold-weather procedure the filtering and acidification of the water and the conductivity and pH measurements are performed at a sheltered location (a vehicle will do) away from the sample site. The cold-weather procedures are to be used only during periods of extreme cold weather.

Take to the sample location the scintillometer, two thermometers, a large polyethylene beaker or bottle, a polyethylene scoop, and a sediment bag (premarked with the sample location number) and data form.

(1) Hang one thermometer in the shade and place the second one in the source water.

(2) Take and record the scintillometer readings as described in Sec. III.F.

(3) Rinse the large beaker or bottle with uncontaminated source water three times, then fill it.

(4) Fill the sediment bag as described in Sec. III.C. If you must break through ice, be careful not to sample material that has been in contact with metal tools.

(5) Read and record water and air temperatures.

(6) Fill in site data on the field form.

(7) Return to the shelter with equipment and samples.

(8) At the shelter, rinse the conductivity meter cup twice with sample water. Measure and record the conductivity as described in Sec. III.D. Rinse the meter cup with deionized water.

(9) Filter and acidify two vials of sample water as described in Secs. III.B.2 and 3.

(10) Measure the temperature of the remaining water.

(11) Adjust TEMPERATURE setting on pH meter to the temperature of the water (do NOT record this temperature on the data form; it is for calibration purposes only).

(12) Measure and record the pH of the remaining sample water as described in Sec. III.E (be sure to rinse the probe with deionized water before storing it).

(13) Rinse the large beaker or bottle with deionized water and clean up all other equipment for storage.

V. SAMPLE SHIPMENT

The samples, data forms (minus the last page), and sample inventory sheets (Fig. 11) are to be shipped <u>together in unbroken numerical sequence, in blocks of 100, at 2-week intervals or oftener</u>, to:

Shipping, Receiving, and Warehousing
Group SP-4, MS 274
University of California
Los Alamos Scientific Laboratory
Los Alamos, New Mexico 87545

Attn: HSSR PROGRAM, Group G-5
Ref: Contract No. _____

Use the special LASL-furnished shipping labels and the cardboard shipping boxes or shock- and temperature-insulated shipping containers (Fig. 12) for all such shipments.

The contractor is to complete a sample inventory sheet for each block of 100 samples. All indicated information (contract number, map name and number, sample sequence, last four digits of the sample location number, and the total number of water vials, sediment vials, water rabbits, and data forms shipped) shall be provided by the contractor and is to accompany each shipping container, along with the pertinent data forms (minus the orange, rearmost copy which is retained by the contractor as a receipt and turned over to the LASL only upon payment in full for the contract work).

CONTRACT AREA CONTRACT NO. SAMPLE SEQUENCE

LOCATION NUMBER	WATER		SED.	DATA FORM	COMMENTS	LOCATION NUMBER	WATER		SED.	DATA FORM	COMMENTS
	VIAL	RAB.	VIAL				VIAL	RAB.	VIAL		
01						51					
02						52					
03						53					
04						54					
05						55					
06						56					
07						57					
08						58					
09						59					
10						60					
11						61					
12						62					
13						63					
14						64					
15						65					
16						66					
17						67					
18						68					
19						69					
20						70					
21						71					
22						72					
23						73					
24						74					
25						75					
26						76					
27						77					
28						78					
29						79					
30						80					
31						81					
32						82					
33						83					
34						84					
35						85					
36						86					
37						87					
38						88					
39						89					
40						90					
41						91					
42						92					
43						93					
44						94					
45						95					
46						96					
47						97					
48						98					
49						99					
50						100					
TOTAL						TOTAL					

Fig. 11. Sample inventory sheet.

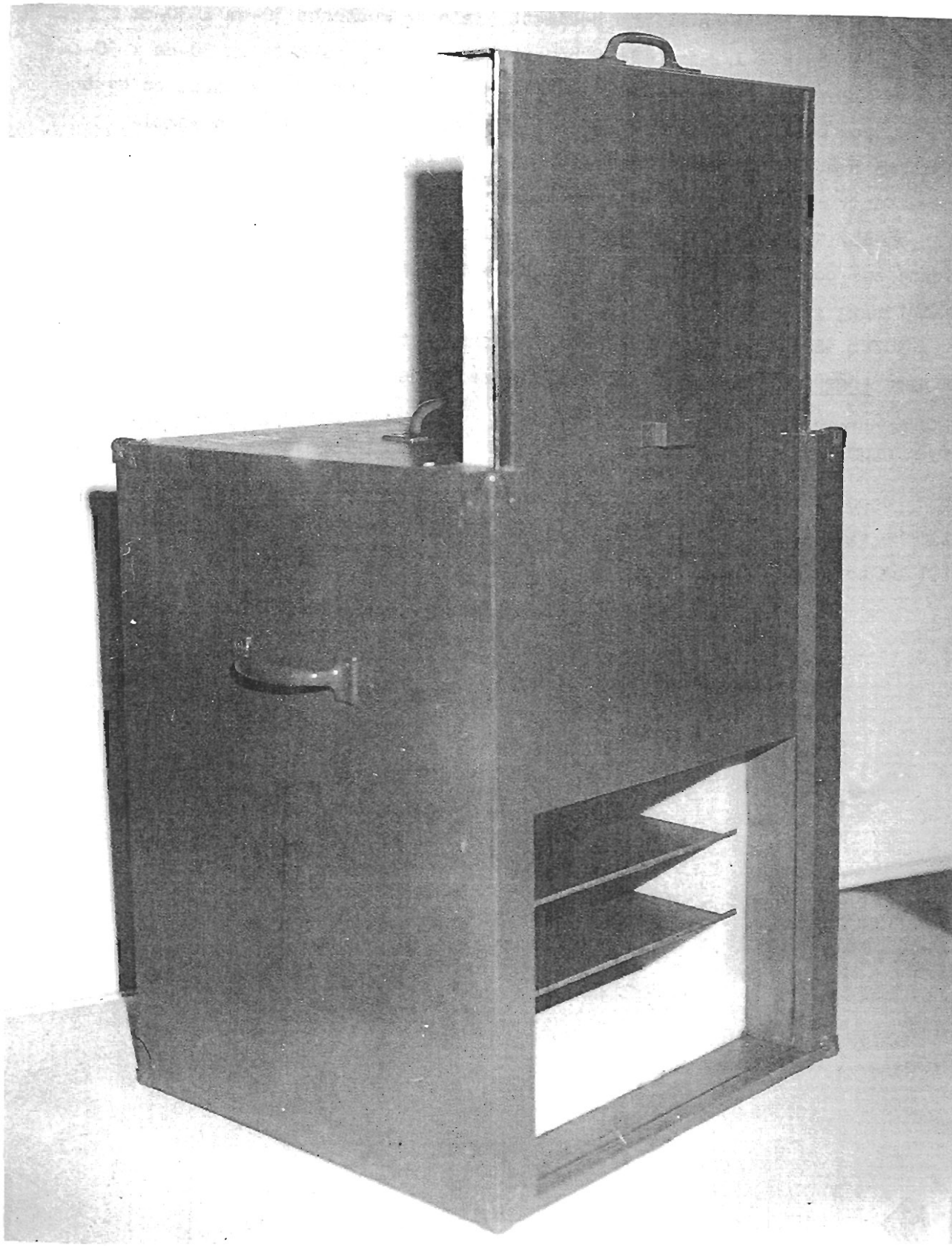

Fig. 12. LASL shipping container for HSSR samples.

Place the 25-mℓ water and sediment vials in separate 30-cm x 30-cm x 5-cm (12-in x 12-in x 2 1/2-in) flats and the 41-mℓ water rabbits in 30-cm x 30-cm x 10-cm (12-in x 12-in x 5-in) flats, both types of which are supplied by the LASL. Each of the 100 positions in a flat represents a specific sample location number (according to the location's last three digits, 001 to 100). The water vial, sediment vial, and water rabbit for a given sample location will occupy the same relative position in their respective flats. Leave vacant any position for which a sample vessel is missing. The proper sample positioning is shown in Fig. 13.

NOTE: Sediment samples and water samples from the same location must be shipped together unless the LASL authorizes otherwise.

VI. CONTRACTOR EVALUATION

Upon completion of each contract, a Contractor Evaluation Form (Fig. 14) will be filled out by the LASL contract monitor. The information on this form will be provided to the contractor.

SEDIMENT VIALS
26 and 82
MISSING

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25		27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81		83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

SEDIMENT VIAL FLAT

WATER VIALS
32, 46,82 and 90
MISSING

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31		33	34	35	36	37	38	39	40
41	42	43	44	45		47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81		83	84	85	86	87	88	89	
91	92	93	94	95	96	97	98	99	100

WATER VIAL FLAT

RABBITS
32, 46,82 and 90
MISSING

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31		33	34	35	36	37	38	39	40
41	42	43	44	45		47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81		83	84	85	86	87	88	89	
91	92	93	94	95	96	97	98	99	100

WATER RABBIT FLAT

EMPTY

Fig. 13. Diagram of proper sample-positioning sequence.

CONTRACTOR EVALUATION FORM

CONTRACTOR_____ CONTRACT NUMBER_____

To be filled out by the Group G-5 Technical Advisor in charge upon completion of each commercial HSSR field sampling contract.

Completed copies are to be provided the contractor involved, the Contracting Officer in Group SP-DO, and Group G-5.

1. Overall evaluation of contractor's performance (circle one): (a) Excellent (b) Above average (c) Average (d) Below average (e) Unsatisfactory
2. Number of sample locations specified in contract area _____
3. Number and percentage of specified locations sampled _____
4. Number and percentage of locations from which one or more samples were rejected due to incomplete, missing, or ambiguous data _____
5. Percentage of latitudes and longitudes incorrect or missing on data forms _____
6. Percentage of locations with missing or incorrect measurements on data forms _____
7. Percentage of locations with missing or incorrect site information on data forms _____
8. Percentage of sediment samples having less than 20 ml of -100-mesh material (i.e., more than 5 ml below desired amount) _____
9. Were samples properly taken, processed, and labeled? Yes___ No___
10. Were maps clearly and properly (unambiguously) marked with sample location numbers? Yes___ No___
11. Did the contractor and his personnel show continued and adequate effort in recalibrating field instruments? Yes___ No___
12. Were samples, data forms, and location maps delivered to the University in a timely and orderly fashion? Yes___ No___
13. Did contractor complete work on schedule? Yes___ No___
14. Was field equipment properly used and maintained? Yes___ No___
15. Was field equipment kept and returned in a clean and well-cared-for condition? Yes___ No___
16. Was work performed in a conscientious, professional, and systematic manner? Yes___ No___
17. Were field personnel all properly trained? Yes___ No___
18. Did contractor obtain, utilize, and return DOE identification cards as required by the University? Yes___ No___

Comments or explanatory remarks. Any overall performance below average, as well as any negatively rated items of performance must be explained. Use and attach extra sheets as necessary.

By_____, Evaluator
Date_____

Fig. 14. Contractor evaluation form.

FIELD PROCEDURES

FOR

THE URANIUM HYDROGEOCHEMICAL AND STREAM SEDIMENT RECONNAISSANCE

AS USED BY

THE LOS ALAMOS SCIENTIFIC LABORATORY

PART II

ALASKAN SAMPLING PROCEDURES

PART II

ALASKAN SAMPLING PROCEDURES

INTRODUCTION

Most field-sampling operations in Alaska require aircraft support. For this reason, the procedures and equipment must be efficient and simple so that the time spent at each location is as short as possible.

In the mountainous areas where lakes (the normal sample sites) are scarce, most field equipment and procedures for stream sampling, described in Part I of this manual, should be used. However, a Horiba water checker (discussed below) may be used for taking the stream-water chemistry measurements.

I. PREPARATIONS PRIOR TO LEAVING FOR THE FIELD

The contractor is responsible for providing the required helicopter support. One to three pontoon-equipped helicopters normally are required for lake sampling, and essentially all other sampling work is also to be done with helicopter support.

Fixed-wing aircraft support is necessary for ferrying fuel and supplies to base camps and fuel caches because much of the state is remote. Fixed-wing support is also required for the removal of all empty fuel drums from base camps and fuel caches after completion of field sampling. All fuel drums used must be labeled clearly with the contractor's name, address, and year of contract work. The economical range for sampling by helicopter is 240 km (150 mi), or less, and camps should be located accordingly.

The actual sampling rate depends upon the type of helicopter and the planning and efficiency of the individual contractor. Previous LASL experience with lake-sampling work in Alaska has shown that an average sampling rate of 10 to 20 samples per hour of helicopter $\frac{\text{flying time}}{}$ is possible when the sampling density is one location per 23 km^2 (9 mi^2). Stream sampling may or may not take longer than lake sampling, depending upon the terrain and the method of delivering the field people to each site (e.g., whether a leap-frogging technique can be used). Careful planning, aimed at sampling both branches of confluences and sampling tributaries systematically along the bases of hills, for example, can do much to increase the rate of stream sampling.

A. Equipment

In general, the LASL furnishes all equipment required for making the specified measurements and all materials that will touch the samples. "Fair wear" will be allowed, and required repairs for fair wear will be provided by the LASL. However, all nonexpendable items are the responsibility of the contractor, and upon completion of the survey are to be returned to the LASL clean and in good operating condition.

In addition to those listed in Part I, Sec. I.A., the following equipment and materials will be supplied:

· At least three water-sampling extension handles (Fig. 15) and three lake-sediment samplers (Fig. 16) for each active sampling aircraft.

· One Martek Mark V water analyzer and probe (Fig. 17) and one Horiba water checker and probe (Fig. 18) for each active sampling aircraft, for measuring temperature, conductivity, pH, and dissolved oxygen. Dissolved oxygen is to be determined as a special field measurement, and its value is to be inserted in the SPECIAL FIELD MEASUREMENTS box on the data forms, adding an S in column 40.

· One field-sampling kit (Fig. 19) for each active sampling aircraft, similar to but more compact than the kit described in Part I, with spare batteries and components for taking temperature, pH, scintillometer, and conductivity measurements when collecting stream-water and stream-sediment samples. Although a Horiba water checker will normally be used for these water measurements, the field kit will provide backup capability should the Horiba malfunction while in the field.

· Sufficient prewashed 25-mℓ vials and 41-mℓ reactor rabbits (both polyethylene) for use as sample containers. Place the dried and sieved sediment into properly labeled 25-mℓ vials before shipping them to the LASL.

· Acid (16M reagent-grade HNO_3 that must be cut to 8M) for sample acidification. See Part I, Sec. I.C. for 8M acid preparation.

· Sufficient 13- by 35-cm, polyethylene twist-top sediment sample bags, each with a presealed and perforated mouth, for use in field collection.

· Sufficient stainless steel sieves in 10- and 100-mesh sizes for sieving the sediment samples. Use ONLY the LASL-furnished stainless steel sieves for sieving sediment samples.

· Sufficient shipping labels and cardboard boxes or shock- and temperature-insulated sample shipping containers (Fig. 12).

B. Work Schedule, Inspection, and Training

To the extent that weather permits, sampling is to be done on a continuous day-by-day basis from beginning to end. All aspects of the contractor's field

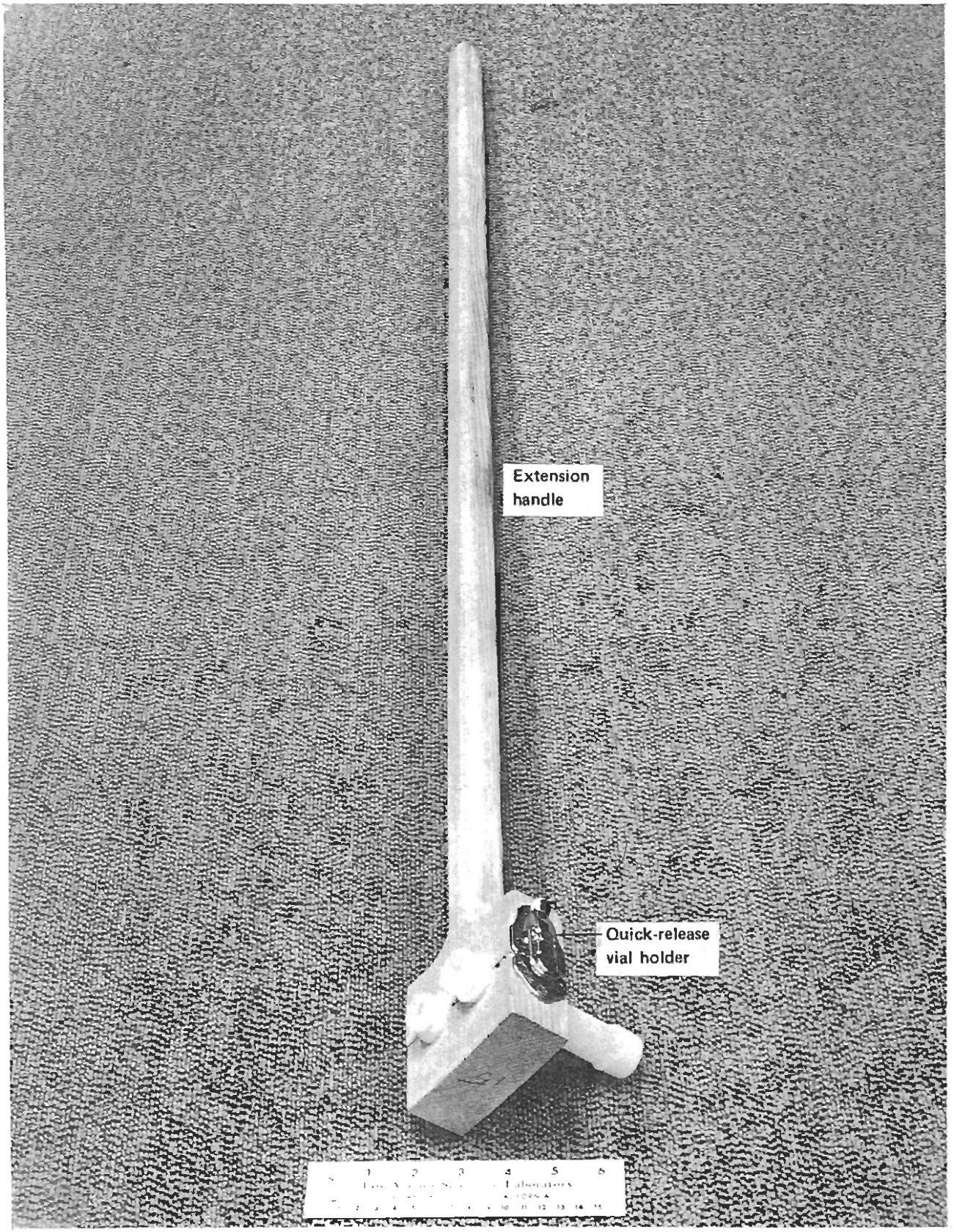

Fig. 15. Water-sampling extension handle for use in Alaska.

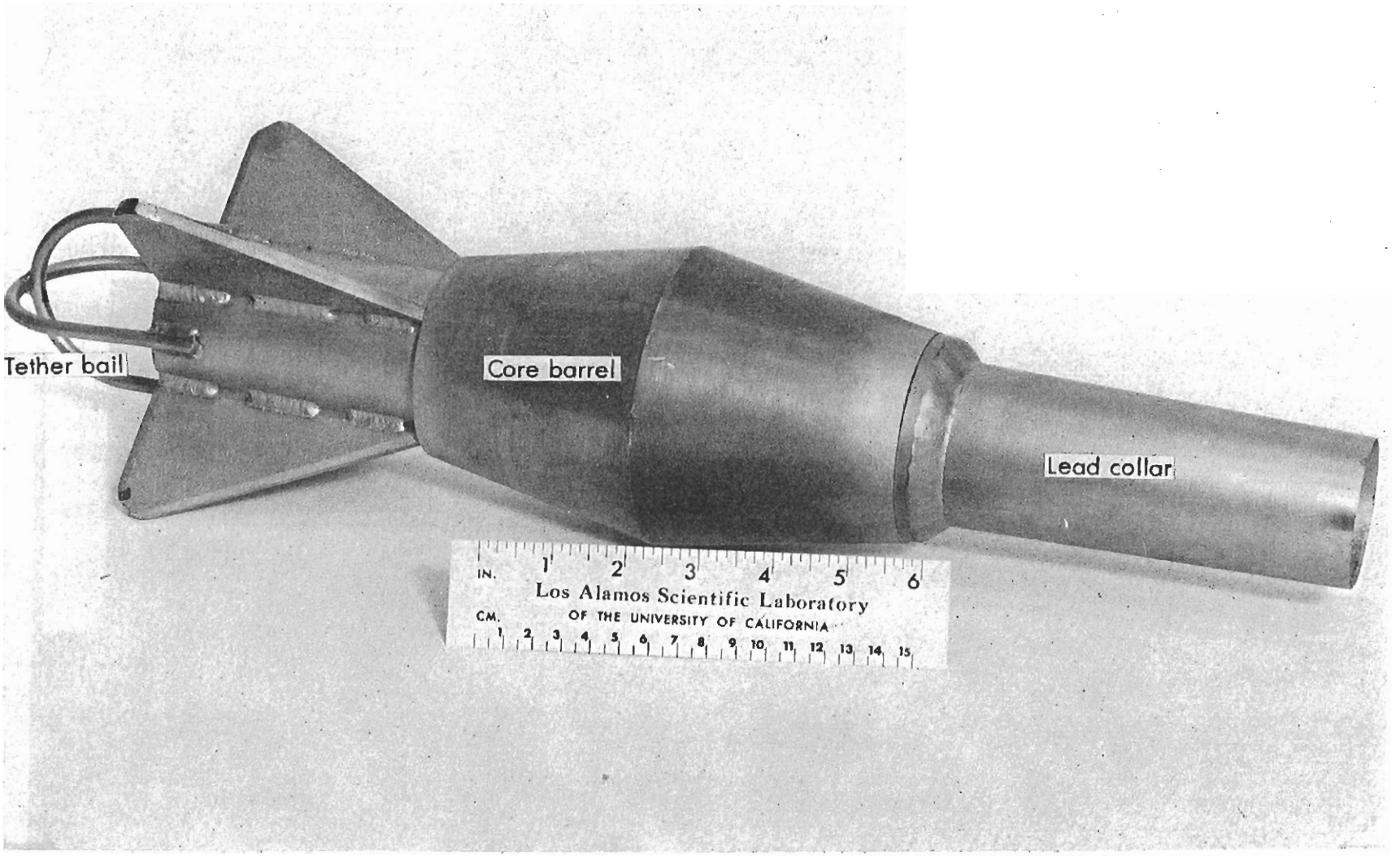

Fig. 16. Lake-sediment sampler for use in Alaska.

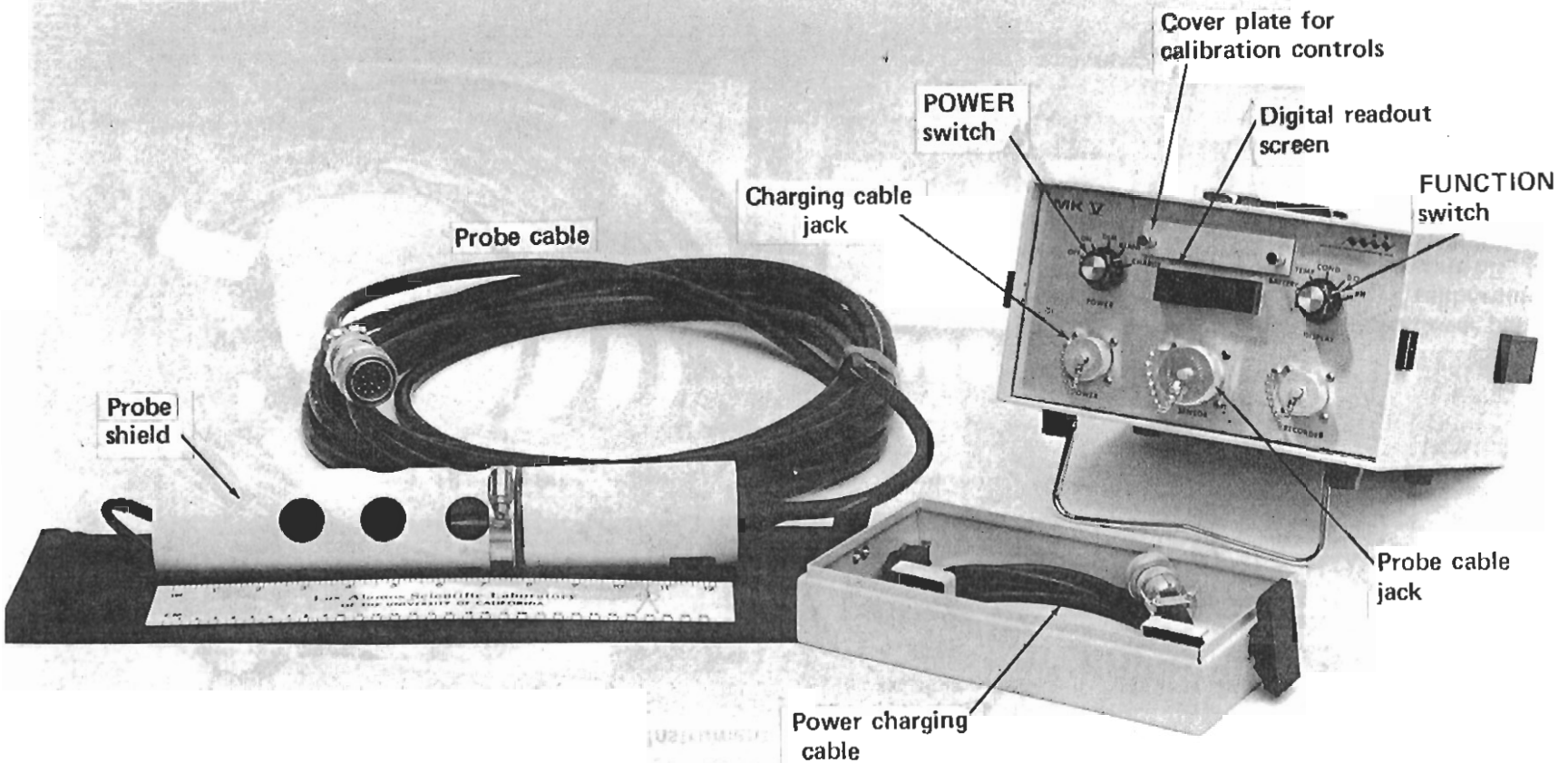

Fig. 17. Martek Mark V analyzer for use in Alaska.

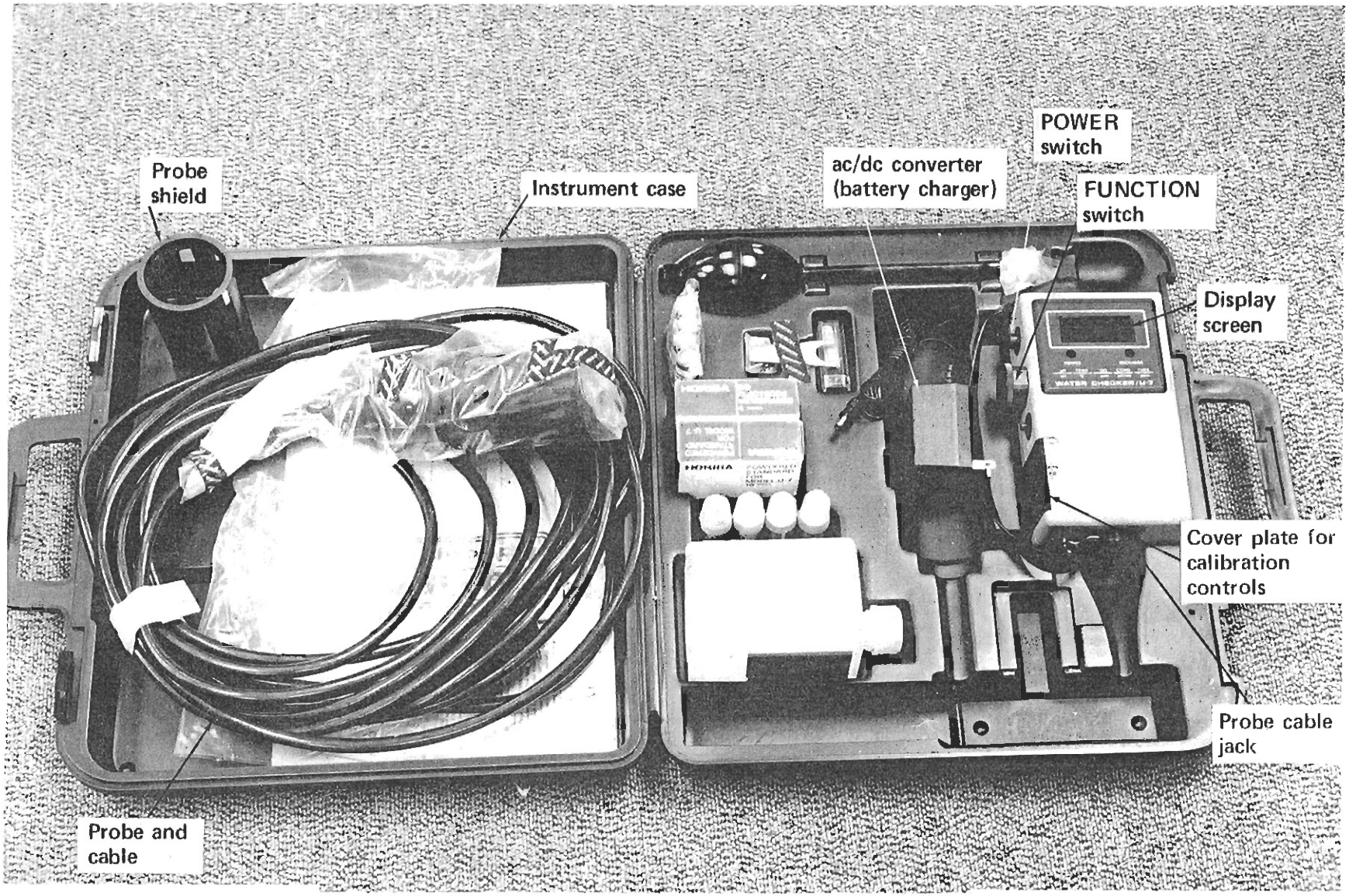

Fig. 18. Horiba water checker for use in Alaska.

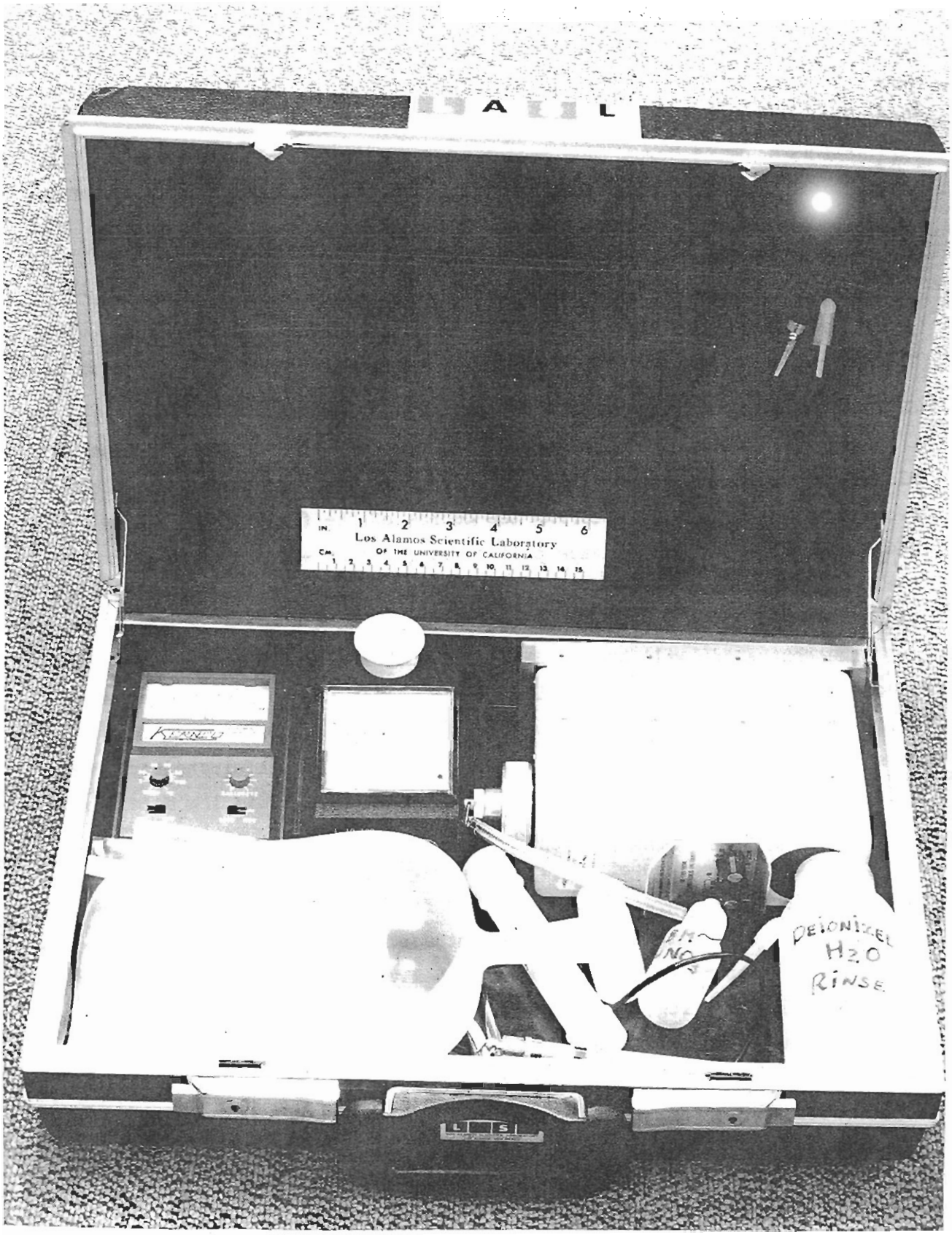

Fig. 19. Alaska stream-sampling field kit.

operations and drying and sieving facilities will be inspected several times by the LASL Group G-5 to ensure that all work is performed in accordance with specifications. Each inspection will last as long as the LASL representative deems necessary.

Before work is begun, contractor personnel will be trained in sampling procedures, data recording, taking of field measurements, and sample numbering in a 1-day (or longer) session given by the LASL. Care and respect for the land and any wildlife thereon will be emphasized in these sessions.

The contractor and each of his employees will be issued a DOE identification card to be carried at all times when conducting DOE-sponsored work. These cards must be returned to the LASL upon completion of the field work.

C. Reports and Communication

The contractor shall contact the LASL (either the G-5 Group Office in Los Alamos, New Mexico, or the Alaska field representative) by phone or other means at least once a week during the course of the field work. Calls to the New Mexico facility can be made collect to (505) 667-7590. The contractor shall also provide the LASL with a phone number where he can be reached directly or from which a message can be delivered to him within a 24-hr period.

The contractor will keep a daily log that includes a complete record of aircraft hours (helicopter and fixed-wing), the number of sites sampled per shift, an account of aircraft down-time (for weather and/or mechanical reasons), and an account of any unusual conditions, unanticipated problems, and suggestions pertaining to current or future work. This log also must include information on the location and time of occupancy at each base camp and the location and use of all fuel caches. A copy of this log, along with copies of receipts for all helicopter and fixed-wing support, must be supplied to the LASL at the completion of the contract.

The contractor also will prepare a weekly report summarizing the information in the daily log, along with a small-scale, updated map showing the areas sampled. A copy of the weekly summary will be given to the Alaska field representative or sent to the LASL Group G-5 at the address given below.

The contractor is to prepare a final report summarizing all information in the daily log and weekly reports. This final report is to be received by the LASL no later than 1 month after completion of the contract.

All weekly and final reports are to be sent to the following address. Note that this is NOT the same address to which the samples and the completed data forms are to be sent.

University of California
Los Alamos Scientific Laboratory
Attn: Group G-5, Mail Stop 586
Los Alamos, New Mexico 87545

D. Data Forms and Maps

Sufficient prenumbered multicopy field data forms, plus another 2% unnumbered spares will be supplied. Attached to each prenumbered data form will be a sheet of 12 identically numbered, adhesive labels for easy and clear labeling of all samples. The unnumbered spare data forms will have blank adhesive labels.

Topographic base maps (two field originals with cloth backing and one master, all 1:250 000 scale), of the entire area contracted for will be supplied. The field maps will have an inked-on, 23-km^2 (9-mi^2) sampling grid from which the contractor or sampling personnel are to select and correctly mark (in the field) the sample locations as the samples are taken. On request, one original of all USGS topographic maps (1:63 360 scale) available for the appropriate areas will be provided for use in planning and carrying out the field work.

When the required coverage on the cloth-backed topographic field maps (1:250 000 scale) has been completed and the locations are correctly marked on each corresponding master map, the field copies, with actual sample locations marked with a circled point and correctly and clearly identified with sample location numbers matching those of the respective data forms, will be turned over to the LASL field representative or mailed to the same address to which the reports are sent (see Sec. I.C.). All master maps will be delivered to the LASL at the completion of the contract.

II. SAMPLE TYPES

A. Lake Water

Samples are to be as void of suspended material as possible and taken directly in LASL-furnished 25- and 41-mℓ containers. Acidify ONLY the 25-mℓ sample (at the time of collection or in camp at the end of each sampling day) by adding 10 drops of prepared 8M HNO_3.

B. Lake Sediment

Samples should be of silt- and clay-sized sediment with ample organic material. Take samples in the manner specified in Sec. IV below.

C. Stream Water

Take water samples before taking sediment samples. Water samples should be as void of suspended material as possible and be taken from fast-moving current. Collect samples in LASL-furnished 25- and 41-mℓ containers. Acidify ONLY the 25-mℓ container full, as described in Secs. II.A. and III.A. for lake waters.

D. Stream Sediment

With a LASL-furnished polyethylene scoop (which holds a good handful) sample three locations within 10 m (30 ft) of one another to make a composite sample. Necessary quantities of the samples and their treatment are identical to those for lake sediment. In areas where lakes are scarce and stream sediment is the dominant sample type, the LASL will provide additional guidance as to the type of stream and location that should be sampled within each grid block. However, it is the contractor's responsibility to select and record the actual location sampled.

E. Dry Sediment

Take dry sediment samples only when water and underwater sediment are not available. Samples should consist of silt- and clay-sized components with sufficient organic content. In samples of this type, of which it is hoped there will be few (if any), a full 25-mℓ vial of -100-mesh material is required from each location sampled. If not fully dry, these samples too must be dried at 100°C, or less, before being sieved.

III. FIELD PROCEDURES

In a routine lake-sampling operation, one member of the sampling crew collects the samples while another member records data on the standard LASL field data form (see Appendix). The record-keeper may also aid the helicopter pilot, but the pilot is responsible for navigation during the preplanned traverses and for correctly numbering each specific sampling site. The sampling crew may exchange duties among themselves.

A. Lake Sampling

The required data from any sample location should be recorded while the helicopter is on the station, but recording must be completed before the next location is approached. When the helicopter has landed near the center of a lake to be sampled, one member of the sampling crew will collect the samples while the other takes and records the water measurements and site data on the field data form.

Take the water samples before releasing the lake-sediment sampler. LASL-supplied wooden extension handles with a quick-release holder (Fig. 15), for taking the required water samples, can be used at the contractor's discretion. At each sampling site, collect from below the water surface a full 25-mℓ polyethylene vial and a full 41-mℓ polyethylene rabbit of water. Place prenumbered adhesive labels (provided on the back of the data form) on the side and top of each container. Acidify ONLY the 25-mℓ container full (at the time of collection or in camp at the end of the sampling day) by adding 10 drops of 8M HNO_3.

In all lakes, take the required water measurements with either a Martek Mark V water analyzer or a Horiba water checker (Figs. 17 and 18) in the manner directed in the user's manual provided with each instrument. At least once a week, calibrate the water analyzers according to the directions given in the appropriate user's manual. As soon as the helicopter sets down, prepare to make measurements from the opposite side of the helicopter from which the samples are being taken. Keeping the water analyzer in the helicopter, lower the probe (attached to the analyzer by a reinforced, watertight, electrical suspension cable) to just below the water surface and make the measurements. If a Martek water analyzer is being used, it should be left ON throughout each day. Normally, about 1 min is required to make the full suite of water measurements. A complete suite of measurements for lake waters includes water temperature (°C); conductivity (μmhos/cm); pH (pH units); and dissolved oxygen (in parts per million). All measurements except that for dissolved oxygen can be entered directly in the appropriate columns of the field data form (see Appendix). Write the dissolved oxygen measurement in the SPECIAL FIELD MEASUREMENTS box in the lower right-hand corner of the field data form and enter an "S" in column 40 of the data form to indicate that a special measurement was made.

After taking the lake-water sample, release the LASL-furnished lake-sediment sampler (described in the next paragraph) by dropping it vertically into the water and allowing it to sink, unimpeded, to the lake bottom. Then lift the sampler about a meter off the bottom and quickly release it to obtain the sample. The exact procedure can be modified to conserve time, but the water sample and water data must be collected in procedural sequence so that they are in hand before the sediment sampler has hit bottom and the water adjacent to the helicopter is contaminated by bottom sediment stirred up by the sampler. During this entire operation the pilot should keep the helicopter as stationary as possible.

The lake-sediment sampler (Fig. 16) weighs 11.8 kg (26 lb) and is a hollow, finned, pipelike device, 45 cm long, with a gravity-activated, one-way, floating ball valve that holds the sample core in the lower section. Just before each use, rinse it quickly in the water of the lake to be sampled. It is driven into the lake-bottom sediment by gravity, facilitated by a conical band of lead around the outside of the sampler body. Retrieve the sampler by pulling on an attached tether until the top of the sampler is a few inches below the surface. At that point, the crew member taking the sample reaches below the water surface, grasps the apparatus about its middle, turns it to a horizontal position, and lifts it out of the water. If the apparatus is lifted out of the water without being horizontal, the sample may fall out of the lower core-retaining section.

To remove the sample from the core barrel, turn the sampler to a vertical position with its nose down, and shake it to move the one-way floating ball valve, thereby breaking the suction effect. The sample should then fall out of the core-retaining section and can be caught in a polyethylene sample bag appropriately labeled with both a prenumbered adhesive label (provided on the back of the data form) and by indelible marking pen. After communicating the required sample features to the person recording the data, close the sample bag by rolling and sealing it at the top and put it into a box either in or mounted on the outside of the helicopter. A small, hand-powered or motorized winch could be mounted in or on the helicopter for greater speed and efficiency in retrieving the sampler, but the provision and use of such a device are left entirely up to the contractor.

B. Stream Sampling

Samples of stream water and wet (or dry) stream sediment are to be collected on foot, using procedures given in Part I of this manual. Take stream-water samples in the same kind of LASL-furnished polyethylene sample bottles used for lake waters, but take them from a fast-flowing part of small streams. Treat these water samples in precisely the same way as those from lakes. The data required are the same as for lakes, except that scintillometer readings will be taken, as described in Part I, Sec. III.F.

Use identical data forms for all sample types taken. Both wet and dry stream-sediment samples are to be composites of three nominally equal samples taken from within a 10-m (30-ft) length of the stream. In addition, the wet stream-sediment samples are to be taken from within 10 m (30 ft) of where the water sample from the same stream is taken. All wet sediments (those from under water) and those from dry streams (when necessary) are to be dried at 100°C, or less, before being sieved to -100 mesh. After samples have been dried and sieved, place the -100-mesh fraction in a 25-mℓ vial, which must have appropriate prenumbered adhesive labels (provided on the back of the data form) placed on both the side and top. A full 25 mℓ vial of -100-mesh sediment is required from each sample site.

In all cases, respect and care for the land and waters being sampled, observing carefully any special requirements of the landowners. Do not litter, denude, or pollute any lands or waters, and leave them in the same (or better) condition than you found them.

IV. RECORDING DATA ON MAPS AND DATA FORMS

On the original, 1:250 000-scale, cloth-backed field maps provided for sample-site selection, place a circled, inked dot at the location of each site actually sampled, together with the sample location number from the field data form (the last four digits) clearly written beside it in ink. This must be done at the time of the sampling. Update each day a duplicate (unfolded) master map and transmit the original field maps to the LASL upon completion of sampling in the area covered by each map. The latitude and longitude of each sample location can be entered on the appropriate data form upon returning to camp, but it must be done within 48 hrs of the time each location is sampled.

Neither the samples nor their respective data forms will be deemed adequate for payment unless both the map location and latitude and longitude of the location actually sampled are provided in each of the following ways: (1) the location must be correctly marked and numbered on the appropriate original field map and on the duplicate, unfolded, master map, and (2) the corresponding latitude and longitude must be correctly entered on the data form.

V. SAMPLE SHIPMENT

The samples, data forms (minus the last page), and sample inventory sheets (Fig. 11) are to be shipped together in unbroken numerical sequence, in blocks of 100, at 2-week intervals or oftener, to the following address:

Shipping, Receiving, and Warehousing
Group SP-4, MS 274
University of California
Los Alamos Scientific Laboratory
Los Alamos, New Mexico 87545

Attn: HSSR PROGRAM, Group G-5
Ref: Contract No. _____

Use the special LASL-furnished shipping labels and cardboard shipping boxes or shock- and temperature-insulated shipping containers (Fig. 12) for all such shipments.

The contractor is to complete a sample inventory sheet for each block of 100 samples. All indicated information (contract number, map name and number, sample sequence, last four digits of the sample location number, and the total number of water vials, sediment vials, water rabbits, and data forms shipped) shall be provided by the contractor and is to accompany each shipping container, along with the pertinent data forms (minus the orange, rearmost copy which is retained by the contractor as a receipt and which is turned over to the LASL only upon payment in full for the contract work).

Place the 25-mℓ water and sediment vials in separate 30-cm x 30-cm x 5-cm (12-in x 12-in x 2 1/2-in) flats and the 41-mℓ water rabbits in 30-cm x 30-cm x 10-cm (12-in x 12-in x 5-in) flats, both types of which are supplied by the LASL. Each of the 100 positions in a flat represents a specific sample

location number (according to the location's last three digits, 001 to 100). The water vial, sediment vial, and water rabbit for a given sample location will occupy the same relative position in their respective flat. Leave vacant any position for which a sample vessel is missing. The proper sample positioning is shown in Fig. 13.

NOTE: Sediment samples and water samples from the same location must be shipped together unless the LASL authorizes otherwise.

VI. CONTRACTOR EVALUATION

Upon completion of each contract, a Contractor Evaluation Form (Fig. 14) will be filled out by the LASL field representative(s) in charge of the contract area, evaluating the performance of the contractor in completion of the work specified. The information on this form will be provided to the contractor.

APPENDIX

THE LOS ALAMOS SCIENTIFIC LABORATORY

HYDROGEOCHEMICAL AND STREAM/LAKE RECONNAISSANCE

FIELD DATA FORM

AND

STANDARD CODING INSTRUCTIONS

LASL HYDROGEOCHEMICAL AND STREAM/LAKE SEDIMENT FIELD DATA

ATTACH IDENTICAL SAMPLE NUMBER HERE

S/N 302379

1	2	3	4	5	6	(7)	(8)	(9)	(10)	(11)	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	(39)	(40)
						REPLICATE	SAMPLE TYPE(S) WATER	TREATMENT	SEDIMENT	TREATMENT	LOCATION LATITUDE DEG		MIN		SEC		LONGITUDE DEG			MIN		SEC		DATE DAY		MO		YR		HR		AIR TEMP + or − °C			WATER TEMP °C			COMMENTS	SPEC. MEAS.

41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	(58)	(59)	(60)	(61)	(62)	(63)	(64)	(65)	(66)	(67)	(68)	(69)	(70)	(71)	(72)	73	74	75	76	77	78	79	80
pH			µmhos/cm SPECIFIC CONDUCTANCE					LETTER I.D.	CPS SHIELD IN				CPS SHIELD OUT				TYPE ROCK	COLOR ROCK	TYPE SED.	COLOR SED.	FLOW WATER	LEVEL WATER	COLOR WATER	STREAM CHANNEL	TYPE VEG.	DENSITY VEG.	RELIEF	WEATHER	OWNERSHIP	CONTAMINANTS	TYPE		IN. WELL DIAM.			FT WELL DEPTH (SURFACE)			FT WATER DEPTH (SURFACE)	
								SCINTILLOMETER									GENERAL SITE DATA																WELL DATA							

IN THE CASE OF EACH CIRCLED ENTRY SPACE, ENTER MOST APPROPRIATE DESIGNATORS LISTED BELOW:

(7) USE WITH REPLICATE SAMPLES ONLY (CHRONOLOGICALLY A, B, C, etc.)

(8) 1 NONE
2 STREAM<1.5m WIDE
3 STREAM>1.5m WIDE
4 SEEP
5 SPRING
6 WELL
7 NATURAL POND
8 ARTIFICIAL POND
9 OTHER

(9) 1 NONE
2 FILTERED AND ACIDIFIED
3 FILTERED ONLY
4 ACIDIFIED ONLY
5 OTHER

(10) 1 NONE
2 WET STREAM
3 WET SEEP
4 WET SPRING
5 WET POND
6 DRY STREAM
7 DRY NATURAL POND
8 DRY ARTIFICIAL POND
9 OTHER

(11) 1 SIEVED +40 MESH
2 SIEVED −40 MESH
3 SIEVED −80 MESH
4 SIEVED −100 MESH
5 SIEVED −170 MESH
6 SIEVED −230 MESH
7 OTHER

(39) ENTER "C" WHEN COMMENTS ARE MADE

(40) ENTER "S" WHEN SPECIAL MEASUREMENTS ARE MADE

(58) 1 SEDIMENTARY
2 METAMORPHIC
3 IGNEOUS
4 UNKNOWN

(58) & (61) 1 WHITE/BUFF
2 YELLOW
3 ORANGE
4 PINK/RED
5 GREEN
6 BROWN
7 GRAY
8 BLACK
9 OTHER

(60) 1 BOULDERS
2 COBBLES
3 GRAVEL
4 SAND
5 MUD
6 MUCK
7 OTHER

(62) 1 STAGNANT
2 SLOW
3 MODERATE
4 FAST
5 TORRENT

(63) 1 DRY
2 LOW
3 NORMAL
4 HIGH
5 FLOOD

(64) 1 CLEAR
2 MURKY
3 CLOUDY
4 MUDDY
5 ALGAL
6 OTHER

(65) 1 DEPOSITING
2 ERODING
3 UNKNOWN

(66) 1 CONIFER
2 DECIDUOUS
3 BRUSH
4 GRASS
5 MOSS
6 MARSH
7 OTHER

(67) 1 BARREN
2 SPARSE
3 MODERATE
4 DENSE
5 VERY DENSE

(68) 1 FLAT
2 LOW<15m
3 GENTLE 15-60m
4 MODERATE 60-300m
5 HIGH>300m
6 OTHER

(69) 1 CLEAR
2 PARTLY CLOUDY
3 OVERCAST
4 RAINY
5 SNOWY
6 OTHER

(70) 1 FEDERAL
2 STATE
3 PRIVATE
4 INDIAN
5 OTHER

(71) 1 NONE
2 MINING
3 AGRICULTURE
4 INDUSTRY
5 SEWAGE
6 POWER GENERATION
7 URBAN
8 RECREATION
9 OTHER

(72) 1 WINDMILL - STOCK
2 WINDMILL - DOMESTIC
3 SUBMERSIBLE PUMP
4 SUCTION PUMP
5 JET PUMP
6 LARGE TURBINE
7 HAND BAIL
8 UNKNOWN
9 OTHER

MAP NAME(s)_____ MAP NUMBER(s)_____ MAP SCALE_____

COMMENTS: EXPLAIN ALL "OTHER" DESIGNATORS USED ABOVE, PLUS DESCRIBE ALL UNUSUAL OR SIGNIFICANT CONDITIONS SUCH AS SPECIAL RESTRICTIONS, TYPE(s) AND PROXIMITY OF CONTAMINANTS, QUANTITY OF ORGANIC DEBRIS, WELL CASING DESCRIPTION (AGE, RUST, AMOUNT OF USE, etc.), AQUIFER DESCRIPTION (NAME, DEPTH, etc.), STREAM CHANNEL DESCRIPTION, AND GENERAL ROCK NAME WHEN KNOWN. NOTE EVIDENCE OF RECENT PRECIPITATION.

SPECIAL FIELD MEASUREMENTS AS PER CONTRACT SPECS

I CERTIFY THAT THE ABOVE SAMPLE HAS BEEN TAKEN AND TREATED AS SPECIFIED BY LASL AND INDICATED ABOVE _____
SIGNATURE

LASL HSSR MAR 76

STANDARD CODING INSTRUCTIONS FOR
THE LASL HSSR FIELD DATA FORM

LASL Group G-5 January 1, 1977

General Statement: Enter all data on the LASL HSSR field data form correctly, and right-justify them in the appropriate columns of the 80-column form. The data form is designed for use with several sample types, of which only one or two will be taken at any given location; therefore leave blank any columns that are NOT applicable to a given sample site. In addition, leave blank those columns that do not require an entry because the number of digits to be entered is less than the number of columns provided. However, place a small check or a slash above or below every unused column space to indicate that there has been no oversight.

Contractors will be paid only for those sample locations where all data appropriate to the type(s) of sample taken are unambiguously provided on the field data form.

Column(s)

1 - 6
Sample Location Number

Enter in columns 1-6 the appropriate sample-location number which is a precoded six-digit number assigned on the basis of state boundaries and unique to each sample location. Usually, numbers between 000 001 and 099 999 are assigned to New Mexico; 100 001 to 199 999, to Colorado; 200 001 to 299 999, to Wyoming; 300 001 to 399 999, to Montana; and 400 001 and above, to Alaska. Location numbers will always be assigned to contract areas by sequential number blocks. Once a number is used for a sample location, the same number must always be used when identifying samples from that particular location. If a location is ever resampled, which would require additional data forms, the location number originally assigned is to be hand-coded on blank data forms and an appropriate letter is to be coded in the replicate column (7) as described immediately below.

7
Replicate Sample Designator - for use only when a location is resampled, or when multiple samples are taken at a single time

Enter in column 7 an alphabetical/sequential designator to indicate additional samples taken from a single location (otherwise, leave it blank). Replicate samples may be taken on the same day as the original samples or on subsequent days, weeks, or months. For instance, if a location is sampled initially for one water sample and one composite sediment sample on 4/1/77, code nothing in column 7. If the same location is resampled for either one or both water and sediment on 5/6/77, code an A in column 7. If the location is again resampled for one or

Column(s)	
7 (cont)	both water and sediment on 6/10/77, code a B in column 7. In every case of resampling, hand-code on the new data form the sample location number (columns 1-6) originally assigned to that location. For those location numbers prefixed by zeros, be sure to code all zeros as part of the six-digit number. This is the only place on the form where prefixed zeros may be entered. Replicate sampling will be done only when specifically directed by the LASL so that correct alphabetical/sequential designators can be provided to the contractor in advance. This will ensure an unbroken sequence of replicate samples (if a replicate sample shows the replicate designator D in column 7 of the appropriate data form, there are in fact earlier samples from the same location that carry the replicate sample designators A, B, and C).
8 - 11 Sample Type(s)	The sample type specifically designates three things: the sample medium (water or sediment), the sample source (stream, spring, pond, dry stream, etc.), and the sample treatment performed by the sampling crew or sampling contractor (filtration and/or acidifiction, no treatment of water samples, or sieving of sediment to a specified size). All water samples taken in the states of New Mexico, Colorado, Wyoming, and Montana will include either two full 25-mℓ polyethylene vials or one full 25-mℓ polyethylene vial and one full 41 mℓ polyethylene reactor vial (rabbit). Whenever the 41-mℓ rabbits are provided, it is to be understood that one water sample will include one 25-mℓ vial and one each 41-mℓ vial, both identically treated (unless otherwise specified) and from the same sample location. All composite sediment samples are to consist of approximately 25 g of dried and sieved material. A single field data form can be used to record data for either a single water sample (two full sample vials), a single composite sediment sample, or both a water and composite sediment sample. In the case of well water samples taken from the well-piping or a bailer, a surface sediment sample will not be taken. An entry is always required in columns 8 and 10 even if only a water sample or only a sediment sample is taken. Whenever an Other designator is used it must be explained in the space provided for Comments at the bottom of the field data form and a C entered in column 39.
8 - 9 Water Source/Treatment	Enter in columns 8 and 9 (water source and treatment, respectively) using the appropriate descriptors listed on the form. Column 8 describes the kind of water source sampled, and column 9 indicates the field treatment performed. Together, columns 8 and 9 define the water sample type. If No. 1-None is entered in column 8 to

Column(s)	
	indicate that no water sample was taken, then the information for which column 9 is reserved is NOT required, therefore column 9 should be left blank. When more than one water sample (more than two full vials) at a single location is requested in advance by the LASL, code additional field data forms (and the replicate column (7) appropriately.
10 - 11 Sediment Source/Treatment	Enter in columns 10 and 11 (sediment source and treatment, respectively) the appropriate descriptors listed on the form. Column 10 describes the composite sediment sample on the basis of its source and natural condition when taken. Column 11 describes the treatment (sieved fraction) performed on the composite sediment sample. Normally, column 11 will be coded at the time the composite sediment sample is actually sieved (for this reason, and also to have the identification labels available to put on the sieved-sediment vials, always keep the field samples and data forms together from the field to the interim field laboratory, where the sediment samples can be dried and sieved, and on to the LASL where additional splits must be made). As a rule, an originally dry composite sediment sample never should be taken if a wet sediment sample is available. When No. 1-None is entered in column 10 to indicate that no sediment sample was taken, column 11 is not applicable, so leave it blank. If more than one composite sediment sample from a single location is requested by the LASL, properly code the replicate column (7) on additional data forms for each replicate sample.
12 - 24 Sample Location	Enter in columns 12-24 the sampled location, using latitude and longitude interpreted to the nearest second. Each sampling team is responsible for locating every sample site as precisely as possible, and the maximum location error must not exceed a 100-m radius unless this fact is specifically noted in the Comments (and a C added in column 39). Samples will NOT be accepted by the LASL unless they are positively located within a radius of 300 m (100 ft).
25 - 32 Date and Time	Enter in columns 25-30 the day, month, and year, using one or two digits (right-justified) as necessary, and leave blank any unused columns. Code the time (hour) in columns 31 and 32, using the military (24-h) clock and rounding to the nearest whole hour. Right-justify the hour entry so that column 31 will remain blank when only one digit is appropriate.

Column(s)	
33 - 35 Air Temperature	Enter in columns 33-35 (right-justified) the air temperature, taken at the time of sampling. Code the air temperature [in degrees Celsius (°C)] to the nearest whole degree. Always code either a plus (+) or minus (-) sign in column 33 to indicate above (+) or below (-) freezing (0°C) conditions. When the temperature is exactly 0°C, code a plus sign (+) in column 33. Column 34 will have an entry only if the temperature is above +9°C or below -9° C. Column 35 will always have an entry.
36 - 38 Water Temperature	Enter in columns 36-38 the water temperature, taken at the time of sampling. Code the water temperature [in degrees Celsius (°C)] to the nearest tenth of a degree (0.1°C). Note the stationary decimal point between columns 37 and 38 on the field data form; code whole numbers (degrees) in columns 36 and 37, and the tenths of a degree in column 38. When the water temperature is between 0°C and 9.9°C, temperature will be coded in columns 37 and 38, and column 36 will be blank.
39 Comments	If any Comments are entered at the bottom of the data form, enter a C in column 39. If there are no comments, leave column 39 blank.
40 Special Measurements	The LASL occasionally contracts for special measurements such as dissolved oxygen at certain locations, and provides specific instructions for these measurements. Enter the resulting data in the box in the lower right-hand corner of the form. Whenever special measurements are made, enter an S in column 40. When no special measurements are made (the usual case) leave column 40 blank. In Alaska, the dissolved oxygen content (in ppm) is measured routinely at lake and stream sites. Enter this value in the box in the lower right-hand corner of the form and add an S to column 40.
41 - 43 pH	Enter in columns 41-43 the pH of the sampled water to the nearest tenth (0.1) of a pH unit. Note the stationary decimal point between columns 42 and 43; code whole numbers in column 42 and the tenths in column 43. (Rarely will the pH be greater than 10, so column 41 will usually be left blank.)
44 - 48 Specific Conductance (µmhos/cm)	Enter in columns 44-48 (right-justified) the specific conductance as read from the meter or as some multiple of the meter reading that is determined by the scale range setting used.
49 - 57 Scintillometer	Column 49 (Letter I.D.) is an alphabetical entry that identifies the scintillometer used. The side of each instrument bears a large, printed, red letter, which is the I.D. of that instrument. Enter this letter in column 49.

Column(s)	
50 - 53 Shield In (counts per second--CPS)	Enter in columns 50-53 (right-justified) the scintillometer reading taken with the shield in place.
54 - 57 Shield Out (counts per second--CPS)	After entering the shield-in measurement, enter in columns 54-57 (right-justified) the scintillometer reading with the shield pulled back (shield out). Enter the average value in cases where the needle continues to fluctuate between two points. (The shield-out measurement normally is slightly higher than the shield-in reading.)
58 - 71 General Site Data	Code columns 58-71 with the most appropriate indicator elements listed on the form. Good judgment is requisite to these evaluations.
58 - 59 Rock	Rock type (column 58) calls for a general description of the lithologic (rock) regime from which the samples are taken. For stream samples, the rock type should be indicative of the bedrock over which the stream is flowing at the sample location. For springs and seeps, the entry should indicate the rock type from which the water is emanating. Treat ponds and small lakes like streams whenever possible. For wells, the rock-type description should relate to the surface rock and NOT the aquifer formation--unless they are the same (enter the aquifer description, name, etc., in the Comments when known, and enter a C in column 39). In areas where the bedrock does not outcrop, a reasonable interpretation can sometimes be made by looking at nearby exposures. Enter in column 59 the most appropriate designator for rock color.
60 - 61 Sediment	The sediment entry should reflect the nature of the loose sediment material sampled at the site. In cases where the sampled material differs markedly from the surrounding sediment, note this fact in the Comments and add a C in column 39.
62 - 65 Water	The water descriptor should indicate the general condition of the water at the time of sampling. In column 62 indicate the rate of flow at the sampled location (if a stream is sampled in rapids, the No. 4-Fast or No. 5-Torrent may apply, but if the same stream is sampled above or below the rapids, the No. 2-Slow or No. 3-Moderate descriptors might be more accurate). Enter in column 63 a descriptor for the water level relative to its apparent normal level. Use good judgment to make this determination. Enter in column 64 a descriptor for the amount and type of dissolved or suspended load in the water on the basis of color. If a large amount of algae is suspended in the water, enter No. 5-Algal (if only the

Column(s)	
62 - 65 (cont)	bottom of the stream, spring, or lake is covered with algae or other plant life, note this fact in the Comments and add a C in column 39).
65 Stream Channel	Code column 65 with the appropriate descriptor. A steeply inclined stream bed with fast-moving water can usually be considered as No. 2-Eroding, whereas a nearly level, slow-moving stream may indicate a No. 1-Depositing channel (the stream is depositing its load of sand and silt in the calm-water areas). In all cases, the descriptor should apply to the place at which the sample was taken.
66 - 67 Vegetation	Descriptors for columns 66 and 67 should reflect the type and amount of plant growth in the area of the sampled location. The type of vegetation (column 66) should reflect the dominant plant type at or near the sample location. Conifers include evergreen trees and certain shrubs. Deciduous plants include trees (such as cottonwoods and aspens) and shrubs that seasonally lose their leaves. Brush denotes relatively low-growing plants (which may or may not be deciduous) such as sage and thorny bushes. Grass comprises grasses of all types, including crops such as alfalfa and wheat. Moss denotes all types of nonaquatic or semi-aquatic surface-clinging plants (often predominant in arctic environments). The density (column 67) is decided by a subjective observation of the ease of access, visibility, etc.
68 Relief	Relief is an indicator of variations in local surface elevations. In mountainous terrains the area to be included around a sampled location will usually not exceed a few tens of meters, but in relatively flat areas it may extend up to 0.8 km (1/2 mi). If it seems worthwhile to include an area much larger or smaller, include a descriptive note in the Comments and enter a C in column 39.
69 Weather	The weather entry should indicate the prevalent conditions at the time of sampling (also, note in the Comments any evidence of precipitation within a few days before sampling and add a C in column 39).
70 Ownership	Code column 70 with the appropriate descriptor. If proper ownership cannot be ascertained, leave column 70 blank.
71 Contaminants	The proper entry for column 71 is very important and should be chosen carefully. It indicates any nearby activities that might influence the analytical results. Also, if more than a single contamination source exists nearby, enter in the Comments details such as proximity to the sampling site, type (gold, silver, lead-zinc, coal),

Column(s)	
71 (cont)	and status (active, inactive) of mine, type of fertilizer used (if known), or type of power plant (hydroelectric, coal-fired, nuclear) and add a C in column 39.
72 - 80 Well Data	Well type (column 72) gives an indication of possible well contaminants and frequency of well use. Code column 72 with the appropriate designator, remembering that No.8 can be used when the well type cannot be ascertained.
73 - 74 Diameter	Enter in columns 73 and 74 (right-justified) the inside diameter (i.d.) of the well casing (in inches) when it is known (or measureable). Otherwise, enter a note to that effect in the Comments, and add a C in column 39. (Leave unused columns blank.)
75 - 77 Well Depth	Enter in columns 75 and 77 (right justified) the total drilled depth from the surface (in feet) when known. If depth is not known, enter a reasonable estimate (in feet) with a note to that effect in the Comments, and a C in column 39. If a reasonable estimate is impossible, leave columns 75-77 blank. (Leave unused columns blank.)
78 - 80 Water Depth	Enter in columns 78-80 (right-justified) the distance from the well surface to the water (in feet) when known. If distance is not known, enter a reasonable estimate (in feet) and make a note to that effect in the Comments, and add a C in column 39. If a reasonable estimate is impossible, leave columns 78-80 blank. (Leave unused columns blank.)
Map name, Number, and Scale	Each topographic quadrangle map, forest map, highway map air photo, or other map to be used in the field for locating the sample sites has an assigned name and/or number. Always enter on the data form the name and/or number of any map(s) used to locate each sample site. In addition, indicate the scale of the map(s) used.
Comments	Remember that there can never be too many comments. Enter for each sampling site every observation pertaining to geography, geology, hydrology, climate, vegetation, possible contamination, etc. Such information is extremely important in evaluating the data for each sample and sample site. Make all comments legible. If necessary, use a second (unnumbered) data form and hand-code with the identification number shown on the first data form. Staple or otherwise attach the two forms so that they always remain together. (Whenever comments are made, enter a C in column 39.)

Column(s)	
Special Measurements	Whenever special field measurements, such as dissolved oxygen are required, enter the data plus appropriate units of measurement in the box in the lower right-hand corner of the data form. (Whenever special measurements are made, enter an S in column 40.)
Certification	A member of the sampling crew must sign his/her name legibly on the signature line to certify that the sample was taken and treated as described and that the information is as correct and complete as possible.