

EP-DIV-SOP-20126, R0

BOREHOLE CAMERA AND GEOPHYSICAL LOGGING SYSTEM USE

Effective Date: 5/12/14

Procedure Owner:	Signature:	Date:
Steve Pearson	/s/ Steve Pearson	5/9/14

Reference

REVISION HISTORY

Document No./ Revision No.	Issue Date	Action	Description
ENV-WQH-SOP-015, R0	12/97	New Document	New document
ENV-WQH-SOP-015, R1	6/00	Periodic Review	Annual review
ENV-WQH-SOP-015, R2	10/01	Periodic Review	Annual review
ENV-WQH-SOP-015, R3	3/06	Periodic Review	Annual review
EP-DIR-SOP-20126, R0	5/9/14	Major Revision	Document revised for current activities and new updated equipment. Document number revised to reflect current ADEP Document Numbering Guide. Document supersedes ENV-WQH-SOP-015.

Reference

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1. PURPOSE AND SCOPE

This Associate Directorate (ADEP) procedure describes the setup for and the operation of the Laval Borehole Video System, the Mount Sopris Borehole Geophysical Tools and Logging System (collectively referred to as the Borehole Logging System), and the Laval R-CAM 1000 portable borehole camera.

This procedure applies to all ADEP staff and contractors authorized to operate, assist, or maintain the Laval Borehole Cameras and Borehole Logging System. This procedure is not to for use in a Nuclear Environmental Site (NES).

2. PREREQUISITES

The training method for this procedure is self-study (reading) and **on-the-job** training by a previously trained individual. In addition, the following training is also required before work can be performed under this procedure:

- ENV-DO-QP-100: General Field Safety
- ENV-DO-QP-110: Records Management
- ENV-DO-QP-114: Logbook Use and Control

3. BACKGROUND

The ADEP camera trailer contains a system built around the Laval Underground Surveys, Inc., borehole camera system, and the Mount Sopris Instrument Company's MATRIX platform. All instruments and computer software must be compatible with a single Mount Sopris precision-controlled downhole cable and winch. All specified instruments interface with this cable system, and software tools communicate with each vendor's products using proprietary protocols. All specified equipment has been configured to meet precision logging, inspection, and documentation requirements.

The Laval R-CAM 1000 is a stand-alone system that is powered off a 12-V direct current (DC) rechargeable gel cell battery pack. Although equipped with 1000 ft of coaxial cable, this system is best used for alluvial and shallow intermediate wells at depths of 600 ft and shallower.

4. EQUIPMENT DESCRIPTION

The Logging Systems consists of the following equipment:

- Laval Underground Surveys, Inc., Model R-10 control unit

Reference

- Laval Underground R2000 dual-cam borehole camera
- Aries WC1750 Slimline Dual View Waterwell Inspection Camera
- Laval R-CAM 1000 portable borehole camera
- Mount Sopris Instruments high precision winch for geophysical logging systems
- WNA Winch with 1000-m ¼-in. armored coax cable (refer to Attachment 1)
- 13-in. TV monitor and DVD/VCR
- 14-ft enclosed trailer
- MATRIX logging system (logger version 11)
- 3WCA-1000 winch control
- 2PGA-1000 Poly-Gamma Probe
- 2PIA-1000 Poly-Induction Probe
- 2SAM-1000 fluid sampler
- 2PCA-1000 Poly-Caliper Probe
- 2WQA-1000 fluid resistivity/temperature probe
- Optical borehole imager
- QL40 gamma probe
- QL40-IND dual-induction probe

The system is capable of logging boreholes from 2–24 in. in diameter, including those filled with air or water. This logging equipment is operated out of a 14-ft Wells Cargo tandem axle trailer.

5. PRECAUTIONS AND LIMITATIONS

All personnel conducting this work SHALL be authorized for this work in the U-Train Worker Qualification and Authorization System (WQAS).

Reference

Personnel shall comply with all Facility Operations Director entry requirements.

Personnel SHALL follow the integrated work document (IWD), EP-CAP-IWD-1021, "Corrective Action Program (CAP) General Field Work Activities and Site Visits in Undeveloped Areas for the Monitoring Well Network, Well Plug and Abandonment, and Data Retrieval Activities," as well as all applicable site-specific IWDs.

Personnel SHALL wear leather-type gloves for all hose, tool, and cable movement and connection and SHALL utilize the two-person lifting requirement, as needed.

Workers will use established pathways when available and avoid walking on uneven or unstable surfaces.

7. USING THE BOREHOLE CAMERA SYSTEM

7.1 Connect the Cable

Field Personnel

- [1] CONNECT the black coaxial cable (located on the side of the winch system to the port labeled "CAMERA"). Refer to photos in Attachment 2. **NOTE:** Never move the coaxial cable connected to the middle port.
- [2] CONNECT the cable labeled "CAMERA OPS" to the top of the small grey box that the coaxial cables attach to. Refer to photos in Attachment 2.

NOTE: Ensure an adequate supply of DVD-R and VCR tapes is on hand. Also note that the VCR system may be run as a backup to the DVD system.

7.2 Assemble the Borehole Camera System

Field Personnel

- [1] ENSURE all power switches for camera control and winch controls are in the OFF position.
- [2] EXTEND exhaust hose for generator and power up the generator. Use of the exhaust hose prevents fumes from entering the trailer.

Reference

- [3] SPOOL OUT enough cable to extend the mast arm and center cable/cable head over hole or well. Provide tension to the cable to avoid backlash on the winch drum.

NOTE: If the drill rig is set up over the borehole, instruct driller to hang sheave to run cable into hole. Ensure the tool is centered in borehole/well.

- [4] PLACE metal centralizers on the camera (when hole/well diameter exceeds camera diameter by more than 2 in.) and perform the following:
- Screw each end in tightly.
 - Adjust diameter as needed.
 - Ensure centralizer bands are secure on each end using screw driver or allen wrench (varies with camera manufacturer).
- [5] PLACE silicon grease on the O-ring at end of cable head and rotate camera onto cable head. DO NOT rotate the cable head or winch line.
- [6] SUSPEND camera over borehole/well by use of extended mast arm or sheave suspended by drill rig.

7.3 Operate the Video Camera

Field Personnel

Note the following precautions before operating the video camera:

- NEVER assemble or disassemble any parts on the camera while the power is in the ON position.
- DO NOT power up trailer while the R-10 power switch is ON.
- DO NOT hit the bottom of hole with the camera system.
- RAISE and LOWER camera slowly in unknown or unstable borehole conditions. Use common sense when selecting winch speed.
- For more detailed instructions, maintenance, trouble shooting, and detailed diagrams, see the Laval Underground Surveys R-2000 instruction manual located in the trailer.

Reference

To operate the video camera, perform the following steps:

- [1] TURN ON winch control system (black CE box on counter above winch drum). Refer to photo in Attachment 3.

NOTE: Controls referenced in steps 2 through 5 are located on the LAVAL R-10 control unit. Refer to photo in Attachment 4.

- [2] TURN LAMP VOLTAGE DOWN knob to the vertical position. This will put voltage at medium setting.

- [3] TURN selector knob to position number 2: camera voltage.

- [4] TURN power ON for the camera control system, DVD/VCR unit, and monitor.

- [5] LOWER the camera lens to desired datum and push the reset button on the LAVAL R-10 unit.

This will give a depth of 0 ft 0 in. on the monitor. Use the VERT (vertical) and HORIZ (horizontal) switches to move the depth display location on the monitor to the least obstructive view.

- [6] SET depth on black CE box:

Step	Action
1	<p>Push "P" (program), then use the buttons directly below the LED readout to change digits display.</p> <p>For example:</p> <ul style="list-style-type: none"> • Push "3" until 0 is displayed. • Push "2" until 0 is displayed. • Push "1" until 0 is displayed.
2	Push "E" (enter) and "R" (reset).
3	Use "Disp" (display) to toggle between depth and speed display.

- [7] Use the camera control module (refer to Attachment 5) to control all downhole camera functions.

Reference

[8] MOVE camera up and down the borehole by using the black CE box (winch control), then complete the following:

- Flip the switch to choose between up and down.
- Adjust the speed as needed.
- Ensure the control is switched to LOCAL.

NOTE: when moving camera up and down in borehole operator shall always be aware of cable tension readings, visual movement of camera via video screen and observation of cable and mast.

[9] RECORD video by performing the following:

- Place VCR/DVD media into VCR/DVD.
- Hit the RECORD button on VCR/DVD at any time while using the camera.

[10] RUN camera survey over desired depth intervals. Finalize disk when video run is complete.

[11] REMOVE the camera from borehole. When disconnecting camera from cable head, make sure power to camera is OFF. Screw end cap onto cable head to protect it.

[12] Pressure-wash or wipe the cable (on way out) and tool to remove dirt and other foreign material.

[13] RETRACT and secure mast. Applying tension to the cable, walk it back onto the winch drum and secure the cable head to the boom (retracted mast).

[14] TURN power OFF on the VCR/DVD, monitor, and Laval R-10 control unit.

8. USING THE R-CAM 1000 PORTABLE CAMERA SYSTEM

Field Personnel

To operate this camera system, perform the following steps:

[1] CONDUCT all operation of the system per the Laval R-CAM 1000 Operations Manual.

Reference

NOTE: The R-CAM 1000 portable borehole camera is best suited for alluvial and shallow intermediate well applications. Ensure the 12-V DC battery is fully charged before field mobilization to the well site.

9. USING THE MOUNT SOPRIS GEOPHYSICAL LOGGING TOOLS

9.1. Connect the Cable

Field Personnel

- [1] Before operating the geophysical tools, connect the coaxial cable (located on the side of the winch system) to the “Logging” port. The second coaxial cable should already be connected to the middle port and should never be removed. Refer to photo in Attachment 6.

9.2. Operate the Borehole Geophysical Tools

Field Personnel

- [1] To operate any of the borehole logging tools, refer to the appropriate Mount Sopris user manual for calibration, operation and maintenance steps for the individual tool in use.

10. RECORDS RESULTING FROM THIS PROCEDURE

10.1 Records

Field Personnel

- [1] Submit the following records, generated as a result of this procedure, within 30 days of data collection to the Records Management Facility:
- Logbook providing a summary of trip events, video well name and location, disposition of wastes, and other significant trip information
 - DVD and/or VCR recording of camera log runs
 - Computer files (in both .id and .las format) of the geophysical logging runs

Reference

11. REFERENCES

The following documents are incorporated into this procedure by reference:

ENV-DO-QP-100, General Field Safety
ENV-DO-QP-110, Records Management
ENV-DO-QP-114, Logbook Use and Control
Laval Operations Manual R-CAM 1000
Logger for Matrix, Operating Manual V 11
Mount Sopris WNA Winch Manual
Mount Sopris 3WCA Winch Control Manual
Mount Sopris 2PGA-1000 Poly-Gamma Probe Manual
Mount Sopris 2PIA-1000 Poly Induction Probe Manual
Mount Sopris 2SAM-1000 Fluid Sampler Manual
Mount Sopris 2PCA-1000 PolyCaliper Probe Manual
Mount Sopris 2WQA-1000 Fluid Resistivity/Temperature Probe Manual
Mount Sopris Optical Borehole Imager Manual
Mount Sopris QL40 Gamma Probe Manual
Mount Sopris QL40-IND Dual Induction Probe Operator Manual
ASTM D 6167-97: Standard Guide for Conducting Borehole Geophysical
Logging: Mechanical Caliper
Logging – Gamma
ASTM D 6726-01: Standard Guide for Conducting Borehole Geophysical
Logging – Electromagnetic Induction

Reference

12. ATTACHMENTS

- Attachment 1 Mount Sopris Instruments High-Precision Winch
- Attachment 2 Coaxial Cable Connection for Video Camera System
- Attachment 3 Winch Control System – Black CE Box
- Attachment 4 LAVAL R-10 Control Unit
- Attachment 5 Camera Control Module for Borehole Camera System
- Attachment 6 Coaxial Cable Connection for Borehole Logging System

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Attachment 1
Mount Sopris Instruments High-Precision Winch
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Reference

Attachment 2
Coaxial Cable Connection for Video Camera System
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Reference

Attachment 2
Coaxial Cable Connection for Video Camera System
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Attachment 3
Winch Control System – Black CE Box
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Attachment 4
LAVAL R-10 Control Unit
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Attachment 5
Camera Control Module for Borehole Camera System
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Attachment 6
Coaxial Cable Connection for Borehole Logging System
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