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Energy Systems Environmental Restoration Program
ORNL Environmental Restoration Program

**Field Operations Procedures Manual for Environmental Monitoring
in Waste Area Grouping 6 at Oak Ridge National Laboratory,
Oak Ridge, Tennessee**

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**Field Operations Procedures Manual for
the Environmental Monitoring Plan in Waste Area Grouping 6
at Oak Ridge National Laboratory, Oak Ridge, Tennessee**

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EXECUTIVE SUMMARY

This manual contains the project-specific Field Operations Procedures and the Field Equipment Manual references to be used when conducting field activities for Martin Marietta Energy Systems, Inc. (Energy Systems), Environmental Restoration (ER) Division monitoring activities at Waste Area Grouping (WAG) 6, Oak Ridge National Laboratory, Oak Ridge, Tennessee. The objective of the manual is to provide CDM Federal Programs Corporation personnel and their subcontractors with a consolidated source of project-specific instructions and information so that consistent data are generated during ER activities conducted at WAG 6. Whenever possible, Energy Systems Environmental Surveillance Procedures will be used to ensure compliance with Energy Systems requirements. The manual is intended for use in conjunction with field equipment manuals and individual task-specific Work Plans, including Field Sampling and Analysis Plans, Quality Assurance Project Plans, Health and Safety Plans, and Waste Management Plans.

WAG 6
FIELD OPERATIONS PROCEDURES

Subject: Retrieving Automatic Storm Event Samples

I. PURPOSE

The purpose of this Field Operations Procedure (FOP) is to describe the standard method and equipment employed by Waste Area Grouping (WAG) 6 sampling personnel to maintain the quality of water samples collected by ISCO automatic samplers at surface water monitoring sites. This procedure is to be used after storm event samples have been collected by the automatic samplers. It presents the required steps for retrieving the full samples and for preparing the samplers for the next sample collection event. Users of this procedure must be familiar with the ISCO 3700 Sampler, the ISCO 3230 Flow Meter, and the ISCO FLOWLINK communications software. This procedure is not intended to replace the instruction manuals for the sampler, the flow meter, or FLOWLINK software. Users of this procedure must also be familiar with the configuration and programming of these devices.

II. REFERENCES

ISCO, Inc. 1991. *3700 Portable Sampler Instruction Manual*, Part #60-3704-101. Rev. C, Lincoln, Nebraska, December 6.

III. SCOPE/LIMITATIONS

This FOP applies to the retrieval of samples from WAG 6 surface water monitoring sites equipped with ISCO 3700 Samplers.

IV. DEFINITIONS

Master/Slave Configuration - A configuration option of the ISCO 3700 Sampler for which two samplers are required. This configuration allows one sampler (i.e., the master) to perform its preprogrammed sampling routine while the other sampler (i.e., the slave) remains dormant. Once the master sampler has completed its routine, the slave sampler is activated and performs its preprogrammed routine.

V. REQUIREMENTS

- Personal protective equipment (PPE), as required
- Plastic sheeting
- Keys to the ISCO 3230 Flow Meter and ISCO 3700 Samplers
- 48 clean, 1000-mL, polyethylene sample bottles with caps
- 10 clean, 250-mL, polyethylene sample bottles with caps

Subject: Retrieving Automatic Storm Event Samples

- Plastic sample bottle containment bags
- Sample containment cooler
- Sample preservation equipment and solutions
- Sample labeling equipment
- Clear tape

VI. RESPONSIBILITIES

Sample Task Leader - The Sample Task Leader is responsible for ensuring that procedures are followed and for determining what actions will be taken in circumstances that require variance from the procedure. All variances from the procedure will be documented by the Sample Task Leader, and will be reviewed by the Field Task Manager and any appropriate Quality Assurance personnel.

Field Technicians - Field Technicians are responsible for field measurement instrument calibration, sample collection, field measurements, informing team leader of any variances, sample preparation, and completion of all required forms.

VII. QUALITY ASSURANCE AND QUALITY CONTROL

All pertinent sample identification, preparation, custody, and field data will be recorded on the WAG 6—Automatic Storm Event Sample Collection Form (SW-05), the WAG 6—Automatic Storm Event Sample Selection Form (SW-06), and chain-of-custody forms.

VIII. TRAINING

All site personnel will receive procedural training before the commencement of work.

IX. ACTION STEPS

- Don PPE as required by the Site Health and Safety Officer (SHSO) and/or Site Health Physicist before beginning work.
- Prepare the site by laying out uncontaminated plastic sheeting on the ground and on any other surfaces used. Designate a decontamination area, and do not allow any equipment to enter this area.
- Survey the condition of the hydraulic structure and remove any debris or sediment accumulation.

Subject: Retrieving Automatic Storm Event Samples

- Confirm that the ISCO Flow Meter is logging data as programmed. Stop the plotter and remove the chart containing the record of the storm event and sample collection information. Note any problems or discrepancies and subsequent corrective actions in the field logbook.
- Record the duration of runoff and number of sample pairs collected as indicated by the chart on the WAG 6—Automatic Storm Event Sample Collection Form (SW-05).
- Remove the sampler covers from both samplers and check the status of each in the sampler controller's LCD window. One of the following three messages should be displayed. (Other messages are not expected. If they occur, refer to the ISCO Instruction Manual.)
 1. **"STANDBY"**: replace cover. No samples have been collected if the samplers are in standby mode. Make sure that the sampler and flow meter are connected, configured, and programmed properly. Determine why no samples were collected during the storm and document this conclusion in the WAG 6—Flow Paced Sample Collection Form (SW-04). Perform the brief site inspection according to the documentation form and leave the site.
 2. **"BOTTLE ## AT MO/DY/YR HR:MN"**: replace covers and allow sampling to continue. Because the samplers are set up in a master/slave configuration, only one sampler should display this message at a time. Estimate the approximate time that the sampling event will be completed. If runoff is expected to continue beyond the completion of the current sampling event, sampling personnel must return to the site to retrieve filled samples, restock the samplers with clean bottles, and reset the samplers for collection as soon as possible after current sampling-event completion.
 3. **"DONE"**: proceed to the next step in this FOP.
- Decide if samples from this storm will be analyzed and record this on the WAG 6—Automatic Storm Event Sample Collection Form (SW-05). If so, proceed to the next step. If not, pour out the collected samples downstream of the hydraulic structure and install clean bottles in the positions from which the filled bottles were removed.
- Use the WAG 6—Automatic Storm Event Sample Selection Form (SW-06) in conjunction with the flow meter chart and WAG 6—FOP 8 to choose the collection pairs to be analyzed.
- The following steps should be performed for each sample pair selected for analysis.
 1. Remove the selected pair from the sampler.
 2. Label one of the filled 1000-mL polyethylene bottles and one empty 250-mL polyethylene bottle in accordance with WAG 6—FOP 9. Affix bar code labels to both

Subject: Retrieving Automatic Storm Event Samples

bottles. The 1000-mL sample will be analyzed for strontium; the 250-mL sample will be analyzed for tritium.

3. Record the sample identification numbers (IDs) and bar code IDs on the WAG 6—Automatic Storm Event Sample Selection Form (SW-06).
 4. Fill the 250-mL bottle with water from the unlabeled 1000-mL bottle.
 5. Preserve the strontium sample with HNO_3 to a $\text{pH} < 2$. Use a pipet and litmus paper to ensure $\text{pH} < 2$.
 6. Use the excess water from the unlabeled 1000-mL bottle to top off the strontium sample.
- Dispose of any excess water (including pairs not selected for analysis) downstream of the hydraulic structure.
 - Install clean bottles in the sampler positions where filled bottles were.
 - Verify that the samplers are properly programmed and configured. Reprogram or reconfigure if needed, using WAG 6—FOP 5 as a guide. Record all programming changes made in the WAG 6—Automatic Storm Event Sample Collection Form (SW-06). Return the samplers to “STANDBY” mode, ensuring that the master sampler is started first. Replace sampler covers.
 - Confirm that the flow meter is in the correct mode and ready for the next sample collection event. Reprogram if needed, using WAG 6—FOP 4 as a guide. Be sure that the plotter has sufficient paper for the next event.
 - Affix clear tape over each sample label and seal all sample bottles with custody tape.
 - Ask the Site Health Physicist to screen the samples.
 - Decontaminate used collection containers in accordance with Environmental Surveillance Procedure (ESP)-900.
 - Dispose of surgical gloves and any other sampling waste in appropriate containers in accordance with ESP-1000.
 - Place samples in storage until the end of the month and then ship them to the laboratory for analysis.

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X. REQUIRED RECORDS

- WAG 6—Automatic Storm Event Sample Collection Form (SW-05)
- WAG 6—Automatic Storm Event Sample Selection Form (SW-06)
- ISCO instruction manuals
- Field logbook

XI. ADMINISTRATION

The Sample Task Leader is responsible for administration of this procedure.

XII. APPROVAL

All procedures and instructions generated by and/or applicable to the WAG 6 Environmental Monitoring Program must receive the signed approval of the WAG 6 Project Manager and the Environmental Restoration Quality Assurance Specialist.

Effective date: November 1, 1993

XIII. APPENDIXES

This FOP has no appendixes.

Subject: Retrieving Flow-paced Composite Samples

I. PURPOSE

The purpose of this Field Operations Procedure (FOP) is to describe the standard method and equipment employed by WAG 6 personnel to maintain the quality of composite samples collected by ISCO automatic samplers at surface water monitoring sites. Users of this procedure must be familiar with the ISCO 3700 Sampler, the ISCO 3230 Flow Meter, and ISCO FLOWLINK communications software. This procedure is not intended to replace instruction manuals for the Flow Meter, the Sampler, or FLOWLINK software. Users of this procedure must also be familiar with the configuration and programming of these devices.

II. REFERENCES

ISCO, Inc. 1991. *3700 Portable Sampler Instruction Manual*, Part #60-3704-101, Rev. C. Lincoln, Nebraska, December 6.

III. SCOPE/LIMITATIONS

This FOP applies to the retrieval of the weekly flow-paced composite samples.

IV. DEFINITIONS

Flow-paced Sampling - Type of sampling in which a predetermined amount of sample is collected at equal flow-volume intervals.

V. REQUIREMENTS

- Surgical gloves and other appropriate personal protective equipment (PPE) as specified by the SHSO and/or Site Health Physicist
- Plastic sheeting
- ISCO 3700 Sampler (installed in the composite setup)
- ISCO 3230 Flow Meter
- Keys to the flow meter and sampler
- One clean, 4-gal polyethylene sample container with cap

Subject: Retrieving Flow-paced Composite Samples

- One clean, 500-mL polyethylene sample bottle with cap
- Funnel
- Bar code reader
- Sample labels
- Sample preservatives

VI. RESPONSIBILITIES

Sample Task Leader - The Sample Task Leader is responsible for ensuring that procedures are followed and for determining what actions will be taken in circumstances that cause variation from the procedure. All variances from the procedure will be documented by the Sample Task Leader and reviewed by the Field Task Leader.

Field Technicians - Field Technicians are responsible for collecting samples, preparing samples, informing the team leader of any variances, and completing all required forms.

VII. QUALITY ASSURANCE AND QUALITY CONTROL

All pertinent sample identification, preparation, custody, and field data will be recorded on the Flow-paced Sample Collection Form (SW-04) and chain-of-custody form.

VIII. TRAINING

All site personnel will receive procedural training before work begins.

IX. ACTION STEPS

- Don PPE as required by the SHSO and/or Site Health Physicist before beginning work.
- Prepare site by placing uncontaminated plastic sheeting on the ground and any other surfaces used. Designate a decontamination area, and do not allow any equipment to enter it.
- Survey the condition of the hydraulic control (i.e., flume or weir) and document all observations on the WAG 6—Flow-paced Sample Collection Form (SW-04). Possible items

Subject: Retrieving Flow-paced Composite Samples

to record include debris lodged in the flow control device or sediment accumulation that may be affecting flow measurement. Correct any problems as needed.

- Confirm that the ISCO Flow Meter is logging data as programmed. Note any problems or discrepancies and subsequent corrective actions in the documentation form.
- Open the ISCO 3230 Flow Meter case and look at the liquid crystal display window. Record the total flow volume, flow rate, and water level on the WAG 6—Flow-paced Sample Collection Form (SW-04).
- Compare the staff gauge reading and the water level taken from the flow meter. If they differ, adjust the flow meter water level by pressing the “GO TO PROGRAM STEP” key and selecting program step number 9.
- Reset the flow totalizer by pressing the “GO TO PROGRAM STEP” key and choosing option 10.
- Remove the sampler cover and check the status in the sampler controller’s display window. One of the following three messages should be displayed. (Other messages are not expected; if they occur, refer to the ISCO Instruction Manual.)
 1. **“STANDBY”**: replace cover. No aliquots have been collected if the sampler is in standby mode. Make sure that the sampler and flow meter are connected, configured, and programmed properly. Determine why no aliquots have been collected and document this conclusion in the WAG 6—Flow-paced Sample Collection Form (SW-04). Perform a brief site inspection according to the documentation form and leave the site.
 2. **“BOTTLE ## PUMPING XXX mL”**: replace the cover and allow the sampler to finish delivering the aliquot to the bottle.
 3. **“DONE”**: the bottle is full. Proceed to the next step.
- Label the sample bottle that will be placed in the sampler carefully and clearly in accordance with WAG 6—FOP 9. Do not fill in the date (MMDDYY) portion of the label, because information will be entered on the label when the bottle is retrieved. Do not affix clear tape to the sample bottle.
- Remove the filled sample container from the sampler and complete the date portion of the sample label.
- Insert the clean composite bottle into the sampler and replace the sampler cover.

Subject: Retrieving Flow-paced Composite Samples

- Mix the contents of the filled container either by inverting the capped container several times or by swirling the contents from side to side until they are adequately mixed.
- Using a funnel, fill the 500-mL bottle and cap it. This sample will be composited at the end of the month and analyzed for tritium and total suspended solids.
- Preserve the remaining water in the 4-gal container according to the guidelines outlined in the WAG 6 Surface Water Sampling and Analysis Plan (see Table 2.1); cap the container. Use a pipet and litmus paper to ensure $\text{pH} < 2$. At the end of the month, this water will be used to create a composite sample that will be decanted and analyzed for Contract Laboratory Procedure metals, gross alpha activity, gamma activity, and strontium.
- Affix clear tape over the labels and seal the bottles with evidence tape in accordance with Environmental Surveillance Procedure (ESP-) 500.
- Ask the Site Health Physicist to screen the outside of the filled sample containers.
- Place the collected samples in storage until the end of the month.
- If this is the last weekly collection of the month, obtain a sample to be analyzed for volatile organic compounds, according to WAG 6—FOP 6.
- Complete the WAG 6—Flow-paced Sample Collection Form (SW-04).

X. REQUIRED RECORDS

- WAG 6—Flow-paced Sample Collection Form (SW-04)
- ISCO instruction manuals
- Field logbook

XI. ADMINISTRATION

The Sample Task Leader is responsible for administering this procedure.

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XII. APPROVAL

All procedures and instructions generated by and/or applicable to the WAG 6 Environmental Monitoring Program must receive the signed approval of the WAG 6 Project Manager and the Environmental Restoration Quality Assurance Specialist.

Effective date: November 1, 1993

XIII. APPENDIXES

This FOP has no appendixes.

Subject: Downloading and/or Viewing Data Recorded on the ISCO 3230 Flow Meter

I. PURPOSE

The purpose of this Field Operations Procedure (FOP) is to describe the standard method and equipment required for retrieving or on-site viewing of all Waste Area Grouping (WAG) 6 water level and sample collection data from the ISCO 3230 Flow Meter. This procedure does not address electronic data reduction, review, analysis, or management, nor does it address on-site calculation and representation (graphical or tabular) of flow. Users of this procedure must be knowledgeable of the capabilities, applications, and structure of FLOWLINK software.

II. REFERENCES

ISCO, Inc. 1990. *FLOWLINK® Instruction Manual*. Rev. G. Lincoln, Nebraska.

ISCO, Inc. 1992. *Model 3230 Instruction Manual*. Rev. J. Lincoln, Nebraska, March.

III. SCOPE/LIMITATIONS

This FOP applies to the downloading and/or viewing of data at WAG 6 sites equipped with ISCO 3230 Flow Meters.

IV. DEFINITIONS

FLOWLINK - Software system available from ISCO used for the purpose of data acquisition, storage, retrieval, and analysis.

LAPCOMM - Component of the FLOWLINK system that allows the user to set up level data acquisition and interrogate stored level readings from the ISCO 3230 Flow Meter with software stored on a laptop computer.

V. REQUIREMENTS

- Personal protective equipment, as required
- ISCO 3230 Flow Meter
- Laptop computer with FLOWLINK software
- Flow meter interrogator cable with mating connector
- Serial port cable with 4-pin connector to flow meter interrogator cable
- Extra floppy disks
- Bar coding equipment

Subject: Downloading and/or Viewing Data Recorded on the ISCO 3230 Flow Meter

VI. RESPONSIBILITIES

Sample Task Leader - The Sample Task Leader is responsible for ensuring that procedures are followed and for determining what actions will be taken in circumstances that require variance from the procedure. All variances from the procedure will be documented by the Sample Task Leader, and will be reviewed by the Field Task Manager and any appropriate Quality Assurance personnel.

Site Technicians - Site Technicians are responsible for data retrieval, file back-ups, informing the Sample Task Leader of any variances, and completion of all required forms.

VII. QUALITY ASSURANCE AND QUALITY CONTROL

All partition information and the names of the files retrieved or updated will be recorded on the WAG 6—Surface Water Site Inspection Form (SW-02). All problem messages displayed and any corrective actions taken will be documented in the WAG 6—Surface Water Site Inspection Form (SW-02) and in the site logbook.

VIII. TRAINING

All site personnel will receive procedural training before the commencement of work.

IX. ACTION STEPS

- Using the Serial Port Cable and the Flow Meter Interrogation Cable, connect the laptop computer to the interrogator port on the flow meter. The 6-pin connector attaches to the flow meter; the 9- or 25-pin connector attaches to the computer's serial port. Connect the two cables using the 4-pin connector.
- Turn the laptop computer on.

1.0 Procedure for Downloading Level and Sample Data

- Start LAPCOMM by selecting LAPCOMM from the FLOWLINK menu or by typing LAPCOMM at the command prompt. The latter procedure can be performed only if LAPCOMM has been installed as a stand-alone module.

Subject: Downloading and/or Viewing Data Recorded on the ISCO 3230 Flow Meter

- The message **"VERIFY FLOW METER'S STATUS"** will appear on the screen as LAPCOMM checks the flow meter's clock, identification number (ID), and other information. Consult the flow meter or FLOWLINK instruction manuals if messages indicating problems are displayed. Record any problem messages and actions taken to correct such problems on the Surface Water Site Inspection Form (SW-02).
- Select **"CONNECT"** from the Base Menu. The Connect Menu will be displayed on the computer screen, along with the current status of the flow meter.
- View the information given for each partition of the flow meter. Record the partition information on the WAG 6—Surface Water Site Inspection Form (SW-02).

NOTE: The **"FIRST READING TIME"** reports the time and date of the oldest data. The **"LAST READING TIME"** reports the time and date of the most recent data.

NOTE: The partition status should state **"NO-ROLLOVER."** If **"ROLLOVER"** is displayed, document the reasons why the data were not retrieved before rollover (e.g., overwriting).

- Select **"INTERROGATE"** from the Connect Menu.
- Select **"ALL"** from the Interrogate Menu to download all data contained in the flow meter. If a compatible data file exists in the data directory, the incoming data will be added to the end of the existing data and will create a continuous dataset. If compatible data files do not exist, new DAT files will be created.
- When LAPCOMM completes the interrogation, it will return to the Connect Menu. Exit LAPCOMM and verify that all necessary data (*.DAT) and flow conversion (*.FCS) files have been updated or created. Updated files can be verified by examining the file size and date. If new files were created, three files should exist—one containing water level data, one containing sample collection data, and one *.FCS file.
- Copy all three files to an electronic diskette.
- Record the date and time that the data were retrieved and the names of the files created or updated in the WAG 6—Surface Water Site Inspection Form (SW-02).

2.0 Procedure for Viewing Flow Meter Data On Site.

- Start LAPCOMM by selecting LAPCOMM from the FLOWLINK menu or by typing LAPCOMM at the command prompt. The latter procedure can be performed only if LAPCOMM has been installed as a stand-alone module.

Subject: Downloading and/or Viewing Data Recorded on the ISCO 3230 Flow Meter

- The message **"VERIFYING FLOW METER'S STATUS"** will appear on the screen as LAPCOMM checks the flow meter's clock, ID, and other information. Consult the flow meter or FLOWLINK instruction manuals if messages indicating problems are displayed. Record any problem messages and actions taken to correct such problems on the documentation form being completed for this activity or in the site logbook.
- Select **"CONNECT"** from the Base Menu.
- Select **"GRAPH"** from the Connect Menu.
- Select the letter corresponding to the partition that is to be graphed. The water level partition must be selected if graphical flow data are desired. LAPCOMM will ask if flow data are desired. If so, respond **"YES" (Y)**.
- Press the **F1** key to display the legend listing the available option keys. The left and right arrows advance or reverse the graph at major time increments. The page keys will advance or reverse the graph one page at a time. The **HOME** key will display the first page of the graph, whereas the **END** key will display the last page.
- Press **J** to jump to a specific date in the graph. The date and time desired must be entered.
- Press **T** to adjust the time scale. The scaling options will be listed.
- When graph viewing is completed, press the **ESCAPE** key to exit the graph.
- Turn the laptop computer off. Disconnect the computer and flow meter cables.

X. REQUIRED RECORDS

- WAG 6—Surface Water Site Inspection Form (SW-02)

XI. ADMINISTRATION

The Sample Task Leader is responsible for administration of this procedure.

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Subject: Downloading and/or Viewing Data Recorded on the ISCO 3230 Flow Meter

XII. APPROVAL

All procedures and instructions generated by and/or applicable to the WAG 6 Environmental Monitoring Program must receive the signed approval of the WAG 6 Project Manager and the Environmental Restoration Quality Assurance Specialist.

Effective date: November 1, 1993

XII. APPENDIXES

This FOP has no appendixes.

Subject: Programming the ISCO 3230 Flow Meter

I. PURPOSE

The purpose of this Field Operations Procedure (FOP) is to describe proper operation of an ISCO 3230 Flow Meter with Plotter for continuous monitoring of Waste Area Grouping (WAG) 6 surface streams and direction of ISCO 3700 flow-proportional and storm event (i.e., multiplexed) automatic samplers.

II. REFERENCES

ISCO, Inc. 1990. *Instruction Manual: Model 3230 Flow Meter*, Part#60-3234-063, Rev. J, Lincoln, Nebraska.

III. SCOPE/LIMITATIONS

This procedure applies to only the programming, configuration, and general operation of an ISCO 3230 Flow Meter and the ISCO 3700 Samplers that it controls. A separate procedure has been written for the operation of the ISCO 3700 Sampler. This procedure addresses the initial configuration and programming of the flow meter; it does not address activities such as flow meter installation, maintenance, and servicing, or data downloading. This procedure can be implemented after the meter is installed on site. This procedure provides information only on programming a flow meter manually, without the aid of FLOWLINK software.

There are many configuration and programming options available for the 3230 Flow Meter. This procedure addresses only those options that must be used to perform the WAG 6 surface water monitoring tasks specified in the Surface Water Sampling and Analysis Plan.

IV. DEFINITIONS

Activation Level - This is the level of stage (i.e., water level in a stream) that, when exceeded (as determined by the flow meter), will cause the sampler to collect a sample. This value must be programmed into the flow meter.

Flow-paced - An operating state of the sampler that paces sample collection based on electrical pulses received from the flow meter. A pulse is sent from the flow meter after a prescribed amount of water (i.e., volume) has passed through the hydraulic structure being monitored. The sampler is activated to collect a sample when it receives some preprogrammed number of pulses. This number is based on the flow volume pace desired by the user. During flow-mode sampling, the entire sampling routine is directed by the flow meter.

Subject: Programming the ISCO 3230 Flow Meter

Time-paced - An operating state of the sampler that paces sample collection on time increments. This time interval can be uniform or non-uniform. The time increment must be programmed into the sampler. For purposes of surface water monitoring, all time-paced sampling initially will be activated by the flow meter when it has detected some prescribed water level. Once activated by the flow meter, this entire sampling routine is controlled by the sampler.

Multiplexing - A programming option of the sampler that allows more than one bottle to be filled every time a sampler is activated for collection. This option is useful when one needs sets of identical samples or a larger sample volume than can be contained in one bottle.

Master/Slave configuration - A configuration option of the ISCO 3700 Sampler in which two samplers are required. This configuration allows one sampler (i.e., the master) to perform its preprogrammed sampling routine while the other sampler (i.e., the slave) remains dormant. When the master sampler has completed its routine, the slave sampler is activated and performs its preprogrammed routine.

Run state - A state of the sampler in which the sampler's programmed collection routine is being executed.

Sampler Interval - The time increment (frequency) at which samples are to be collected.

V. REQUIREMENTS

- One ISCO 3230 Flow Meter (with all necessary accessories)

VI. RESPONSIBILITIES

Sample Task Leader - The Sample Task Leader is responsible for ensuring that procedures are followed and for determining what actions will be taken in circumstances that cause variation from the procedure. All variances from the procedure will be documented by the Sample Task Leader and reviewed by the Field Task Manager and any appropriate QA authorities.

Field Technicians - Field Technicians are responsible for operating, configuring, programming, and calibrating equipment, for informing the Sample Task Leader of any variances, and for completing all required forms.

Subject: Programming the ISCO 3230 Flow Meter

VII. QUALITY ASSURANCE AND QUALITY CONTROL

All pertinent equipment operation and programming information will be recorded on the WAG 6—Surface Water Initialization Form (SW-01) when equipment is initially installed, and will be recorded weekly on the WAG 6—Surface Water Site Inspection Form (SW-02).

VIII. TRAINING

All site personnel will receive procedural training before work begins.

IX. ACTION STEPS

The user should be aware that the flow meter **always** has a program in it, stored in memory, even if it is only the "default" program installed at the factory. This program is always running, even when allowing the user to make changes.

- If the flow meter is not already on, turn the ON/OFF toggle switch to the ON position.

Programming the ISCO 3230 Flow Meter

- Press the ENTER PROGRAM STEP key.
- To view or change the program currently in the flow meter, press the GO TO PROGRAM STEP key. If the entire program does not need to be changed, press the number key (1-12) that corresponds to the particular program step to be changed. Once the program has been entered into the flow meter, it generally will not be necessary to go through all 12 steps each time the application of the meter changes. The 12 program steps available to set up a flow monitoring program are as follows.
 1. SELECT MODE OF OPERATION
 2. SELECT SAMPLER FLOW PACING
 3. SELECT PLOTTER MODE OF OPERATION
 4. ENTER PLOTTER FULL-SCALE READING
 5. SELECT PLOTTER CHART SPEED
 6. SET CALENDAR/CLOCK
 7. SITE IDENTIFICATION NUMBER
 8. SET AUTO PURGE FREQUENCY
 9. ADJUST LEVEL
 10. RESET FLOW TOTALIZER
 11. REPORT GENERATION
 12. ENABLE LOCK

Subject: Programming the TLO 3230 Flow Meter

Each step of the program, except for steps 11 and 12, is addressed in this FOP and is identified by its step number. Calibration of the flow meter is addressed in steps 9 and 10.

- Press the ENTER PROGRAM STEP key again. The display will advance to the step specified or, if no particular step was defined, to step 1.

IMPORTANT INFORMATION: To select an option from the display window or to enter a value into memory, press the ENTER PROGRAM STEP key. This will cause the flow meter to accept the selection or entry into memory. The program will then automatically advance to the next step. (To go to a different program step, press the GO TO key, followed by the number of the desired step.) Always complete an entry by pressing the ENTER PROGRAM STEP key.

Step 1. Mode of Operation (Entering Level to Flow Conversion Information)

- Select NORMAL to enter the level to flow conversion information.
- The next menu will display the options for the calculation tool for level-to-flow conversions. All flow conversions will be calculated using the equations that were developed by the manufacturer of the hydraulic structure monitored.
- The next three menus will prompt to specify the units of measurement for water level, flow, and flow volume. Select FEET for level measurements, CFS (cubic feet per second) for flow measurements, and GAL (gallons) for volume measurements.
- The next menu will require specification of the type of device (i.e., flume or weir) to be monitored by the flow meter being programmed. If WEIR is selected, the meter will prompt to specify the type of weir (i.e., rectangular or Cipoletti), the V-notch angle (in degrees), whether the weir is contracted, and the crest length (in feet). If FLUME is selected, the meter will prompt to select the type of flume (i.e., Parshall, Palmer-Bowlus, trapezoidal, or H-type) and the size of the flume (in inches).
- The next menu will require specification of the maximum head of the hydraulic structure. This value should be entered in the same units specified in the third step above.
- Press the EXIT PROGRAM key to return the flow meter to the running state, or to proceed to the next step desired. Record all programming changes on the field documentation form and in the site logbook.

Subject: Programming the ISCO 3230 Flow Meter

Step 2. Select Sampler Flow Pacing (Entering Sampler Pacing and Enabling Information)

- The first menu in step 2 will require the user to specify whether samples will be flow-paced. Select ENTER FLOW INTERVAL for flow meters located at sites where flow-proportional sampling will be performed.
- If flow-proportional sampling will be performed at the site, the meter will prompt the user to enter the "FLOW INTERVAL PER PULSE." This is simply the volume of flow, in gallons, that must pass the monitoring site before an electronic signal is sent to the flow-proportional sampler either to initiate the collection of an aliquot or to be subtracted from the countdown (of pulses) to the next aliquot collection.
- The next menu (SAMPLE ENABLE CONTROL) will require specification of how the sampler will be enabled. Select LEVEL for storm samplers. This will enable the samplers when the level in the stream has exceeded a certain value. Select ENABLE for flow-paced samplers. If ENABLE is selected, move to step 3.
- Enter the water level, in feet, at which to enable the master sampler. The master sampler will be enabled if the level rises above this value. The master sampler will collect samples first. Once it completes sampling, the slave sampler will begin.
- In the next menu, specify that the sampler will be disabled when the water level drops below the activation level, by selecting DISABLE BELOW X.XX FT..
- The next menu will require specification of whether the plotter should begin plotting when the master sampler is enabled. Select YES.
- Press the EXIT PROGRAM key to return the flow meter to the running state, or proceed to the next step desired. Record all programming changes on the field documentation form and in the site logbook.

Steps 3, 4, and 5. Plotter Information (Entering Plot Contents, Scale, Units, and Speed)

- Step 3 will require specification of the mode of operation of the plotter (i.e., level or flow). Select FLOW to have the runoff hydrograph plotted.
- Step 4 will require specification of the full-scale reading of the plotter. The full-scale reading is simply the flow value that will be plotted on the extreme right side of the plot (i.e., full-scale across the plotter paper). The flow meter can over-range if flow levels higher than the full-scale value are detected. Over-ranged values are plotted on the left side of the plot. Normally, select a low to mid-range flow as the full-scale to allow some resolution of smaller storm events on the meter-generated plots. If possible, increase this

Subject: Programming the ISCO 3230 Flow Meter

value when large or very long runoff events are expected. The full-scale flow value can be adjusted at the discretion of the field personnel.

- Step 5 will require specification of the plotter chart speed. Normally, 4"/HR will allow a well-detailed plot to be made. This value can be adjusted at the discretion of field personnel.
- Press the EXIT PROGRAM key to return the flow meter to the running state, or proceed to the next step desired. Record all programming changes on the field documentation form and in the site logbook.

Steps 6 and 7. Setting the Date/Time and Site ID

- Enter the year, month, day, and time. The time entered must be Eastern Standard Time, specified in military format. The time entered should be synchronized with all other equipment (i.e., samplers and loggers) on site.
- Enter the three-digit site identification number. Only numbers between 0 and 999 can be entered. This number will be printed on the plot and used for subsequent identification of the record. The site number must never change.
- Press the EXIT PROGRAM key to return the flow meter to the running state, or proceed to the next step desired. Record all programming changes made on the field documentation form and in the site logbook.

Step 8. Setting the Auto Purge Frequency and Locking the Program

- Step 8 allows you to set the frequency at which the flow meter will purge the bubble line. Set the purge frequency at 60 min.
- Step 12 allows the user to lock the program in the flow meter. When the program is locked, it can be viewed but not altered when the lock is enabled. Once enabled, the letter L will appear on the right side of the message display window. To make changes in the program, you must first enter the pass number (i.e., 3230). After the changes have been installed and the program exited, the program will relock automatically. Select YES to lock the flow meter program.
- Press the EXIT PROGRAM key to return the flow meter to the running state, or proceed to the next step desired. Record all programming changes on the field documentation form and in the site logbook.

Subject: Programming the ISCO 3230 Flow Meter

Steps 9 and 10. Calibrating the Meter (Water Level and Flow Volume)

- Perform this procedure only when the water level and flow rate in the hydraulic structure are fairly constant. You may cause further inaccuracies in the measurements made by the flow meter if this procedure is performed during rapidly changing flow conditions (e.g., during runoff events).
- Accurately determine the water level of the stream from the staff gauge. Be sure that there are no obstructions of flow upstream of the hydraulic structure. Such obstructions could affect both the water level and flow measurements made. Record these observations in the field documentation form being completed for the day's activities.
- Observe the level, flow, and volume displayed in the flow meter's liquid crystal display window. Record these observations in the same field documentation form. If the values displayed by the flow meter differ from the observed measurements, proceed to the next step. Do not adjust the level or flow totalization if there is no difference between the meter and measured values.
- Enter Step 9 of the flow meter's program (ADJUST LEVEL).
- Adjust the water level measured by the meter up or down using the left and right arrow keys. Be as accurate as possible when entering the actual level value. Any error will result in errors that become more significant as the water level increases.
- The next menu (Step 10: RESET FLOW TOTALIZER). When the flow meter is calibrated, reset the flow totalizer to allow an accurate flow volume to be displayed in the message window. Select YES to reset this feature.
- Press the EXIT PROGRAM key to return the flow meter to the running state, or proceed to the next step desired. Record all calibration information on the field documentation form and in the site logbook.

X. REQUIRED RECORDS

- Field logbook

XI. ADMINISTRATION

The Sample Task Leader is responsible for administering this procedure.

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XII. APPROVAL

All procedures and instructions generated by and/or applicable to the WAG 6 Environmental Monitoring Program must receive the signed approval of the WAG 6 Project Manager and the Environmental Restoration Quality Assurance Specialist.

Effective date: November 1, 1993

XIII. APPENDIXES

This FOP has no appendixes.

Subject: Programming the ISCO 3700 Sampler

I. PURPOSE

The purpose of this Field Operations Procedure (FOP) is to describe proper operation of an ISCO 3700 Sampler for automatic collection of both flow-proportional and storm-event stream flow samples for the Waste Area Grouping (WAG) 6 surface water monitoring task. Some samplers will be collecting flow-paced, composite samples, whereas others will be collecting time-paced, multiplexed samples. The time-paced samplers will be used in a master/slave configuration. All samplers will be controlled by an ISCO 3230 Flow Meter.

II. REFERENCES

ISCO, Inc. 1991. *3700 Portable Sampler Instruction Manual*, Part #60-3704-101, Rev. C. Lincoln, Nebraska, December 1.

III. SCOPE/LIMITATIONS

This FOP applies to the programming of the ISCO 3700 Sampler for automatic collection of both flow-proportional and storm-event stream flow samples at WAG 6. Calibration of the sampler is also discussed.

IV. DEFINITIONS

Master/Slave Configuration - A configuration option of the ISCO 3700 Sampler for which two samplers are required. This configuration allows one sampler (i.e., the master) to perform its preprogrammed sampling routine while the other sampler (i.e., the slave) remains dormant. Once the master sampler has completed its routine, the slave sampler is activated and performs its preprogrammed routine.

V. REQUIREMENTS

- ISCO 3230 Flow Meter
- ISCO 3700 Sampler

For calibration:

- 1000-mL graduated cylinder
- Sample bottle

Subject: Programming the ISCO 3700 Sampler

VI. RESPONSIBILITIES

Sample Task Leader - The Sample Task Leader is responsible for programming all ISCO 3700 Samplers.

Field Technicians - Field Technicians will assist the Sample Task Leader in the programming of the samplers. They are also responsible for the completion of all required forms.

VII. QUALITY ASSURANCE AND QUALITY CONTROL

All pertinent equipment operation, calibration, configuration, and programming information shall be recorded on the field documentation form completed for that day's activities and in the site logbook.

VIII. TRAINING

All site personnel will receive procedural training before work begins.

IX. ACTION STEPS

1.0 Configuring the ISCO 3700 Sampler

This procedure must be performed before programming the sampler. This procedure can also be used to verify the sampler configuration if the user is unfamiliar with the previous routine or is unsure of whether the settings may have been changed. Configuration options are selected by using the left and right arrow keys to scroll through the options and by pressing the ENTER/PROGRAM key when the desired option is identified. This procedure addresses only those configuration options that must be changed from factory settings, or those settings that must be verified. Refer to the ISCO 3700 Sampler instruction manual for more information on the factory settings. The master and slave samplers have slightly different configurations; therefore, it is important to permanently designate one sampler as the master and the other as the slave.

- If the sampler is not already on, press the ON/OFF key to turn it on. The "STANDBY" message will be displayed. Press the ENTER/PROGRAM key.
- Select the CONFIGURE option.
- Select the SET CLOCK option. Set the clock in military format in Eastern Standard Time. Synchronize the clock of each sampler as closely as possible to other devices (i.e., flow meters and samplers) that are installed on site.

Subject: Programming the ISCO 3700 Sampler

- Select the BOTTLES AND SIZES option. Enter the type of sampler used (i.e., portable) and the number and volume, in milliliters, of the bottle(s) used. **NOTE:** Specify 15,000-mL for a 4-gal composite bottle.
- Select the SUCTION LINE option. Enter the diameter, type, and length of suction line used. The diameter and type of suction line used is the same for each sampler. The length specified must be measured during installation of that sampler and should be recorded in the site logbook.
- Select the LIQUID DETECTOR option. The liquid detector will allow the sampler to deliver more accurate volumes of sample. This feature also enables the sampler to rinse the line and try again to collect a sample if no liquid is detected (e.g., as the result of a clogged tube). Enable the liquid detector on each sampler. Do not enter a head manually. The number of rinse cycles should be kept to an absolute minimum (i.e., zero or one). Allow at least one sampling retry.
- Select the PROGRAMMING MODE option. Both composite and multiplex samplers will be programmed in BASIC mode.
- Select the CALIBRATE SAMPLER option. Enabling this option will allow the user to precisely calibrate the sample volumes when programming the sampler.
- Select the START TIME DELAY option. This option should remain at its factory setting of zero.
- Select the ENABLE PIN option. This option is used to activate the master/slave mode and allows specification of how the sampler may be controlled by the flow meter. The responses to the option will vary depending upon the sampler being configured. Use the responses defined below.

	<u>Composite</u>	<u>Multiplex Master</u>	<u>Multiplex Slave</u>
Master/Slave option	DISABLE	ENABLE	ENABLE
Sample Upon Disable	NO	NO	NO
Sample Upon Enable	NO	NO	NO
Reset Sample Interval	NO	NO	YES
Inhibit Countdown	NO	NO	NO

The master sampler will send an ENABLE signal to the slave sampler as soon as it has collected its last sample pair. The slave sampler will begin its sample routine immediately after it receives the ENABLE signal. Answering YES to the RESET SAMPLE INTERVAL option in the slave sampler configuration will ensure that the slave sampler waits one time interval before collecting its first (i.e., the 13th total) sample pair. Using this option will ensure that all samples are collected at uniform time intervals.

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- Select the **EVENT MARK** option. This option is used to specify the type of event mark (sample collection information) that will be sent to the flow meter for logging and plotting. Note that the bottle number will not be reported for the master/slave multiplex samplers. Enter that **PULSE** event marks will be sent during **FWD PUMPING ONLY**.
- Select the **RUN DIAGNOSTICS** option. Selection of this option will prompt the sampler to perform a number of diagnostic functions, including testing of the RAM, ROM, liquid crystal display, pump, and distributor. Several display messages will appear during this test. Refer to the ISCO 3700 Sampler instruction manual for information on corrective actions for any error messages. Record such error messages and any corrective actions taken in the field documentation form or site logbook.
- The **RE-INITIALIZE CONTROLLER?** message will appear in the display window once the diagnostic tests are complete. Select **NO** to leave the controller unchanged. **DO NOT ANSWER YES**, as this will return all configuration settings to the factory settings.
- Select the **EXIT CONFIGURATION** option. Sampler configuration is now complete.

2.0 Programming the ISCO 3700 Sampler (Composite, Flow-paced Mode)

- If the sampler is not already on, press the **ON/OFF** key to turn it on. The **"STANDBY"** message will be displayed. Press the **ENTER/PROGRAM** key.
- Select the **PROGRAM** option.
- The next menu requires specification of the sampling mode. Select the **FLOW** paced sampling option.
- The next menu requires specification of the flow pulse interval. Enter the number of pulses that will be received by the sampler before an aliquot is to be collected. For example, if an interval of 5 is entered, an aliquot will be collected every fifth flow pulse.
- The next menu requires specification of whether the samples will be multiplexed. Choose **NO**.
- The next menu requires specification of the aliquot volume (i.e., the amount of sample that will be delivered into the bottle each time that the sampler is activated). Enter the aliquot volume in milliliters.
- The next menu requires specification of whether the sample volumes are to be calibrated. Answer **YES** if necessary. Use the sample volume calibration procedure in Sect. 4.0 of this FOP. Perform this routine during weekly site inspections, if the aliquot volume is changed,

Subject: Programming the ISCO 3700 Sampler

or if you think that the sampler may not be delivering the correct volume to the bottle. Answer NO if the sample volume does not require calibration.

- The next menu will allow choice of a start time. Choose YES and enter the date and time that the sampler is to begin accepting pulses from the flow meter. Normally, this will be the current date and time.
- The sampler will briefly display "PROGRAMMING SEQUENCE COMPLETE" and then will go into standby state. Press the START SAMPLING key to run the program.

3.0 Programming the ISCO 3700 Master/Slave Samplers (Multiplex, Time-paced Mode)

NOTE: It is important that the sampler designated as the master **not** be inhibited during programming. This means that the leg of the master/slave connect cable labeled "FLOW METER" **must not** be connected to the flow meter, or the sample enable feature must be in the enable mode when the master is programmed. This is of vital importance because the ISCO 3700 Sampler decides if it is the master or the slave based on its enable pin status. Upon programming, the master will sense the enable pin status and declare itself the master. When programmed, the master will disable the slave sampler until the master completes its routine. The enable pin of the slave is controlled by the master. The enable pin of the master is controlled by the sample enable feature of the ISCO 3230 Flow Meter. The samplers will not reverse master/slave roles, making this configuration not a true master/slave relationship as defined in the instruction manual.

It is extremely important that this procedure be performed on the master sampler before being performed on the slave sampler. The master sampler must always be started (i.e., the START SAMPLING key must be pressed) before the slave sampler is started. The sampler that is started first automatically designates itself as the master sampler.

- If the sampler is not already on, press the ON/OFF key to turn it on. The "STANDBY" message will be displayed. Press the ENTER/PROGRAM key.
- Select the PROGRAM option.
- The next menu requires specification of the sampling mode. Select the TIME paced sampling option.
- The next menu requires specification of the sample collection interval. Enter the desired interval in hours and minutes.
- The next menu requires specification of whether the samples will be multiplexed. Choose YES.

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- The next menu requires specification of the type of multiplexing routine used. Choose BOTTLES PER SAMPLE because more than one bottle must be filled for every sample collected.
- Enter the number of bottles per sample event. For surface water monitoring, this number will be 2.
- Enter the volume in milliliters to be delivered to each bottle. For surface water monitoring this will be 1000 mL.
- The next menu requires specification of whether the sample volumes are to be calibrated. Answer YES if necessary. Use the sample volume calibration procedure in Sect. 4.0 in this FOP. Perform this routine during the weekly site inspections, if the sample volume is changed, or if the sample may not be delivering the correct volume to the bottle. Answer NO if the sample volume does not need to be calibrated.
- The next menu will allow you to enter a start time. Choose NO, because the master sampler will be activated by the flow meter.
- The sampler will briefly display "PROGRAMMING SEQUENCE COMPLETE" and then go into standby state. Press the START SAMPLING key to run the program. Always press the START SAMPLING key of the master sampler first, before doing the same on the slave sampler.

4.0 Calibrating the ISCO 3700 Sampler

If the sampler is being programmed at this time, skip to the third step. A sample bottle and a 1000-mL graduated cylinder are required for this procedure. Calibration should be performed as needed.

- Remove the tub housing. Place the sample bottle to be used for sample calibration under the sample distributor.
- If the sampler is not already on, press the ON/OFF key to turn it on. The "STANDBY" message will be displayed. Press the ENTER/PROGRAM key.
- Select the PROGRAM option. Step through the sampler program until the CALIBRATE SAMPLER input display appears. Be careful not to change any aspect of the sampler program while working in the interactive state. Choose YES to calibrate the sampler.
- Press the MANUAL SAMPLE KEY when ready. The sampler will deliver the programmed sample amount into the calibration bottle.

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- Remove the calibration bottle from the sampler and pour the sample into the graduated cylinder to measure the volume. Enter that volume into the sampler and record it on the field documentation form. If the measured sample volume differs greatly from the programmed volume, consult the ISCO 3700 Sampler instruction manual for possible causes and corrective actions.
- Repeat this procedure if desired, or select NO in the next display window. Step through the additional program sequence displays, being careful not to change any aspect of the routine. Wait for the sampler to return to the standby state. Press the START SAMPLING key to run the program.

X. REQUIRED RECORDS

- ISCO instruction manuals
- Field logbook

XI. ADMINISTRATION

The Sample Task Leader is responsible for administration of this procedure.

XII. APPROVAL

All procedures and instructions generated by and/or applicable to the WAG 6 Environmental Monitoring Program must receive the signed approval of the WAG 6 Project Manager and the Environmental Restoration Quality Assurance Specialist.

Effective date: November 1, 1993

XIII. APPENDIXES

This FOP has no appendixes.

Subject: Grab Sampling

I. PURPOSE

The purpose of this Field Operations Procedure (FOP) is to describe the standard method and equipment required for manual surface water sampling at Waste Area Grouping (WAG) 6. This procedure can be applied to the collection of flow-paced grab, baseflow, and manual storm event samples.

II. REFERENCES

Kimbrough, C. W., Long, L. W., and McMahon, L. W., eds. 1988. *Environmental Surveillance Procedures, Quality Control Program, Martin Marietta Energy Systems, Inc.*, ESH/Sub/87-21706/1, Oak Ridge, Tennessee, September 1.

III. SCOPE/LIMITATIONS

This FOP applies to the collection of flow-paced grab, baseflow, and manual storm event samples at WAG 6.

IV. DEFINITIONS

Baseflow - Flow in a channel resulting from soil moisture or groundwater (not influenced by storm runoff).

V. REQUIREMENTS

- Surgical gloves and other appropriate personal protective equipment (PPE) as specified by the Site Health and Safety Officer and/or the Site Health Physicist
- Plastic sheeting
- Sample dipper cup, clamp, and extension handles
- Sample containers and lids, prewashed
- Sample labels
- Plastic sample bottle containment bags

Subject: Grab Sampling

- Sample containment cooler
- Sample preservatives
- Calibrated in situ parameter measurement equipment (i.e., HORIBA System)
- Bar code reader
- Decontamination equipment

VI. RESPONSIBILITIES

Sample Task Leader - The Sample Task Leader is responsible for ensuring that procedures are followed and for determining what actions will be taken in circumstances that require variance from the procedure. All variances from the procedure will be documented by the Sample Task Leader, and will be reviewed by the Field Task Manager and appropriate Quality Assurance personnel.

Field Technicians - Field Technicians are responsible for sample collection, sample preparation, informing Sample Task Leaders of any variances, and completion of all required forms.

VII. QUALITY ASSURANCE AND QUALITY CONTROL

All pertinent sample identification, preparation, custody, and field data will be recorded on the appropriate sample collection form and chain-of-custody form.

VIII. TRAINING

All site personnel will receive procedural training before the commencement of work.

IX. ACTION STEPS

- Don PPE as required by the Site Health and Safety Officer and/or Site Health Physicist before beginning work.
- Use plastic sheeting as ground cover for staging of equipment and/or materials, as necessary, to prevent equipment from coming into contact with potentially contaminated surfaces.

Subject: Grab Sampling

- Select sample bottles and/or volatile organic compound (VOC) bottles to be used and place them ready for use. Examine each bottle closely for any signs of contamination. Do not use if contaminated.
- Survey the condition of the hydraulic structure (if present) and document any observations in the appropriate sample collection form. Possible items to record include debris lodged in the flow control device or sediment accumulation that may be affecting flow measurement. Correct any problems as needed.
- For flow-paced grab and baseflow sampling sites where ISCO 3230 Flow Meters are installed (FB, DA, and WOD), record the water level and flow rate displayed in the liquid crystal display window on the appropriate form.
- Check the calibration of the HORIBA meter and recalibrate if necessary.
- Measure all in situ parameters directly in the stream. Measurements will be recorded on the appropriate form.
- If wading is required, approach the sampling area from downstream.
- Fill all sample bottles directly from the stream, if possible. If sufficient water depth is not present, a dipper should be used to collect the samples.
- The following steps should be followed if a dipper is used.
 1. Submerge a clean dipper slowly into the water to avoid splashing or mixing.
 2. Slowly lift the dipper from the water surface. Avoid collecting floating materials.
 3. Remove the cap from the sample bottle and tilt the bottle slightly.
 4. Pour the sample slowly from the dipper down the inside of the sample bottle. Avoid splashing of the sample. Ensure that any suspended matter in the sample is transferred quantitatively to the sample bottle.
 5. Cap the sample bottle, leaving adequate air space in the bottle to allow for expansion (except in VOC vials).
- Preserve all appropriate samples, including quality control samples, in accordance with the sample preparation and transport guidelines given in the WAG 6 Surface Water Sampling and Analysis Plan.
- Label each sample container carefully and clearly in accordance with WAG 6—FOP 9.

Subject: Grab Sampling

- Affix sample labels and bar code labels, and seal containers with custody tape.
- Complete the Sample Collection Information table on the appropriate form.
- Ask the Site Health Physicist to screen the outside of the filled sample bottles.
- Place all samples to be analyzed for volatiles, semivolatiles, pesticides/polychlorinated biphenyls (PCBs), and herbicides in individual containment bags. Pack them with ice in sample containment coolers, complete a chain-of-custody form, and ship them to the laboratory for analysis.
- Decontaminate the sample dipper (if used) in accordance with Environmental Surveillance Procedure (ESP)-900. Use a beta-gamma meter to check for contaminants on equipment and self. Prepare any necessary rinseate blanks or field blanks. Dispose of surgical gloves and any other sampling waste in appropriate containers in accordance with ESP-1000.
- Place all samples to be analyzed for Contract Laboratory Procedure (CLP) metals, gross alpha, gamma, tritium, and strontium in storage until the end of the month. At the end of the month, complete a chain-of-custody form and ship the samples to the laboratory for analysis.

X. REQUIRED RECORDS

- Appropriate field forms
- Field logbook

XI. ADMINISTRATION

The Sample Task Leader is responsible for administration of this procedure.

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Environmental Restoration Division
WAG 6 Environmental Monitoring Program
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Subject: Grab Sampling

XII. APPROVAL

All procedures and instructions generated by and/or applicable to the WAG 6 Environmental Monitoring Program must receive the signed approval of the WAG 6 Project Manager and the Environmental Restoration Quality Assurance Specialist.

Effective date: November 1, 1993

XIII. APPENDIXES

This FOP has no appendixes.

Subject: Compositing Weekly Flow-paced Samples

I. PURPOSE

The purpose of this Field Operations Procedure (FOP) is to describe the standard method required for compositing weekly flow-paced samples into a monthly sample.

II. REFERENCES

Not applicable.

III. SCOPE/LIMITATIONS

This FOP applies to the compositing of weekly flow-paced samples.

IV. DEFINITIONS

Flow-Paced Sampling - Type of sampling in which a predetermined amount of sample is collected at equal flow-volume intervals.

V. REQUIREMENTS

- Surgical gloves and other appropriate personal protective equipment (PPE) as specified by the Site Health and Safety Officer (SHSO) and/or Site Health Physicist.
- Plastic sheeting
- Graduated cylinder
- Weekly preserved and nonpreserved samples for the month
- One 4-gal compositing container with cap
- One 1000-mL compositing bottle with cap
- Necessary sample bottles
- Sample labels
- Funnel

Subject: Compositing Weekly Flow-paced Samples

- Bar code reader
- Decontamination equipment

VI. RESPONSIBILITIES

Sample Task Leader - The Sample Task Leader is responsible for ensuring that procedures are followed and for determining what actions will be taken in circumstances that cause variation from the procedure. All variances from the procedures will be documented by the Sample Task Leader and reviewed by the Field Task Manager.

Field Technicians - Field Technicians are responsible for compositing samples, informing the team leader of any variances, and completing all required forms.

VII. QUALITY ASSURANCE AND QUALITY CONTROL

All pertinent sample identification, preparation, custody, and field data will be recorded on the WAG 6—Flow-paced Monthly Composite Form (SW-08) and chain-of-custody form.

VIII. TRAINING

All site personnel will receive procedural training before work begins.

IX. ACTION STEPS

Precompositing Procedure

- Don PPE as required by the SHSO and/or Site Health Physicist before beginning work.
- Prepare compositing area by placing uncontaminated plastic sheeting on the ground and any other surfaces used.
- Retrieve all preserved and nonpreserved weekly samples for the month from storage.

Compositing Procedure

- Determine the volume of water (in mL) needed for the nonpreserved composite samples. Add 250 mL to this volume and record the change on the WAG 6—Flow-paced Monthly Composite Form (SW-08). (The extra 250 mL is used to account for spillage during compositing.)

Subject: Compositing Weekly Flow-paced Samples

- Determine the "Total flow volume since last retrieval" for each weekly sample from the WAG 6—Flow-paced Sample Collection Form (SW-04) and calculate the "Total flow volume for month." Record these data on the WAG 6—Flow-paced Monthly Composite Form (SW-08).
- Determine the "Percent of total flow volume" and "Aliquot amount" for each weekly sample and record the amounts on the WAG 6—Flow-paced Monthly Composite Form (SW-08).
- Begin with the first weekly sample. Shake the sample and aliquot the desired amount by pouring it into the graduated cylinder. Once the desired amount is obtained, pour it into the 1000-mL polyethylene bottle (the compositing bottle).
- Repeat the previous step for each of the weekly samples.
- Cap the compositing bottle and shake up the sample.
- Decant the composite sample into the appropriate sample containers.
- Label each sample container carefully and clearly in accordance with WAG 6—FOP 9.
- Affix sample labels and bar code labels, and seal containers with custody tape.
- Repeat the previous steps if quality control samples are required.
- Ask the Site Health Physicist to screen the outside of the filled sample bottles.
- Place the samples in individual containment bags. Pack them with ice in sample containment coolers, complete a chain-of-custody form, and ship them to the laboratory for analysis.
- Repeat all steps under **Compositing Procedure** for the preserved samples. Use a 4-gal polyethylene bottle for compositing. If more than four gallons of water are needed for the samples, perform two composites, using half the required volume each time.
- Decontaminate all compositing equipment in accordance with ESP-901. Dispose of surgical gloves and any other sampling wastes in appropriate containers in accordance with ESP-1000.

X. REQUIRED RECORDS

- All WAG 6—Flow-paced Sample Collection Forms (SW-04) for the month
- WAG 6—Flow-paced Monthly Composite Form (SW-08)

Subject: Compositing Weekly Flow-paced Samples

- Chain-of-custody form
- Field logbook

XI. ADMINISTRATION

The Sample Task Leader is responsible for administering this procedure.

XII. APPROVAL

All procedures and instructions generated by and/or applicable to the WAG 6 Environmental Monitoring Program must receive the signed approval of the WAG 6 Project Manager and the Environmental Restoration Quality Assurance Specialist.

Effective date: November 1, 1993

XIII. APPENDIXES

This FOP has no appendixes.

Subject: On-site Automatic Storm Event Sample Selection

I. PURPOSE

The purpose of this Field Operations Procedure (FOP) is to describe the standard method employed by Waste Area Grouping (WAG) 6 surface water sampling personnel to select, at the sample collection site, the storm event sample pairs that will be submitted for analyses. Use of this procedure will minimize data gaps in storm event data sets by directing the sampling technician to choose the most useful storm event samples for contaminant analysis.

II. REFERENCES

Not applicable.

III. SCOPE/LIMITATIONS

This FOP applies to the selection for analysis of storm event sample pairs that are collected by ISCO 3700 Samplers at WAG 6.

IV. DEFINITIONS

Runoff Condition - The condition in which stream flow at the site is above baseflow levels (i.e., levels normally observed during periods of no rainfall).

V. REQUIREMENTS

Not applicable.

VI. RESPONSIBILITIES

Sample Task Leader - The Sample Task Leader is responsible for ensuring that procedures are followed and for determining what actions will be taken in circumstances that require variance from the procedure. All variances from the procedures will be documented by the Sample Task Leader, and will be reviewed by the Field Task Manager and any appropriate Quality Assurance personnel.

Field Technicians - Field Technicians are responsible for informing the Sample Task Leader of any variances and for completion of all required forms.

Subject: On-site Automatic Storm Event Sample Selection

VII. QUALITY ASSURANCE AND QUALITY CONTROL

All pertinent identification, preparation, and custody of the sample pairs selected for analysis will be recorded on the WAG 6—Automatic Storm Event Sample Selection Form (SW-06).

VIII. TRAINING

All site personnel will receive procedural training before the commencement of work.

IX. ACTION STEPS

- Determine the first sampling time. This should always correspond with the first sample pair collected and will be designated as the START PAIR. Note the sampler (Master) and the positions (1 and 2) of the pair on the WAG 6—Automatic Storm Event Sample Selection Form (SW-06).
- Determine the last sample pair collection **during runoff conditions**. This pair will be designated as the END PAIR. Note the sampler and positions of the pair on the WAG 6—Automatic Storm Event Sample Selection Form (SW-06).
- Determine the time of the hydrograph's peak flow. Determine the sample pair collected either on the peak or nearest it, on the rising limb. This sample pair will be designated as the PEAK PAIR. Note the sampler and positions of the pair on the WAG 6—Automatic Storm Event Sample Selection Form (SW-06).
- Determine the number of eligible sample pairs remaining within the runoff event. Eligible pairs are defined as those collected between the START and PEAK samples on the rising limb, and those collected between the PEAK and END samples on the falling limb.
- Select rising and falling sample pairs according to the following guidelines. A group of from 6 to 10 sample pairs, including the START, END, and PEAK samples, will be selected.
 1. If the number of the END PAIR is 10 or lower, submit all samples.
 2. If the number of the END PAIR is higher than 10, then for each limb, discard samples such that selection samples are as evenly spaced in time as possible. **Priority in the selection of samples is given to submit samples closer to the PEAK PAIR, within the constraints of evenly spaced selection. When possible, rising limb samples should account for approximately 50% to 60% of all samples selected.**

Subject: On-site Automatic Storm Event Sample Selection

3. For storm events having rising limbs of short duration, resulting in the collection of one or two rising limb pairs, all samples before the PEAK PAIR will be selected. Falling limb pairs selected for analysis will then be as evenly spaced as possible.
- Once sample labels and bar code labels have been affixed to the selected pairs, record the field sample and bar code sample identification numbers (IDs) on the WAG 6—Automatic Storm Event Sample Selection Form (SW-06).

X. REQUIRED RECORDS

- ISCO 3230 Flow Meter-generated plot of flow and sample collection times
- WAG 6—Automatic Storm Event Sample Collection Form (SW-05)
- WAG 6—Automatic Storm Event Sample Selection Form (SW-06)
- Field Logbook

XI. ADMINISTRATION

The Sample Task Leader is responsible for administration of this procedure.

XII. APPROVAL

All procedures and instructions generated by and/or applicable to the WAG 6 Environmental Monitoring Program must receive the signed approval of the WAG 6 Project Manager and the Environmental Restoration Quality Assurance Specialist.

Effective date: November 1, 1993

XIII. APPENDIXES

This FOP has no appendixes.

Subject: Sample Labeling

I. PURPOSE

The purpose of this Field Operations Procedure (FOP) is to describe the standard method and equipment required for labeling all samples collected for the Waste Area Grouping (WAG) 6 Environmental Monitoring Plan. This procedure is in accordance with Martin Marietta Energy Systems, Inc., Environmental Surveillance Procedure (ESP-) 500.

II. REFERENCES

Kimbrough, C. W., Long, L. W., and McMahon, L. W., eds. 1988. *Environmental Surveillance Procedures, Quality Control Program, Martin Marietta Energy Systems, Inc.*, ESH/Sub/87-21706/1, Oak Ridge, Tennessee, September 1.

III. SCOPE/LIMITATIONS

This FOP applies to the labeling of samples collected at WAG 6.

IV. DEFINITIONS

Bar Code Sample ID - Unique string of numbers attached to a sample container that is used for identification by WAG 6 data base.

V. REQUIREMENTS

- Sample labels
- Black, indelible ink pen

VI. RESPONSIBILITIES

Sample Task Leader - The Sample Task Leader is responsible for ensuring that procedures are followed and for determining what actions will be taken in circumstances that require variation from the procedures. All variances from the procedures will be documented by the Sample Task Leader and reviewed by the Field Task Manager.

Field Technicians - Field Technicians are responsible for informing the Sample Task Leader of any variances and for completing all required forms.

Subject: Sample Labeling

VIII. QUALITY ASSURANCE AND QUALITY CONTROL

Sample labels will be numbered sequentially throughout the sampling program to ensure that no two samples have the same ID.

VIII. TRAINING

All site personnel will receive procedural training before work begins.

IX. ACTION STEPS

- Fill in all blanks on the sample label using indelible black ink.
- Affix clear adhesive tape over each completed sample label after it is placed on the sample bottle.

X. REQUIRED RECORDS

- Sample labels

XI. ADMINISTRATION

The Field Task Manager is responsible for administering this procedure.

XII. APPROVAL

All procedures and instructions generated by and/or applicable to the WAG 6 Environmental Monitoring Program must receive the signed approval of the WAG 6 Project Manager and the Environmental Restoration Quality Assurance Specialist.

Effective date: November 1, 1993

XIII. APPENDIXES

This FOP has no appendixes.

Subject: Electronically Editing, Reducing, Analyzing, and Archiving Data

I. PURPOSE

The purpose of this procedure is to describe the method and equipment required for electronically editing, reducing, analyzing, and archiving all data generated from the WAG 6 Environmental Monitoring Program. Such data consist of continuous water level and flow data and storm event sample collection data (i.e., collection times and bottle numbers).

II. REFERENCES

Equipment User's Manuals

III. SCOPE/LIMITATIONS

This procedure does not address the retrieval of such data from the field equipment.

IV. DEFINITIONS

FLOWLINK - Software system available from ISCO used for data acquisition, storage, retrieval, and analysis.

LAPCOMM - Housed on the hard drive of the laptop computer, LAPCOMM is a component of the FLOWLINK system. The LAPCOMM system allows the user to set up data acquisition and interrogate stored readings from the field data collection equipment.

CorderBase - Software program that is designed to help manage large numbers of data records and their record data. The program includes a data base that allows manipulation of records and data. In addition, the software has graphics and report generating features that allow interpretation of collected data.

RS232 Port - The RS232 Port on the HERMIT Data Logger allows transferral of data to most IBM PCs (personal computers) and compatibles.

DataTransfer - DataTransfer is software used for transferring raw data from the HERMIT to the IBM PC and compatibles.

DATAMAN - DATAMAN is the file management component of the FLOWLINK system which is used to combine data sets that are not joined when downloaded.

Subject: Electronically Editing, Reducing, Analyzing, and Archiving Data

V. REQUIREMENTS

- Personal computer (IBM compatible) with three ports—RS232, serial, and parallel.
- 1.2- or 1.44-megabyte electronic diskette drive.
- A hard disk with at least 2 megabytes of free disk space.
- A graphics card (either Hercules, EGA, or VGA) or a compatible equivalent.
- Standard editing software, the EZ-BRK program, and the REPORTER program.
- *.DAT and *.CSV data files.
- DOS Version 3.3 or greater.
- SMARTERM 240
- Bernoulli disk drive
- 1.2- or 1.44-megabyte diskettes

VI. RESPONSIBILITIES

Sample Task Leader - The Sample Task Leader is responsible for ensuring that procedures are followed and for determining what actions will be taken in circumstances that require variation from the procedures. All variances from the procedures will be documented by the Sample Task Leader and reviewed by the Field Task Manager.

Field Technicians - Field Technicians are responsible for editing and archiving data, informing the Sample Task Leader of any variances, and completing all required forms.

Data Entry Clerk - The Data Entry Clerk is responsible for uploading all field data into the Oak Ridge Environmental Information System (OREIS) data base.

VII. QUALITY ASSURANCE AND QUALITY CONTROL

All pertinent information and the names of the files retrieved or updated will be recorded on the appropriate field form.

Subject: Electronically Editing, Reducing, Analyzing, and Archiving Data

VIII. TRAINING

All site personnel will receive procedural training before work begins.

IX. ACTION STEPS

1.0 Procedure for Merging the Downloaded Data and/or Data Sets

- If the computer is not already on, turn it on. Start the appropriate software.
- Select the DATAMAN module from the software menu.
- Determine whether there will be any incompatibilities in the site identification number (ID), partition type, and letter between the data sets to be merged. These markers should not change for a site, even if the data collection equipment has been replaced, unless documented on a WAG 6—Monitoring Variance Request Form (MV-01). If these markers are not the same, verify that you are merging data sets from the same site before correcting the problem. If there is no 16 reading overlap or if the data recording interval has been changed, do not continue merging the data using DATAMAN. Export the data sets and merge the data into monthly files using the computer editor installed on the PC you are using. Document all activities on the Electronic Data Management Form.
- To change the site ID or partition information, select EDIT from the Base Menu.
- Select SOURCE from the Data Set Editor Menu, and enter the path of the data set that is to be edited.
- Select the data set to be edited from the menu displayed on the screen.
- Select DESTINATION from the Data Set Editor Menu, and enter the path of the destination of the edited data set.
- Select EDIT from the Data Set Editor Menu.
- Select DESCRIPTIONS from the submenu.
- Select the menu item corresponding to the descriptor change to be made. Revise the information as desired. Once finished, select QUIT from the menu, and return to the Base Menu.

Subject: Electronically Editing, Reducing, Analyzing, and Archiving Data

- Select MERGE from the Base Menu. The resulting display will prompt you to enter the source files (i.e., FIRST SOURCE and SECOND SOURCE) that will be merged.
- After selecting the source files, select DESTINATION from the menu. Enter the desired path of the merged file.
- Select MERGE from the menu to initiate the combination of data. When complete, the source file names and the file name of the combined file will be displayed on the screen; record them on the Electronic Data Management Form.
- If the data need to be adjusted, do so in accordance with the operator's manual. If not, go to Sect. 2.0 of this procedure to export monthly data sets.

2.0 Procedure for Translating Data to Monthly ASCII-Formatted Data Files (and converting data)

- If the computer is not already on, turn it on. Start the appropriate software.
- Select the EXPORT module from the software menu.
- To convert and translate the data to an ASCII-formatted file, select LEVEL from the EXPORT base menu.
- Select SOURCE from the Data Menu. Enter the name of the DAT file containing the data that will be converted and exported to a monthly file. Be sure that the correct path has been specified.
- Select DESTINATION from the Data Menu. Enter the path and name of the file to be written, using the file naming convention shown below. Write the file to a directory named CSV. There must be no other file with this filename. EXPORT will not notify if another file with the same name exists—it will simply overwrite the file—so be sure that the correct path has been specified.
- Files should be named according to the appropriate convention as specified in the data collection equipment user's manuals.
- Perform the required steps for each set of monthly data at each site to be converted and exported.
- Verify that all data files have been generated and are properly named.
- On the Electronic Data Management Form, record the filename of all ASCII data files generated.

Subject: Electronically Editing, Reducing, Analyzing, and Archiving Data

3.0 Streamflow and Water Level Data Analysis and Summarization

This procedure is applicable for all data files. This procedure will not be used for CSV sample collection data files. Each file must be breakpointed separately. All CSV files will be contained in a CSV directory.

- If editing a CSV file, delete the column containing the partition letter.
- Record the file name of the data file to be breakpointed in the EZ-BRK inspection points form. Also record the date and time of both the first and last complete lines in the data file.
- **This step should be performed by only the Primary Site Technician or the Field Task Manager.** Examine the data and determine if the data need to be corrected. Corrections must be determined independently for each column of data. Be sure that any corrections made will also be reflected in the corresponding CSV file.

To determine whether surface water data need to be corrected, compare the data in the file with staff gauge measurements recorded on the documentation forms and in the site logbook. Notes in the site logbook are the tool for determining the corrections to be made. Use reference values readings and any other observations or notes on unusual service activities. It is not possible to list every reason that recorded data would differ from actual measured values. The following are some of the most common reasons for differences.

Drift: Pressure transducers will sometimes drift by a small amount over a long period of time.

Debris Blockage: In surface water flow, debris is sometimes caught in the weir and dams the water in the mouth or outlet. This could cause an artificially low or high water level reading until the debris is dislodged or removed by field personnel.

Deciding on the magnitude and time scale of a correction, or even if a correction needs to be applied, is not always a straightforward process. If uncertain of the next step, consult the Field Task Manager or an experienced hydrologist who may be able to confirm or deny any unusual fluctuations in levels or flows. Notes on how and why corrections were determined and the magnitude of the correction must be recorded on the EZ-BRK inspection points form.

- Make all corrections as needed and list them on the EZ-BRK inspection points form. Be sure to indicate whether the corrections were positive or negative. If the recorded values are higher than the actual value, the corrections are negative; if the recorded values are lower than the actual values, the corrections are positive. The corrections must be entered into the EZ-BRK program in the same units and form as the data appear in the input file (e.g., to apply a correction of +0.5 ft, enter +0.5 as the correction).

Subject: Electronically Editing, Reducing, Analyzing, and Archiving Data

- Run the EZ-BRK program on the data file. All needed information should be on the inspection points form. Breakpoint the files into individual months. Use the following naming convention to rename the monthly files:

XSSSmmyy.MIN

X - Q for combined flow and level data, or flow data only

L - level data only

S - sample data

SSS - three-letter site identification

mm - month that data in the file were collected

yy - year that data in the file data were collected

MIN - "MIN" extension to be used for files of continuous (minute) data.

- Place all MIN files in a directory named **MIN**. Document these files on the Electronic Data Management Form.
- Generate a report of daily averages of flow and level. Create a computer copy, using the naming convention described in the previous procedure. However, use a "DAY" filename extension. Generate a hard copy of the file to place in the site notebook.
- Generate a report of hourly averages of flow and level. Create a computer copy, using the naming convention described in the previous procedure. However, use an "HR" filename extension. Generate a hard copy of the file to place into the site notebook.
- Document the file names and sizes of all MIN, DAY, and HR files in the Electronic Data Management Form.

4.0 Procedure for Archiving Monthly Data Files

- When all data have been processed for all sites for the month, back up the computer files onto one Bernoulli disks. The Bernoulli disk will be a permanent storage disk; An additional working 3.5 in. high-density (HD) diskette will be transferred to OREIS. Record appropriate information on a label affixed to the diskette. Put each file in a directory having the same extension as the files (e.g., all DAY files must be placed in a directory named **DAY**). Use this file management configuration on both the Bernoulli disk, the working diskette, and the hard drive of the personal computer. Make a copy of all DAT, XXX, CSV, MIN, DAY, and HR files on diskettes if the data are to be removed from the hard drive of the personal computer.
- Store one Bernoulli disk separately from the original files. Submit the working disk to the Data Manager.

Subject: Electronically Editing, Reducing, Analyzing, and Archiving Data

- Make two duplicates of the hard copy data. Store the original in the site notebook and submit both duplicates to the Data Manager.

X. REQUIRED RECORDS

- Electronic Data File Management Form
- EZ-BRK Program Inspection Points Form
- Field logbook

XI. ADMINISTRATION

The Sample Task Leader is responsible for administering this procedure.

The Data Manager is responsible for the electronic upload of data to the OREIS data base.

XII. APPROVAL

All procedures and instructions generated by and/or applicable to the WAG 6 Environmental Monitoring Program must receive the signed approval of the WAG 6 Project Manager and the Environmental Restoration Quality Assurance Specialist.

Effective date: November 1, 1993

XIII. APPENDIXES

This FOP has no appendixes.

Subject: Pressure Transducer Deployment

I. PURPOSE

The purpose of this Field Operations Procedure (FOP) is to describe the standard method and equipment required to deploy a pressure transducer in preparation for the collection of water level data at Waste Area Grouping (WAG) 6.

II. REFERENCES

Telog Instruments, Inc. 1992. *Level Tracker™ Hardware & Installation Manual*, Henrietta, New York.

III. SCOPE/LIMITATIONS

This FOP applies to the deployment of a pressure transducer in preparation for the collection of water level data at WAG 6.

IV. DEFINITIONS

Not applicable.

V. REQUIREMENTS

- Pressure transducer
- Data logger
- Electronic water level indicator
- Dessicant
- Output terminal
- Field box and connectors
- Field logbook

VI. RESPONSIBILITIES

Sample Task Leader - The Sample Task Leader is responsible for ensuring that procedures are followed and for determining what actions will be taken in circumstances that require variance from the procedure. All variances from the procedure will be documented by the Sample Task Leader, and will be reviewed by the Field Task Manager and appropriate Quality Assurance personnel.

Subject: Pressure Transducer Deployment

Site Technicians - Site Technicians are responsible for data retrieval, file back-ups, informing the Sample Task Leader of any variances, and completion of all required forms.

VII. QUALITY ASSURANCE AND QUALITY CONTROL

All pertinent pressure transducer deployment information will be recorded in the appropriate field documentation form or logbook.

VIII. TRAINING

All site personnel will receive procedural training before the commencement of work.

IX. ACTION STEPS

1.0 Hardware Setup

- Hard wire the transducer to the chosen data logger according to the following guidelines.
 1. Secure the transducer cable at the well casing (i.e., through the hubble connector in the well casing).
 2. Secure the transducer cable through the field box (i.e., by the hubble connector through pre-machined holes).
 3. Attach transducer wires to the logger.
 4. Secure the supplied ground wire to the bus terminal strip and to an appropriate grounding source outside the field box.
- Record the transducer serial number and secure the transducer at the desired depth with a nondamaging device (e.g., a rubber grip). Appropriate depth will be a factor of transducer rating and the expected fluctuations in water level.
- Verify that all holes in the field enclosure are sealed or have a breather plug (e.g., a 5-micron Teflon filter, available from Druck).
- Place desiccant in the field enclosure. Replace as necessary to maintain a dry environment.
NOTE: Particles of desiccant must not enter the vent tube.
- Verify the power supply to the logger.

Subject: Pressure Transducer Deployment

- Verify that there is a thin coating of silicon grease on the pressure transducer membrane if the transducer type requires it.

2.0 Software Setup Procedure

- Configure the data logger output value as appropriate. For depth-to-water measurements, use the "one point calibration" guidelines given in FOP 12.

3.0 Sensor Response Verification Procedure

- Raise/lower the submerged transducer a discrete distance through the water column.
- Monitor the logger output to verify correlation between the magnitude of the transducer movement and the logger output change.
- If the logger output does not change in direct proportion to the distance moved by the transducer, verify that the transducer is submerged and review the setup procedure.

X. REQUIRED RECORDS

- Field logbook

XI. ADMINISTRATION

The Sample Task Leader is responsible for administration of this procedure.

XII. APPROVAL

All procedures and instructions generated by and/or applicable to the WAG 6 Environmental Monitoring Program must receive the signed approval of the WAG 6 Project Manager and the Environmental Restoration Quality Assurance Specialist.

Effective date: November 1, 1993

XIII. APPENDIXES

This FOP has no appendixes.

Subject: Pressure Transducer One-point Calibration Check

I. PURPOSE

The purpose of this Field Operations Procedure (FOP) is to describe the standard method and equipment required for verifying pressure transducer accuracy at one point in a monitoring well or in other similar applications at Waste Area Grouping (WAG) 6.

II. REFERENCES

Martin Marietta Energy Systems, Inc. *Calculation of Calibration Constants for Pressure Transducers Calibrated in the Field Using the In-situ Method*. HMD-E-C004/R1. Prepared by S. M. Gregory, Hydrology Group, Environmental Sciences Division.

III. SCOPE/LIMITATIONS

This FOP applies to the verification of pressure transducer accuracy at one point in a WAG 6 monitoring well.

IV. DEFINITIONS

DTW - Depth to water.

V. REQUIREMENTS

- Electronic water level indicator
- Data logger
- Timepiece

VI. RESPONSIBILITIES

Sample Task Leader - The Sample Task Leader is responsible for ensuring that procedures are followed and for determining what actions will be taken in circumstances that require variance from the procedure. All variances from the procedure will be documented by the Sample Task Leader, and will be reviewed by the Field Task Manager and appropriate Quality Assurance personnel.

Site Technicians - Site Technicians are responsible for data retrieval, file back-ups, informing the Sample Task Leader of any variances, and completion of all required forms.

Subject: Pressure Transducer One-point Calibration Check

VII. QUALITY ASSURANCE AND QUALITY CONTROL

Because of the possibility of electronic circuit drift and other influences that may impair the ability of a pressure transducer to record accurate depth measurement, a one-point check should be performed at regular intervals on the monitoring system. This procedure is performed in situ. All activities performed must be recorded on a Transducer Calibration Worksheet or similar form.

Note that large discrepancies in data noted during the performance of this procedure may indicate system problems that should be investigated. For a well that is experiencing rapidly changing elevations, a more instantaneous comparison between the electronic water level indicator and the data logger may be necessary.

All pertinent pressure-transducer-calibration information will be recorded in the appropriate field documentation form or logbook.

VII. TRAINING

All site personnel will receive procedural training before the commencement of work.

IX. ACTION STEPS

1.0 Method 1 - One-minute Data Logging Calibration

- Program the data logger to report at one-minute intervals.
- Synchronize the timepiece with the time on the data logger.
- Manually check the water level from the reference point at the well using the electronic water level indicator. Record the level to the nearest 0.01 ft.
- Record the corresponding water levels from the data logger output.
- Using the following equation, calculate delta depth to water (ΔDTW).

$$DTW_{tape} - DTW_{logger} = \Delta DTW$$

- If ΔDTW is less than or equal to 0.1 ft, no adjustment of the pressure transducer is necessary. If ΔDTW is more than 0.1 ft, correct the reference in the logger.

Subject: Pressure Transducer One-point Calibration Check

- Return the logger to its prescribed scan and report intervals, and record the time that normal logging will resume.

2.0 Method 2 - Real-time Output Calibration

NOTE: Only experienced operators should use this method, because the apparent sensor output will fluctuate.

- Measure and record the depth to water with the electronic water level meter (DTW_{tape}).
- Record the real-time output value (DTW_{logger}).
- Using the following equation, calculate ΔDTW .

$$DTW_{tape} - DTW_{logger} = \Delta DTW$$

- If ΔDTW is less than 5% of the manual water level measurement, no adjustment of the pressure transducer is necessary. If ΔDTW is more than 5% of the manual water level measurement, correct the reference in the logger.

X. REQUIRED RECORDS

- Field logbook

XI. ADMINISTRATION

The Sample Task Leader is responsible for administration of this procedure.

XII. APPROVAL

All procedures and instructions generated by and/or applicable to the WAG 6 Environmental Monitoring Program must receive the signed approval of the WAG 6 Project Manager and the Environmental Restoration Quality Assurance Specialist.

Effective date: November 1, 1993

MARTIN MARIETTA ENERGY SYSTEMS, INC.
Environmental Restoration Division
WAG 6 Environmental Monitoring Program
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Subject: Pressure Transducer One-point Calibration Check

XIII. APPENDIXES

This FOP has no appendixes.

Subject: Measuring Flow Rates in Streams, Seeps, and Springs

I. PURPOSE

The purpose of this Field Operations Procedure (FOP) is to describe measuring flow rates in selected streams, seeps, and springs under conditions that allow for timed volume measurements or in streams where weirs or flumes exist and stage-discharge relationships are available. This procedure is meant to provide specific instructions regarding flow measurements when seep and tributary sample collection is occurring as part of the surface water monitoring task of the Waste Area Grouping (WAG) 6 Environmental Monitoring Program.

II. REFERENCES

Martin Marietta Energy Systems, Inc. 1993. *Draft Environmental Restoration Division WAG 2 RI Project Standard Operating Procedures*. Oak Ridge National Laboratory, Oak Ridge, Tennessee.

III. SCOPE/LIMITATIONS

This procedure can be applied to any weir or flume with a known rating equation.

IV. DEFINITIONS

This FOP requires no definitions.

V. REQUIREMENTS

- Personal protective equipment (PPE)
- Containers for volume measurements
- Ink pen
- Stopwatch
- Ruler/staff gauge
- Binoculars
- Appropriate documentation form or field logbook
- Hand-held calculator

Subject: Measuring Flow Rates in Streams, Seeps, and Springs

VI. RESPONSIBILITIES

Sample Task Leader - The Sample Task Leader is responsible for ensuring that procedures are followed and for determining what actions will be taken in circumstances that cause variation from the procedure. All variances from the procedures will be documented by the Sample Task Leader, and will be reviewed by the Field Task Manager and any appropriate Quality Assurance authorities.

Field Technicians - Field Technicians are responsible for field-measurement-instrument calibration, for informing the Sample Task Leader of any variances, and for completion of all required forms.

VII. QUALITY ASSURANCE AND QUALITY CONTROL

All pertinent site identification and field observations and measurements must be recorded on the appropriate documentation form or in the site logbook.

VIII. TRAINING

All site personnel will receive procedural training before work begins.

IX. ACTION STEPS

- Don PPE required by the Site Health and Safety Officer (SHSO) and/or Site Health Physicist before beginning work.
- Timed Volume Flow Measurements
 1. For those seep or stream locations where the flow discharges from a pipe, small weir, or flume such that a container can be placed to collect the water, timed volume flow measurements should be made at the time of sample collection. A container of sufficient size and volume should be used such that a minimum collection time of 15 seconds is possible.
 2. Simultaneously place a container to collect discharge and begin stopwatch. **Note:** discontinue measurements if placement of the container is significantly obstructing the flow such that water is backing up in the channel (upstream) or if a significant percentage ($\geq 5\%$) of the flow is bypassing the container.

Subject: Measuring Flow Rates in Streams, Seeps, and Springs

3. Stop the stopwatch as soon as the container is full or if flow is especially slow; stop the stopwatch and remove container simultaneously. Mark a horizontal line on the container that indicates the volume of water present in the container.
 4. Record all volume and time measurements on the appropriate documentation form or in the field logbook. In the laboratory, determine unknown volumes from containers bearing marked lines using a graduated cylinder, and record measurements on the appropriate documentation form or in the field logbook.
- **Water Level Flow Measurements**
 1. For stream locations where weirs or flumes exist and verified water level-discharge relationships are available, measurements should be recorded at the time of sample collection.
 2. If a staff gauge is not installed at the hydraulic structure, a ruler or yardstick can be used to measure water level. In flumes, the ruler should be inserted in the upstream stilling well. For weirs, the ruler should be inserted upstream of the weir in an area where weir drawdown effects are not affecting the water level. If this is not possible, insert the ruler against the weir wall, far enough away from the notch to ensure that drawdown effects are not influencing the water level. Rulers, yardsticks, or permanent staff gauges should always be as nearly vertical as possible.
 3. Observe and record the water level to the nearest 0.1 in. Use binoculars if necessary. Record the water level on the appropriate documentation form or in the field logbook. For sites with more than one water level measurement apparatus, observe and record all readings.
 4. Convert the water level to the appropriate units for use in the discharge equation. Usually this unit will be feet. Using a hand-held calculator, calculate flow using the specified discharge equation for the structure. Record results to the nearest 0.1 liter per second. Record the water level, calculated flow, and time of measurement on the appropriate documentation form or in the field logbook.

X. REQUIRED RECORDS

- Appropriate WAG 6 documentation form
- Registered field logbook
- Personnel training record

Subject: Measuring Flow Rates in Streams, Seeps, and Springs

XI. ADMINISTRATION

The Field Task Manager is responsible for administering this procedure.

XII. APPROVAL

All procedures and instructions generated by and/or applicable to the WAG 6 Environmental Monitoring Program must receive the signed approval of the WAG 6 Project Manager and the Environmental Restoration Quality Assurance Specialist.

Effective date: November 1, 1993

XIII. APPENDIXES

This FOP has no appendixes.

APPENDIX A

FIELD EQUIPMENT MANUAL REFERENCES

FIELD EQUIPMENT MANUAL REFERENCES

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