DPST-77-363

FIELD MANUAL FOR STREAM WATER AND SEDIMENT RECONNAISSANCE

SAVANNAH RIVER LABORATORY
NATIONAL URANIUM RESOURCE EVALUATION PROGRAM

SAVANNAH RIVER LABORATORY
AIKEN, SOUTH CAROLINA 29801

PREPARED FOR THE U.S. DEPARTMENT OF ENERGY UNDER CONTRACT AT(07-2)-1

DPST-77-363

FIELD MANUAL FOR STREAM WATER AND SEDIMENT RECONNAISSANCE

SAVANNAH RIVER LABORATORY
NATIONAL URANIUM RESOURCE EVALUATION PROGRAM

by

R. B. Ferguson, V. Price, and E. I. Baucom

Approved by:

R. L. Folger, Research Manager
Analytical Chemistry Division

Publication Date: November 1977

E. I. DU PONT DE NEMOURS AND COMPANY
SAVANNAH RIVER LABORATORY
AIKEN, SOUTH CAROLINA 29801

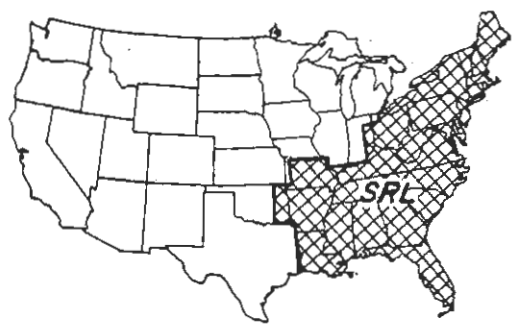
PREPARED FOR THE U.S. DEPARTMENT OF ENERGY UNDER CONTRACT AT(07-2)-1

FOREWORD

This manual is intended to direct and coordinate field operations, site selection, sample collection, and information codes for the Savannah River Laboratory (SRL) contribution to the National Uranium Resource Evaluation (NURE) program. The manual provides technical direction and public relations information for field sampling teams.

The NURE program was begun in 1973 to evaluate domestic uranium resources in the continental United States and to identify areas favorable for commercial exploration in response to the rapidly increasing national demand for uranium. The Grand Junction Office (GJ) of the Department of Energy (DOE) is responsible for administering and coordinating NURE program efforts.* Inputs to the NURE program come from DOE prime contractors, DOE-sponsored research and development, the uranium industry, U. S. Geological Survey, U. S. Bureau of Mines, other government agencies, and independent sources.

In 1975, SRL accepted responsibility for hydrogeochemical and stream sediment reconnaissance surveys of twenty-five states in the eastern United States. Oak Ridge Gaseous Diffusion Plant (ORGDP), Los Alamos Scientific Laboratory (LASL), and Lawrence Livermore Laboratory (LLL) have accepted responsibility for similar reconnaissance surveys in the rest of the continental United States including Alaska. Bendix Field Engineering Corporation (BFEC) is the prime GJ contractor for the uranium resource assessment.



* Formerly administered by the Energy Research and Development Administration (ERDA); incorporated into the Department of Energy (DOE) as of October 1, 1977.

CONTENTS

Grand Junction Office
P.O. Box 2567, Grand Junction, CO 81501

FOR IMMEDIATE RELEASE
December 23, 1977

DOE ISSUES NURE PROGRAM FIELD MANUAL FOR STREAM WATER AND SEDIMENT RECONNAISSANCE

The Grand Junction, Colorado, Office, U.S. Department of Energy (DOE), has issued a report entitled "Field Manual for Stream Water and Sediment Reconnaissance."

The report, prepared by R.B. Ferguson, V. Price, and E. I. Baucom, all of the Savannah River Laboratory (SRL), Aiken, South Carolina, is intended to direct and coordinate field operations, site selection, sample collection, and information codes for SRL's contribution to the National Uranium Resource Evaluation (NURE). The manual provides technical direction and public relations information for field sampling teams.

NURE is a program of DOE's Grand Junction Office which includes the compilation and development of 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. SRL is operated for DOE's Savannah River Operations Office by E.I. du Pont de Nemours and Company.

The 78-page report, GJBX-80(77) [SRL No. DPST-77-363], dated November 1977, has been placed on open file at the following locations:

No. 77-132
News Media Contact: Peter Mygatt, 303/242-8621, Ext. 293
To order microfiche: Contact Library, Ext. 278

INTRODUCTION

The Department of Energy (DOE) was created by Congress in October 1977 to consolidate various energy agencies and programs funded by the Federal Government. DOE is conducting or funding research and development work in a number of fields including solar energy, wind energy, geothermal energy, nuclear fission, breeder reactors (including alternate breeder fuels), and nuclear fusion. DOE is also evaluating the United States reserves of fuels for energy sources and methods of containing or disposing of their wastes.

The National Uranium Resource Evaluation (NURE) program was established in the spring of 1973 by the U. S. Atomic Energy Commission, was continued under the aegis of the Energy Research and Development Administration, and is now funded by the DOE. The objective of the program is to evaluate domestic uranium resources and to identify favorable areas for commercial exploration. the NURE program is expected to increase the activity of commercial exploration for uranium in the United States.

The principal objectives of the NURE program are:

- To prepare, based on existing data, a preliminary evaluation of domestic uranium resources and favorable exploration areas.
- To complete a more comprehensive assessment of the uranium reserves of the United States as rapidly as possible.
- To identify areas favorable for uranium resources.
- To develop new and improved technologies for resource assessments.

The Grand Junction (Colorado) Office of the Department of Energy (DOE-GJ) has completed the first objective* and is responsible for administering and coordinating efforts to meet the other objectives. Inputs to the NURE program come from DOE prime contractors, DOE-sponsored research and development, the uranium industry, U. S. Geological Survey, U. S. Bureau of Mines, other government agencies and independent sources.

---

* The report was issued by the Grand Junction Office as Document GJBX-111(76).

The NURE program consists of 5 parts:

1. Hydrogeochemical and Stream Sediment Reconnaissance Survey
2. Aerial Radiometric Survey
3. Surface Geologic Investigations
4. Drilling for Geologic Information
5. Geophysical Technology Department

The Savannah River Laboratory (SRL), Oak Ridge Gaseous Diffusion Plant (ORGDP), Los Alamos Scientific Laboratory (LASL), and Lawrence Livermore Laboratory (LLL) have accepted responsibility for hydrogeochemical and stream sediment reconnaissance of the United States as shown in Figure 1. The objective of this portion of the program is to accomplish a systematic determination of the distribution of uranium in surface and underground waters and in stream sediments in the continental United States, including Alaska. The significance of the distribution of uranium in natural waters and stream sediments will be assessed as an indicator of areas favorable for the discovery of uranium deposits.

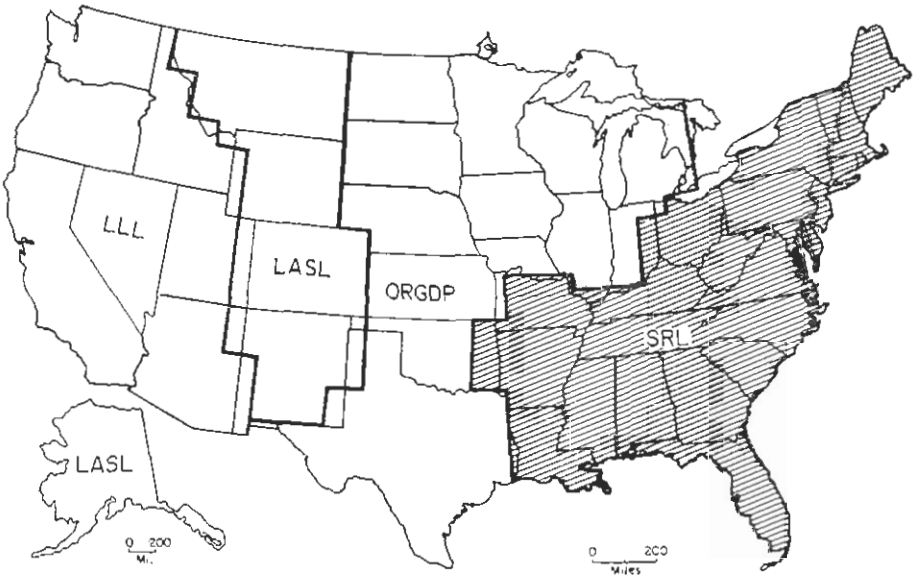


FIGURE 1. Areas of Responsibility for Hydrogeochemical Reconnaissance

Assignments of areas of responsibility are based on geologic provinces because similar geochemical factors should control both the occurrence of uranium deposits and the hydrogeochemical expression of uranium. To simplify reporting, areas of responsibility are coincident with 1° x 2° National Topographic Map Service (NTMS) quadrangle boundaries.

The area of responsibility for SRL includes all of the Atlantic and Gulf Coastal Plain states except Texas, all of the Appalachian Highlands, most of the Interior Low Plateaus (Kentucky and Tennessee), and most of the Interior Highlands (Missouri, Arkansas, and Oklahoma).

Before entering the reconnaissance phase of the NURE program, SRL conducted an extensive development program (see References 1-10 for planning and progress reports). Techniques were developed to obtain great precision and accuracy for analyzing uranium concentrations from <0.020 parts per billion (ppb) in natural waters to >1000 parts per million (ppm) in rocks and sediments. Field orientation studies were conducted in a variety of geologic and geographic settings to develop technical and operational experience applicable to the reconnaissance program. Variability of sampling techniques was studied to ensure that a representative sample can be taken at a given site. Sampling instructions in this manual are derived in part from SRL experience and in part from standard geochemical sampling practices.

Samples collected in the NURE program will be archived for future study. Geochemical samples collected systematically over broad areas will constitute a significant national resource. SRL will analyze samples for uranium and geochemically related elements, and every effort will be made to preserve the integrity of the samples for possible additional analyses in the future.

The NURE program is being conducted with public funds for the equal benefit of all Americans. Contractors participating in the NURE program have an obligation to protect the public interest. ALL SAMPLES, SAMPLE SPLITS, DUPLICATES, DATA, OBSERVATIONS, AND ALL OTHER ITEMS OF INFORMATION OBTAINED DURING THE COURSE OF OPERATION UNDER A CONTRACT TO PARTICIPATE IN THE SRL/NURE PROGRAM ARE TO BE PROVIDED ONLY TO SRL. NONE ARE TO BE RETAINED FOR PRIVATE USE OR COMMUNICATED TO OTHERS WITHOUT THE PRIOR WRITTEN CONSENT OF SRL AND DOE.

All data, theories, speculations, and conclusions derived from operations under an SRL/NURE contract are the property of DOE and are to be communicated only to SRL. The Grand Junction Office of DOE will release data and reports simultaneously at a number of sites across the country as rapidly as these releases can be processed. SRL will notify individual land owners of

results obtained on samples from their property at the time of the DOE release, if their request for such information has been noted on a field data form.

A number of individuals and companies, both domestic and foreign, are currently exploring for uranium in the eastern United States. The field supervisor should stress to his personnel that ANY information released may result in proprietary benefit not in the public interest. It should be stressed to individual land owners who inquire that a contractor's presence at a given site is in no way related to the presence or absence of a uranium deposit at that site, and that this sampling is part of a program to cover the entire nation.

FIELD OPERATIONS

A. LOGISTICS AND PUBLIC RELATIONS

1. Notification of Public Officials

Prior to team operation in a given county, the field supervisor is REQUIRED to visit the county seat, present proper identification, and notify the county sheriff's office and health department of the sampling program in that county. A few minutes spent in a public relations effort in various county offices could prove of immense benefit.

2. Access to Property

a. Private Property

Most NURE samples will be collected on private property. The rights of the property owner should be respected. Care should be taken to avoid any damage to private property; even snakes and briars are private property.

b. Military Bases

The commanding officer of each base enjoys a great deal of autonomy in controlling access to the base. The field supervisor should attempt to contact this person well in advance of any planned sampling on the base. Problems in gaining access should be reported promptly to SRL.

c. Forest Service Lands

The Forest Service of the United States Department of Agriculture manages, protects, and conducts research on many thousands of acres of timberland in the SRL area of responsibility. We have been assured the cooperation of the Forest Service in our program as long as our activities are no detriment to the forest

environment or resources. SRL will provide contractors with lists of the appropriate personnel to contact in each forest area. In general, each Forest Supervisor should be consulted some time in advance of field operations and MUST be notified at least a week in advance of actual sampling so that he can advise District Rangers of the presence of authorized DOE sampling teams in an area. SRL should receive a copy of any correspondence between a contractor and the Forest Supervisor. The field supervisor MUST contact District Rangers when sampling teams actually arrive and before sampling is begun. Commercial exploration of Forest Service lands requires the issuance of a mineral exploration permit. The Forest Service has agreed to waive this requirement for the NURE program, and the greatest care must be taken to respect Forest Service requests.

District Rangers may be of assistance in arranging contacts with private land owners and other persons having a proprietary interest in lands within the District.

d. Indian Reservations, Parks, Wildlife Refuges, and Other Public Preserves

The field supervisor should contact the local agent, tribal representative, ranger, warden, or other official-in-charge several days prior to anticipated sampling. No problems in gaining access are anticipated. SRL should receive copies of any correspondence between the contractor and the agencies or individuals contacted.

3. Identification

DOE identification cards are to be issued to all sampling team personnel. A short brochure giving some highlights of the NURE program has been prepared so that sampling teams will have something tangible to leave with property owners. In no case is false identification or misrepresentation of purpose to be used.

4. Rejection

Most land owners will be more than happy to cooperate and may volunteer much useful information. Some may forbid access to their property, and at least one will be downright hostile during the course of operation. LEAVE WHEN ASKED!

5. Team Numbers

Each field supervisor will assign team codes to his teams and furnish SRL a list of the team members and codes. A team code consists of a letter designating the field supervisor and a number which is unique for each person or pair on a team.

EXAMPLE: Team K07
Field Supervisor: King
Team Seven: J. Doe, M. Brown

6. Liaison with SRL

The field supervisor will contact SRL at least weekly by telephone or messenger. He will provide a motel or boarding house address and a telephone number where he can be contacted at SRL initiative during any twenty-four-hour period. The supervisor will also apprise SRL during the last week of each month of the area to be sampled during the coming month.

A telephone recording device is available to record collect calls from field supervisors. It is monitored at least once daily and should be used for all routine calls.

The field supervisor is expected to be abreast of team activities at all times. Under normal circumstances, SRL will communicate with field teams only through the supervisor.

Routine maintenance of equipment is the responsibility of the field supervisor. SRL will perform major repairs or replacements of equipment, but turn-around time may be on the order of several weeks. The field supervisor should try to detect failing instruments and anticipate needed repairs. It is suggested that a daily log of instrument checks be kept to aid in identifying failing meters or probes.

The supervisor should also anticipate the need for re-supply far enough in advance to allow time for shipping. SRL will process requests for supplies once per week and turn around time on such requests can be expected to be two weeks on the average.

B. SAMPLING SITE SELECTION AND SITE OPERATIONS

1. Sampling Density

Orientation studies indicate that the average sampling density needed to define most geologic features varies depending upon rock type and geologic complexity. Samples are normally collected in the range of one site per five to twenty square miles (10 to 50 km^2). Specific instructions will be provided by SRL on a county-by-county basis.

2. Site Selection Procedure

The procedure suggested for site selection is given in Appendix A.

3. Sample Collection

Detailed instructions for sample collection are given in Appendix B.

4. Coding of Field Data Forms

Detailed instructions for coding of field data forms are given in Appendix C.

C. RETURN OF SAMPLES TO SRL

The contractor is responsible for all samples until these are received by SRL in usable form. Payment will be made only for samples which are clearly labeled and which are accompanied by correctly completed data forms, keypunched data cards, and sampling site maps.

Contractors are advised that inaccuracies in field forms add considerably to sample processing costs at SRL. These additional costs are noted and are considered in evaluating future bids.

1. Maps

Each sampling contractor will be furnished two or more sets of field maps, one of which is returned with the samples. Coordinates of sampling points will be measured directly from the map returned with each group of samples.

Maps must be clean, unfolded (rolled in protective tubes), and labeled with sampling sites precisely indicated as points within circles in red ink. Each map should be labeled with the contract number (AX number) and with a list of the number of samples taken.

Care must be taken to assure that each site identifier is unique to only one sample. Two samples with the same identifier are both worthless.

2. Data Forms

Data forms and 80-character, IBM-compatible, keypunched, verified data cards suitable for automated processing must accompany samples in a moisture-proof enclosure. Detailed instructions for completing these forms are given in Appendix C.

All data forms are to be checked for errors by the field supervisor. If the supervisor is also a sampling team member, his cards should be checked by a different sampling team member.

3. Samples

Samples are to be arranged in serial order within each map unit (normally a county) and packaged by map unit. Neatness in packaging will facilitate sample check-in at SRL and thereby facilitate payment.

Sediment samples should be oven dried (90 to 100°C) before shipping in the prescribed Kraft paper collection bags. The paper bags may weaken and burst during shipment if samples are damp; higher drying temperatures may char and weaken bags. Heat lamps will damage the bags and are not acceptable for drying.

Resin samples should be checked before shipping to assure that labels and lids are securely attached. Labels are to be taped with transparent tape. Sediments and resins should be packaged in separate containers to reduce possible contamination.

4. Cartons

Each shipping carton should contain samples and forms from only one map unit. If multiple map units are shipped together, they must be separated or compartmentalized within cartons. Samples of a given type from a given map unit may be shipped in separate cartons only if the number of samples is too large for one carton.

A packing list must be attached to the exterior of each carton shipped. The packing list should include: (a) the total number of samples contained in the carton, (b) any data forms enclosed, (c) any maps accompanying the shipment, and (d) the order number (AX number) of the contract. A duplicate packing list, an invoice which must agree with the packing list and sample inventory, and an SRL sample transfer form should be enclosed in the carton.

5. Shipping

Samples are to be delivered or shipped to SRL at approximately two(2)-week intervals. The recommended method of shipping is by motor freight to E. I. du Pont de Nemours and Company, 300/700 Receiving Department, Dunbarton, South Carolina. Air freight to Augusta, Georgia, via Delta Air Line has been satisfactory. Air freight forwarders are not recommended.

APPENDIX A: SITE SELECTION PROCEDURE

This site selection procedure was developed for areas which are being sampled at a nominal density of one site per 5 to 20 square miles. Other areas may be sampled at different densities, but similar logic applies. The procedure is meant to serve as a guideline to assure a degree of uniformity in site selection. It should be kept in mind that the primary objective is to obtain coverage that is (as nearly as possible) uniform, complete, and representative.

1. Adequate maps are required to pinpoint the sampling sites. County road maintenance maps appear to be the most generally useful maps. They are current and show all road-stream intersections. Topographic maps, U.S. Forest Service maps, and other special maps will be useful in some areas and may be necessary where counties do not maintain roads. Duplicate maps (a field map and a clean copy) must be delivered to SRL.

2. A drainage overlay should be prepared on drafting film with all road-stream intersections marked.

3. The drainage overlay is then placed over a sampling-density grid having squares each representing a 5 to 20 square-mile area (depending upon detailed SRL specifications) and sites are selected.

4. The sample is intended to represent the area drained by the stream. For example, at a nominal 5-square-mile spacing, most streams draining 3 to 10 square miles should be sampled. In general, the largest stream in a grid unit which originates in that unit or in an adjacent unit should be selected. Very few streams draining over 20 square miles should be sampled. On rare occasions, a grid unit may not contain a stream suitable for sampling. However, no two adjacent units should go unsampled even if the normal stream size criteria must be violated. No samples shall be taken closer than one mile from any other sample.

5. We have considered arguments for completeness of our survey and for invalidation of samples by severe pollution. It is not practical to sample within major metropolitan areas but many small towns may afford pristine sampling sites. As a guideline, we suggest that samples not be taken within the statutory limits of towns with populations over 5000.

We recognize that city limits bear no set relation to land-use patterns within them, and the judgment of the sampling team must be relied upon to maximize coverage while minimizing strongly biased samples.

6. Selection of sampling sites is the responsibility of the field supervisor and should be completed well in advance of sampling in an area. SRL will normally inspect and approve site locality maps at least two (2) weeks before samples are collected in an area. Sampling teams may collect from an alternate site when it is impractical to collect a valid sample from the preselected site.

7. As samples are taken, sites are numbered sequentially, i.e., no valid sample identifiers are to be skipped. Sampling locations are to be accurately marked on working maps in the field as the samples are collected. Compilation maps showing sampled sites as points within circles are to be prepared and returned to SRL with samples. Sampling site identifiers on the maps should be listed in the margins.

APPENDIX B: SAMPLE COLLECTION

PART I. DAILY PREPARATION

Several tasks must be completed prior to each day's field work. These tasks are discussed in this section, and are summarized in a checklist at the end of this Appendix.

The sampling team in the field will normally comprise two people. One person (designated in this discussion as Team Member 1) will be primarily responsible for water sampling and field analyses (pH, temperature, conductivity, and alkalinity). His equipment will be a portable field laboratory packed in an instrument case (Figure B-1), a pressure filter in a carrying case (Figure B-2), an ion exchange resin recovery case (Figure B-3), and an ion exchange stirring case (Figure B-4). A second person, Team Member 2, will be primarily responsible for sediment sample collection. His equipment is carried in a standard backpack. Both team members should assist one another to check supplies and equipment, and to perform sampling and record-keeping tasks.

Specific Supplies, Equipment, and Instructions

Team Member 1 (See Table B-1)

- *Maps and Data Forms* - Enough data forms should be kept in the lid of the instrument case to provide one for each site to be visited, plus several spares. THESE MUST BE KEPT DRY.

  The SRL sampling site map(s) showing exact sample site locations must also be readied for each day's work and stored in the instrument case or other suitable container. At the end of each day, the exact sample site locations and site codes are transferred to a master map in red ink. Each map should be individually checked to see that all needed information is present, and that an SRL site code is designated on each map. Spare wooden or mechanical #2 soft lead pencils should also be carried in the instrument case.

- *Bromo-cresol Green/Methyl-Red Indicator* - A plastic dropping bottle of bromo-cresol green/methyl-red indicator solution (hereafter called "indicator") is securely closed in a plastic bag and placed in the instrument case. A 125-ml Ehrlenmeyer flask is cleaned, condition-checked, and placed in the instrument case.

FIGURE B-1. Instrument Case Containing Portable Field Laboratory

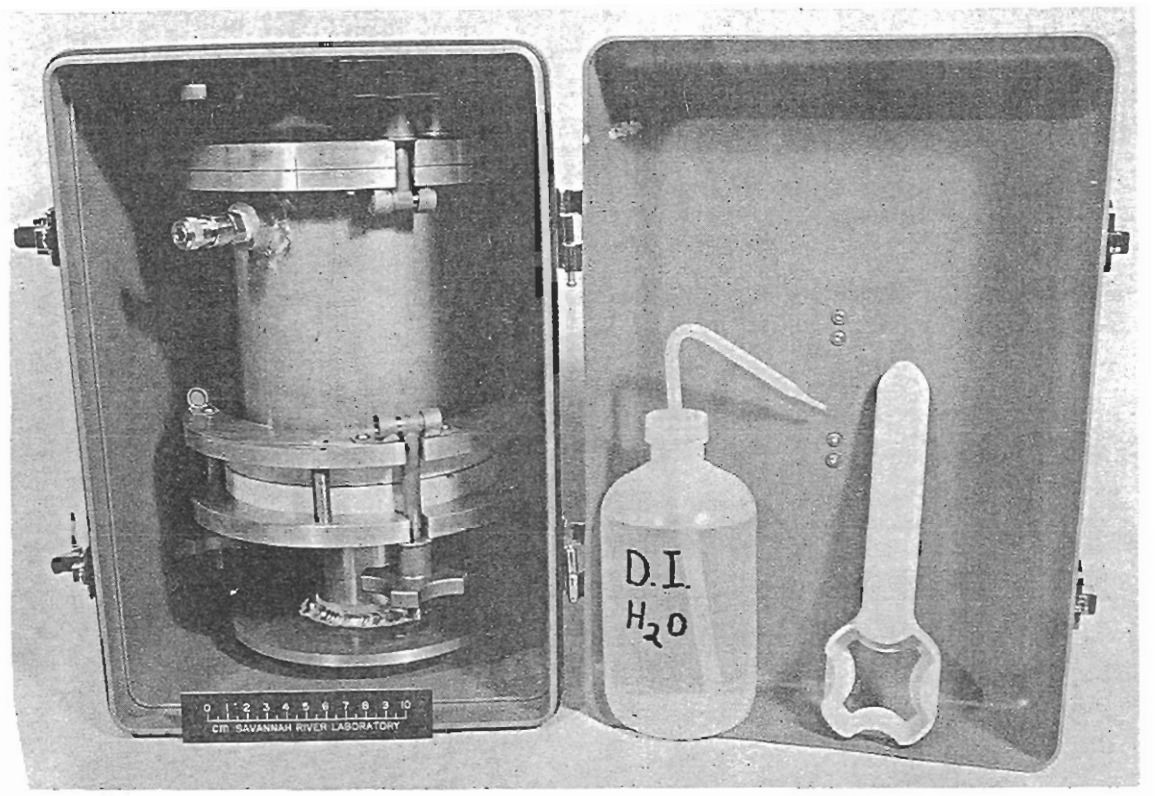


FIGURE B-2. Pressure Filter Assembly in Case

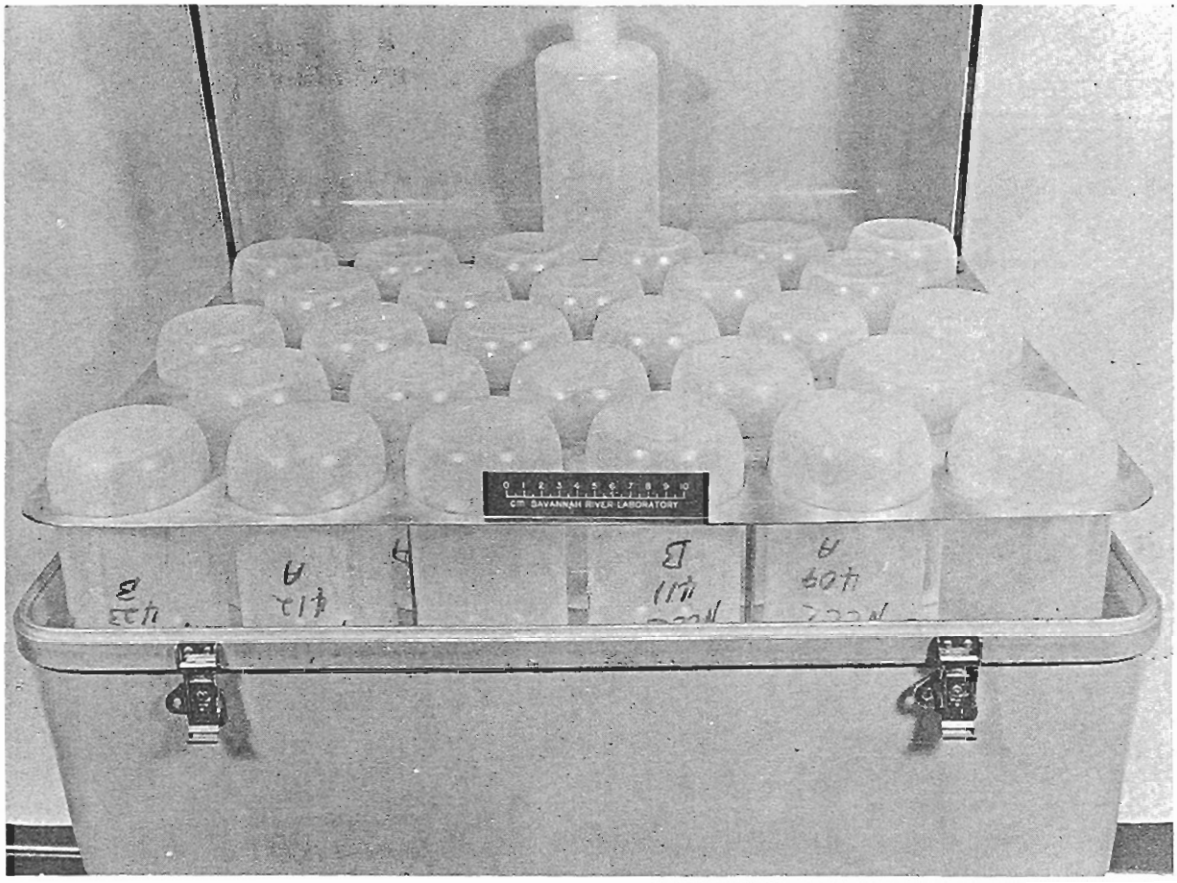


FIGURE B-3. Ion Exchange Resin Samples in Recovery Case

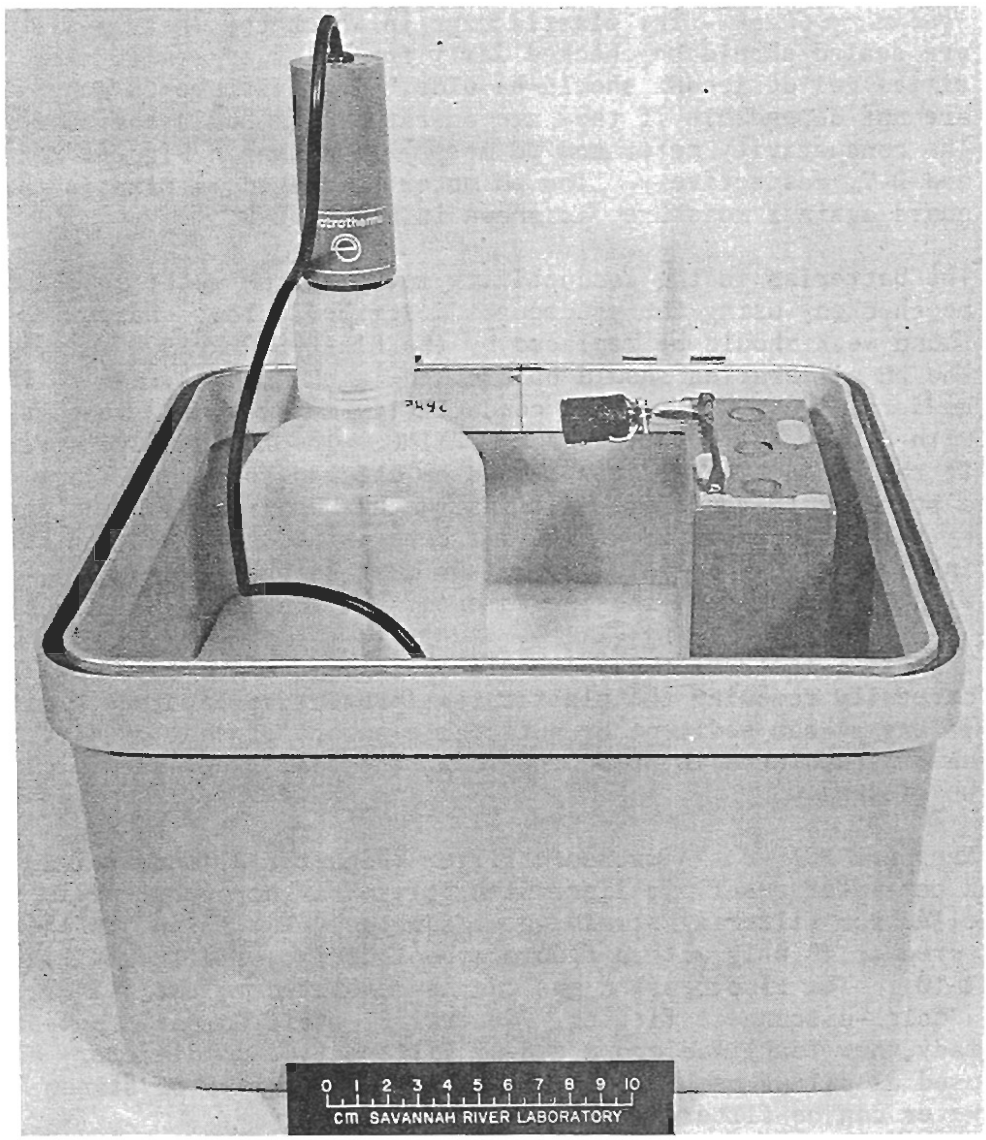


FIGURE B-4. Stirring Assembly and Case for Ion Exchange Resin Samples

- *Acid Bottle 0.02N* - A plastic dropping bottle full of 0.02N sulfuric acid is SECURELY CLOSED in a plastic bag and placed in the instrument case (Figure B-5). Use only the dropper provided by SRL.

- *Equipment Check* - The plastic bags in which the instruments are sealed should be checked daily for holes or leaks. The silica gel desiccant should be blue. The instruments generally are not dependable if they are operated in a humid environment. The conductivity meter and pH meter are shown in Figures B-6 and B-7, respectively. The pH meter, packaged in plastic to guard against moisture, is shown in Figure B-8.

  The batteries in the conductivity meter and pH meter should all be checked, using the procedures described below. Batteries found weak should be replaced by the FIELD SUPERVISOR only. The pH calibration should be checked in pH 4, pH 7, and pH 10 buffers EACH MORNING. The conductivity meter should be checked with 0.001M KCl solution EACH MORNING. The temperature circuit in the conductivity meter should be checked once a week against a standard thermometer. All instrument repairs should be done by the FIELD SUPERVISOR, who has been issued a manual for the instruments. The field supervisor must be thoroughly familiar with the manual and the instruments.

  The field instrument case should be emptied and cleaned daily, carefully removing the plastic foam protective liner each time. If any stream sediment or noticeable amount of dust or dirt have accumulated in or on the foam, the foam liner should also be cleaned.

- *Pressure Filter* - A pressure filter (Figure B-9) consisting of a one-liter reservoir lined with polytetrafluoroethylene is supplied for filtering stream water samples. The filter is pressured to 40 psig with a fluorocarbon gas in a small can (Figure B-10). The fluorocarbon gas can is connected to the filter by a quick-disconnect fitting. General Electric Company (Schenectady, New York) *Nuclepore* 0.8-μm filters (142-mm diameter) are used as filter membranes.* In general, one liter of stream water can be filtered in several minutes.

* No endorsement either by E. I. du Pont de Nemours and Company or by USDOE is intended by reference to brand names in this report. Other similar equipment or supplies may perform satisfactorily.

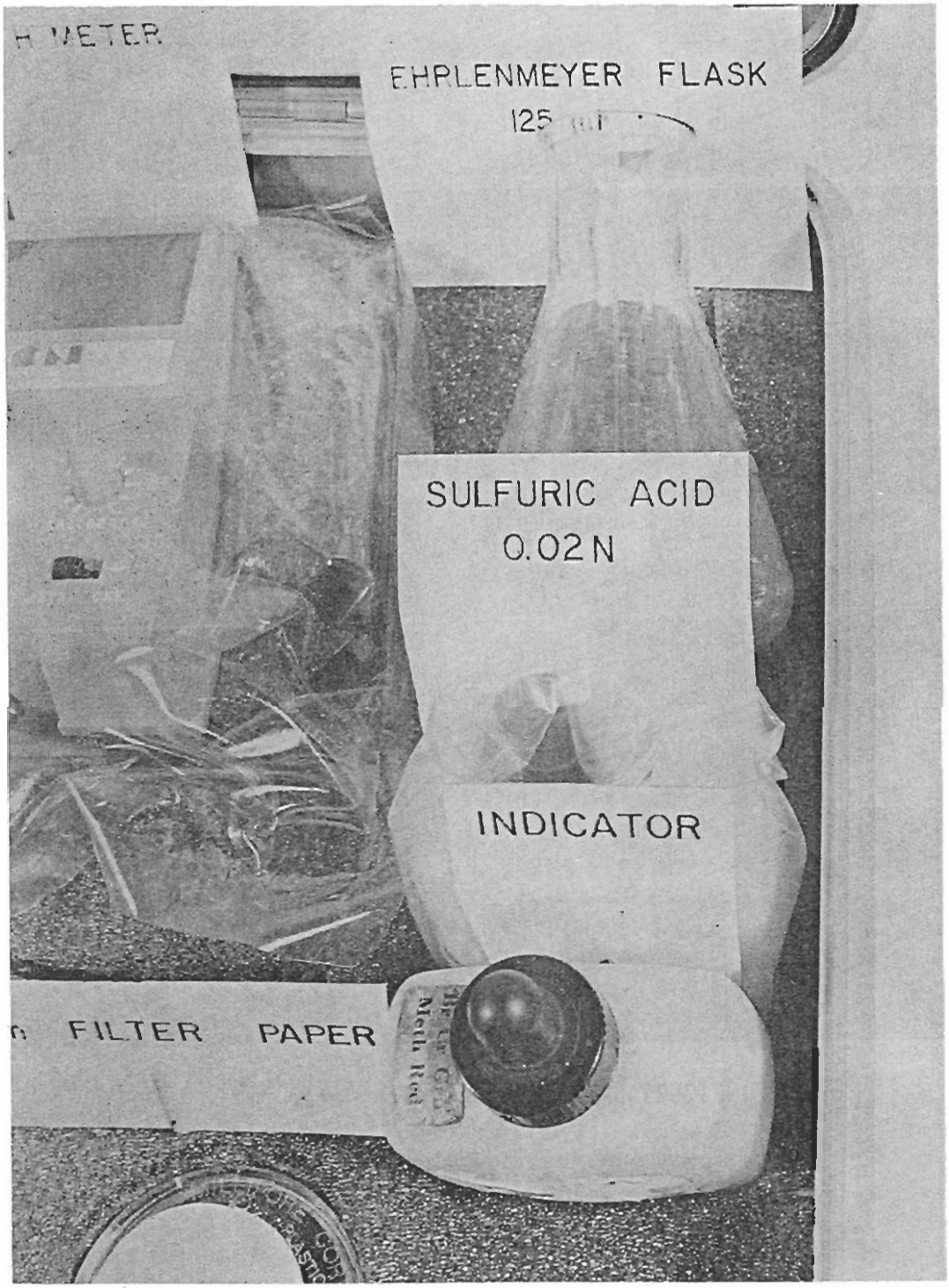


FIGURE B-5. Stowage of Acid Bottle in Instrument Case

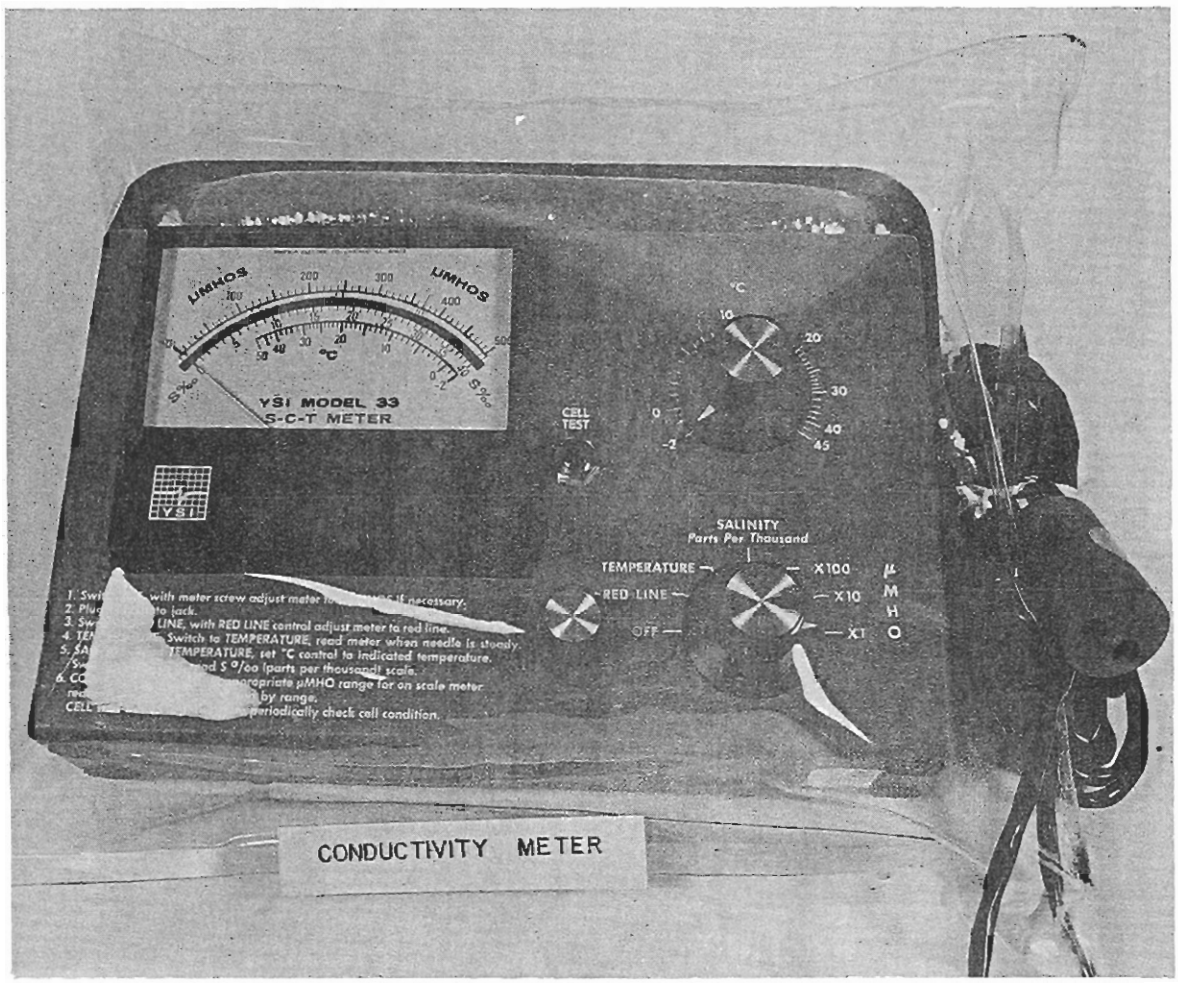


FIGURE B-6. Conductivity Meter

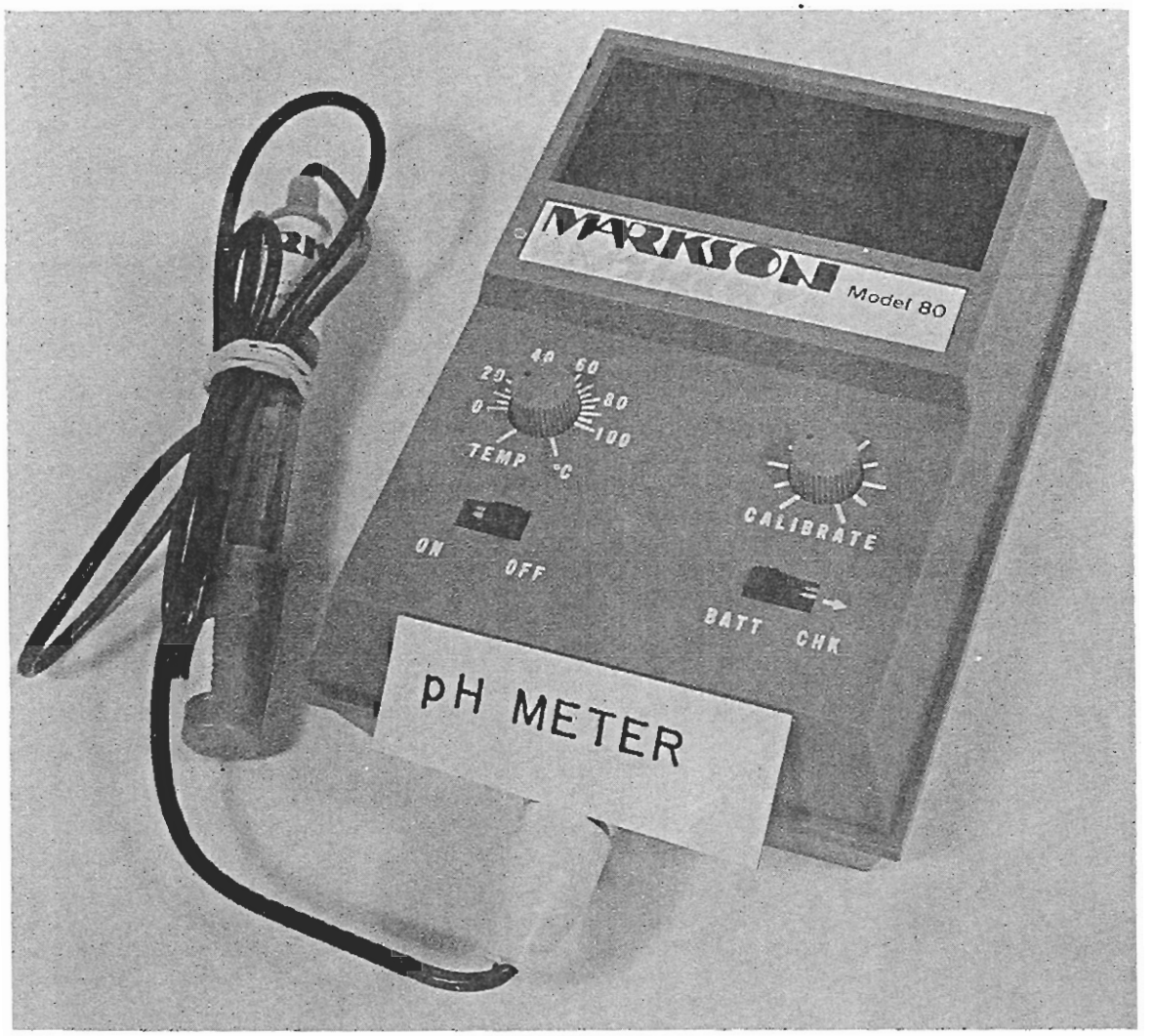


FIGURE B-7. pH Meter

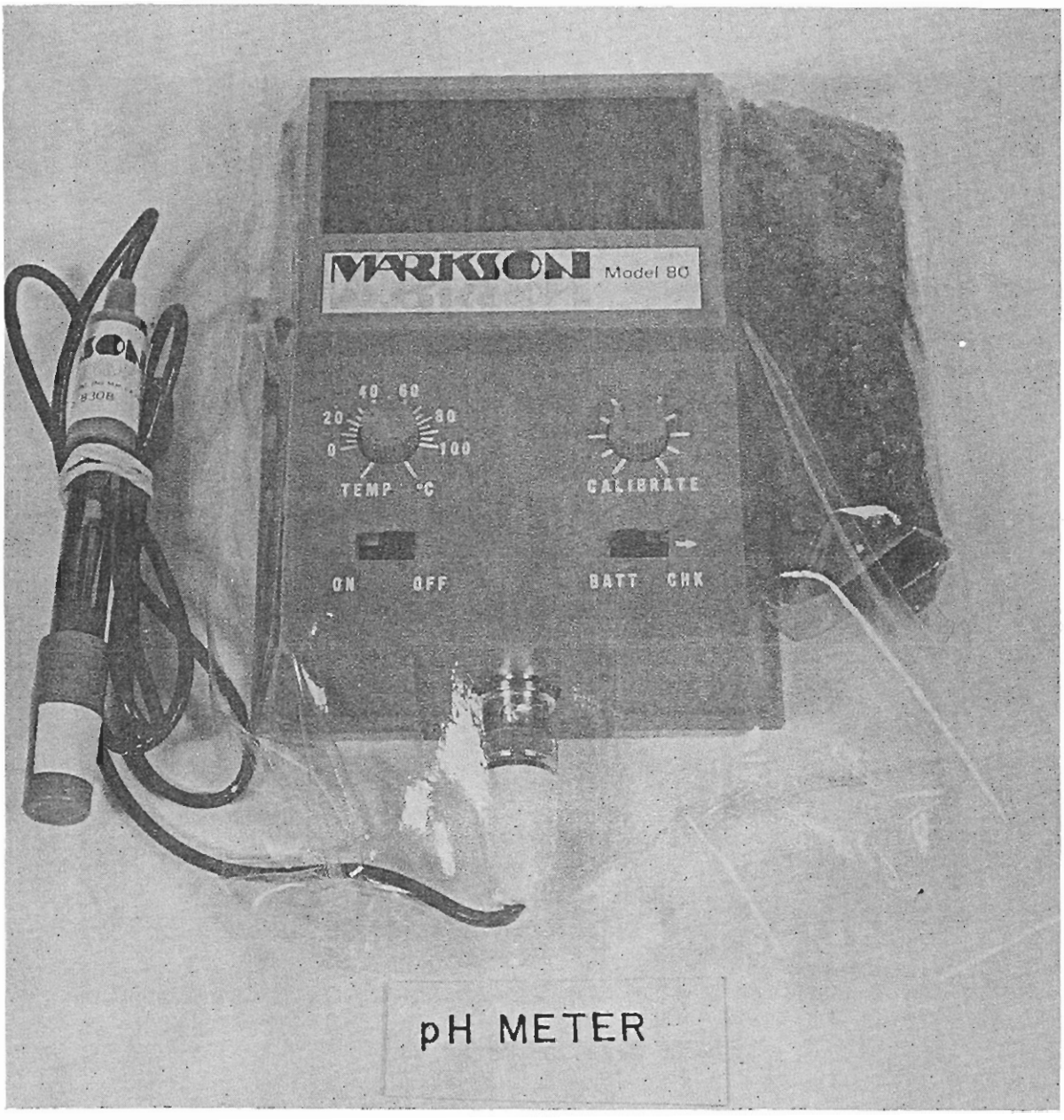


FIGURE B-8. Packaged pH Meter

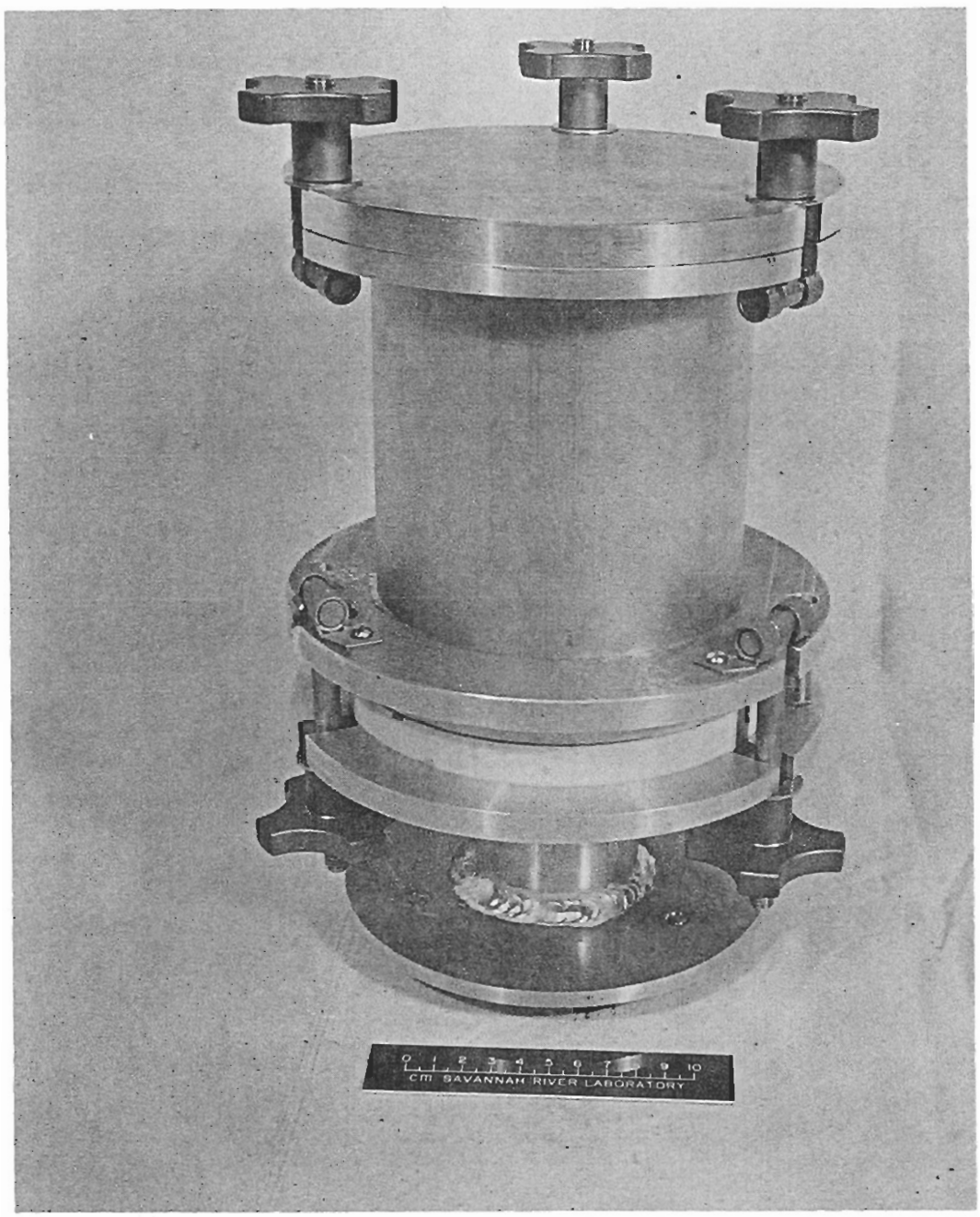


FIGURE B-9. Pressure Filter Assembly

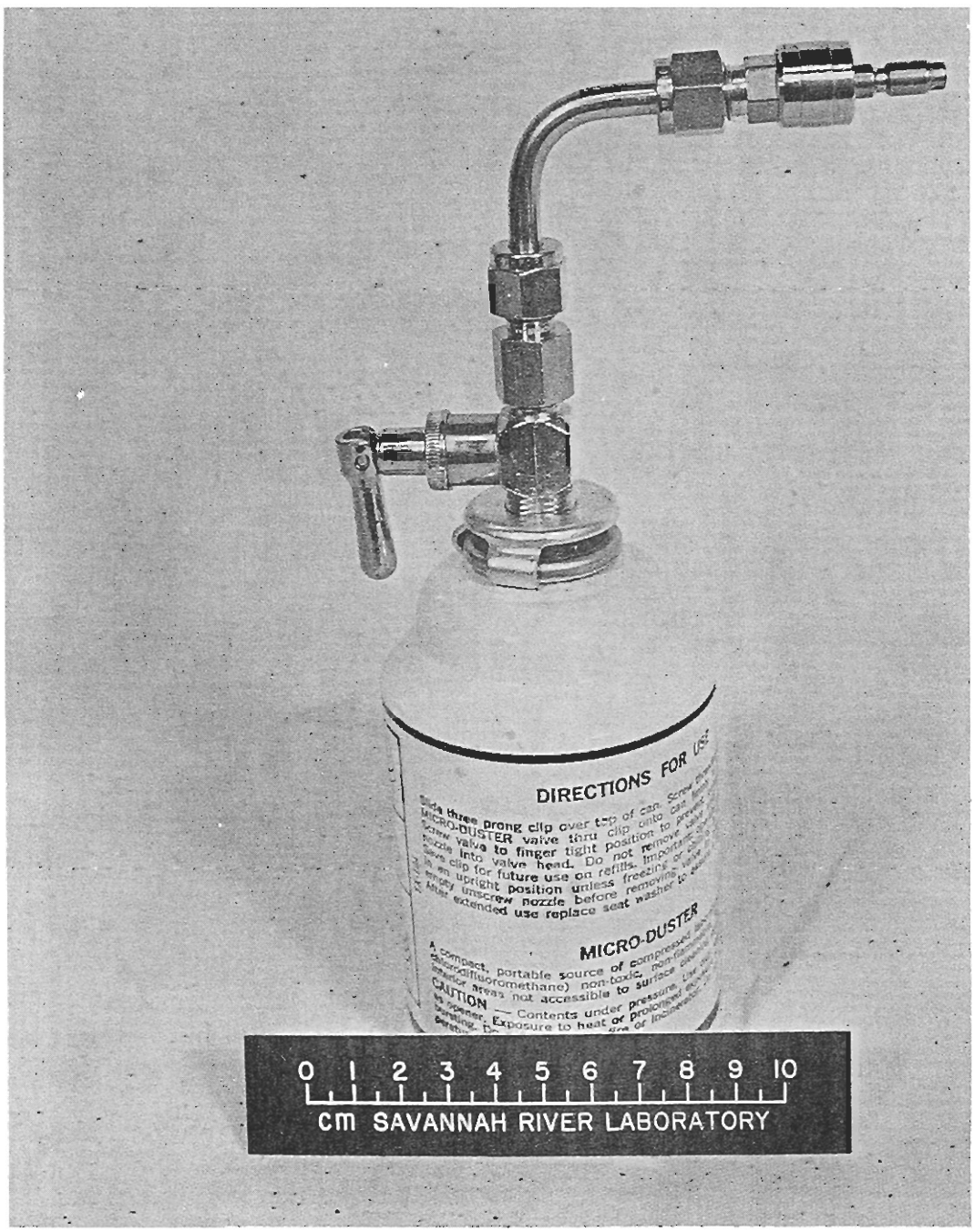


FIGURE B-10. Gas Pressurizing Assembly

- *Ion Exchange Resin* - A special, high-purity, mixed ion exchange resin (100 to 200 mesh) is packaged in 2-ounce polyethylene bottles (Figure B-11). This resin is VERY expensive and packaged in special clean areas. DO NOT OPEN a bottle until just before using. Special care should be taken to prevent dust from getting into the resin or into the filtered stream water. If contamination is suspected, then discard the contaminated resin or water.

- *Interchange Cap* - A special interchange cap has been designed to couple the liter bottle of stream water to the 2-ounce bottle of ion exchange resin. The interchange cap (Figure B-12) allows resin to be added to the water sample without dust getting into the sample. The interchange cap is also used to transfer the resin back into the 2-ounce bottle (Figure B-13).

- *Ion Exchange Resin Recovery Case* - An ABS plastic case containing an aluminum rack is provided to carry 28 one-liter bottles. After the stream water samples are collected, filtered, and treated with the ion exchange resin ("ion-exchanged"), the bottles are inverted in the carrying case to recover the resin. This is shown schematically in Figure B-14 and is pictured in Figure B-15.

- *Stirrer* - A 6-volt, direct-current stirrer and battery (Figure B-16) are provided to stir the ion exchange resin in the liter of stream water. The resin is stirred a minimum of 10 minutes. A special 6-volt battery charger is provided to recharge the battery each evening. A spare battery is also provided. A fully charged battery will provide more than 20 hours of stirring. In an emergency, a standard 6-volt lantern battery can be used.

- *Water Deionizer Columns* - A water deionizer (Figure B-17), consisting of three columns, is provided to obtain deionized water for rinsing. The first column contains activated charcoal to remove organics and chlorine. The second and third columns contain mixed-bed, ion exchange resin to remove dissolved ions. Use drinking water as supply water for the columns. When the color changes on ~1/2 the length of the second column (indicating it is exhausted), then replace the first and second columns.

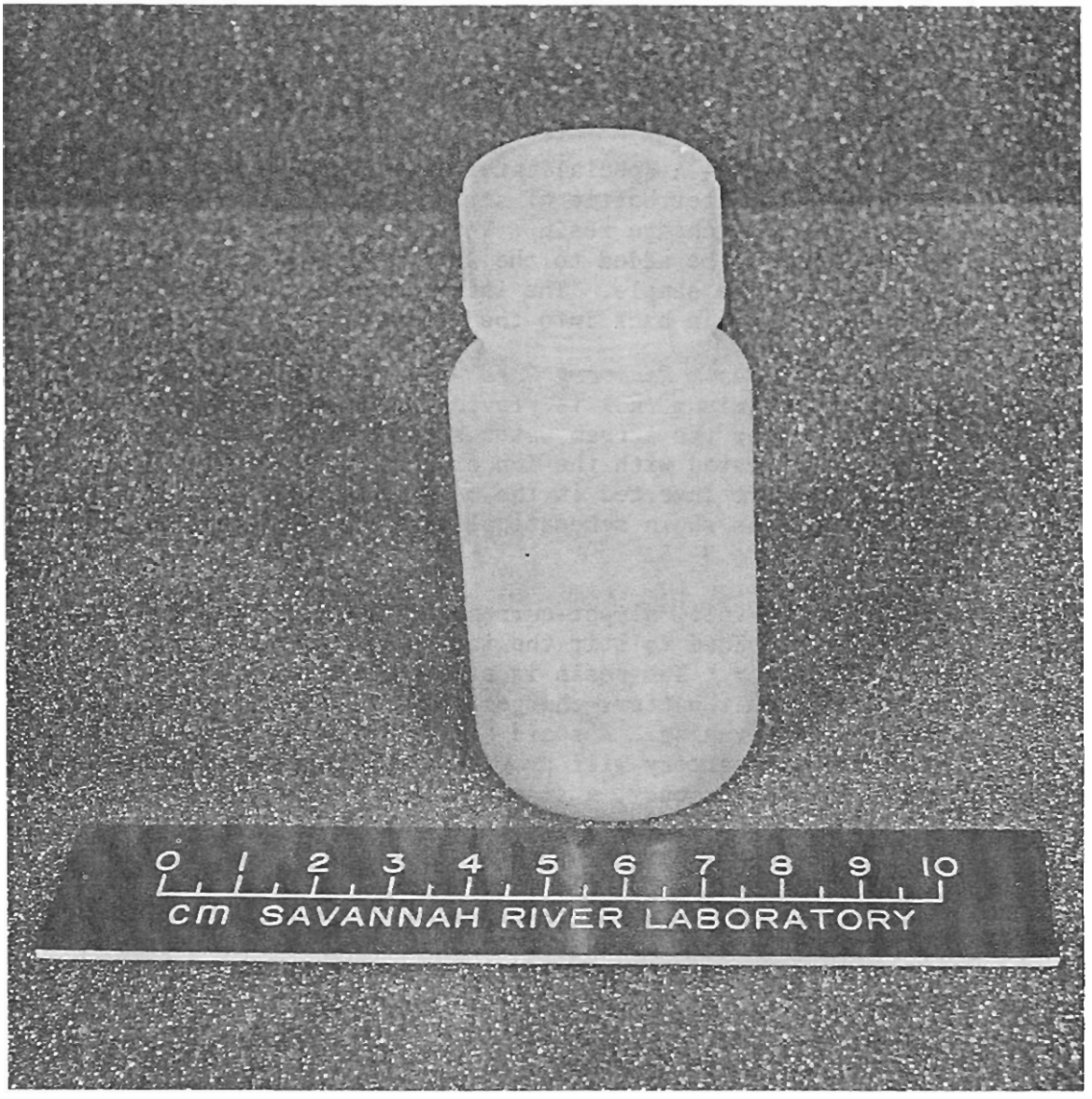


FIGURE B-11. Bottle Containing Ion Exchange Resin

FIGURE B-12. Interchange Cap for Ion-Exchange Resin Bottle

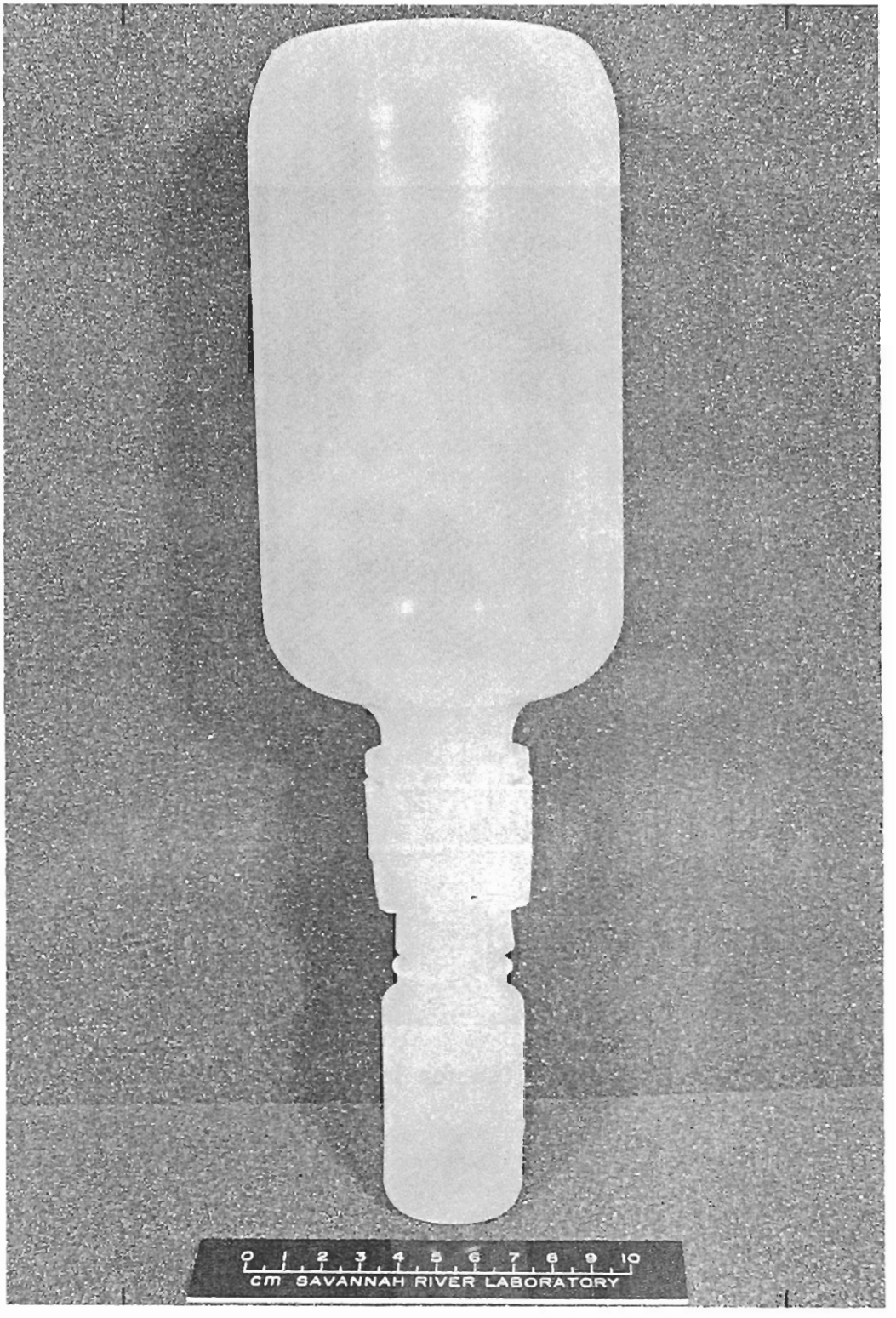


FIGURE B-13. Assembly for Transfer of Ion Exchange Resin

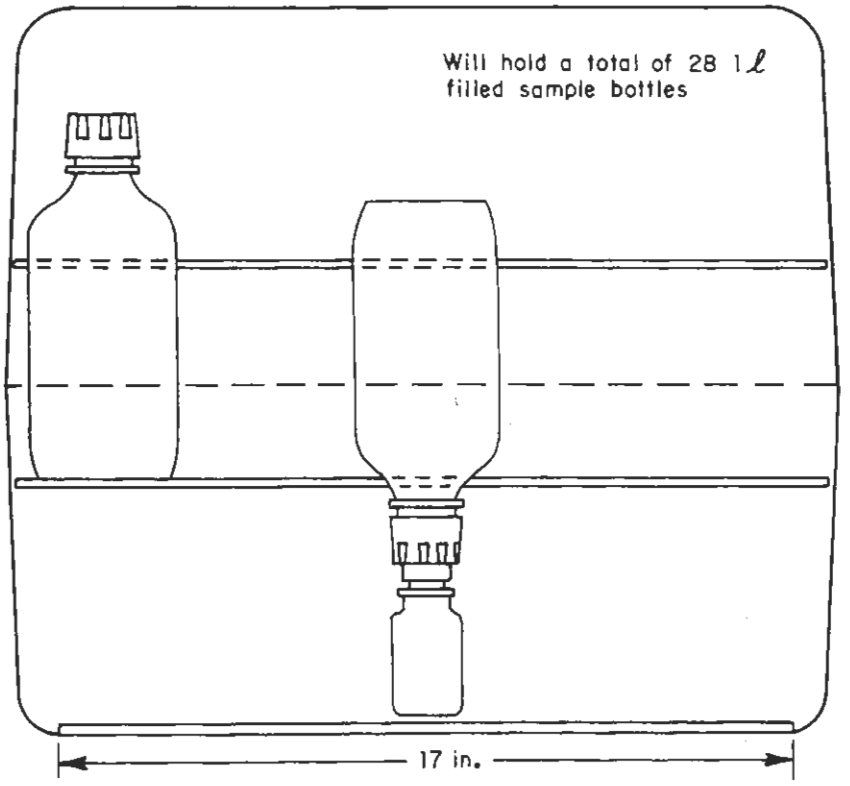


FIGURE B-14. Cross-Section of Carrier for Ion Exchange Resin Bottles

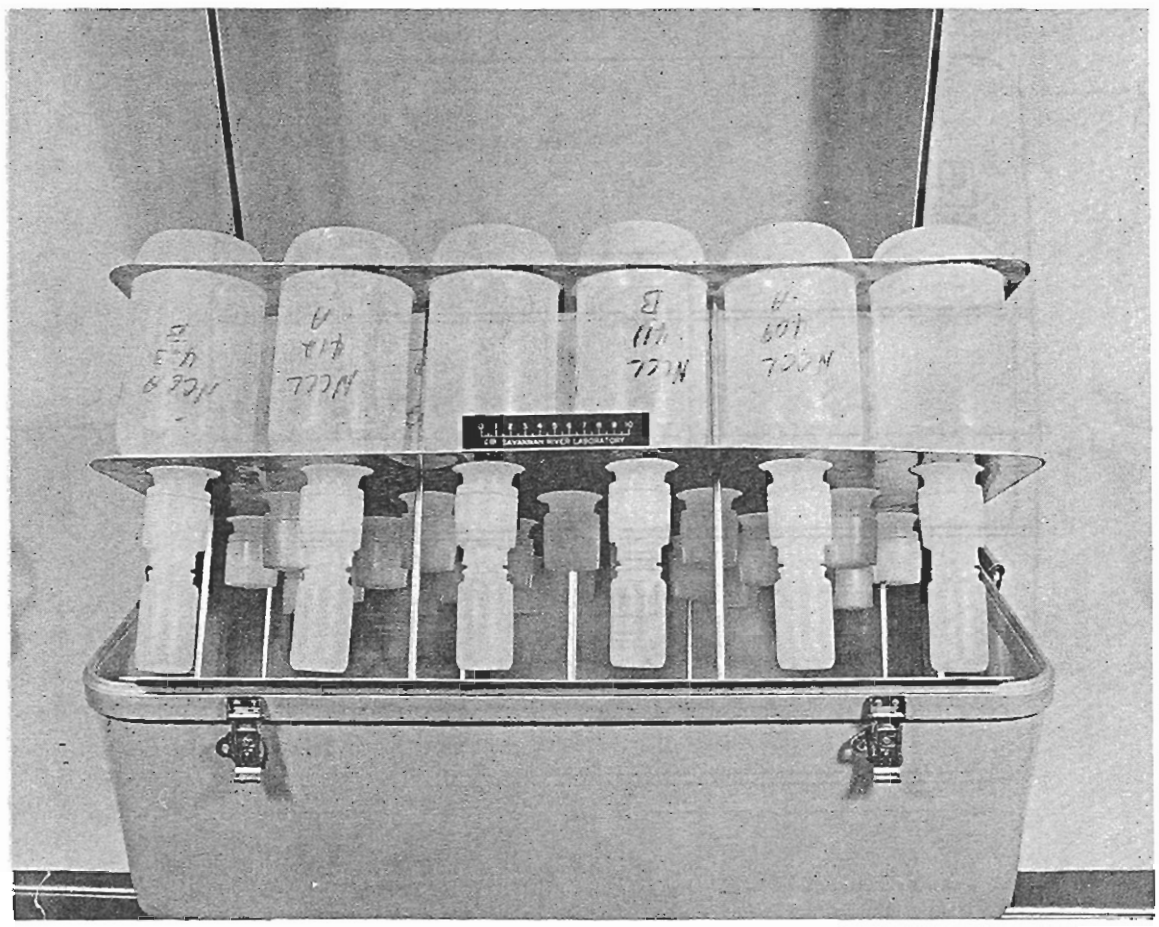
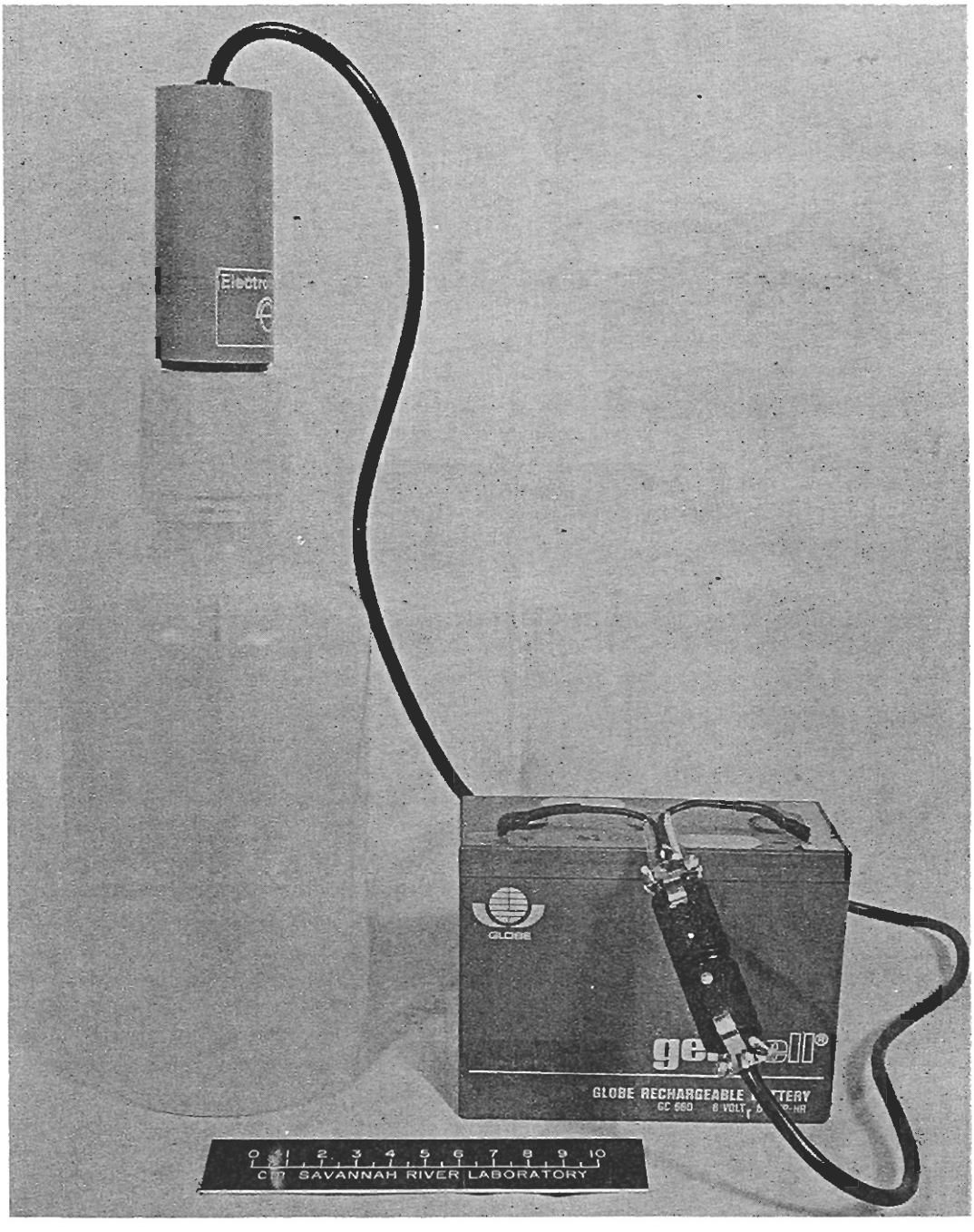
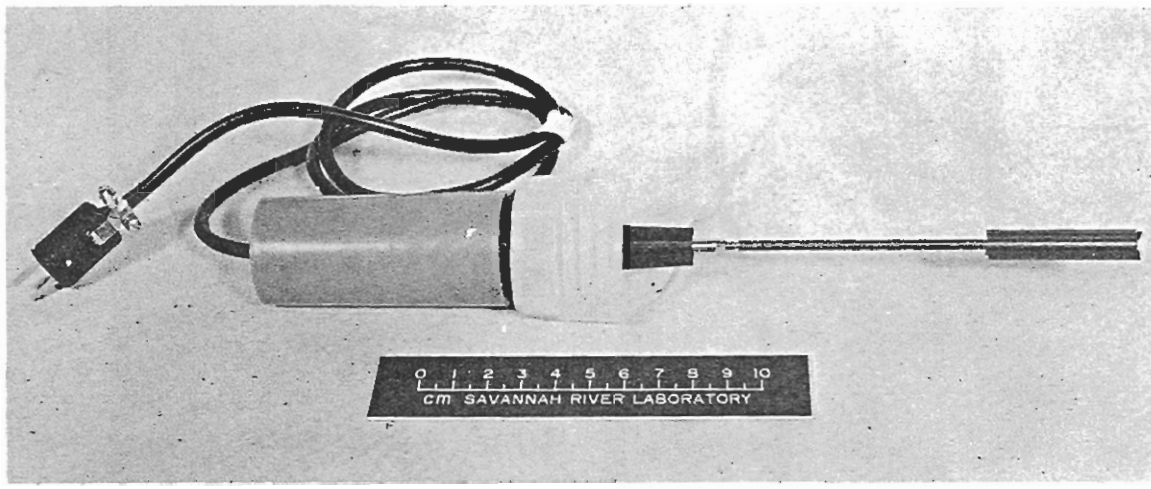


FIGURE B-15. Ion Exchange Resin Bottles in Carrier Ready for Transporting

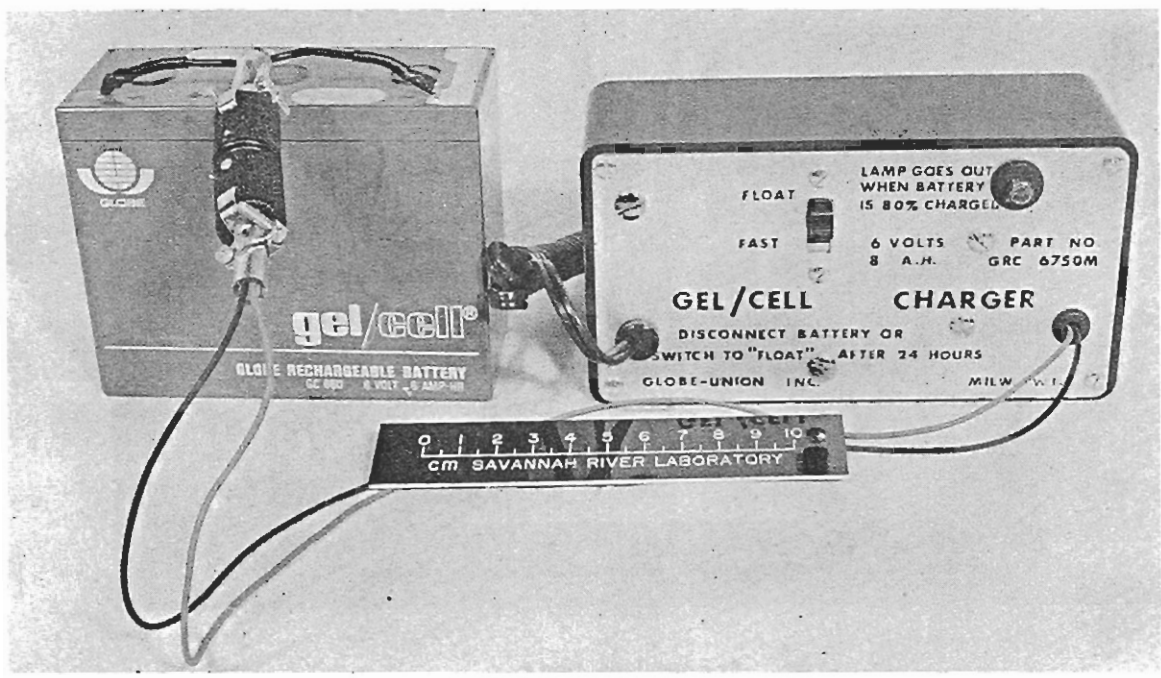


a. Assembled Unit

FIGURE B-16. Stirring Assembly for Ion Exchange Bottle



b. Stirrer



c. Battery and Battery Charger

FIGURE B-16. Continued

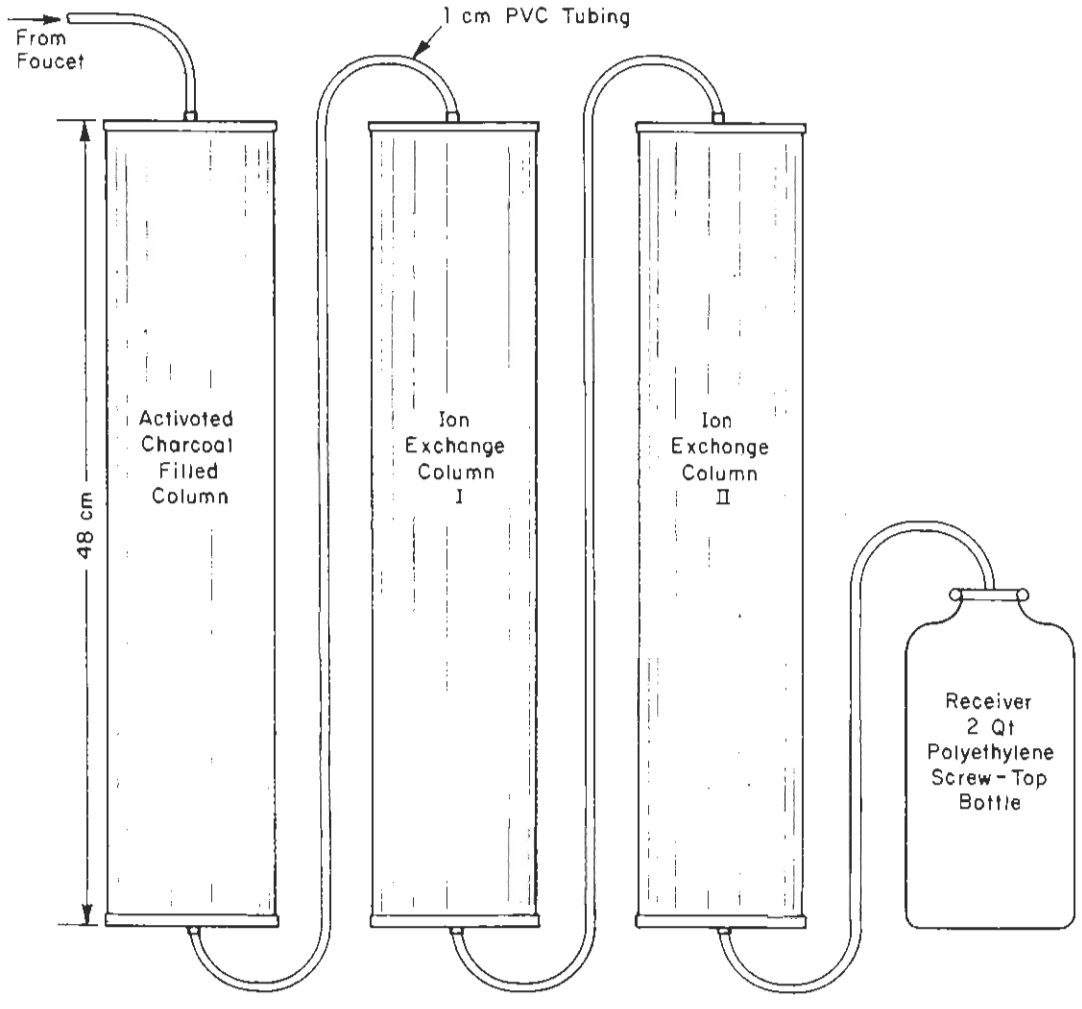


FIGURE B-17. Deionizer Columns

TABLE B-1

Daily Work and Equipment Checklist (Team Member 1)

A. Equipment Stored in Instrument Case

Item Number	*Equipment*	*Amount and Condition*
1	Sulfuric Acid, 0.02N	One dropper-bottle, full, carefully wrapped
2	Indicator	One dropper-bottle, full, carefully wrapped
3	Ehrlenmeyer Flask, 125 ml	Clean, check condition
4	Conductivity Meter	Daily check calibration and batteries, check plastic bag for holes, call Field Supervisor for any needed repair
5	pH Meter	Daily check calibration and batteries, check plastic bag for holes, call Field Supervisor for any needed repair
6	Data Forms	Enough, plus spares, keep dry
7	Maps	Check each map individually
8	ID Cards	Keep handy at all times
9	Wooden or Mechanical (No. 2) Pencils	Enough, plus spares
10	Aluminum Case	Clean and dry
11	Paper Towels	Enough, plus spares
12	*Nuclepore* 0.8-µm (142-mm diam.) Filter Membranes	Enough, plus spares, handle very carefully
13	Filter Membrane Tweezers	Check condition
14	Spare Filter Support	Keep clean
15	Spare Filter O-Ring	Check condition
16	Plastic Graduated Cylinder	Clean and inspect

Continued

TABLE B-1, Continued

B. Equipment Stored in Pressure Filter Case

Item Number	*Equipment*	*Amount and Condition*
1	Pressure Filter	Clean, dry, check condition very carefully
2	Filter Wrench	Check condition
3	Squeeze Bottle of Deionized Water	One full bottle, keep spare bottle in car
4	Fluorocarbon Gas Pressure Can	Enough, plus spare

C. Equipment Stored in Ion-Exchange Resin Recovery Case

1	1-liter Plastic Bottles and Caps	28 bottles, clean, rinse with deionized water, shake dry, and cap
2	Interchange Caps	28 caps, clean, rinse with deionized water, shake dry, store in clean plastic bags
3	Bottle Holder	Check condition

D. Equipment Stored in Ion Exchange Stirring Case

1	DC Stirrer and PTFE Coated Blade	Check condition, carry a spare
2	6-Volt Battery	Check for full charge, carry a spare

Team Member 2 (See Table B-2)

- *Sample Paper Bags* - An adequate supply of Kraft paper sediment bags must be set aside, ready for the day's collection. A ball of white cotton cord is also set aside to tie the bags shut. A pocketknife or other cutting tool should be available to cut the cord. The bags and cord should be stored in the backpack. A felt-tip pen with indelible ink (*Flo-master* or equivalent) should be carried in the backpack for marking the sediment sample paper bag (Figure B-18).

- *Sediment Samplers* - The bag sampler (Figure B-19) and scoop sampler (Figure B-20) should be checked DAILY to ensure they are in sound working order, e.g., loose nuts, etc., should be tightened; samplers cleaned, etc. The rope on the bag sampler should be checked to see it is securely attached. Enough cloth bags for the bag sampler for the day's sampling should be placed in the backpack. The bag sampler and scoop samplers are placed in the backpack.

- *Stainless Steel Sieve* - The 40-mesh sieve, pan, and cover are cleaned. A brush is used to remove all trapped sand grains from the sieve mesh. The sieve should be cleaned between samples. The clean sieve assembly is stored in the backpack.

TABLE B-2

Daily Work Checklist (Team Member 2)

A. Equipment Stored in Backpack

Item Number	*Equipment*	*Amount and Condition*
1	Bag Sampler and Rope	Clean, check condition
2	Cloth Bags	Enough, plus spares
3	Scoop Sampler	Clean, check condition
4	Stainless-Steel Sieve Assembly	Check condition, clean out trapped particles
5	Stainless-Steel Spatula	Check condition
6	Paper Sediment Bags	Enough, plus spares
7	White Cord	Enough, plus spares
8	Cutting Tool	Keep sharp
9	*Flowmaster* Pen	Full of ink, plus spare pen
10	2-liter Water Collection Plastic Beaker and Cord Cradle	Clean, check condition

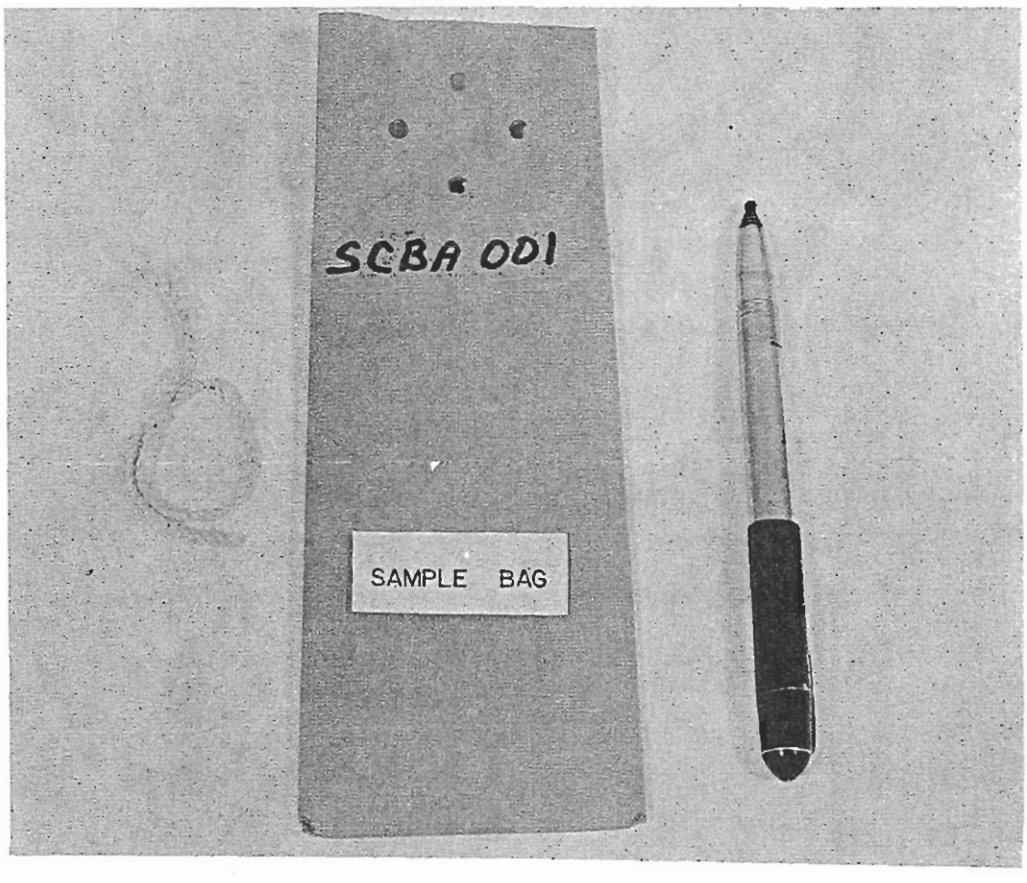


FIGURE B-18. Kraft Paper Bag for Sediment Sample

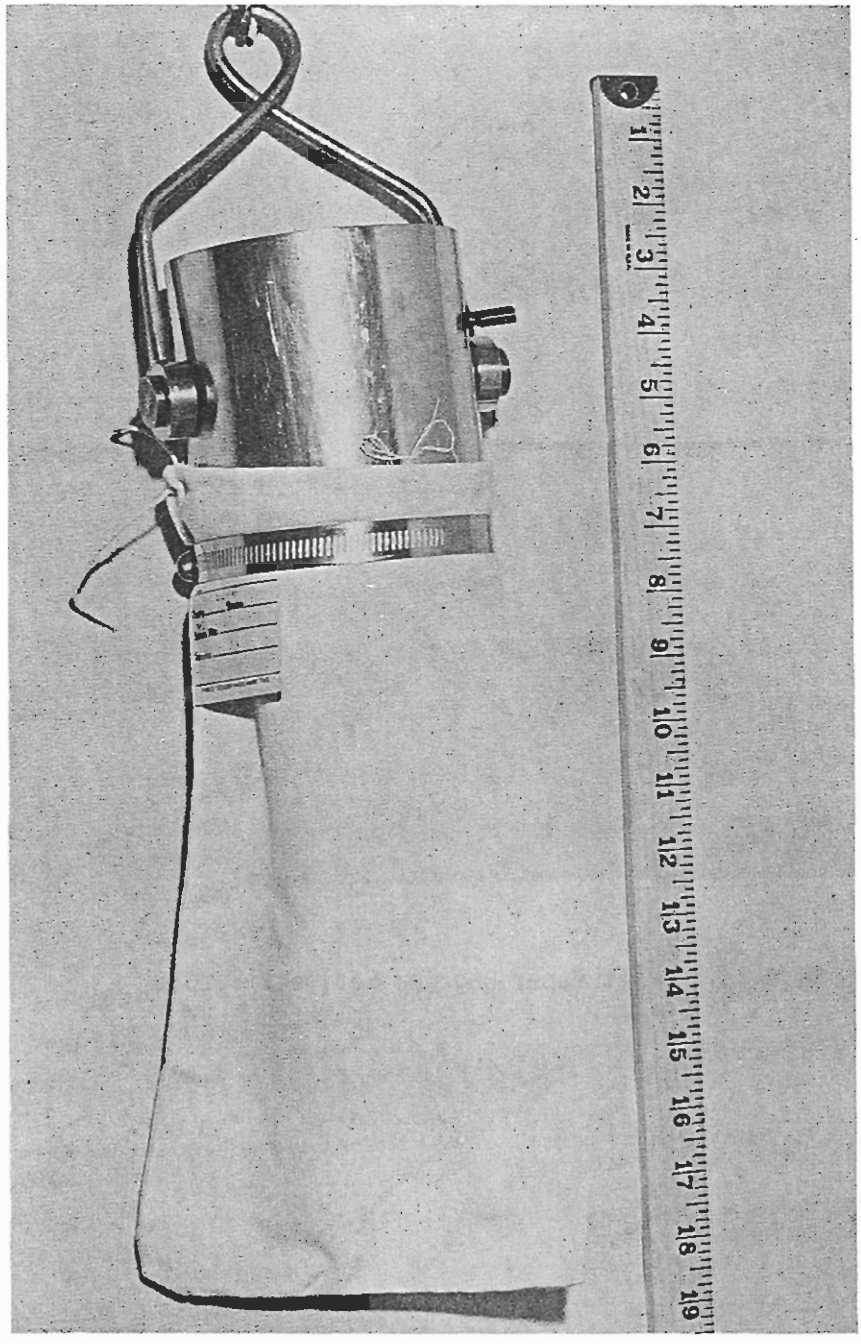
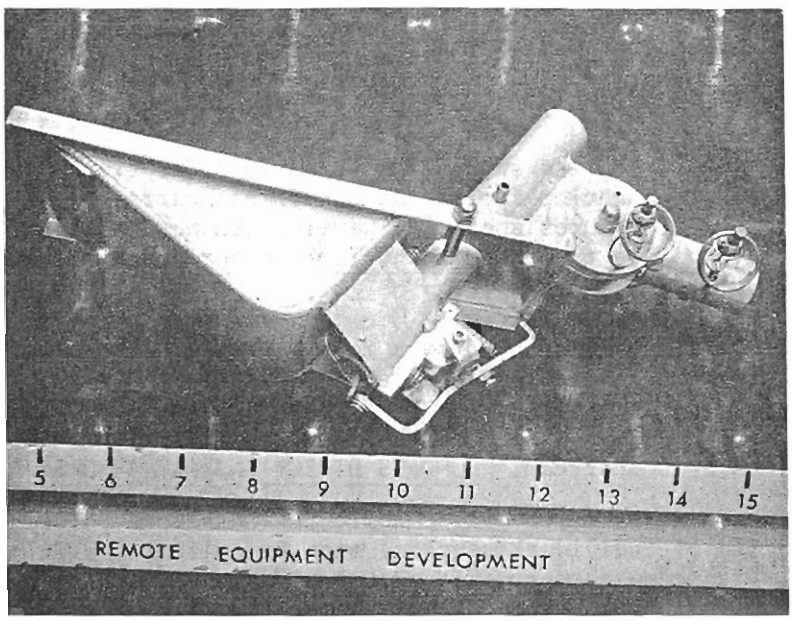


FIGURE B-19. Bag Sampler for Collecting Loose, Fine, Bottom Sediments



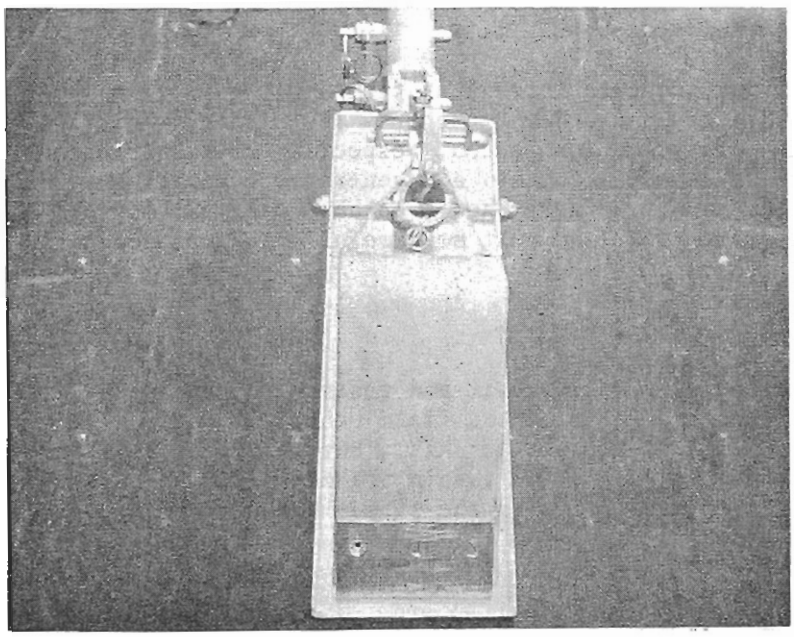


FIGURE B-20. Scoop Sampler for Collecting Confined or Coarse Bottom Sediments

PART II. OUTLINE AND SEQUENCE OF FIELD PROCEDURES (2-Member Sampling Team)

General Instructions

This manual provides specific instructions for field operations. Where the sampler feels that conditions warrant a departure from procedures specified herein, SRL must be contacted in advance. Failure to obtain authorization for specific exceptions may invalidate samples.

Where a stream is crossed by a road or trail, the sample site must be UPSTREAM, beyond the range of road litter or rainwater, dirt, mud, or snow thrown by automobiles, trucks, roadgraders, or snow plows. Directions (i.e., right or left) are defined looking downstream. COMPASS DIRECTIONS MAY ALSO BE USED.

Sample validity is crucial. While SRL has check points, the integrity of individual samplers must be relied upon in this program. Please make every effort to ensure that the samples you collect are correctly located, treated, and labeled.

Take care to see that land owners' misgivings or questions are satisfied. We may want to come back. Public relations are the contractor's responsibility.

A primary concern throughout the sampling program will be respect for the land owner's property and wishes. This includes obtaining permission for access, respecting any restrictions, following any special routes, and generally exhibiting a courteous and careful manner. There should be absolutely no littering; and gates, streams, and land must be carefully left as found.

Sampling Kit Setup

Operating the filter unit and testing the equipment are most conveniently done in or on the field vehicle. Water may be carried short distances to the testing kit. But where the transport time would be over one-half hour (as in the case of most off-road sites), the kit should be carried to the site. Concentrations of dissolved

uranium and values of pH, etc., for samples cannot be expected to remain stable over an extended period. Temperature changes, loss of dissolved gases, and microbiological activity can significantly alter the water characteristics on which these values depend.

For all sites greater than one-quarter mile from the field vehicle and in dusty areas where road dust from the passage of vehicles might pose a contamination problem, the sampling kit should be carried to a clear, level area as close to the sample site as possible, where snow, mud, dirt, leaves, or other debris will not fall into it, and where it will not slide into the water or be tipped over during use.

Normal Field Procedures

Sampling Procedures - Team Member 1 (See Table B-3)

The primary duties of Team Member 1 are to collect, filter, ion-exchange the stream water, and measure the pH, specific conductance, temperature, and alkalinity of the stream water. He also records various site descriptions on the data forms.

- *Water Collection* - Using the beaker and cord cradle (Figure B-21), obtain 1 to 2 liters of water from the active, flowing portion of the stream near mid-channel.

  Stagnant streams, which may consist of isolated pools with little or no indication of flow, should be sampled only when an alternate flowing stream is not available. Particulars of sampling conditions in stagnant streams should be entered under comments.

- *Water Filtration* - Carry the two-liter stream water sample back to where the field laboratory is set up. Lock the pressure filter on top of its carrying case (Figure B-22) and rinse the filter support with deionized water. Using tweezers, place a new filter membrane in the filter (Figure B-23). Place a clean 1-liter bottle inside the carrying case under the filter (Figure B-24). Remove the filter top and pour in ~1100 ml of water (Figure B-25). The remaining unfiltered stream water (~1 liter) will be analyzed as described in the following sections. Replace the top and pressurize the filter with the can of fluorocarbon gas (Figure B-26). Conductivity, temperature, and pH are to be measured while the filtration is in progress. After filtering the water, remove the liter of filtered water and place the filter inside the carrying case.

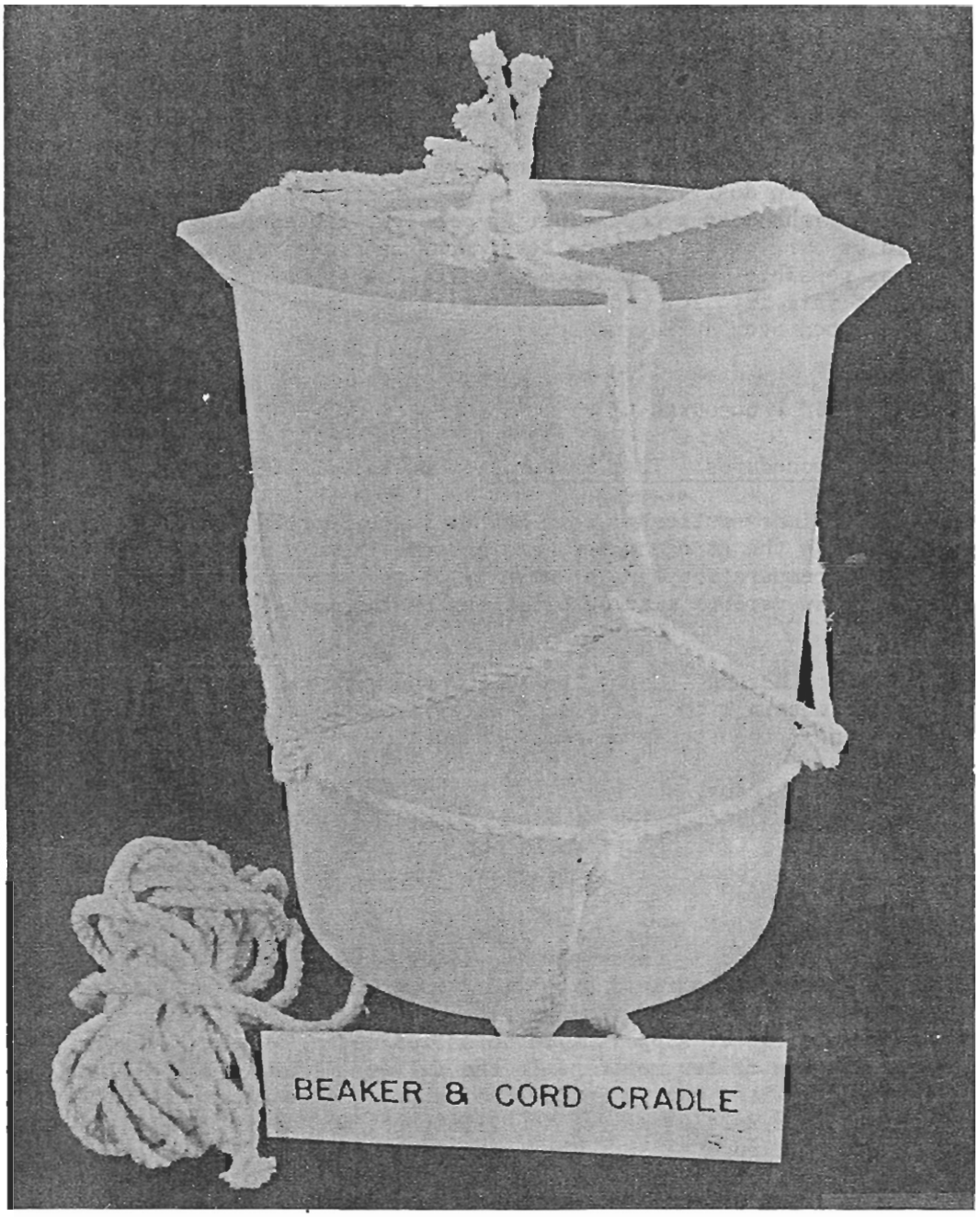


FIGURE B-21. Collector for Stream Water Samples

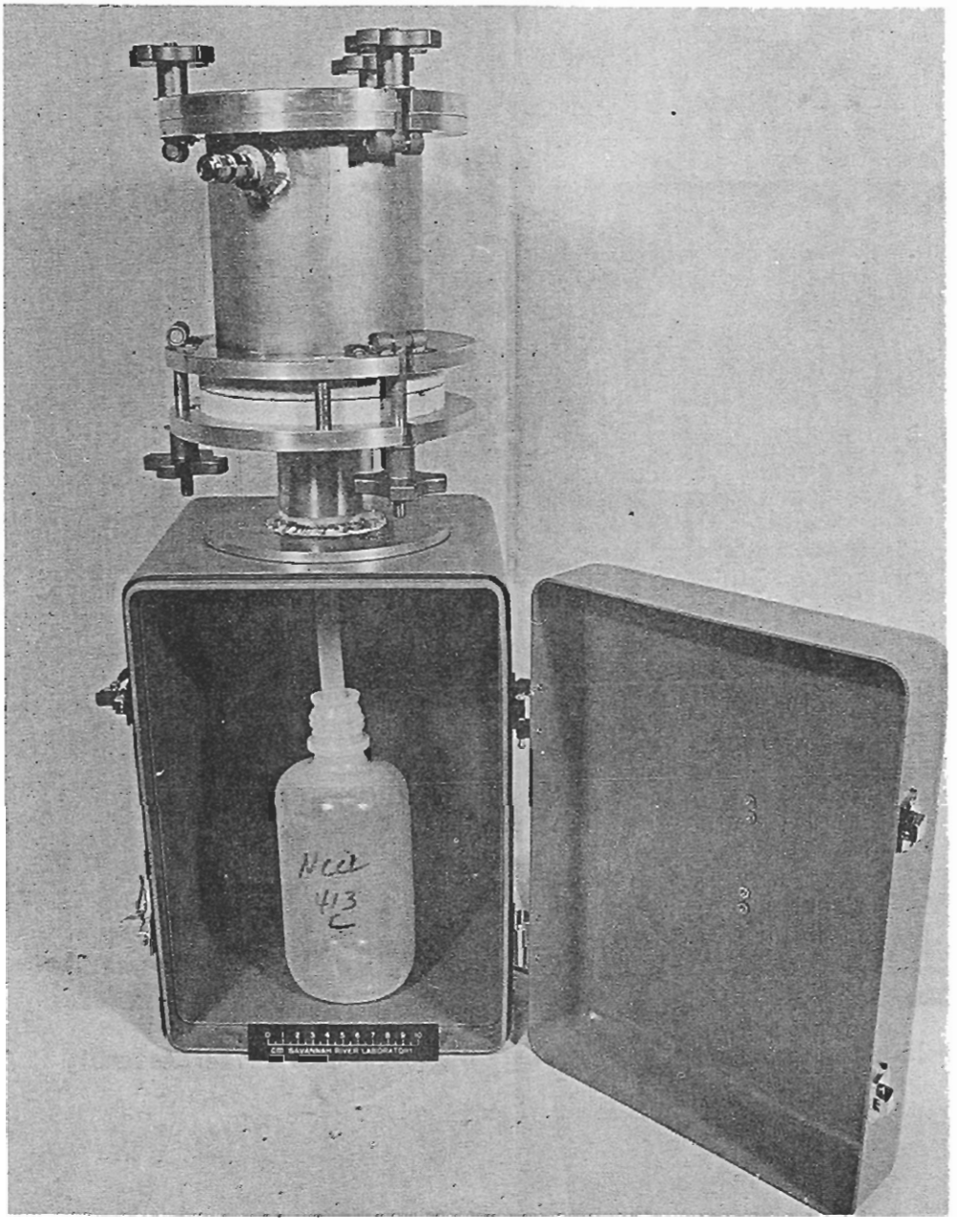


FIGURE B-22. Assembled Pressure Filter

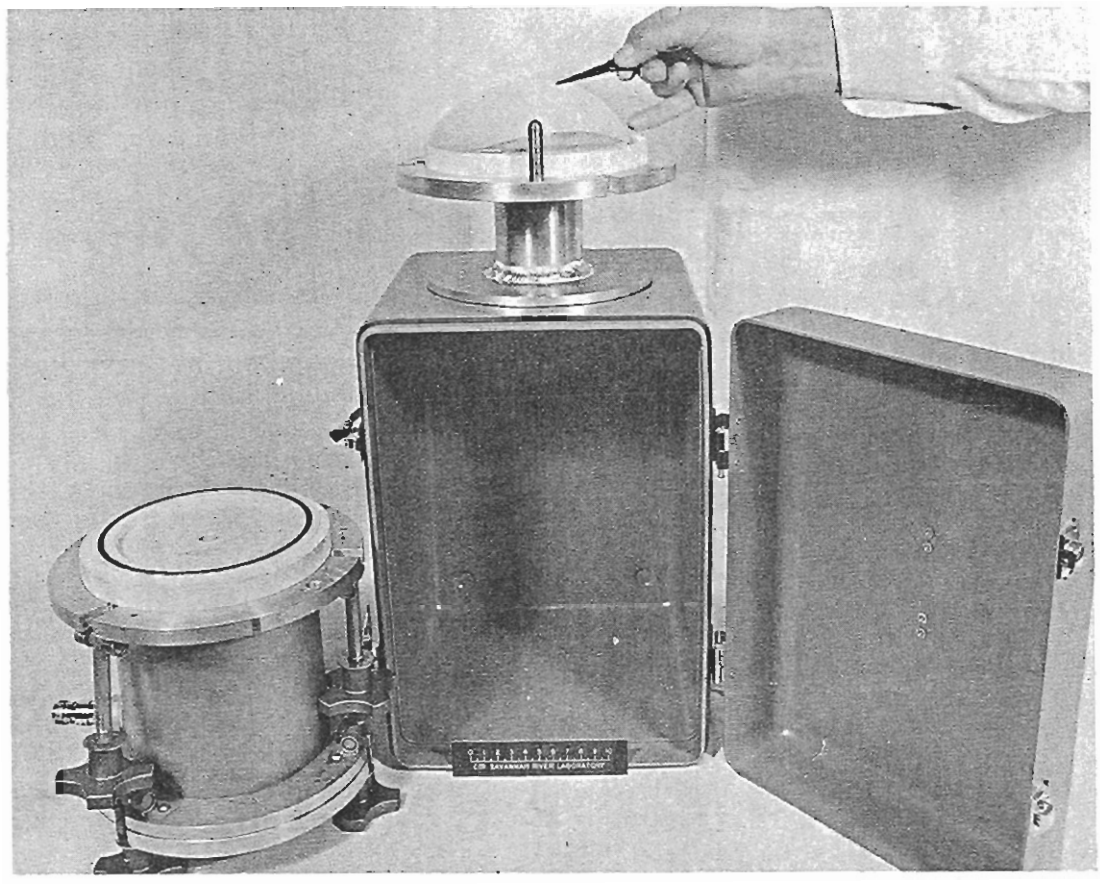


FIGURE B-23. Replacing Filter Membrane in Pressurized Filter Assembly

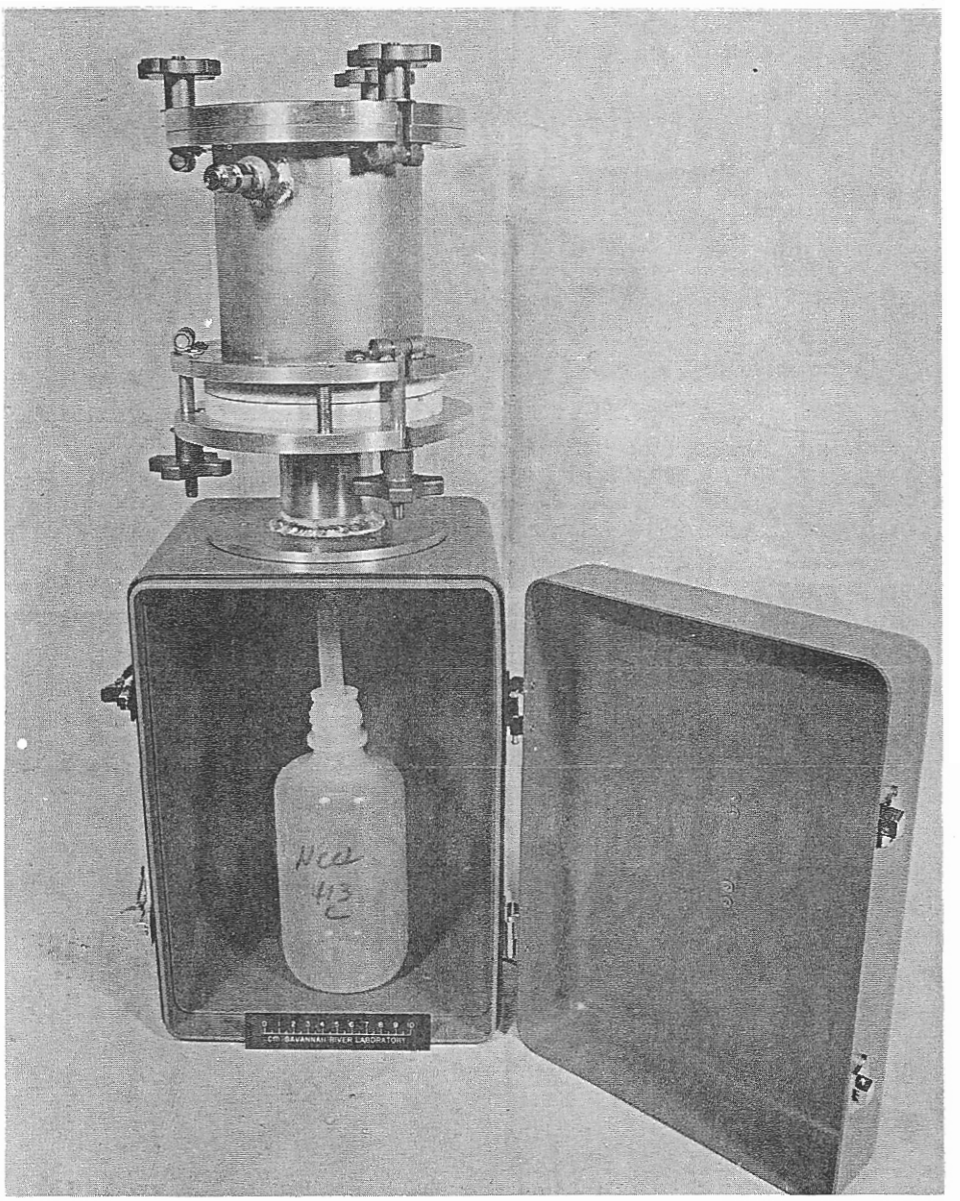


FIGURE B-24. A 1-Liter Collection Bottle in Place Under Filter

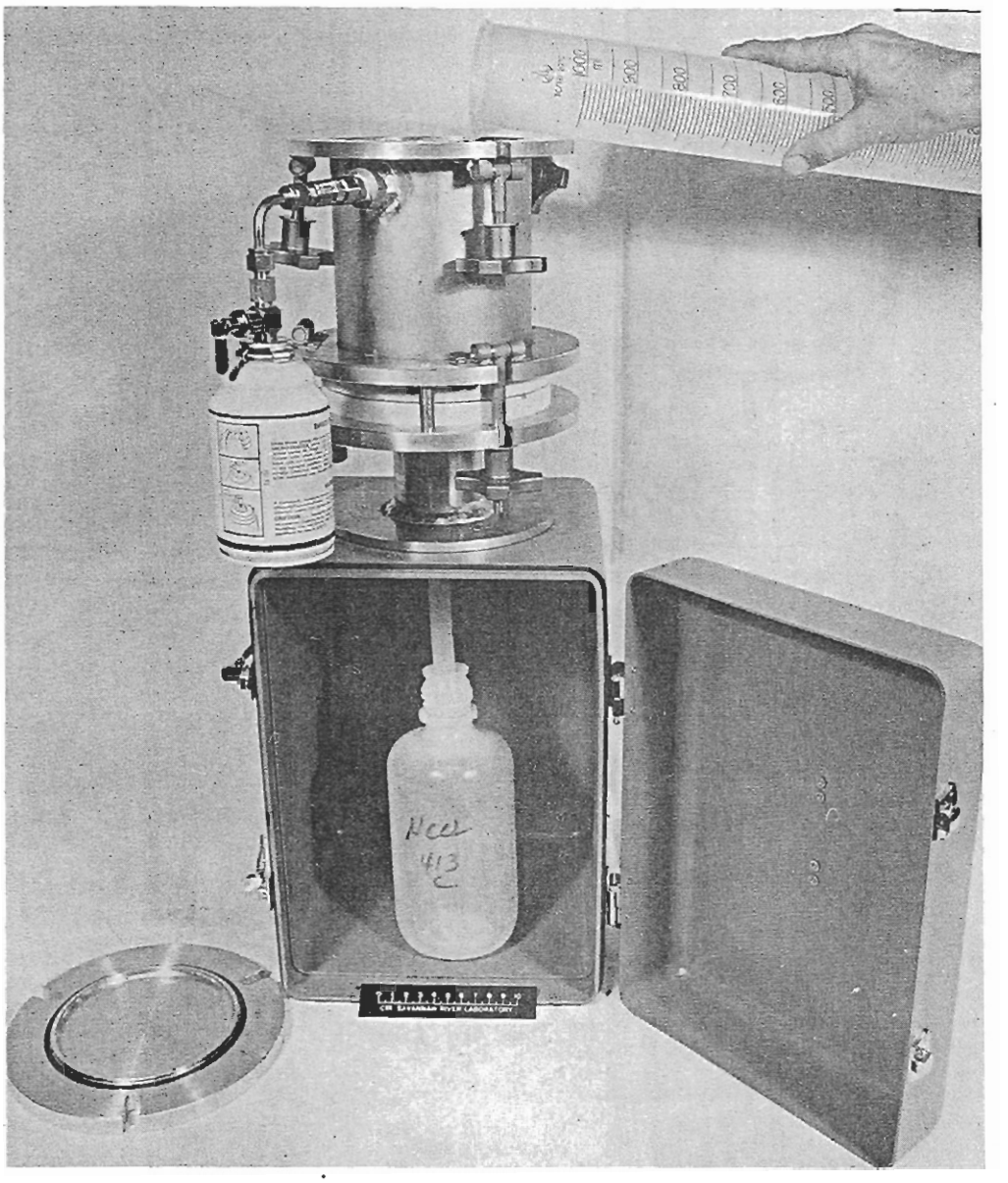


FIGURE B-25. Stream Water Sample Being Poured in Filter Reservoir

FIGURE B-26. Filtration Apparatus in Operation

- *Conductivity - Temperature Measurement** - Place the conductivity probe into the beaker of remaining unfiltered water (Figure B-27). The probe should be completely submerged in water and suspended about 2 inches above the bottom center of the beaker. Metal objects should be kept at least 6 inches away from the probe. Measure the temperature and conductivity as described below.

    1. Check meter zero. If not zero, contact the field supervisor.

    2. Calibrate the meter by turning the switch to "Redline" and adjusting the meter needle with the redline control to the red line on the scale. If this cannot be accomplished, contact the field supervisor.

    3. Put the probe in the solution to be measured.

    4. Set the switch to temperature. Allow the needle to stabilize. Read the temperature on the bottom scale of the meter in degrees Celsius (°C). (Note: This scale reads from right to left.) Allow time for the probe temperature to come to equilibrium with that of the water before reading.

    5. Record the temperature as the nearest whole °C on the data form.

    6. Switch the meter to the X100 µmhos/cm range. If the reading is below 50 on the 0-500 meter scale, switch to the next lower range (X10 µmhos/cm). If the reading is still below 50, switch to the next lower range (X1 µmhos/cm). Read the meter scale and multiply that reading by the range (X100, etc.). The answer is the reading in µmhos/cm.

        Example: Meter Reading: 247
        Scale: X10
        Answer: 2470 µmhos/cm

    7. Record the conductivity in µmhos/cm on the data form. (Units on the field form are for specific conductance, e.g., µmhos. The numerical values for conductivity and for specific conductance are the same.)

    8. TURN THE INSTRUMENT OFF.

---

* These instructions apply to the Yellow Springs Instruments Model 33 S-C-T conductivity meter. If a different instrument is used, appropriate instructions will be issued.

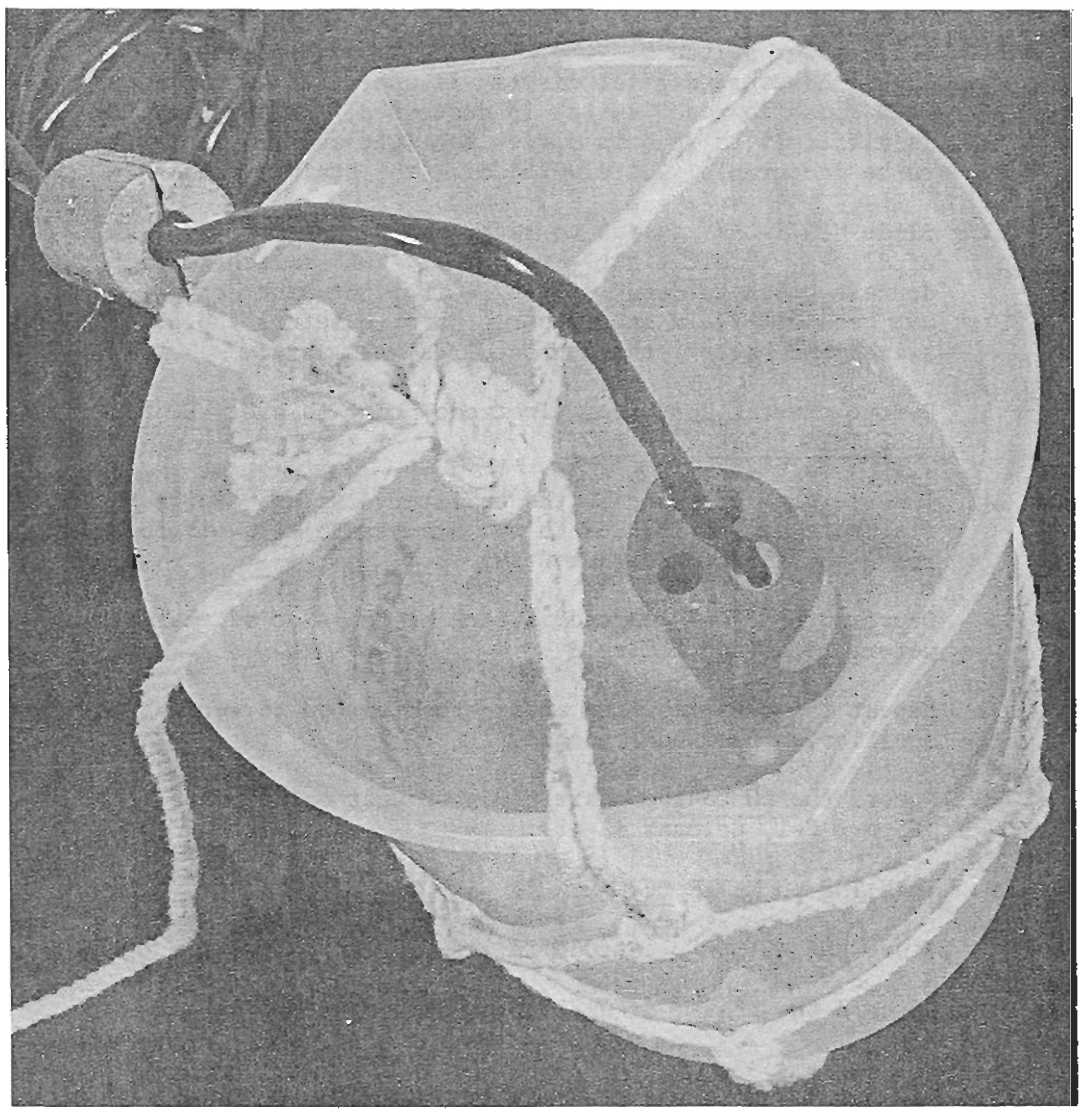


FIGURE B-27. Measuring Conductivity of Ground Water Sample

- *pH Measurement** - The pH measurement is made after the conductivity measurement to be certain KCl solution from the tip of the pH electrode will not change the water's conductivity.

  1. Slide power switch to "ON". Note: Decimal point will light; however, digital display is operational only when "push-to-read" switch is depressed. The display is difficult to read in direct sunlight and may appear to be inoperable. Shield the dial to obtain a reading.

  2. Slide "BATT-CHK" switch to right. A red dot to the right of display should light. With "BATT-CHK" switch to right, depress "push-to-read" switch -- if right hand dot goes out, contact field supervisor. On some meters the power switch and battery check procedures will vary.

  3. Remove plastic boot from electrode prior to use. DO NOT LOSE THIS PROTECTIVE BOOT!

  4. Immerse the electrode in the unfiltered water. Swirl the electrode around for one to two minutes to allow it to reach equilibrium (Figure B-28).

  5. Depress the "push-to-read" switch on the side of the pH meter; read the pH display.

  6. Repeat the siwrling step and re-read the pH to verify equilibrium has been reached.

  7. Record the pH to the nearest 0.1 pH unit on the data forms (Figure C-1, Columns 41-43).

  8. TURN THE pH METER OFF.

  9. Store the WET pH electrode in its plastic boot.

  10. Discard the beaker of unfiltered stream water.

- *Water Ion Exchange* - Enter the site code on a gummed label in pencil and attach that label to a 2-ounce bottle of fresh ion exchange resin. Cover the label with transparent tape. Using the ion exchange interchange cap, transfer the resin from the labeled, 2-ounce bottle of resin into the filtered stream water sample. Remove the interchange cap and 2-ounce bottle (keep it clean). Place the 6-volt stirrer into the water-resin mixture and stir until the next site is reached

---

* These instructions apply to the Markson Model 80 mini-pH meter. If a different instrument is used, appropriate instructions will be issued.

(at least ten minutes). When the stirrer is removed, rinse and insert it into a fresh 1-liter bottle to make sure that it remains clean until used again.

The amount of filtered stream water which is allowed to react with ion exchange resin will normally be exactly one liter, with the excess amount saved for the alkalinity titration below. It is possible for one liter of water to contain more dissolved solids than can be removed by the resin. Conductivity gives a measure of the concentration of dissolved material and will be used to estimate the amount of water to be ion exchanged. For samples with a conductivity of less than 500 µmhos/cm, a full liter can be used. If the conductivity is between 500 and 1000 µmhos/cm, then 1/2 liter (500 ml) is used. If the conductivity is between 1000 and 2000 µmhos/cm, 200 ml of the filtered water is used. If the conductivity exceeds 2000 µmhos/cm, only 50 ml of the filtered water is used.

- *Alkalinity Titration* - Measure up to 50 ml of the remaining filtered stream water and pour this into the 125-ml Ehrlenmeyer flask, add 4 to 6 drops of bromo-cresol green/methyl-red indicator solution and mix. Add 0.02N sulfuric acid solution dropwise, while gently swirling the flask. Count the number of drops required to cause the solution to turn light pink and record this on the data sheet (Figure C-1, Columns 51-54).

  Occasionally, particularly in limestone areas, alkalinity may be quite high. If the solution has not shown signs of changing to light pink after the addition of twenty (20) drops of 0.02N sulfuric acid, discard the solution. Repeat the titration on 10 ml of filtered stream water. (Do not use less than 10 ml). The titration solution is harmless and may be poured on the ground. Shake the flask dry.

- *Data Form Completion* - Before leaving the sample location, fill in the site description on the data form according to the standard coding instructions provided. Make a final check to be sure that the appropriate sample location number has been written on the sediment sample bag and on the label of the 2-ounce, ion exchange resin bottle.

- *Cleanup and Storage* - Beakers, and all other gear should be wiped dry with clean towels and replaced in the field kit. Be sure that sand grains or other debris sticking to the equipment are carefully removed. Return all equipment to cases. Check the ion exchange stirrer and drive to the next site.

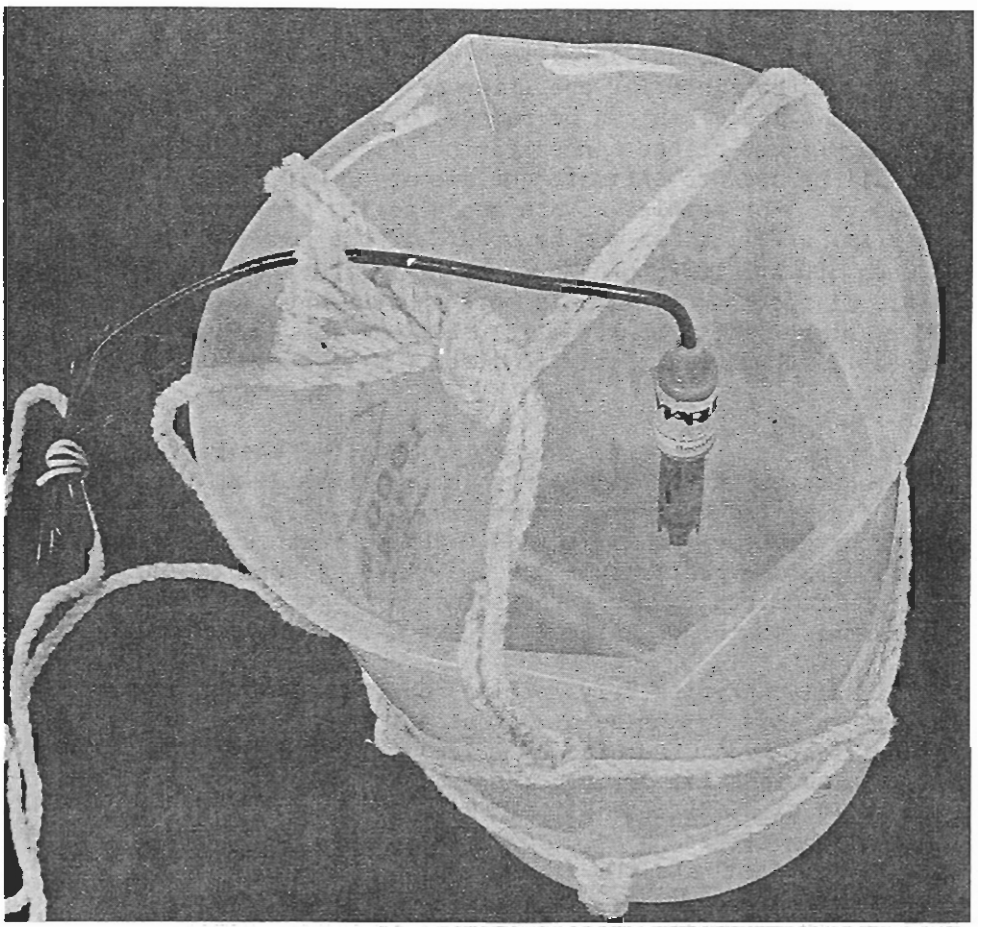


FIGURE B-28. Measuring pH of Ground Water Sample

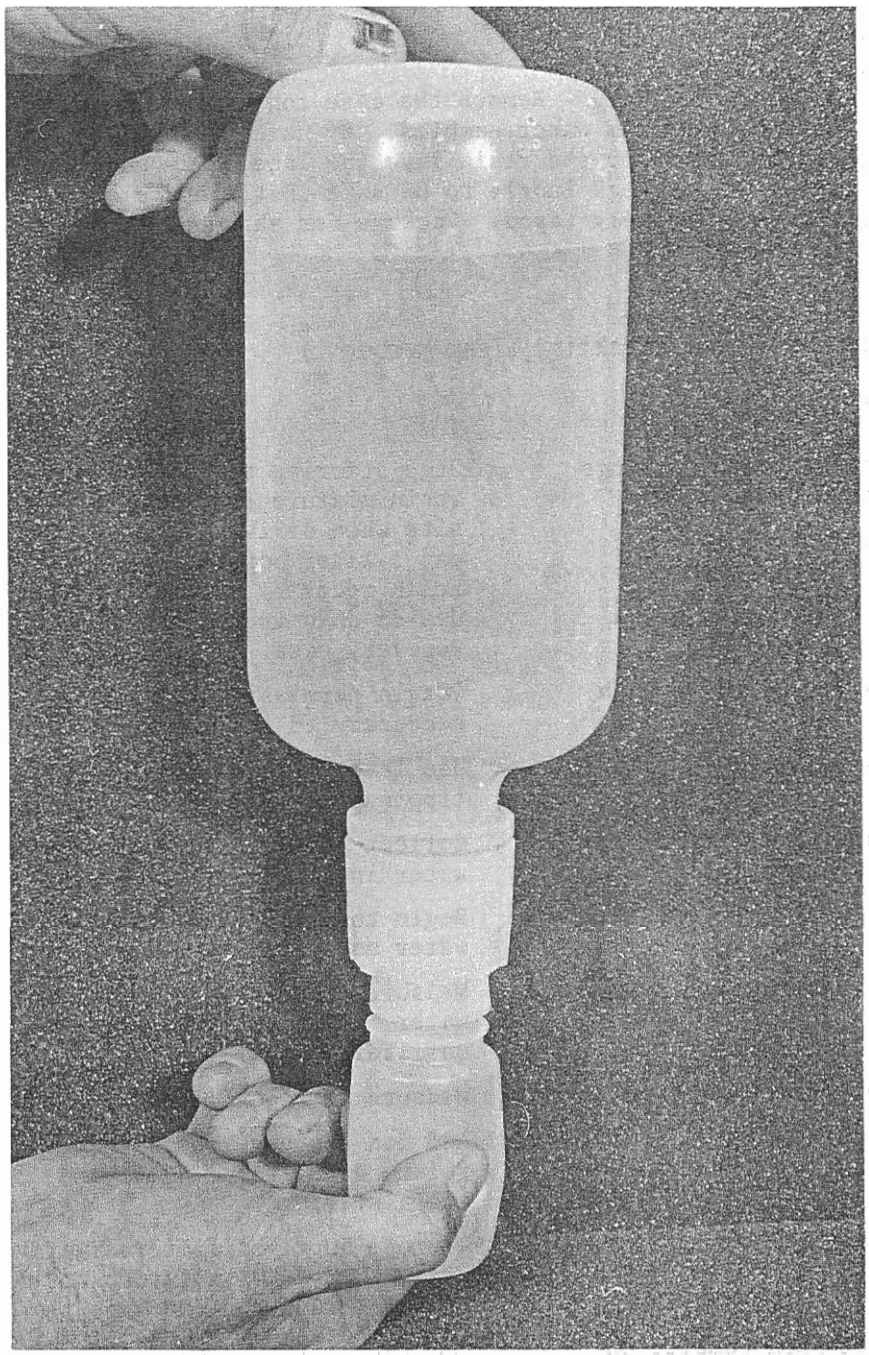


FIGURE B-29. Transfer of Ion Exchange Resin into 2-oz Sample Bottle

At the End of Each Day

- *Ion Exchange Recovery* - Remove the case containing the day's collection of stream water samples. By using a swirling, pumping action, transfer the resin into the labeled 2-ounce bottles (Figure B-29). Check labels to be sure that all are correct, legible, and securely taped. Package for shipment to SRL.

TABLE B-3

Sampling Procedure Checklist (Team Member 1)

A. At the Site

1.	Stirring Ion Exchange Resin Mixture	Stop stirring the ion-exchange resin mixture from the previous site when arriving at new site; cap 1-liter bottle with 2-ounce resin recovery bottle and place upside-down in ion exchange resin recovery case.
2.	Sample Site Approach	Obtain permission for access, if necessary.
3.	Sampling Kit Set-Up	Use level ground or vehicle, avoid tipping over.
4.	Water Collection	Collect 1 to 2 liters of stream water in plastic beaker.
5.	Water Filtration	Begin to filter 1 liter of stream water using pressure filters.
6.	Conductivity-Temperature[a]	Measure temperature of unfiltered water, measure conductivity of unfiltered water.
7.	pH Measurement[a]	Measure pH of unfiltered water.
8.	Ion Exchange	Add ion exchange resin to proper volume of filtered water and start stirrer.
9.	Alkalinity Titration	Titrate 50 ml of filtered water with 0.02N H_2SO_4 solution until pink color of indicator is reached.
10.	Data Form Completion	Complete all entries.
11.	Clean-Up and Storage	Return equipment to case, remove all debris, police sampling area.

a. Measure temperature, conductivity, and pH on a portion of water while filtration is in progress.

TABLE B-3, Continued

B. At the End of the Day

1. Ion Exchange Resin Recovery	Recover the resin into the properly labeled 2-ounce bottles and package for shipment to SRL.
2. Master Map Preparation	Transfer the site locations from the daily working maps to a clean, unfolded, master map.
3. Form Check	Check each form and resin bottle for accuracy, legibility, etc.
4. Instrument Care	Check condition of drying agent, check for moisture in instrument case, leave case open in room overnight.

Sampling Procedures - Team Member 2 (See Table B-4)

The duty of Team Member 2 is to collect, sieve, and package correctly a multi-composited stream sediment sample. He will also assist Team Member 1 in site descriptions of sediment type, color, and water flow.

Description of Sediment Sampling Equipment

- *Scoop Sampler* — A jaw scoop sampler is provided for reaching sediment in small inaccessible areas (Figure B-20). This sampler is spring-loaded and should be used with care. The sampler attaches to the fiberglass walking staff. The attachment angle of the scoop can be varied from 90° to 180° for use under conditions ranging from clay through silt and sand to rocky bottoms.

- *Bag Sampler* — The bag sampler consists of a stainless steel tube with an attached bail, band clamp, and removable drill bag (Figure B-19). The attachment point of the bail was carefully selected to force the sampling element down into the sediment as the bail rope is pulled. The bag sampler was designed primarily for sampling sand or silt sediments. It is thrown slightly across- and downstream and then dragged UPSTREAM against the flow. This technique keeps even very fine silt in the bag and effectively samples the mid-channel of the stream. Make certain the knot holding the sampler is strong and the free end of the rope is secure. Use a new cloth bag for each NEW site. The bag should be turned inside-out (seams out) before attaching to the bag sampler.

Collection of Sediment Sample

Using either the bag sampler or the scoop sampler, collect sediment samples from the active portion of the stream. Bear in mind that stream sediment is the sampling target; NOT dirt from nearby banks. Sample ONLY from the active portion of the stream.

To reduce the sampling error, always take a MINIMUM of FIVE (5) different samples from along 100 to 500 feet of stream bottom. All of these samples are to be only from the active portion of the stream. These 5 or more subsamples are combined and sieved together to yield one site sample.

Where a stream is crossed by a road or trail, the sample site must be upstream, beyond the range of road litter or rainwater, dirt, mud, or snow thrown by automobiles, trucks, roadgraders, or snow plows.

Using stream water, rinse the samples onto the assembled 40-mesh sieve and bottom pan. Cover the screen, and sieve the -40 mesh sediments into the bottom pan.

Separate the sieve from the bottom pan and allow the suspended solids to settle. VERY CAREFULLY decant off the water losing as few fines as possible.

Using the spatula transfer the -40 mesh sediment (Figure B-30) into a new Kraft paper sediment bag.

SPECIAL NOTE A minimum of 150 cm^3 ($\sim$9 $in.^3$ or $\sim$1 lb) of -40 mesh sediment must be collected at each site. THIS IS A MINIMUM.

Label the top fold of the paper sediment bag using ONLY a *Flowmaster* pen. The site code is written on both sides of the top fold. It is suggested that the bag be labeled before the sediment is put in it.

SPECIAL NOTE All writing must be LEGIBLE AND CORRECT.

Tie a piece of white cord through the folded top of the paper sediment bag. Allow the sample to air-dry. (Samples are to be OVEN DRIED (90 to 100°C) before shipment to SRL; up to 30 hr may be necessary to dry some samples).

Clean-Up and Storage

Brush off sediment sample bag, clean sieve assembly and replace in backpack.

Police the area. Leave area as clean OR CLEANER than you found it.

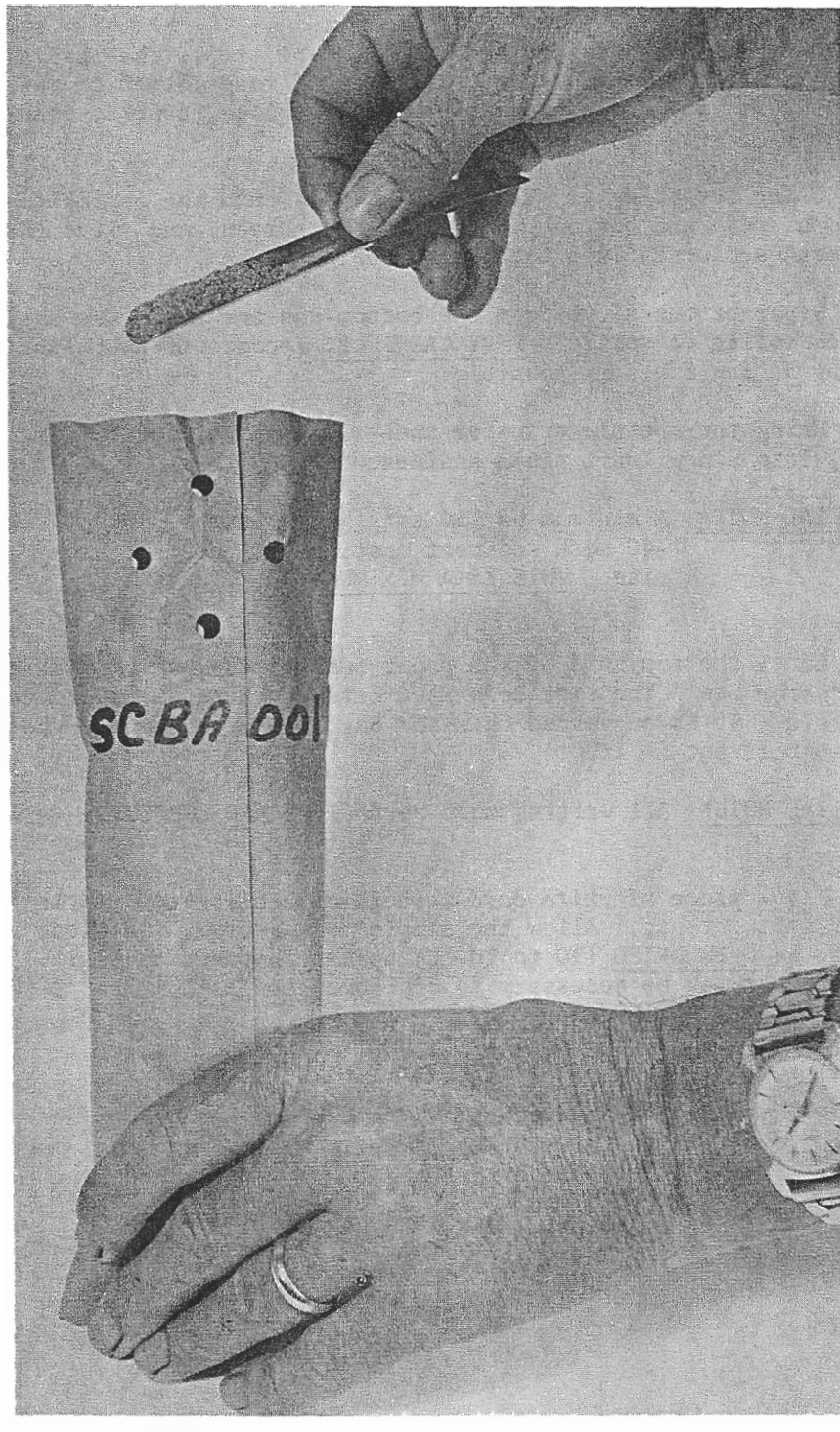


FIGURE B-30. Transfer of Sediment Sample, -40 Mesh

TABLE B-4

Sampling Procedure Checklist (Team Member 2)

1.	Sample Site Approach	Obtain permission for access, if necessary.
2.	Sampling Backpack Kit Setup	Use level ground, avoid tipping over.
3.	Sediment Sample Collection	Collect 5 or more subsamples from along 100 to 500 feet of stream.
4.	Sediment Sample Sieving	Sieve sample to -40 mesh, retain fines.
5.	Sediment Sample Packaging	Package a minimum of 150 cm^3 of -40 mesh sample, label correctly.
6.	Cleanup and Storage	Return samplers to backpack, remove all debris, police sampling area.

APPENDIX C: STANDARD CODING INSTRUCTIONS

SAVANNAH RIVER LABORATORY GEOCHEMICAL STREAM SEDIMENT AND WATER SURVEY FIELD DATA FORM (Card Code No. 4)

General Statements

A copy of the data form is shown in Figure C-1. All data to be entered on the SRL Field Data Form MUST be entered CORRECTLY and RIGHT JUSTIFIED in the appropriate columns of the 80-column form. The form MUST be completed using ONLY a No. 2B soft-lead wooden or mechanical pencil. All data forms and associated samples must be CHECKED for accuracy, correct format, and legibility. All letters and numbers will be formed ONLY as shown below and at the bottom of each form:

Standard Letters and Numbers

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

0 1 2 3 4 5 6 7 8 9

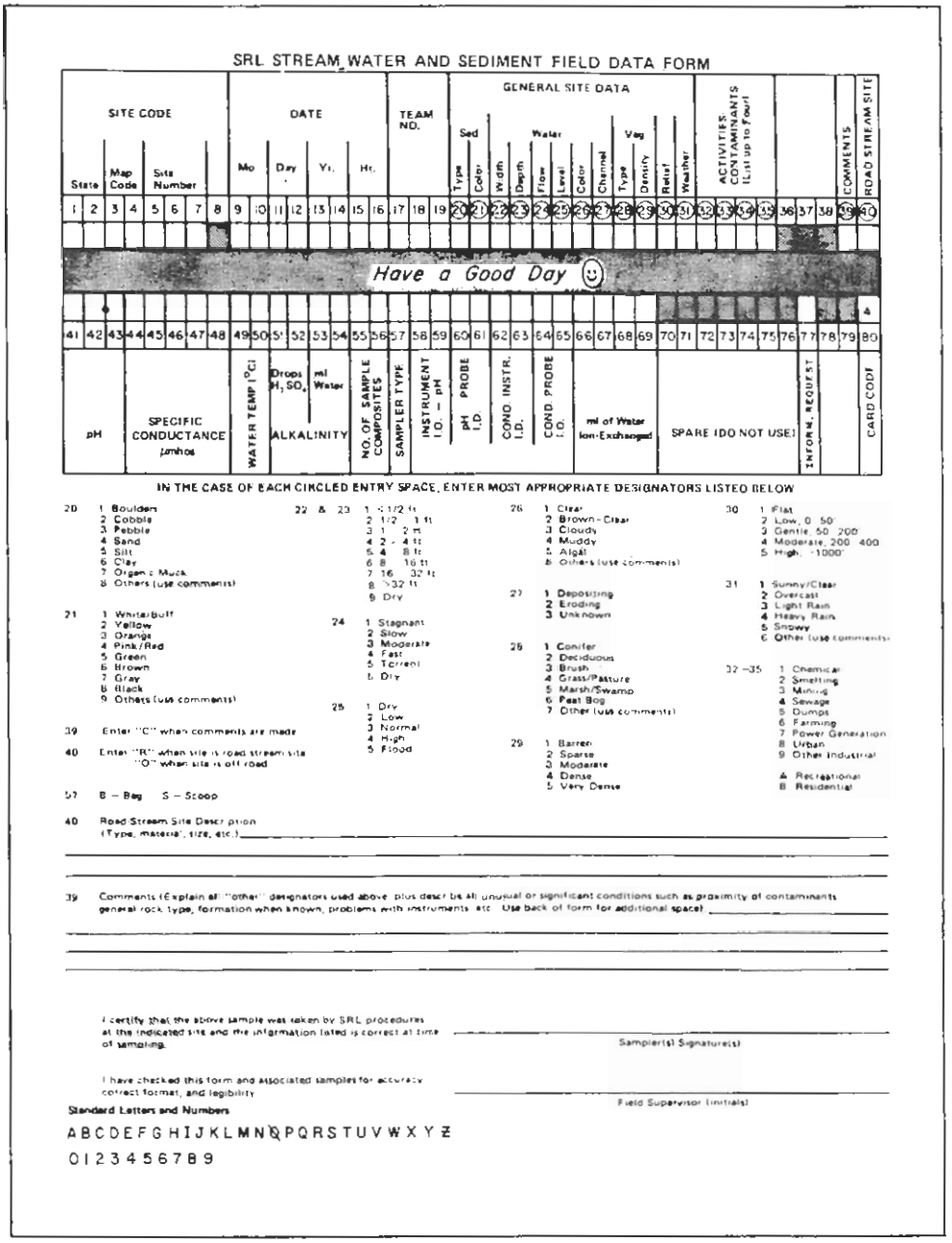
Only those choices given on the form are acceptable. DO NOT IMPROVISE. When checking, be sure that all blanks are properly filled. ANY error will cause the data card to be rejected by the computer.

PAYMENT TO CONTRACTORS WILL BE MADE ONLY FOR THOSE SAMPLE LOCATIONS WHERE ALL APPROPRIATE DATA ARE UNAMBIGUOUSLY PROVIDED ON THE FIELD DATA FORM AND SAMPLE SITE LOCATION MAP.

Specific Coding

Columns 1-8

Site Code — Columns 1-2 are coded with the two-letter designator for the state in which the sample is collected, e.g., NC for North Carolina, GA for Georgia, etc. Columns 3-4 are coded with the two-letter designator for the map from which the sample is collected. Official map codes are furnished with each county map. Only the official codes are acceptable. Sites should be consecutively numbered within each map unit, beginning with 001. No valid site codes should be skipped. Columns 1-7 should be filled. None should be blank. Column 8 is left BLANK.



SRL STREAM WATER AND SEDIMENT FIELD DATA FORM

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
State		Map Code		Site Number				Mo.		Day		Yr.		Hr.		TEAM NO.			GENERAL SITE DATA: Sed Type	Sed Color	Water Width	Water Depth	Water Flow	Water Level	Water Color	Water Channel	Veg Type	Veg Density	Veg Relief	Veg Weather	ACTIVITIES, CONTAMINANTS (List up to Four)						COMMENTS		ROAD STREAM SITE

Have a Good Day ☺

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		SPECIFIC CONDUCTANCE µmhos						WATER TEMP (°C)		Drops H,SO,		ml Water		NO. OF SAMPLE COMPOSITES		SAMPLER TYPE	INSTRUMENT I.D. — pH		pH PROBE I.D.		COND. INSTR. I.D.		COND. PROBE I.D.		ml of Water Ion-Exchanged				SPARE (DO NOT USE)						INFORM. REQUEST			CARD CODE	

ALKALINITY

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

20
1 Boulders
2 Cobble
3 Pebble
4 Sand
5 Silt
6 Clay
7 Organic Muck
8 Others (use comments)

21
1 White/Buff
2 Yellow
3 Orange
4 Pink/Red
5 Green
6 Brown
7 Gray
8 Black
9 Others (use comments)

39 Enter "C" when comments are made

40 Enter "R" when site is road stream site
"O" when site is off road

57 B — Bag S — Scoop

40 Road Stream Site Description
(Type, material, size, etc.) _____

22 & 23
1 < 1/2 ft
2 1/2 - 1 ft
3 1 - 2 ft
4 2 - 4 ft
5 4 - 8 ft
6 8 - 16 ft
7 16 - 32 ft
8 >32 ft
9 Dry

24
1 Stagnant
2 Slow
3 Moderate
4 Fast
5 Torrent
6 Dry

25
1 Dry
2 Low
3 Normal
4 High
5 Flood

26
1 Clear
2 Brown - Clear
3 Cloudy
4 Muddy
5 Algal
6 Others (use comments)

27
1 Depositing
2 Eroding
3 Unknown

28
1 Conifer
2 Deciduous
3 Brush
4 Grass/Pasture
5 Marsh/Swamp
6 Peat Bog
7 Other (use comments)

29
1 Barren
2 Sparse
3 Moderate
4 Dense
5 Very Dense

30
1 Flat
2 Low, 0 - 50'
3 Gentle, 50 - 200'
4 Moderate, 200 - 400'
5 High, >1000'

31
1 Sunny/Clear
2 Overcast
3 Light Rain
4 Heavy Rain
5 Snowy
6 Other (use comments)

32 – 35
1 Chemical
2 Smelting
3 Mining
4 Sewage
5 Dumps
6 Farming
7 Power Generation
8 Urban
9 Other Industrial

A Recreational
B Residential

39 Comments (Explain all "other" designators used above, plus describe all unusual or significant conditions such as proximity of contaminants, general rock type, formation when known, problems with instruments, etc. Use back of form for additional space) _____

I certify that the above sample was taken by SRL procedures at the indicated site and the information listed is correct at time of sampling. _____
Sampler(s) Signature(s)

I have checked this form and associated samples for accuracy, correct format, and legibility _____
Field Supervisor (Initials)

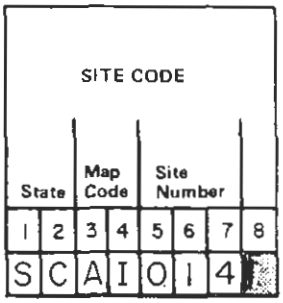
Standard Letters and Numbers

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

0 1 2 3 4 5 6 7 8 9

FIGURE C-1. SRL Field Data Form

EXAMPLE: Sample is taken from Aiken County, South Carolina; site is marked on the Aiken County map with code AI; the site has been numbered as 14:



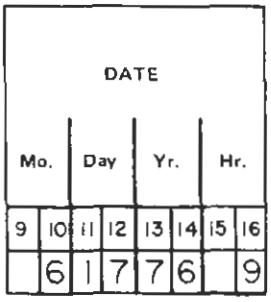
Columns 9-16

Date

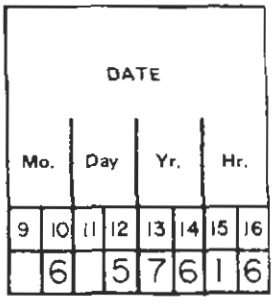
The month, day, and year are to be coded in Columns 9-14 using one or two digits (right justified) as necessary, so that any unused columns are left blank.

The time (hour) will be coded in Columns 15-16 using the 24-hour clock, and rounding to the nearest whole hour. The hour entry will also be right justified so that Column 15 will remain blank when only one digit is appropriate.

EXAMPLE: Sample taken on June 17, 1976, at 9:27 a.m.

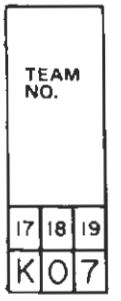


Sample taken on June 5, 1976, at 3:35 p.m.



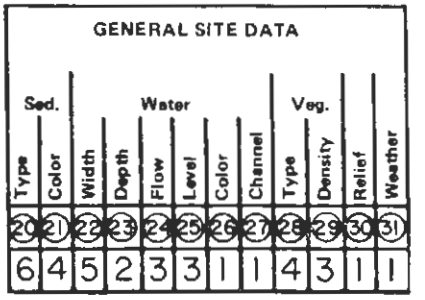
Columns 17-19

Team Number — The assigned team number is coded in Columns 17-19.



Columns 20-31

General Site Data — The general site data columns are to be coded using only the most appropriate indicator descriptor listed on the form. Good judgment is requisite to these evaluations.



Columns 20-21

Sediment:

Type, Color — 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, this fact should be noted in the comments (remembering to see that a "C" is entered in Column 39).

20
1 Boulders
2 Cobble
3 Pebble
4 Sand
5 Silt
6 Clay
7 Organic Muck
8 Others (use comments)

21
1 White/Buff
2 Yellow
3 Orange
4 Pink/Red
5 Green
6 Brown
7 Gray
8 Black
9 Others (use comments)

Columns 22-23

Water:

Width, Depth

22 & 23
1 <1/2 ft
2 1/2 – 1 ft
3 1 – 2 ft
4 2 – 4 ft
5 4 - 8 ft
6 8 – 16 ft
7 16 – 32 ft
8 >32 ft
9 Dry

Estimate the AVERAGE width and depth of the stream over the 100 to 200 feet of stream length where the sample is taken. Good judgment is extremely important. Please estimate CAREFULLY.

Columns 24-26

Water:

Flow, Level, Color

24
1 Stagnant
2 Slow
3 Moderate
4 Fast
5 Torrent
6 Dry

25
1 Dry
2 Low
3 Normal
4 High
5 Flood

26
1 Clear
2 Brown–Clear
3 Cloudy
4 Muddy
5 Algal
6 *Others (use comments)*

The water description should provide an indication of the general condition of the water at the time of sampling. Column 24 is to indicate the rate of flow using the listed descriptors at the sampled location [i.e., if a stream is sampled in rapids the 4 (Fast) or 5 (Torrent) may apply, but if the same stream were sampled above or below the rapids, the 2 (Slow) or 3 (Moderate) descriptors might be more accurate]. The designator "6 Dry" in Column 24 will not be accepted for streams where pH, conductivity, and alkalinity data are taken. If pools are sampled, check "1 Stagnant" in Column 24. Column 25 describes the water level relative to its apparent normal level. A degree of good judgment will usually suffice to make this determination. Column 26 reflects 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 5 (Algal). If only the stream, spring, or lake bottom is covered with algae or other plant life, note this fact in the comments. If the water is transparent, but has a definite brown or black color, then use 2 (Brown-Clear) designator.

Column 27

Water:

Channel

27
1 Depositing
2 Eroding
3 Unknown

The column labeled "stream channel" should be coded with the appropriate descriptor listed on the form. A steeply inclined stream bed with fast-moving water can usually be considered as eroding; whereas a nearly-level, slow-moving stream may indicate a depositing channel (i.e., the stream is depositing its

load of sand, silt, etc. in the calm water areas). The chosen descriptor should apply to the general nature of the stream.

Columns 28-29

Vegetation:

Type, Density

28
1 Conifer
2 Deciduous
3 Brush
4 Grass/Pasture
5 Marsh/Swamp
6 Peat Bog
7 Other (use comments)

29
1 Barren
2 Sparse
3 Moderate
4 Dense
5 Very Dense

This description should reflect the amount and type of plant growth in the immediate area of the sample location. The density is a subjective observation made in relation to visibility, ease of access, etc. The type of vegetation should reflect the dominant plant type at or near the sample location. Conifers are broadly classed as evergreen trees, such as pines, etc. Deciduous plants are broadly classed as trees and shrubs that seasonally lose their leaves such as cottonwoods, maples, oaks, hickory, etc. Brush denotes relatively low-growing plants (which may or may not be deciduous) such as thorny bushes, etc. Grass includes field crops of all types.

Column 30

Relief

30
1 Flat
2 Low, 0–50'
3 Gentle, 50–200'
4 Moderate, 200–400'
5 High, >1000'

Relief is an indicator of local surface expression. The area to be included around a sampled location will usually not exceed a few hundred yards in mountainous terrains, but may exceed up to ~1/2 mile in relatively flat areas. Where it appears noteworthy to include an area much larger or smaller than implied in the general guidelines above, a note should be included in the comments.

Column 31

Weather

31
1 Sunny/Clear
2 Overcast
3 Light Rain
4 Heavy Rain
5 Snowy
6 Other (use comments)

The weather entry is a general indicator of the prevalent conditions at the time of sampling. In addition, it is important to note in the comments any evidence of recent precipitation up to a few days prior to sampling.

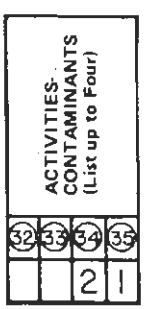
Columns 32-35

Activities:

Contaminants

The activities/contaminants column is to indicate those nearby activities which may influence the analytical results. It is a very important entry, and should be carefully chosen from the list of numerical designators provided on the data form. In addition to the numerical entry, details such as proximity to the sample site, type and status of mine (i.e., gold, silver, lead-zinc, coal, etc.), type of fertilizer used, if known, or type of power plant (i.e., hydroelectric, coal-fired, nuclear, etc.) should be indicated in the comments. The major activity and/or contamination is always listed in Column 35. A second activity, if you consider it important, is listed in Column 34. A third activity, if necessary, in Column 33, etc. Columns 32, 33, and 34 if not used are to be left blank.

EXAMPLE:



32 – 35
1 Chemical
2 Smelting
3 Mining
4 Sewage
5 Dumps
6 Farming
7 Power Generation
8 Urban
9 Other Industrial

A Recreational
B Residential

Columns 36-38

Blank

Leave these columns blank.

Column 39

Comments

Any time there are comments entered at the bottom of the data form, enter a "C" in Column 39. If there are no comments, leave Column 39 blank. It should always be remembered that there can never be too many comments. Every observation made at a sample site pertaining to geology, geography,

hydrology, climate, vegetation, possible contamination, etc. should be entered. This information may be important for evaluating the data which is developed for each sample and sample site. All comments must be written legibly.

39 Comments (Explain all "other" designators used above, plus describe all unusual or significant conditions such as proximity of contaminants, general rock type, formation when known, problems with instruments, etc. Use back of form for additional space). Visible pyrite outcrop near stream; pH meter bag has a hole; black shale is general rock in area; lead smelter located upstream.

Column 40

Road-Stream Site

Enter an "R" in Column 40 if the site is classified as a road-stream intersection site. Enter an "O" or "Ø" if the site is classified as an off-road site. All entries with "R" in Column 40 REQUIRE a unique description of the road-stream site on the lines provided on the form. This description should include the type of bridge, etc.; the material of construction; approximate size, etc. Any additional information to uniquely describe the site should be provided.

EXAMPLE:

40 Road-Stream Site Description (Type, material, size, etc.) Wooden bridge over dirt road. Barbed wire fence along left bank, large brick house 200 yards to the right.

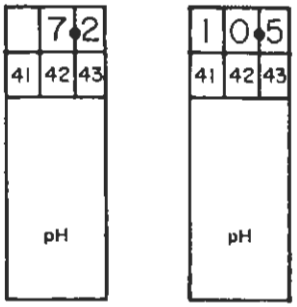
Columns 41-43

pH

The pH of the sampled water is to be measured using the pH meter provided, and will be recorded to the nearest tenth (0.1) of a pH unit.

If the pH is less than 10, only Columns 42 and 43 will be coded, and Column 41 will be left blank (only rarely will the pH be greater than 10, thus Column 41 will normally remain blank). A stationary decimal point occurs between Columns 42 and 43 and it must be respected.

EXAMPLES:

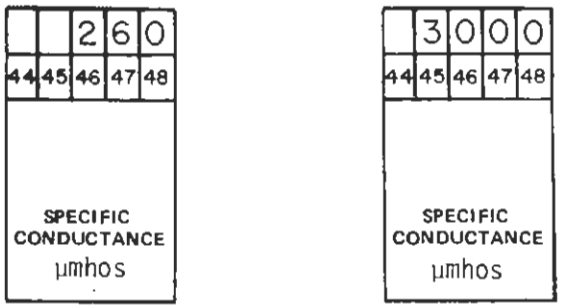


Columns 44-48

Specific Conductance, µmhos/cm

The conductivity measurement is recorded in Columns 44-48 as read on the meter, or as some multiple of the meter reading which is determined by the scale range setting used. The conductivity reading must always be right justified so that any of the appropriately designated (but unused) columns will be left blank.

EXAMPLES:



Meter reads 260 with scale X1, record 260

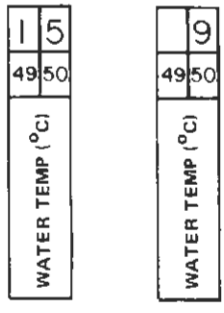
Meter reads 300 with scale X10, record 3000

Columns 49-50

Water Temperature, °C

The water temperature, taken at the time of sampling, will be coded in Columns 49-50. The water temperature will be recorded in degrees Celsius (°C) to the nearest whole degree (1.0°C). Any time the water temperature is between 0°C and 9°C, the temperature will be coded in Column 50, and Column 49 will remain blank.

EXAMPLES:



Columns 51-52

Alkalinity, drops of acid solution

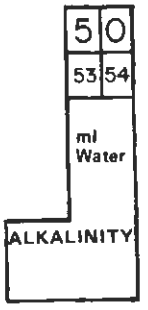
Record in Columns 51-52 the number of drops of 0.02N sulfuric acid solution necessary to reach the end point of the alkalinity titration. If 9 or fewer drops are used, then Column 51 is left blank.

EXAMPLE:

Columns 53-54

Alkalinity, ml of water

Record in Columns 53-54 the actual number of milliliters of water which is titrated with the sulfuric acid. This is normally ∿50 ml, but might be 10 ml in some areas. Do not use less than 10 ml for the titration.



Columns 55-56

Number of Sample Composites

In Columns 55-56, record the number of sub-samples taken at each site that are composited together to give the sieved sample for that site. There should be a minimum of 5 sub-samples. If Column 55 is not needed, then leave it blank.

EXAMPLE:

Column 57

Sampler Type

57 B – Bag S – Scoop

Enter a "B" in Column 57 if the bag sampler is used to collect the sediment sample. Enter an "S" if the scoop sampler is used. If both samplers are used, then enter the letter of the one which collected the majority of the sample.

Columns 58-59

pH Meter, I.D.

Enter in Columns 58-59 the identification number of the pH meter used at the site. If Column 58 is not needed, then leave it blank.

Columns 60-61

pH Probe, I.D.

Enter in Columns 60-61 the identification number of the pH probe used at the site. If Column 60 is not needed, then leave it blank.

Columns 62-63

Conductivity Instrument, I.D.

Enter in Columns 62-63 the identification number of the conductivity meter used at the site. If Column 62 is not needed, then leave it blank.

Columns 64-65

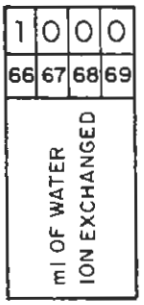
Conductivity Probe, I.D.

Enter in Columns 64-65 the identification number of the conductivity probe used at the site. If Column 64 is not needed, then leave it blank.

Columns 66-69

ml of Water Ion Exchanged

Record (to the nearest ten milliliters) the volume of water which is mixed with the ion exchange resin. Normally, this will be 1000 ml unless the specific conductance is too large. If less than 1000 ml is used, then Column 66 is left blank.



Columns 70-79

Leave blank except in the following case:

Column 77

Inform. Request

If you have to agree to send analytical information to a person in order to gain access to his property, then enter an X in Column 77. Do not volunteer to supply this information. Write the mailing address on the back of the form if you have entered an X in Column 77.

CERTIFICATION: Sign the form where designated to certify that the sample(s) was(were) taken and treated as described, and that the information shown is as true and complete as possible. ALL members of the sampling party will sign the form. The field supervisor will also sign or initial the form to show that he has checked the form AND ASSOCIATED SAMPLE for accuracy, correct format, and legibility. All forms and samples should be checked by at least two different people.

I certify that the above sample was taken by SRL procedures at the indicated site and the information listed is correct at time of sampling.

John D. Doe / Mary Brown
Sampler(s) Signature(s)

I have checked this form and associated samples for accuracy, correct format, and legibility.

L. L. P.
Field Supervisor (initials)

Automated data checking is performed on all cards received. All fields must be completed except where blanks are specifically allowed in the foregoing instructions.

REFERENCES

Savannah River Laboratory Quarterly Report. Hydrogeochemical and Stream Sediment Reconnaissance — Eastern United States National Uranium Resource Evaluation Program.

No.	*Quarter*	*SRL Doc. No.*	*DOE-GJ Doc. No.**
1	January-March 1975	DPST-75-138-1	GJBX-5(76)
2	April-June 1975	DPST-75-138-2	GJBX-6(76)
3	July-September 1975	DPST-75-138-3	GJBX-7(76)
4	October-December 1975	DPST-75-138-4	GJBX-8(76)
5	January-March 1976	DPST-76-138-1	GJBX-17(76)
6	April-June 1976	DPST-76-138-2	GJBX-27(76)
7	July-September 1976	DPST-76-138-3	GJBX-63(76)
8	October-December 1976	DPST-76-138-4	GJBX-6(77)
9	January-March 1977	DPST-77-138-1	GJBX-35(77)
10	April-June 1977	DPST-77-138-2	GJBX- (77)

* Order from:

E. W. Grutt, Jr., Manager
Department of Energy
Grand Junction Office
P. O. Box 2567
Grand Junction, CO 81501

NOTES

NOTES

DISTRIBUTION

Copy No.

1 W. R. Voight, Jr., Director
Div. of Uranium Resources & Enrichment
DOE Headquarters, Washington, DC 20545

2 R. D. Nininger
Assistant Director for Uranium Resources
Div. of Uranium Resources & Enrichment
DOE Headquarters, Washington, DC 20545

3-9 E. W. Grutt, Jr., Manager
Department of Energy
Grand Junction Office, P.O. Box 2567
Grand Junction, CO 81501

10 D. D. Butts, Development Division
Department of Energy
Oak Ridge Operations Office
P.O. Box E, Oak Ridge, TN 37830

11 J. C. White, Manager
Technical Services
Union Carbide Corporation, Nuclear Division
P.O. Box Y, Oak Ridge, TN 37830

12-15 J. W. Arendt, Project Manager
Uranium Resource Evaluation Project
Union Carbide Corporation, Nuclear Division
P.O. Box P, Oak Ridge, TN 37830

16 R. R. Sharp, Group Leader, J-5
Los Alamos Scientific Laboratory
P.O. Box 1663, Los Alamos, NM 87545

17 R. F. Taschek, Associate Director Research
Los Alamos Scientific Laboratory
P.O. Box 1663, Los Alamos, NM 87545

18 Kenneth Street, Jr., Associate Director
Energy and Resource Programs
MS-L13, Lawrence Livermore Laboratory
P.O. Box 808, Livermore, CA 94550

19-22 J. F. Tinney, Program Leader
MS-L517, Lawrence Livermore Laboratory
P.O. Box 808, Livermore, CA 94550

23 A. P. D'Silva
Ames Laboratory
Iowa State University
Ames, IO 50011

24-25 Terry Offield
Branch of Uranium-Thorium Resources
U.S. Geological Survey
Denver Federal Center, Bldg. 25
Denver, CO 80225

26 V. J. Janzer
Water Resources Division, U.S. Geological Survey
Denver Federal Center, Denver, CO 80225

27-28 D. E. Livingston
Bendix Field Engineering Corp.
P. O. Box 1569
Grand Junction, CO 81501

29-30 DOE-SR

31-300 TIS File, SRL

301-400 DOE-GJ (for open file)