K/UR-13

PROCEDURES MANUAL FOR STREAM SEDIMENT RECONNAISSANCE SAMPLING

URANIUM RESOURCE EVALUATION PROJECT

May 8, 1978

UNION CARBIDE

OAK RIDGE GASEOUS DIFFUSION PLANT
OAK RIDGE, TENNESSEE

prepared for the U.S. DEPARTMENT OF ENERGY *under*
U.S. GOVERNMENT *Contract W-7405 eng 26*

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Department of Energy **Information**

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

FOR IMMEDIATE RELEASE
July 5, 1978

DOE ISSUES PROCEDURES MANUAL FOR GEOCHEMICAL SAMPLING OF URANIUM

The Grand Junction, Colorado, Office, U.S. Department of Energy (DOE), has issued a report entitled "Procedures Manual for Stream Sediment Reconnaissance Sampling," as part of the National Uranium Resource Evaluation (NURE).

The report, prepared by the Oak Ridge Gaseous Diffusion Plant (ORGDP), Oak Ridge, Tennessee, presents sampling procedures used in reconnaissance surveys, including site selection criteria, sample collection and field measurement procedures, data recording guidelines, assignment of surface geologic unit codes, evaluation of contaminants, and guidelines for data control.

NURE is a program of DOE's Grand Junction Office to acquire and 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. ORGDP, operated for DOE's Oak Ridge Operations Office by the Nuclear Division of Union Carbide Corporation, is responsible for completing a water and stream-sediment survey of the central U.S.

The 56-page report, GJBX-84(78) [ORGDP No. K/UR-13], dated May 8, 1978, has been placed on open file at the following locations:

No. 78-65
News Media Contact: Peter Mygatt, 303/242-8621, Ext. 293
To order microfiche: Contact Library, Ext. 278

GRAND JUNCTION, CO: Technical Library, Grand Junction Office, Department of Energy

ALBUQUERQUE, NM: Government Publications Section, Zimmerman Library, University of New Mexico

ANCHORAGE, AK: Division of Geological & Geophysical Surveys, 323 E. 4th Avenue

ATLANTA, GA: Department of Energy, Suite 438, 1365 Peachtree Street

AUSTIN, TX: Bureau of Economic Geology, Geology Building, University of Texas

BUTTE, MT: Montana Bureau of Mines and Geology, Montana College of Mineral Science and Technology

CAMBRIDGE, MA: Massachusetts Institute of Technology, Lindgren Library, 14E-210

CASPER, WY: Natrona County Public Library

COLLEGE, AK: Division of Geological and Geophysical Surveys

COLUMBIA, SC: Division of Geology, South Carolina State Development Board

CORPUS CHRISTI, TX: Corpus Christi State University, 6300 Ocean Drive

DENVER, CO: Colorado Geological Survey, Department of Natural Resources, State Centennial Bldg., 1313 Sherman St., Rm. 715

GOLDEN, CO: U.S. Geological Survey Library, 1526 Cole Blvd., (West Colfax and Hawthorne)

HARTFORD, CN: State Geologist & Dir. of National Resources Center, State Office Building, Rm 561, 165 Capitol Ave.

LARAMIE, WY: Wyoming Geological Survey, P.O. Box 3008, University Station

LAWRENCE, KS: Kansas Geological Survey, 1930 Avenue "A", Campus West, The University of Kansas

LINCOLN, NE: Conservation and Survey Division, University of Nebraska

LUBBOCK, TX: Documents Library, Texas Tech University

MADISON, WI: Geological & Natural History Survey, University of Wisconsin—Extension, 1815 University Avenue

MENLO PARK, CA: U.S. Geological Survey, Library, 345 Middlefield Road

NORMAN, OK: Oklahoma Geological Survey, The University of Oklahoma, 830 Van Vleet Oval, Rm. 163

OAKLAND, CA: Department of Energy, Library, Wells Fargo Bldg., 1333 Broadway

PHOENIX, AZ: State of Arizona, Dept. of Mineral Resources, Mineral Bldg., Fairgrounds

PITTSBURGH, PA: Department of Energy, Suite 221, 9 Parkway Center, 875 Greentree Road

PORTLAND, OR: Department of Geology and Mineral Industries, 1069 State Office Building

RALEIGH, NC: Office of Earth Resources, Department of Natural and Economic Resources

RENO, NV: Nevada Bureau of Mines and Geology, Mackay School of Mines, University of Nevada

RESTON, VA: U.S. Geological Survey Library, Gifts & Exchange Unit, National Center

SALT LAKE CITY, UT: Documents Division, Marriott Library, University of Utah

SALT LAKE CITY, UT: Utah Geological Survey, 606 Black Hawk Way

SOCORRO, NM: New Mexico Bureau of Mines, Campus Station

SPOKANE, WA: U.S. Geological Survey Library, U.S. Court House, Rm. 678

TUCSON, AZ: Geological Survey Branch, Arizona Bureau of Mines, 845 Park Avenue

WASHINGTON, D.C.: Department of Energy, Library, 20 Massachusetts Avenue, NW

This report will be available on microfiche from the Grand Junction Office, DOE, for $3.00. Prepaid orders should be sent to: Bendix Field Engineering Corporation, Technical Library, P.O. Box 1569, Grand Junction, Colorado 81501. Checks or money orders should be made out to Bendix Field Engineering Corporation, the operating contractor for DOE's Grand Junction Office.

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Date of Issue: May 8, 1978 Report Number: K/UR-13

PROCEDURES MANUAL FOR STREAM SEDIMENT RECONNAISSANCE SAMPLING

Uranium Resource Evaluation Project

Union Carbide Corporation, Nuclear Division
Oak Ridge Gaseous Diffusion Plant
Oak Ridge, Tennessee

Prepared for the U. S. Department of Energy
Under U. S. Government Contract W-7405 eng 26

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PROCEDURES MANUAL FOR STREAM SEDIMENT RECONNAISSANCE SAMPLING

INTRODUCTION

NATIONAL URANIUM RESOURCE EVALUATION PROGRAM

The National Uranium Resource Evaluation (NURE) Program was established in 1973 by the U. S. Atomic Energy Commission (AEC) which later became the U. S. Energy Research and Development Administration (ERDA) and is now funded by the United States Department of Energy (DOE). The principal objectives of the NURE Program are as follows:

1. To complete a comprehensive assessment of the uranium reserves of the United States as rapidly as possible,

2. To identify areas favorable for uranium resources, and

3. To develop new and improved technologies.

The DOE Grand Junction, Colorado Office (GJO) is responsible for administering and coordinating efforts to meet these objectives. Input to the NURE Program comes from DOE prime contractors, DOE-sponsored research and development, the uranium industry, U. S. Geological Survey, U. S. Bureau of Mines, and other governmental agencies and independent sources.

The NURE Program consists of five parts:

1. Hydrogeochemical and Stream Sediment Reconnaissance Survey,

2. Aerial Radiometric and Magnetic Survey,

3. Surface Geologic Investigations,

4. Drilling for Geologic Information, and

5. Geophysical Technology Development.

To ensure a standard reporting format, data from all five phases of the NURE Program will be combined within the 1° x 2° National Topographic Map Service (NTMS) quadrangle boundaries and will form the basis on which uranium reserve calculations will be made.

In 1975, ERDA assigned the Nuclear Division of Union Carbide Corporation (UCC-ND), Uranium Resource Evaluation (URE) Project located at the Oak Ridge Gaseous Diffusion Plant (ORGDP), Oak Ridge, Tennessee, the responsibility for hydrogeochemical and stream sediment reconnaissance in an area covering the states of Texas, Oklahoma, Kansas, Nebraska, South Dakota, North Dakota, Michigan, Minnesota, Wisconsin, Iowa, Indiana, Illinois, and parts of Missouri, Arkansas, and New Mexico. The objective of this portion of the program is to accomplish a systematic

determination of the distribution of uranium and associated elements in surface and underground waters and in stream sediments. The significance of the distribution of uranium in natural waters and stream sediments will be assessed as an indicator of areas favorable for the identification of uranium provinces and districts.

Because the UCC-ND URE Project is a portion of the NURE Program and is being conducted with public funds, contractors participating in the URE Project have an obligation to hold all information as *Business Confidential*. All samples, duplicates, data, field form observations, site locations, equipment, and other information obtained during the course of operation under a contract to participate in the UCC-ND URE Project are to be provided only to the UCC-ND URE Project. Nothing is to be retained for private use nor is any information to be communicated to others without prior written consent of the URE Project Manager and DOE. The DOE-GJO will time-release data, and reports on each 1° x 2° quadrangle simultaneously in a number of predesignated sites across the country as soon as these reports are made available by the URE Project. At that time, any information presented in the report is available for public use.

Landowners, who require that the Project provide results of analyses of samples collected on their property before giving permission to sample, are provided the information after the data have been open filed. The landowners' names and addresses are recorded on the field form at the time the samples are collected and then stored in the URE data base. After the data have been open filed by DOE, a computerized system prints a letter containing the analytical results and an address label for mailing.

URANIUM RESOURCE EVALUATION PROJECT

Program Concept

Geochemical sampling is considered to be a valuable technique by the exploration industry. The program, which is used for the entire area to be surveyed by the UCC-ND URE Project, is based on the concept that geochemical techniques can identify promising uranium-bearing areas at virtually any scale. Concentrations of uranium increase as a mineralized area is approached. Figure 1 shows an increase in the log uranium concentration versus aerial extent. As will be noted, the largest area is background where uranium concentrations are relatively low. The province may be of the order of 260 km^2 (100 mi^2) to 2600 km^2 (1000 mi^2), and the uranium concentration an order of magnitude greater in the province. Similarly, for a district, the area is 26 km^2 (10 mi^2) to 260 km^2 (100 mi^2) with a corresponding increase of uranium content. At the deposit scale, uranium content increases to ore grade. The objective of the URE Project is to define the aerial extent of uranium provinces and districts using geochemical exploration techniques.

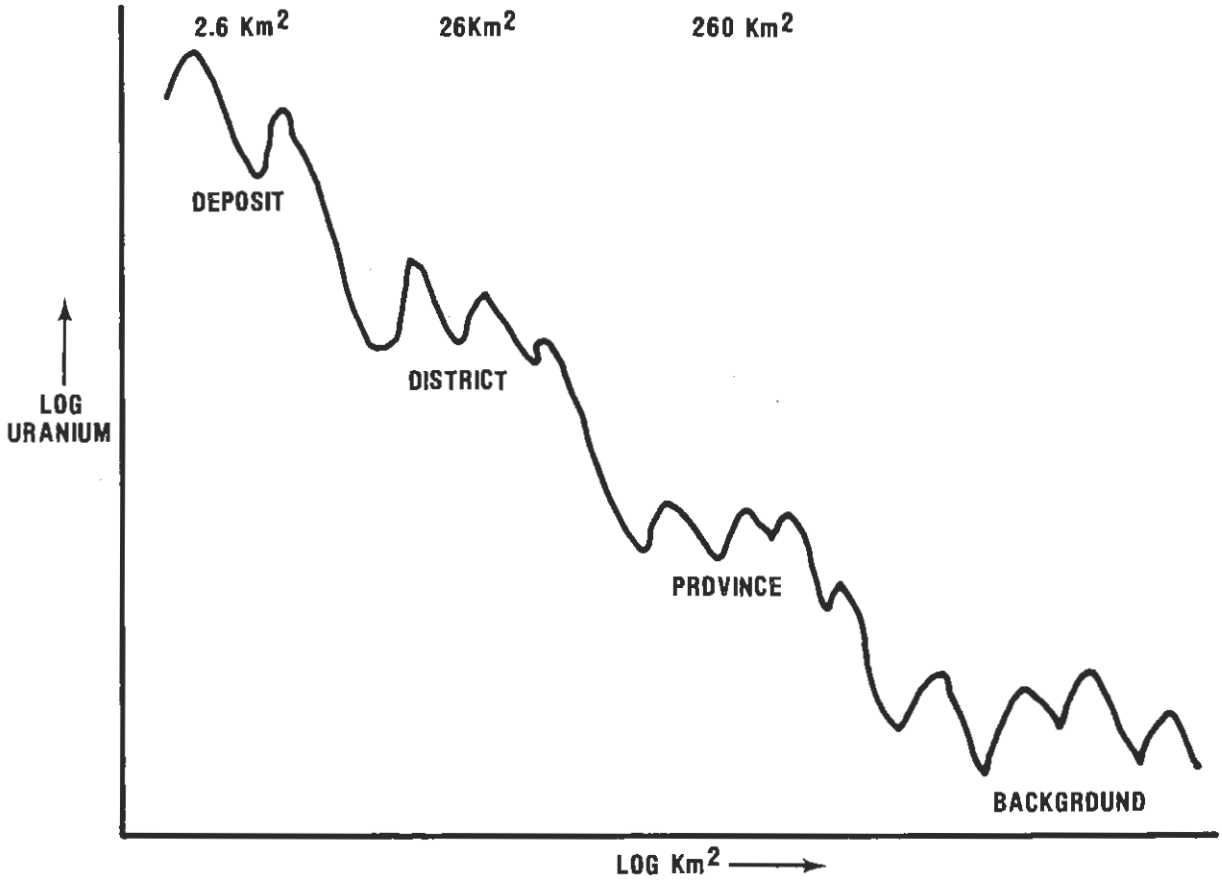


Figure 1

CONCEPT OF GEOCHEMICAL THRESHOLDS

The URE Project of UCC-ND consists of pilot surveys followed by geochemical reconnaissance with samples of stream sediment, stream water, and well water collected, depending on the results of pilot surveys. Samples are analyzed for uranium and other trace elements which more completely describe geochemical patterns. This allows collection of fewer samples than if analyses were for uranium only.

Pilot surveys are intended to provide information on the following:

1. Trace elements indicative of uranium mineralization,
2. Relationship between sample types and relative importance of each,
3. Range of geochemical concentrations from mineralized to background areas,
4. Adequacy of laboratory sensitivity,
5. Types of treatments to be given samples,
6. Area to which pilot survey applies, and
7. Adequacy of sample spacing.

In the reconnaissance program, samples are collected from wells at a grid spacing of 5.1 km (3.2 mi) giving an average density of one well per 26 km^2 (10 mi^2). Stream sediment or stream water samples are collected from basins that range from 5.2 to 52 km^2 with supplemental coverage in areas where basins of the specified size range are not available. The result is an average sampling density for drainage basins of one sample per 26 km^2 (10 mi^2). Samples of well water and those collected from drainage basins provide geochemical data on both surface and subsurface conditions that serve as a basis for defining areas of uranium favorability.

Field Geology Program

The objectives of the field geology program are to:

1. Obtain necessary coverage of a geographic area,
2. Obtain the most representative samples possible,
3. Accurately evaluate and describe the environment from which the samples were taken, and
4. Complete coverage on schedule.

The sample types collected depend on the results of pilot surveys and may include:

1. Stream water,
2. Stream sediment composite, and
3. Well water.

Stream sediments are collected as composite samples generally parallel to the axis of the stream over a 15- to 50-m interval. The samples are placed in paper envelopes and sent to the URE Project Laboratory for disaggregation, sieving to <149 μ (100 mesh), dissolution, and analysis.

Water samples are collected directly in 250-ml polyethylene bottles with no field treatment. Stream water samples are collected at the point of maximum flow. Groundwater samples are collected from wells at the point nearest the well head. Measurements for water which are routinely made in the field include: temperature, conductivity, pH, dissolved oxygen, and alkalinity. Water samples are shipped to Oak Ridge for filtration and analysis.

Some botanical samples (tree branches) have been collected in pilot surveys to determine their potential usefulness but are not currently being collected in reconnaissance surveying.

Planning and Organization

Detailed project planning is an essential element being employed to carry out an innovative and cost-effective hydrogeochemical and stream sediment survey. The URE Project office is located at ORGDP. The expertise and capabilities of the Y-12 Plant and the Oak Ridge National Laboratory (ORNL) are also available to provide essential services to the project. In addition, the facilities and expertise of the Paducah Gaseous Diffusion Plant (PGDP) are also available for use in the project, if required. Functional support services provided within the Nuclear Division are shown in Figure 2, and URE support organizations in Figure 3.

Many of the time-proven production procedures being used by UCC-ND were directly applicable to the URE Project. An example of this activity is the Y-12 Plant production control system which was used in the design of the URE sample storage and retrieval system. Samples collected during the program are optimally scheduled, controlled, and placed in retrievable storage for additional tests, if required.

Project plans include the maximum use of automated equipment to minimize costs and potential errors. Automated equipment is included in the analytical laboratories and data management activity. Automatic digitizers are also used to determine accurate latitudes and longitudes of sample sites on field maps.

Sampling is scheduled on a year-to-year basis and some considerations include: (1) uranium favorability, (2) funds available, (3) coordination with other DOE/NURE Program activities, and (4) weather. Basin sampling is scheduled during time of low runoff, but not during normal periods of freezing.

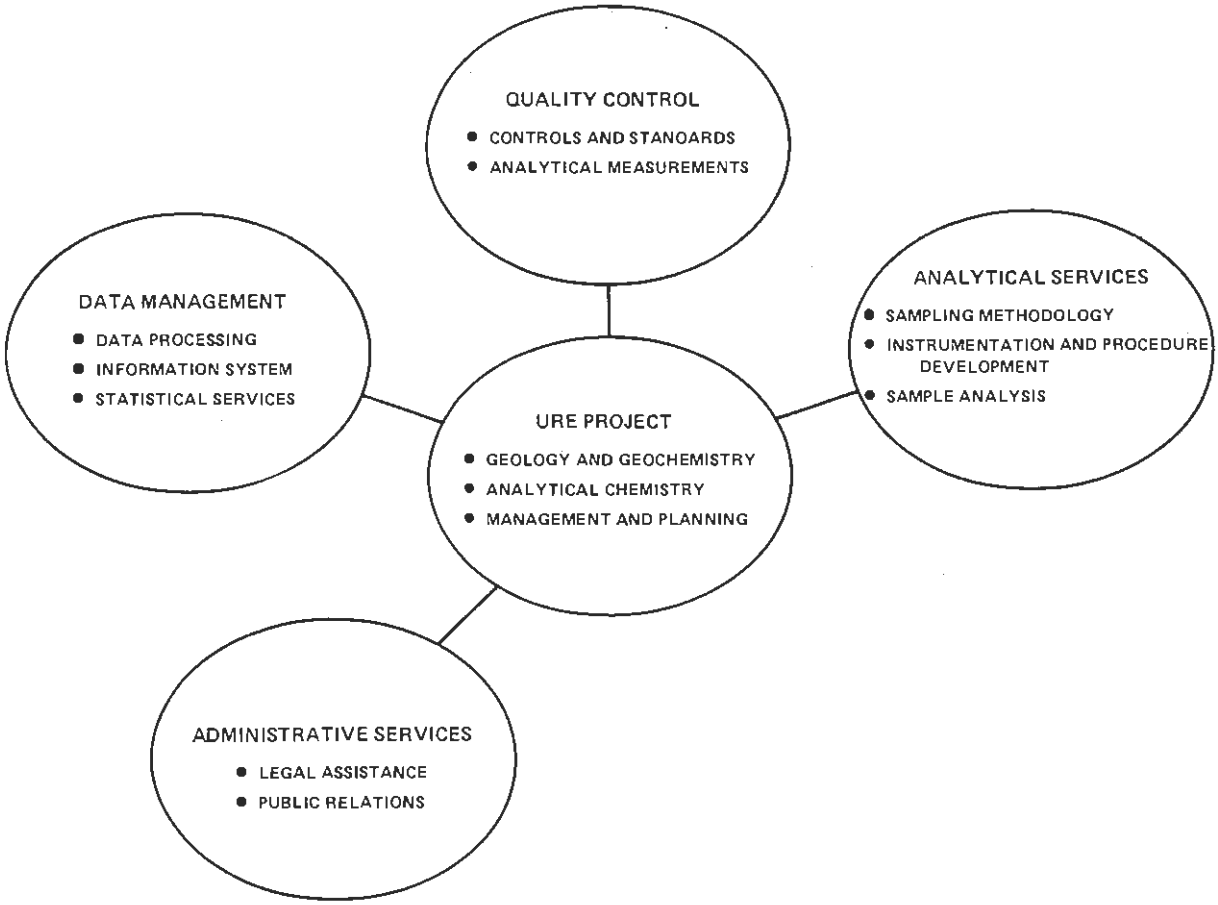


Figure 2

FUNCTIONAL REQUIREMENTS OF THE
URANIUM RESOURCE EVALUATION PROJECT

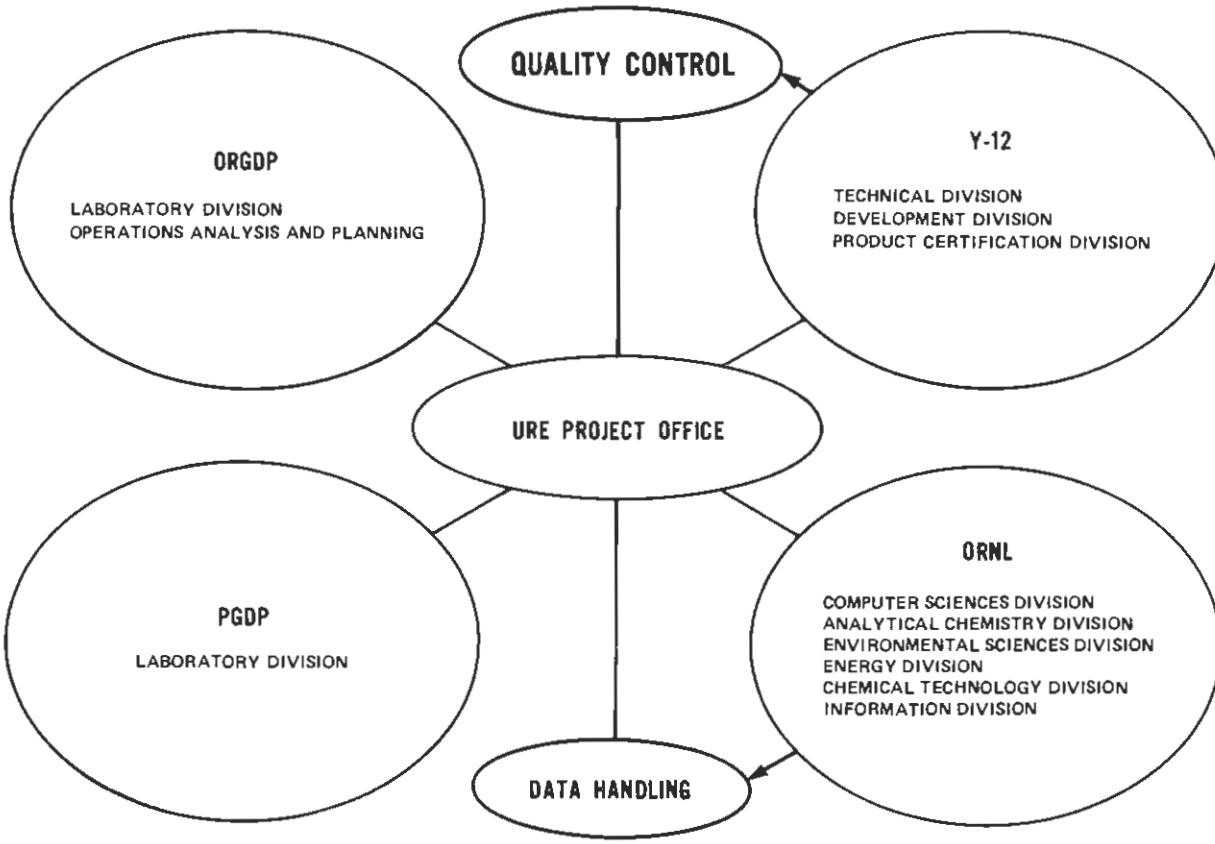


Figure 3

URANIUM RESOURCE EVALUATION PROJECT
SUPPORT ORGANIZATIONS

Present Plans

The URE Project's area of responsibility is equivalent to approximately 2,600,000 km^2 (1,000,000 mi^2) and is contained on 154 maps of the 1° x 2° national topographic map series. Initial reconnaissance will be conducted only in geologically favorable areas assigned the highest priority by DOE. The remainder of the area will be sampled after completion of the favorable quadrangles. Reports for individual 1° x 2° quadrangles will be open filed as soon as possible after sampling, analysis, and data verification have been accomplished.

FIELD OPERATIONS

LOGISTICS

Publicity Program

Pamphlets explaining the NURE Program and the responsibility of the URE Project may be provided to personnel collecting samples for the purpose of increasing public awareness and cooperation. At a contractor's request, the URE Project will provide a short filmstrip to local television stations to increase public awareness of the NURE Program.

Gaining Access

Private Property. Most samples will be collected on private property. All rights of the property owner should be respected and care must be taken to avoid any damage. Most landowners will be happy to cooperate and may volunteer much useful information; however, if a landowner prohibits a sample from being taken or withdraws permission once a sample has been collected, return the sample and leave. Do not argue.

Forest Service Lands. Forest Service Lands of the U. S. Department of Agriculture constitute a significant land area in many of the quadrangles to be sampled. The NURE Program has been assured of the cooperation of the Forest Service as long as the activities are not detrimental to the forest environment or resources. The URE Project will attempt to provide contractors with lists of the appropriate personnel to contact in each forest area. In general, each Forest Supervisor should be consulted in advance of field operations and must be notified at least a week in advance of actual sampling. The URE Project should receive a copy of any correspondence between a contractor and Forest Service personnel. The contractor's field supervisor must contact District Rangers when sampling teams actually arrive and before sampling is begun.

Commercial exploration on Forest Service land requires the issuance of a mineral exploration permit. The Forest Service has agreed to waive this requirement for the NURE Program, so care should be taken to respect Forest Service requests.

Indian Reservations, Parks, Wildlife Refuges, etc. The contractor's field supervisor should arrange contact with the local agent, tribal representative, ranger, warden, or other official in charge several weeks prior to anticipated sampling. In general, good public relations will gain access. The URE Project should receive a copy of any correspondence between the contractor and agencies or individuals contacted.

Military Bases. Government of each military base is left to the discretion of the Base Commander and access to any installation is dependent on permission given only by the Base Commander. The contractor's field supervisor must attempt to contact this individual well in advance of any planned sampling on the base. Problems in gaining access should be reported to the URE Project. The URE Project should receive copies of any correspondence between the contractor and the Base Commander or a designated representative.

Liaison with the URE Project Contract Supervisor

The contractor's field supervisor will contact the URE Project's contract supervisor at least weekly by telephone. A motel address and telephone number where this supervisor can be contacted at URE Project initiative during any 24-hr period will be provided. The supervisor will also provide monthly progress reports due on the last week of each month on 1° x 2° quadrangle maps showing the areas sampled and the total number of samples collected.

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

Routine maintenance of equipment is the responsibility of the contractor's field supervisor. The URE Project will perform major repairs or replacement of equipment, but the turnaround time may be several weeks. The contractor's field supervisor should try to detect failing instruments and anticipate needed repairs. It is suggested that a daily log of instrument calibrations be kept to aid in identifying failing equipment.

The contractor's field supervisor should also anticipate the need for resupply far enough in advance to allow time for shipping. The URE Project will process requests for supplies made through the URE Project's contract supervisor once per week and turnaround time on such request can be expected to be at least two weeks.

SITE SELECTION AND SAMPLING PROCEDURES

Sampling Density

Pilot surveys have indicated the average sampling density necessary to define most geologic features. The sampling density to be used in each 1° x 2° quadrangle has been specified in the contract. It is the responsibility of the contractor to identify sites to maintain the specified density. When it is apparent that sites are not available to be sampled at the specified density, it is the responsibility of the contractor to inform the URE Project contract supervisor of the situation.

Site Selection

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

Sample Collection

Detailed instructions for sample collection are given in Appendix B.

Data Recording

Detailed instructions for completing the Oak Ridge Geochemical Sampling Form and entering sites on *digitizer maps* are given in Appendix C.

SHIPPING PROCEDURES

Samples

Mail all samples within a week of collection, preferably on Friday or Saturday. Prior to mailing, check the total number of samples versus the total number of field forms completed, and make sure that all sample labels are legible. Assemble a packing box that has been provided and tape securely. Samples should be packed snugly so that they cannot move around in the box. It may require using newspapers as a packing material to make sure that the fit is snug. Sediment samples should be dry enough so that they do not cause the box to become wet during shipping. When samples are placed in boxes, they must be kept in sequence within the boxes shipped. If several bags of sediment were collected at a site, they should be taped together so they are not separated in the box. Attach one of the address labels provided to the inside flap of the box. Place another on the outside and also indicate the Oak Ridge address as the return address. The labels for the sample boxes are provided, and an example is shown below.

Union Carbide Corporation
Nuclear Division
Attention: Mr. L. E. White
P. O. Box Y
Building 9720-6, M. S. 002
Oak Ridge, Tennessee 37830

On the outside of the box, record the sample number range included in the box. Two bags of the same sample number should not be split between two boxes. Also, on the outside of the box, write the map code of the 1° x 2° quadrangle from which the samples have been collected (See Figure 5 for map codes); and indicate which box of how many are shipped on that day (example: box 1 of 4, box 2 of 4, box 3 of 4, box 4 of 4). At the post office, insure the box of samples for a minimum amount and mail *Parcel Post Regular*. Indicate at the post office that the contents are geologic samples.

The contractor's field supervisor shall inform the URE Project's field supervisor at the end of each month how many samples have been mailed during that month.

Field Forms

Mail the corresponding Oak Ridge Geochemical Sampling Forms to the URE Project office on the same day the samples are shipped. Field forms are to be placed in an envelope and the seams of the envelope are to be sealed with masking tape. The field forms are to be mailed *Certified Mail, No Return Receipt Requested.* The label for the field form envelopes is shown below. Note that this address is not the same as that to which samples are shipped.

J. W. Arendt
Union Carbide Corporation
Nuclear Division
P. O. Box P, Mail Stop 246
Oak Ridge, TN 37830

Maps

Maps that are to be digitized (*digitizer maps*), with sample locations identified and numbered, are to be mailed to the URE Project office no more than two weeks after sampling has been completed for the area covered by that map. These maps shall remain unfolded and rolled in protective map tubes. Map tubes are to be mailed to the same address as field forms. The address is given below.

J. W. Arendt
Union Carbide Corporation
Nuclear Division
P. O. Box P, Mail Stop 246
Oak Ridge, TN 37830

The contractor's field supervisor is responsible for reporting to the URE Project's contract supervisor at the end of each month the number of maps sent to Oak Ridge to be digitized. It is important to note that many sample locations are present on an individual base map; and without the sample information from a base map, the actual sample and field form data are worthless.

Receiving Packages from the URE Project Office

Packages will be sent to the field addressed to the contractor's field supervisor, in care of either the contractor's office or General Delivery at a particular post office. The post office will usually hold this type of package for ten days. If it is not possible to pick up the package, call the post office to have the package held for a longer period or to have it forwarded.

When a package from the URE Project is received, this information should be reported to the URE Project's contract supervisor.

APPENDIX A

SITE SELECTION

APPENDIX A

SITE SELECTION

The site selection procedure described herein was developed for areas which are being sampled at an average density of one site per 10 mi^2 with basins averaging between 2 and 20 mi^2 in area. The spacing to be used in a particular area is specified in the contract for individual quadrangles. This procedure should be used to serve as a guideline to ensure a degree of uniformity in site selection. It should be kept in mind that when selecting alternate sites, the primary objective is to obtain coverage that is uniform, complete, and representative of surface geology.

Sites to be sampled by contractors will be marked on maps supplied by the URE Project with site numbers and sampling phase (either 2 or G) preassigned. These maps will normally be black-and-white, electrostatic copies of USGS topographic maps, either of 1:24,000 scale (7 1/2' series) or 1:62,500 scale (15' series). Where topographic map coverage is not available, sites to be sampled will be indicated on either county maps or aerial photographs. All sites indicated on the maps supplied by the URE Project that sample basins of 2 and 20 mi^2 in area will be designated as Phase 2 sampling sites. Those basins falling outside that range will be indicated as Phase G (See Appendix C, *Card 1, General Site Data, Block 31*).

When planning basins to be sampled by contractors, consideration has been given to accessibility of sampling sites, as well as evidence of contamination indicated on the base maps. Based on previous experience, it is assumed that circumstances exist that will prevent collection of some samples from predesignated sites. Examples of these circumstances include: refusal of landowners to grant permission, difficult terrain preventing access, or extensive contamination which invalidates the quality of the sample from that site. When valid reasons exist for not collecting a sample at the predesignated site, an alternate site will be chosen by the contractor according to the following guidelines:

1. Alternate sites must sample basins that represent the same geologic formation or formations as the original designated site.

2. Alternate sites must be selected either above the junction of drainage or sufficiently below junctions to allow mixing of the ream water and stream sediments from tributaries so the composite sample represents all of the upstream basin area.

3. Alternate sites must be located on the upstream side of roads, bridges, or man-induced contamination.

4. Alternate sites should be selected that sample basins ranging between 2 and 20 mi^2 (Phase 2 sites), when at all possible. When larger or smaller basins are designated, they should be indicated as Phase "G" (see Appendix C, *Card 1, General Site Data, Block 31*).

5. The alternate basin should be drawn in on the map provided by the URE Project showing sites to be sampled and indicated as an alternate basin by labeling it in red ink "ALTERNATE BASIN". NOTE: Label the site not sampled with the designation "NOT SAMPLED".

6. It is permissible to sample the originally selected basin either upstream or downstream from the originally selected site if necessary to obtain access. Again, that change should be indicated by redrawing the basin on the original map provided by the URE Project showing sites to be sampled.

When it is necessary to choose alternate sites for more than 5% of the predesignated sites within any 1° x 2° quadrangle, it is necessary to contact the URE Project's contract supervisor to seek approval in designating additional alternate sites. CAUTION: Failure to obtain approval or selection and sampling of unsatisfactory alternate sites may result in rejection of samples. To ensure consistent quality, many of the sites designated as alternates will be evaluated by the URE Project quality control team.

APPENDIX B

SAMPLE COLLECTION AND FIELD MEASUREMENT

APPENDIX B

SAMPLE COLLECTION AND FIELD MEASUREMENT

SAMPLING ROUTINE

1. Drive to the location marked on the map showing sites to be sampled, and verify that you are at that location.

2. Secure permission to sample (it may be necessary to conduct this step prior to arriving at the site).

3. Observe the area of the proposed sample site by walking upstream in the basin looking for sources of contamination. Check to see whether the stream is in flood stage. Samples should not be collected during periods of flood conditions.

4. After walking upstream at least 100 m, select a representative sampling interval free from sources of contamination.

5. Examine the sediment carefully to determine the composition of the material to be collected.

6. Collect a composite sediment sample.

7. Label the sample bag(s) and a field form using the stick on sample labels.

8. Complete the field form according to the guidelines in Appendix C.

9. Enter the sample location and sample numbers on the *digitizer map*.

10. Review both the field form and map data for accuracy.

GUIDELINES FOR SAMPLING

General Guideline

1. Sampling the preselected sites is important. Do your utmost to gain access and obtain permission.

2. Attempt to determine whether there is contamination present in the basin above the sampling site by walking at least 100 m upstream from the access point (see Appendix C, *Evaluation of Contamination*).

3. Walk back downstream selecting the sampling interval so that it is upstream from visible signs of contamination, such as trash in the stream, culverts, or slumping bank material around newly constructed bridges.

4. If you are sampling a basin that is a tributary to a major stream, make sure that the sediment sampling interval is not in flood plain alluvium. If necessary, move the sampling interval further upstream to avoid the flood plains sediments.

5. The sampling interval should be selected either above the junction of drainage or sufficiently below junctions to allow the mixing of stream water and sediments from the tributaries so that the sample represents all of the upstream basin area.

Sample Collection

1. After walking upstream 100 m, select a sampling inteval at least 25 m upstream from any manmade contamination. Make every effort within reason to obtain a good sediment sample that is typical of the active stream sediment in the stream bed.

2. Clean the sediment scoop in the active stream sediment that will be sampled.

3. Collect sediment samples from the active portion of the stream. Bear in mind that the stream sediment is the sampling target, not dirt from nearby banks. Sample only the active portion of the stream.

4. To take the necessary composite sample, collect at least six scoops of sediment material taken 2 to 3 m apart over a 15- to 20-m interval. A very heterogeneous sediment will necessitate collection of up to 15 scoops of material over a 50-m interval.

5. Remove windblown debris and organic material from the sediment surface at the site of each scoop. Dig down 1 to 2 in. with the scoop and if heavy minerals are present, include them in the composite.

6. Collect enough material to make up approximately 25 g of clay to silt-sized sediment. If the sediment grade is coarse, it may be necessary to take several samples bags full. When clay or silt material is collected, only one bag is required. The objective is to have at least 25 g of -100 mesh sediment after sieving. If there is any doubt about the composition of the sediment, examine it with a hand lense to determine the composition.

7. Fill the sediment bag(s) two-thirds full. Overfilling will often cause the bag to break and broken bags will constitute a legitimate basis for rejecting samples.

8. Drain any water from the sample bag. Do not touch the sample or the inside of the bag with bare hands in order to minimize chances of contamination.

9. Fold the top of the bag over as indicated on the pattern imprinted on the bag and seal that end of the bag with at least three turns of vinyl tape.

10. After the composite sediment sample has been collected and the bag(s) are sealed, attach a sample label to the bag(s) and the field form that is to be filled out. The sample numbers should be identical for all bags of sediment taken from an individual site and the same as that attached to the field form.

11. If more than one bag of sediment is collected at a site, the number of bags having the same sample number must be indicated on each bag by writing the number of bags in marking pen just below the base of the sample label. If three bags were collected, for example, each would have a "3" entered below the sample label. After labeling, numbering, and sealing, all bags should be taped in a bundle so they do not become separated during packing and shipping. Be careful not to tape over the sample labels. The vinyl tape used to seal the sediment bags should be used to tape the bundle together.

Recommended Field-Pack Contents

1. Sediment scoop,
2. Five sample bags (contained in a plastic bag to prevent contamination),
3. One inch wide vinyl tape,
4. Notebook with field forms, sample labels, geologic map, and geologic unit code list, and
5. Two thermometers.

If it is necessary to hike to a location which is out of sight of the sample vehicle, carry a map for navigational purposes. Remember to keep the pack well-supplied, because a trip back to the sampling vehicle wastes valuable time.

FIELD TEST

Measure the air temperature at the time of sample collection by hanging a mercury thermometer in a shady area adjacent to the sampling site. Let the thermometer stablize for several minutes before reading to the nearest tenth of the degree. Make sure that no gaps are present in the mercury column that will cause false readings.

APPENDIX C

DATA RECORDING

APPENDIX C

DATA RECORDING

THE OAK RIDGE GEOCHEMICAL SAMPLING FORM

All field data are recorded on the Oak Ridge Geochemical Sampling Form (See Figure 4) which is a form designed for all sample types collected in the URE Project. It is subdivided into four keypunch cards which approximate grouping of information. Card 1, *General Site Data*, identifies data needed for all samples. Card 2 is completed for plant, stream sediment, and general water data. Card 3 is completed for well water and lake water samples. Card 4, the *Remarks Section* at the end of the field form, is reserved for specific information otherwise not recorded, such as the specific location of the sediment composite, unusual contamination, etc.

General Guidelines

1. Use red ink to complete the field form. A fine-point accounting pen is best. Legibility is essential to accurate data transcription. To maintain legibility, upper case, readable block letters must be used. No lower case letters are allowed. When all blocks are not filled, all entries must be right justified. When choices are to be indicated, do so by placing an "X" in the box that corresponds to the desired choice.

2. When decimal points are provided in the boxes, do not enter another decimal point in a blank box. Where decimal points are not fixed and one is required, enter a decimal point in a blank box making sure that the numbers are right justified. Be aware of significant digits. A zero to the left of a decimal point is not significant but may be used if desired. A zero to the right of a decimal point is a significant digit. Record a zero to the right of a decimal point only when the zero is an exact measurement. Never use .00 as an entry. If a measurement is lower than .01, then use a .01 and explain in the *Remarks Section* that the number is less than .01.

3. Use Ø for the letter O except when writing in the *Remarks Section* (example: PØQ for the Quartermaster Formation).

OAK RIDGE GEOCHEMICAL SAMPLING FORM

1 — 1 Card Number

GENERAL SITE DATA

Attach Identical Sample Number Here

2 3 4 5 6 7

8 9 10 11 — Site Number

12 13 14 15 – 16 17 — Map Code

Sample Type — 18

M	Stream Sediment
H	Lake Sediment
S	Stream Water
W	Well Water
P	Spring Water
L	Lake Water
A	Bog Water
B	Plant
F	Soil (Use Remarks)
G	Rock
Ø	Other

19 — Replicate Letter (A–Z)

Hour		Day		Month		Year	
20	21	22	23	24	25	26	27

28 29 30 — Collector's Initials

31 — Phase (P, 1, Z, or G)

Field Sheet Status — 32

Ø	Original
C	Correction
V	Voiding

Control Sample — 33

A	Sediment, High U
B	Sediment, Low U
C	Water, High U
D	Water, Low U
Ø	Other

34 35 36 37 — Air Temperature (°C)

Location

Latitude						Longitude						
Deg.		Min.		Sec.		Deg.		Min.		Sec.		
38	39	40	41	42	43	44	45	46	47	48	49	50

51 52 53 54 — Surface Geologic Unit Code

UCN-11992
(1 5-77)

Type of Vegetation — 55 (Within 1 Km Upstream)

C	Conifer
&	Conifer & Deciduous
D	Deciduous
B	Brush
G	Grass
M	Moss
L	Lichen
Ø	Other

Density of Vegetation — 56 (Within 1 Km Upstream)

B	Barren
S	Sparse
M	Moderate
D	Dense
V	Very Dense

Local Relief — 57 (Within 1 Km Upstream)

F	Flat (<2m)
L	Low (2–15m)
G	Gentle (15–60m)
M	Moderate (60–300m)
H	High (>300m)
Ø	Other

Weather

58

C	Calm
P	Lt Wind
V	Windy
R	V. Windy
S	Gale

59

C	Clear
L	Pt Cldy
W	Overcst
V	Rainy
G	Snowy

Classes of Contaminants — 60 (Use Remarks)

N	None
M	Mining
A	Agriculture
F	Oil Field
I	Industry
S	Sewage
P	Power Plant
U	Urban
Ø	Other

Average Stream Velocity (m/sec) — 61 62 63

N = No Visible Movement
P = Stagnant Pool

64 65 66 — Water Width (m)

67 68 69 — Average Depth (m)

Water Level

70

D	Dry
P	Pools
L	Low

70

N	Normal
H	High
F	Flood

Dominant Bed Material — 71

B	Boulder
C	Cobble
P	Pebble
S	Sand
T	Silt
Y	Clay
N	None (Use Remarks)

Sample Color (Except Plants)

	Adj		Noun	
72	73	74	75	76

V V Lt
L Light
M Medium
D Dark

CL Clear
WH White
YL Yellow
OR Orange

PK Pink
RD Red
GN Green
BU Blue
BN Brown
GY Gray
BK Black
OT Other

77 — **Odor of Sampled Material**

N	None
S	H_2S
Ø	Other

78 R — **Results Request** (Use Remarks)

1 — 2 Card Number

PLANT SAMPLE

18 19 — Number of Plants Sampled (Number of grabs for moss)

20 21 22 — Trunk Diameter (m) (1 m above ground)

23 24 25 — Plant Height (m) (Average of Plants Sampled)

Name of Tree, Deciduous

26

R	Alto Verde
A	Ash
B	Beech
I	Birch
D	Box Elder
F	Cherry
N	Cottonwood
E	Elm
H	Hackberry
C	Hickory
W	Huisache
L	Live Oak

26

U	Locust
P	Maple
M	Mesquite
K	Oak, Other
V	Olive
Y	Poplar
S	Sycamore
T	Salt Cedar
G	Walnut
X	Willow
Ø	Other

Name of Tree, Conifer

27

A	N. Wh. Cedar
C	Cedar, Other
F	Fir
H	Hemlock
J	Juniper

27

L	Larch
P	Pine
S	Spruce
Ø	Other

Name of Bush

28

A	Alder
B	Blueberry
P	Pussy Willow

28

W	Witch Hazel
Y	Yew
Ø	Other

Name of Moss — 29

P	Peat
S	Sphagnum (live)
Ø	Other

Algae — 30

G	Blue-Green
B	Brown
Ø	Other

Figure 4

OAK RIDGE GEOCHEMICAL SAMPLING FORM

STREAM OR LAKE SEDIMENT

Sample Condition

31	
D	Dry
W	wet

Sample Treatment

32	
N	None
S	Sieved
Ø	Other

33	34	
		Number of Grabs

35	36	
		% Organic Material (Field Estimate)

GENERAL WATER SAMPLES

Water Sample Treatment

37	
N	None
F	Filtered Only
C	Acidified Only
A	Acidified and Filtered
Ø	Other

Depth of Visibility (m)

38	39	40	
			C = Clear

41	42	43	44	45	
					Conductivity (μmhos/cm)

46	47	48	
			Dissolved O_2 (ppm)

49	50	51	
			Temperature (°C)

52	53	54	
			pH

55	
P	pH by Lo-Ion Paper

56	57	58	59	
				Total Alkalinity (ppm)

60	61	62	63	
				P Alkalinity (ppm)

64	65	66	67	
				M Alkalinity (ppm)

Appearance of Water

68	
C	Clear
M	Murky
A	Algal
Ø	Other

69	70	71	72	73	
					Discharge (liters/min)

REMARKS (Card 4)

74	75	76	77	
				Identification of Producing Horizon (Geologic Unit Code)

Confidence of Producing Horizon Identification

78	
H	High Degree
R	Probable
S	Possible

Source of Producing Horizon Identification

79	
P	Publication
W	Owner
U	User
G	Geologic Inference
Ø	Other

1	
3	Card Number

WELL WATER

Type of Well

18	
D	Drilled
P	Drive Point
G	Dug
U	Unknown
Ø	Other

Power Classification

19	
A	Artesian Flow
E	Electric
G	Gasoline
W	Wind
H	Hand
Ø	Other

Casing

20	
N	None (Below Water Table)
S	Steel
G	Galvanized
P	Plastic
U	Unknown
Ø	Other

Pipe Composition

21	
F	Steel
Z	Galvanized
C	Copper
P	Plastic
U	Unknown
Ø	Other

Sample Location

22	23	24	
			Meters from Well Head H = Holding Tank (Use Remarks)

Where Sample Taken With Respect To Pressure Tank

25	
B	Before
A	After
N	No Pressure Tank
F	From Pressure Tank (Use Remarks)

Use of Well

26	
M	Municipal
H	Household
S	Stock
I	Irrigation
A	All of above
X	H and S
Y	H and I
Z	S and I
N	None
Ø	Other

Frequency of Pumping

27	
C	Constant (hourly)
F	Frequent (daily)
I	Infrequent (weekly)
R	Rare (no recent use)

Depth to top of Producing Horizon

28	29	30	31	
				(Meters)

Confidence of Producing Depth

32	
H	High
R	Probable
S	Possible

Source of Producing Depth Information

33	
P	Publication
W	Owner
U	User
G	Geologic Inference
Ø	Other

Total Well Depth

34	35	36	37	
				(Meters)

Confidence of Total Depth

38	
H	High
R	Probable
S	Possible

Source of Total Depth Information

39	
P	Publications
W	Owner
U	User
G	Geologic Inference
Ø	Other

LAKE WATER

Type of Lake

55	
N	Natural
M	Manmade

Lake Area

56	57	58	59	
				(sq km)

Figure 4 (cont'd)

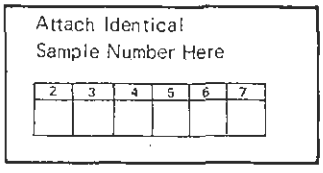
OAK RIDGE GEOCHEMICAL SAMPLING FORM

4. Anytime *Other* is marked as a choice, explain the observation in the *Remarks Section*. Entries are made in the *Remarks Section* by indicating the card and the block number to which the remarks apply and then writing out the remark (Example: 1-78 followed by a name and address for *Results Request*).

5. If it is necessary to void a figure because an error has been made, mark through the original figure and draw another box with its number next to the printed box, and place the correct entry in the sketched box.

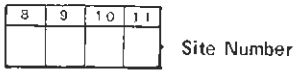
Card 1, General Site Data

Blocks 2-7



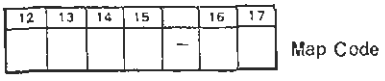
Attach the sample number label identical to that attached to the sample bottles over Blocks 2-7. If the label to be used on the field form is ruined or lost, record the numbers legibly on the field form. Note that multiple bags of sediment collected at each site are identified by identical sample labels.

Blocks 8-11



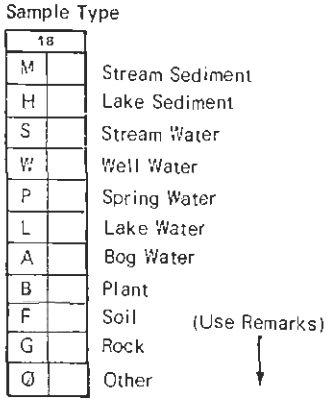
Enter the assigned site number in Blocks 8-11. Each location of sample collection (stream) is defined as a site. Each site will have a unique number within any 1° x 2° quadrangle (starting with 1).

Blocks 12-17



Enter the map code in Blocks 12-17. Each 1° x 2° quadrangle has a unique map code (see Figure 5 at the end of the appendix for the appropriate code).

Block 18



Indicate the sample type in Block 18 by placing an "X" in the box for *Stream Sediment*.

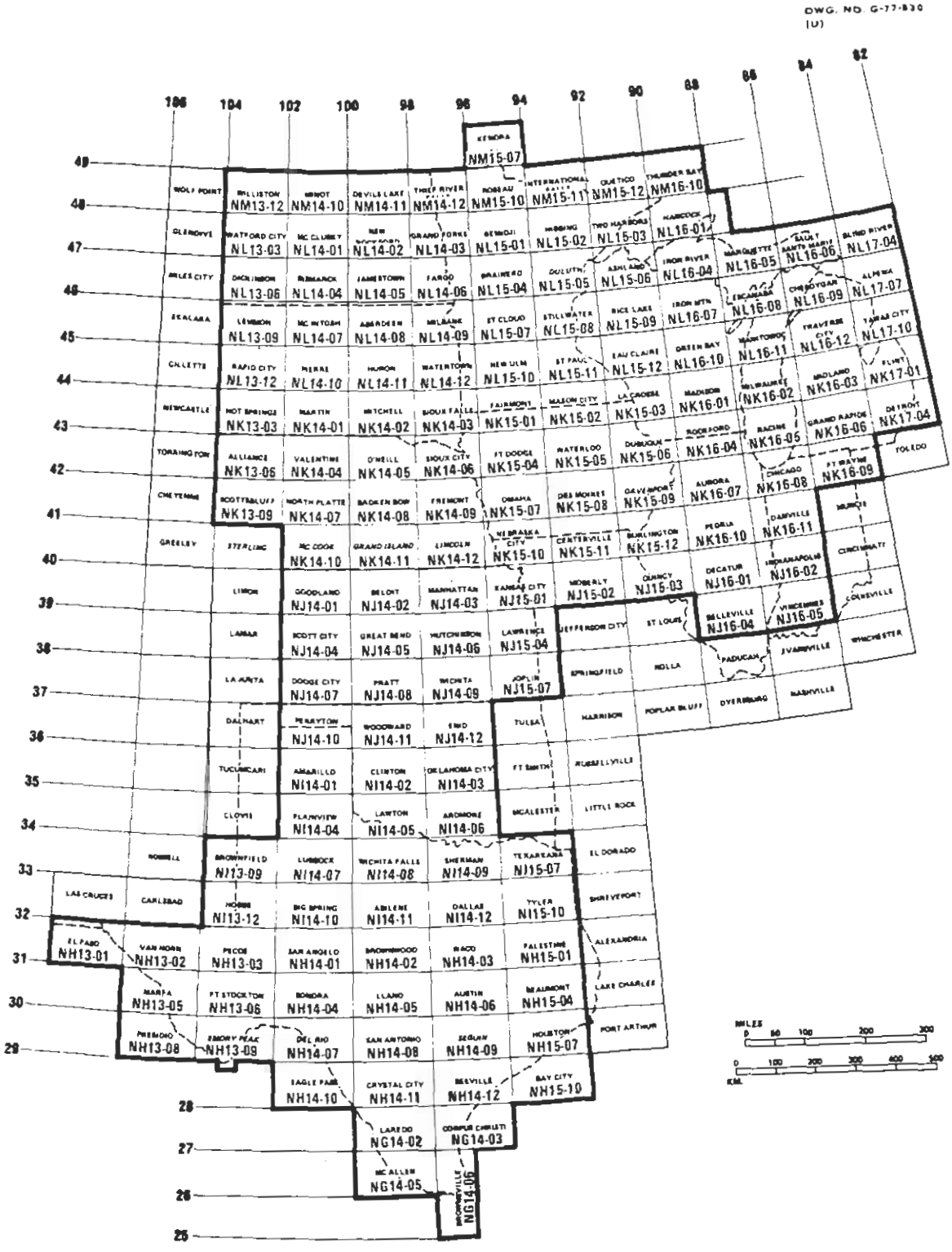


Figure 5

1° x 2° QUADRANGLE MAP CODES

Block 19

19

Replicate Letter (A–Z)

Leave Block 19 blank.

Blocks 20-27

Hour		Day		Month		Year	
20	21	22	23	24	25	26	27

Enter the time to the nearest hour that the sample was collected in Blocks 20-27. Use the military 24-hour system of telling time (example: 1:00 p.m. should be recorded as 13).

Blocks 28-30

28	29	30

Collector's Initials

Enter the sample collector's three initials in Blocks 28-30 (or those designated for their use).

Block 31

31

Phase (P, 1, 2, or G)

In Block 31, enter the phase. If the basin area above the site is between 2 and 20 mi^2 enter "2". If larger or smaller, enter "G". The site location map given to the contractor will indicate the phase to be entered for all preselected sites that are sampled.

Block 32

32	
Ø	Original
C	Correction
V	Voiding

Field Sheet Status

Enter the Field Sheet Status in Block 32. All new forms are *originals* and should be so designated. Forms submitted later to correct errors on forms previously submitted should be marked *Correction*.

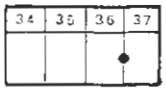
Block 33

33	
A	Sediment, High U
B	Sediment, Low U
C	Water, High U
D	Water, Low U
Ø	Other

Control Sample

Leave Block 33 blank.

Blocks 34-37



Enter the air temperature in Blocks 34-37. Measure the air temperature by hanging the mercury thermometer in the shade. Let the thermometer stabilize for several minutes before reading and record the temperature to the nearest tenth of a degree.

Blocks 38-50

Location

Latitude						Longitude						
Deg.		Min.		Sec.		Deg.			Min.		Sec.	
38	39	40	41	42	43	44	45	46	47	48	49	50

Leave Blocks 38-50 blank. The Latitude and Longitude are obtained from the electronic digitizer in Oak Ridge.

Blocks 51-54

Enter the surface geologic unit code for the dominant surface formation present in the basin in Blocks 51-54. Procedures for determining the surface geologic unit code are described in Appendix D, *Assignment of Surface Geologic Unit Codes*. Prior to leaving the office, obtain a geologic code list for the quadrangle and be absolutely sure that the list is the most recent.

Block 55

Type of Vegetation

55	(Within 1 Km Upstream)
C	Conifer
&	Conifer & Deciduous
D	Deciduous
B	Brush
G	Grass
M	Moss
L	Lichen
Ø	Other

Enter the type of vegetation present within 1 km of the sample site in Block 55. If conifer and deciduous are mixed by more than 10% of the other type, then mark *Conifer* and *Deciduous*. Inspect the sampling site for vegetation type as the site is entered while driving or on foot.

Block 56

Density of Vegetation

56	(Within 1 Km Upstream)
B	Barren
S	Sparse
M	Moderate
D	Dense
V	Very Dense

Enter the density of vegetation within 1 km of the site in Block 56. *Barren* means no vegetation. *Sparse* indicates a definite lack of vegetation where grass, brush, etc. are present but the soil is uncovered between patches of grass. *Moderate* is the normal vegetative cover. *Dense* indicates a growth so thick that movement through it is difficult. *Very Dense* would be a jungle or rain forest. A pasture may appear as a sparse situation but if covered with grass, it would be classified as *Moderate*.

Block 57

Local Relief

57		(Within 1 Km Upstream)	
F		Flat	(<2m)
L		Low	(2–15m)
G		Gentle	(15–60m)
M		Moderate	(60–300m)
H		High	(>300m)
O		Other	

Enter the local relief in Block 57. The categories of local relief are defined by the difference in elevation from the sample site to the highest point within a half kilometer radius of the sampling site. Relief is best estimated while driving or hiking to the site. These numbers are most accurately determined from a topographic map.

Blocks 58-59

Weather

58			59	
C		Calm	C	Clear
P		Lt Wind	L	Pt Cldy
V		Windy	W	Overcst
R		V. Windy	V	Rainy
S		Gale	G	Snowy

Enter the appropriate choices for weather in both Blocks 58 and 59. There is a difference between *Windy* and *Very Windy*. When the wind makes it difficult to handle papers or equipment, it is defined as *Very Windy*. If more than 10% of the sky is covered by clouds, then mark *Partly Cloudy*.

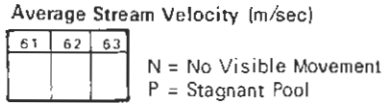
Block 60

Classes of Contaminants

60			
N		None	
M		Mining	(Use Remarks)
A		Agriculture	
F		Oil Field	
I		Industry	
S		Sewage	
P		Power Plant	
U		Urban	
O		Other	

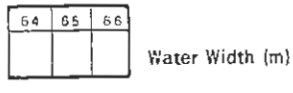
Enter any type of contamination near the site in Block 60 (Refer to Appendix D, *Evaluation of Contamination*). For all categories except *None*, an explanation must be included in the *Remarks Section* of the field form. This includes a specific description of the situation, including the position of the potential source of contamination with respect to the site. In the case of *Mining*, the description should include the size of the area disturbed in the surrounding area and the type of material mined. In the case of *Agriculture*, include the type of crop, size of cultivated field, and information that might be helpful in evaluating the type of fertilizer used. The presence of cows in a field is not of itself considered evidence of agricultural contamination. The categories of *Industry*, *Power Plants*, and *Urban* are included to give an indication of the particular trace elements which are most likely to be present.

Blocks 61-63



Enter the average velocity of the stream, measured in m/sec, in Blocks 61-63. The measurement entered is an average between the velocity of the water at the bank and that of the fastest flowing portion of the water in the center of the stream. This is determined by measuring the time of passage of a floating object, such as a twig against a standard 2-m interval marked out on the bank. Caution must be exercised not to confuse surface movement caused by wind with the velocity of the stream. For example, in a stagnant pool, a twig may move as it is pushed by the wind but there would be no velocity indicated. *No Visible Movement* should be indicated when there is no apparent movement of the surface water. *Stagnant Pool* should be used when water occurs in pools within the stream bed.

Blocks 64-66



The average water width in meters is entered in Blocks 64-66. The width entered is intended to represent the whole stream over at least a 100-m interval, not just at the sample site. For pools, estimate the greatest pool width perpendicular to the stream axis and enter that measurement for water width.

Blocks 67-69

Enter the average depth in meters in Blocks 67-69. The measurement entered should be an average of several readings taken as close as possible to the center of the stream. In the case of an isolated pool, measure the deepest portion of the pool and enter that value.

Block 70

Water Level

70		
D		Dry
P		Pools
L		Low

70		
N		Normal
H		High
F		Flood

Indicate one choice for water level in Block 70. Enter *Dry* if no water is present in the stream bed. Enter *Pools* if nonflowing water is present in the stream, but is interrupted by intervals of stream bed containing no water. Enter *Low* if most of the water is derived from groundwater base flow. Enter *Flood* if the stream is flowing over the banks on to the flood plain. A stream is considered to have *High* water level if it is above *Normal*, often determined by a grass or bush line. In an arid area, the normal flow may be a very thin stream of water running through a relatively large flood plain. Samples should not be collected if streams are in flood stage.

Block 71

Dominant Bed Material

71		
B		Boulder
C		Cobble
P		Pebble
S		Sand
T		Silt
Y		Clay
N		None (Use Remarks)

Enter the dominant bed material in Block 71. This does not include organic material and is not determined from the material collected in the composite sample. The entry is to represent the primary bed material of the stream. *Boulders* are larger than 256 mm in diameter. *Cobbles* are 64-256 mm in diameter. *Pebbles* are 2-64 mm in diameter. *Sand* is 0.06-2 mm in diameter. *Silt* is 0.004-0.06 mm in diameter. *Clay* is less than 0.004 mm in diameter.

Blocks 72-76

Sample Color (Except Plants)

	Adj		Noun	
72	73	74	75	76

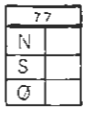
V V Lt
L Light
M Medium
D Dark

CL Clear
WH White
YL Yellow
ØR Orange

PK Pink
RD Red
GN Green
BU Blue
BN Brown
GY Gray
BK Black
ØT Other

Enter the color of the material collected in Blocks 72-76. The color designation consists of three terms: a modifier, adjective, and noun. The modifier is *Very Light*, *Medium*, or *Dark*. These terms refer primarily to the amount of grains of the color. The terms prefaced by *Very Light* would appear almost white. The adjective and noun are derived from the list of 12 choices. Most of the time, all three portions of the color term are to be used although occasionally, the adjective portion may be omitted. In the rare case of a color which is truly black or white, only the noun portion of the term is to be used.

Block 77



Indicate the odor of the sediment material sampled in Block 77. It is particularly important to note H_2S odors as they indicate reducing conditions in the stream sediment. If the choice *other* is used, describe the odor in the *Remarks Section*.

Block 78

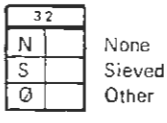
If it is necessary to provide the results to obtain permission to sample, check Block 78. Enter the person's name and mailing address in the *Remarks Section*. Legibility is essential. Place % after the standard pauses in a person's mailing address to instruct the computer where to start a new line when addressing the envelope. Be sure to obtain the Zip Code (See an example in Appendix C, *Card 4, Remarks*).

Card 2, Stream or Lake Sediment

Block 31

Enter the condition of the sediment sample which has been collected in Block 31. The sample is to be considered *Wet* if water drips out of a bottom corner of the bag after it has been filled two-thirds full with sediment.

Block 32



Enter *None* for sample treatment in Block 32.

Blocks 33-34

In Blocks 33-34, enter the number of subsamples that make up the composite sample.

Blocks 35-36

Enter an estimate of the percent organic material in Blocks 35-36. Often, the color of the sediment material sample is related to the organic content. Thus, the darker the sample, the higher the organic content. Make your entry from the following choices: 0, 5, 10, 25, 50, or 100%.

Card 4, Remarks

1. Print all remarks in upper case block letters. Be neat to assure accurate transcription.

2. Start each remark with the card and block number that pertain to the remark. End each remark with a colon (:) and start the next remark (Example: 1-60 POSSIBLE CONTAMINATION FROM RECENT FERTILIZER APPLICATION: 1-77 SEDIMENT HAS ODOR OF AMMONIA:).

3. The first entry in the *Remarks Section* should be the exact location from which the sample was obtained. The information required in the description includes (a) the name of the digitizer map on which the sample is entered, (b) an exact description of the location of the sample site and sample interval. If possible, use a landmark to help describe the site location. EXAMPLE:

   1-38 JACKSON HILL 7.5 MINUTE MAP. SAMPLE COLLECTED IN THE CENTER OF THE STREAM OVER A 16 M INTERVAL GOING UPSTREAM STARTING 62 M UPSTREAM FROM THE LOW WATER BRIDGE. THE SAMPLING INTERVAL STARTS 3 M DOWNSTREAM FROM A LARGE WALNUT TREE THAT HANGS OVER THE WEST BANK OF THE STREAM:

4. If results are requested by the property owner at any site, use the following format (in addition to the well location format).

   1-78 MR JOHN ZLOTECKI%, ROUTE 1, BOX 65%, COON RAPIDS, IOWA 52340:

5. If keying a remark to two or more different categories (boxes), use the following format.

   1-60 #1-77 STRONG ODOR OF AMMONIA INDICATES THE SITE MAY BE CONTAMINATED BY RECENT APPLICATION OF FERTILIZER:

6. Record all information in the *Remarks Section* that helps describe the sample and sampling site. It should be brief but accurate. Small items that seem unimportant at the site may be very significant in interpreting geochemical data.

7. Be neat when crossing out any entry in which an error has been made in the *Remarks Section*.

DIGITIZER MAPS

The accurate location of sites that have been sampled must be done after the samples have been collected. Site locations are plotted on clean unfolded copies of 7-1/2' or 15' topographic maps or, if necessary, on county highway maps. The maps prepared by the URE Project for site selection may be used for navigation and other purposes. The final maps that are to be digitized must be so indicated by writing "DIGITIZER MAP" in the lower right hand corner and by affixing the labels which are provided. An example is shown below.

SAMPLER NAME(S)_____

TYPE MAP _____ DATE _____

QUADRANGLE NAME AND NUMBER _____

_____

PHASE _____ NO. OF SITES _____

PHASE _____ NO. OF SITES _____

Once a sample has been collected, determine the location of the sample site on the *digitizer map* as accurately as possible. Using a red pen, put a dot over the site location and then circle the dot. Next to the sample site location, attach a small sample label that is provided along with the labels for the sample containers. In some cases, the small labels will not be usable, and the six-digit sample number will have to be printed neatly next to the sample location. The sample site location and sample number should be accented using a yellow marking pen if sample number labels are not used.

When all sampling has been completed on either a 7-1/2' or 15' topographic map or on a county highway map, the information must be completed on the label which has been affixed in the margin. "Sampler Name(s)" refers to the initials of all samplers that collected samples from sites identified on the *digitizer map*. "Type Map" refers to whether the map is a 7 1/2', 15', or county map. "Date" refers to the date sampling was completed for the *digitizer map*. "Quadrangle name and number" refer to the name and map code of the 1° x 2° quadrangle to which the *digitizer map* is associated. "Phase" refers to basins designated either Phase "2" or Phase "G". "No. of Sites" refers to the number of sample sites sampled in each phase that are shown on the *digitizer map*. The unfolded *digitizer map* should be returned to Oak Ridge to the address indicated in the procedure for shipping maps.

COMPOSITE MAPS

Sample site locations actually sampled should be entered on an overlay to the 1:250,000 scale, 1° x 2° NTMS topographic map each day. Accompanying the accurately positioned sample site location will be the sample number and site number. This map must be kept up to date so that it can be used to report monthly progress to the URE Project contract supervisor as well as to correct any discrepancies that may occur on *digitizer maps*.

APPENDIX D

ASSIGNMENT OF SURFACE GEOLOGIC UNIT CODES

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ASSIGNMENT OF SURFACE GEOLOGIC UNIT CODES

PURPOSE

Geologic formations for each 1° x 2° quadrangle are assigned 3 or 4 letter codes which are entered on the field form on Card 1, Blocks 51-54. The formation is chosen to be representative of the geology of the basin. The purpose of designating a code for stream sediment is to identify the dominant geologic unit which most influences the geochemical concentrations in the sample. The laboratory analyzes the -100 mesh fraction of stream sediments so the geologic code may not apply to the coarser fractions of these samples.

In terms of presenting data in a report, the geologic code of the dominant formation is used as a fundamental basis for statistical summaries of the results. Summarizing data by formation serves as a basis for determining whether background and anomalous values are comparable between geologic units and which units might comprise a geochemical provinke.

In general, one should avoid sampling the Quaternary alluvium found on large flood plains. Small alluvial deposits along the axis of the 10 mi^2 basins can usually be disregarded in the selection of a dominant geologic code.

PROCEDURE

Two methods of assigning geologic codes are given below. Paragraph A takes precedence when applicable.

A. Look closely at the sediment to see whether you can judge the probable geologic origin of the -100 mesh fraction. In the absence of adequate evidence from the sediment itself, use your understanding of the geomorphic processes operating in the area to assign a geologic code. For example, the source unit may be assigned to a formation cropping out in the portion of the basin which is being eroded most rapidly as in the case of a formation which crops out in the steepest slopes of an arid region. As another example, the choice might be between a limestone and a shale where the limestone tends to dissolve leaving chert nodules not represented in the -100 mesh fraction while the shale erodes to form clay.

B. Where the proper geologic code is not evident after considering the guidelines above, choose the unit which dominates the area of the basin. This may be the geologic unit which occupies at least 60 or 70% of the surface area of the basin.

Where sediment lithology or basin geomorphology is the basis for assigning the dominant geologic code, enter a brief explanation in the *Remarks Section*. No explanation is needed for how the dominant geologic code is chosen when the selection is obvious such as when only one unit crops out in the basin or when a second formation is too insignificant in area or position to be seriously considered.

APPENDIX E

EVALUATION OF CONTAMINATION

APPENDIX E

EVALUATION OF CONTAMINATION

Listed below are the sources of contamination most likely to be encountered. Avoid these circumstances if possible by either moving upstream of the condition or if necessary, by designating a new basin to be sampled nearby. Always record possible/certain contaminants in the *Remarks Section*.

1. Agricultural Contamination

   Agricultural contamination is generally restricted to application of fertilizer. As the midcontinental region of the United States contains 70% of America's agricultural production, this is of major importance. Phosphate fertilizers are widely used and contain concentrations of uranium that may potentially contaminate surface sites. Due to the large tracts of land fertilized, a sampler can rarely move upstream to avoid the problem but should always note this type of contamination in the *Remarks Section*.

2. Road Material

   Road building gravel, fill dirt, etc., commonly wash into streams and settle near bridges. Try to recognize this type of sediment. In addition, the area near a road may contain high values for lead derived from gasoline additives. Do not sample downstream from road beds constructed of mine tailings. When collecting a sample, the site should be located at least 25 m upstream from a bridge or 1 km downstream from a bridge. If it is not possible to sample upstream, the fact that the sample has been taken downstream from a road or bridge should be noted in the *Remarks Section*.

3. Trash

   Any metal objects found in a stream bed should be noted and avoided by moving upstream. Trash is defined to include auto parts, batteries, construction materials, garbage, or dumps.

4. Soil or Slump Material from Channel Banks

   Slump material or soil is not representative of the active stream sediment material that is to be collected. Under no circumstances should soil or slump material be collected. Always sample the active stream sediment.

5. Mining Activities

Any mining activity upstream within a basin represents a source of contamination. The contractor's supervisor should conduct a reconnaissance of areas in advance of sampling to identify mining areas. Be observant of streams which have been supplemented by water pumped out of mines. Haul roads from mines that pass through basins are also sources of contamination by loss of material from trucks or trains. A drainage basin containing half the recommended area with no contamination is better than a basin of the prescribed area with mining upstream from the collection point.

6. Industrial Contamination

Industrial contamination has three major methods of transport: wind, water, and man. Contamination halos are often seen downwind from smoke stacks, smelters, refineries, settling ponds, etc. Effluents from mineral processing plants and sewage treatment plants contain significant trace element concentrations that will contaminate surface sampling sites. Dirt or rock transported by man for building purposes can affect the geochemistry of drainage waters and sediments. When possible, it is important to move upstream, upwind, or as far as possible from industrial contamination while still retaining the integrity of coverage.

7. Dams

Dams are not true sources of contamination unless they are built of mine tailings. However, dams do cause the settling out of fine stream sediments upstream from the dam and may indicate restricted samples that are not representative of a natural drainage basin. The presence of dams upstream from sample sites should be indicated as *Other* in Block 60 of the field form and discussed in the *Remarks Section*.

Random resampling and resampling of sites with unusual analyses will be conducted on a regular basis by the URE Project in order to determine the accuracy of information provided by the contractor. Failure to identify contaminated sites or to collect samples from contaminated sites where alternate sites could have been chosen to minimize the contamination will constitute a legitimate reflection of the performance of the contractor and will be strongly considered in the evaluation of the contractor's performance.

APPENDIX F

GENERAL GUIDELINES FOR DATA CONTROL

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GENERAL GUIDELINES FOR DATA CONTROL

1. Site numbers are unique within any 1° x 2° quadrangle, starting at 0001 and progressing to 9999 (however, that many samples are never collected within an individual quadrangle).

2. Potential sample sites have been identified and located on 7 1/2' or 15' topographic or county highway maps, and assigned a site number and phase of sampling by the URE Project.

3. Site numbers should be consecutive, if possible, within any individual base map and should not be repeated within that 1° x 2° quadrangle.

4. When samples are collected, the actual sample site should be entered in red ink on a new, clean, unfolded map (not the map showing sites to be sampled), called a *digitizer map*, using a "00" rapidograph pen. The sample number label should be attached next to the accurately located sample site as shown below:

   ⊙ 700017

   The *digitizer map* must not be folded because it is the one that goes to the electronic digitizer in Oak Ridge. Folding will distort the position of site locations with respect to coordinates of the maps.

5. If a site cannot be sampled, an alternate site must be selected. The new site should be assigned the site number of the one not sampled. On the original map showing sites to be sampled, label the site in red ink that was not sampled with the designation "NOT SAMPLED". Enter the new site on the *digitizer map*.

6. When all sampling has been completed for a particular *digitizer map*, complete a label and place it on the lower right corner of the map. The label to be used is shown below:

   SAMPLER NAME(S)_____

   TYPE MAP _____ DATE _____

   QUADRANGLE NAME AND NUMBER _____

   _____

   PHASE _____ NO. OF SITES _____

   PHASE _____ NO. OF SITES _____

7. Maintain a 1° x 2° composite map for each quadrangle being sampled, keeping progress up-to-date on a daily basis. The map should indicate site location, sample number, and site number. After sampling is complete in a quadrangle, the map must be turned in to the URE Project's contract supervisor.

8. Ship samples, field forms, and maps to Oak Ridge in the specified manner (See *Sample Shipment Procedures*).

9. Keep a monthly inventory of all boxes, sets of field forms, and *digitizer maps* sent to Oak Ridge including inclusive sample and site ranges, total samples collected as well as dates for each mailing. This inventory should be kept by the contractor's field supervisor. A master copy of the shipping inventory for all personnel must be available for the URE Project's contract supervisor as requested.