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**Environmental Programs Directorate
Waste & Environmental Support**

Standard Operating Procedure

for **Installing and Operating the Portable Solar-Powered AIRNET Station**

APPROVAL SIGNATURES:

Subject Matter Expert:	Organization	Signature	Date
William Eisele	WES-EDA	Signature on File	4/2/2009
Responsible Line Manager:	Organization	Signature	Date
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1.0 PURPOSE AND SCOPE

This procedure describes the steps to install and operate the portable solar-powered air sampling station used for sampling air for the AIRNET project. This procedure applies to the individuals assigned to install, operate and maintain the portable solar-powered AIRNET station.

2.0 BACKGROUND AND PRECAUTIONS

2.1 Background

The portable solar-powered AIRNET station is a battery-powered sampler that will pull air up to approximately 2 cubic feet per minute through a particulate air filter. Airborne radioactive particulate matter will be collected using the standard particulate filter holder (see ENV-MAQ-202). A water vapor sample will also be collected using the standard silica gel cartridge used by the AIRNET project (see ENV-MAQ-204). The solar sampler uses up to eight photovoltaic panels that will recharge the external 12V battery bank and operate the sampler continuously. The flow is controlled by a mechanical air flow control valve for the particulate sampler and a needle valve for the silica gel cartridge. The total sample time is recorded by a timer.

2.2 Precautions

1. This document establishes the basic requirements for installing and operating a solar-powered AIRNET station. Work performed under this procedure by LANL personnel will occur only after required training to applicable documents has been completed and documented.
2. A minimum of two people is required to install, operate, disassemble, or move the portable solar-powered AIRNET station.
3. A sealed type battery should be used to avoid the hazards of a wet battery that contains acid. Sealed batteries may be transported or stored in any position without fear of leakage.
4. Two people should be used to move batteries.
5. Do not package batteries with any other materials. During transport, individually box and secure batteries so that the batteries do not shift or tip. To help prevent accidental shorting of the terminals, label each outer box "Sealed Batteries - This Side Up" with an arrow indicating the top. When installing batteries or removing them from the battery enclosure, cover terminals with plastic boots. If possible, leave plastic boots in place during operation.
6. **Use extreme caution when working with a battery.** Do not allow wrenches or other metallic objects to come in contact with both terminals simultaneously. Serious injury and destruction of the battery may occur.
7. All electrical work (e.g., "making" and "breaking" electrical connections, installing wiring, etc.) outside the housing is to be performed only by a qualified electrician.
8. While wiring inside the housing, assembling, disassembling, and transporting of the portable solar-powered AIRNET station, the main power switch to the housing shall be in the "OFF" (de-energized) position. The de-energized state inside the housing shall be verified with the use of the multi-meter prior to performing any electrical work inside the housing.
9. **Wear safety shoes** whenever moving the housing, photovoltaic panels, structural supports, timbers, batteries or the battery enclosure.
10. Actions specified within this procedure, unless preceded with "should" or "may," are to be considered mandatory guidance (i.e., "shall").
11. Hold a tailgate meeting addressing potential safety issues before initiating any work under this SOP.
12. Do not perform work under conditions you consider unsafe. Before beginning work described in this procedure, review safety needs and requirements, identify hazards, and develop hazard mitigation measures.

3.0 PREREQUISITES AND INITIAL CONDITIONS

1. Assemble equipment needed for the sampling activity. Reference Attachment A, Installation and Operating the Solar-Powered AIRNET Station Equipment Checklist
2. Check the condition of the vehicle and the fuel level. Identify a Point-of-Contact (providing pertinent information of destination, expected time-in, and how to notify field team). When leaving Los Alamos County, notify the group office (667-0808) to place you on travel status. If allowed, ensure that you have a working cell phone and a pager.

4.0 EQUIPMENT AND TOOLS

Refer to “Installing and Operating the Portable Solar-Powered AIRNET Station Equipment Checklist” (Attachment A).

5.0 TRAINING

Personnel performing this procedure shall be trained on this procedure in accordance with the provisions of the WES division training program. Personnel performing this procedure shall also be currently trained to perform the following WES procedures:

- RRES-ES-Field, General Field Safety for All Employees
- ENV-MAQ-202, Environmental Sampling of Airborne Particulate Radionuclide
- ENV-MAQ-204, Sampling of Ambient Airborne Tritium
- ENV-MAQ-205, Calibration of Air Sampling Stations
- ENV-MAQ-207, Evaluation of AIRNET Sampler Sites Against Siting Criteria
- ENV-MAQ-217, Installation of New AIRNET Stations
- SOP-5181, Notebook Documentation for Waste & Environmental Services Technical Field Activities
- EP-DIR-QA-SOP-4004, Records Transmittal and Retrieval Processes
- ISD P101-3, Lockout/Tagout for Hazardous Energy Control

In addition to training to this procedure, the following training is also required prior to performing activities covered by this procedure:

- First Aid Training (course #3574)
- Cardiopulmonary Resuscitation (CPR) Training: Adult (course #3583)

6.0 DEFINITIONS

None

7.0 STEP-BY-STEP PROCESS DESCRIPTION

7.1 Site Solar-Powered AIRNET Station

- | | |
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| Field Team Members (FTM) | <ol style="list-style-type: none"> 1. The sampler will generally be used in remote locations where electrical power is not available. The AIRNET Project Leader will determine the location. <hr/> <ol style="list-style-type: none"> 2. At the sampling site, use ENV-MAQ-207 to provide guidance as to where the station should be located within the site. <hr/> <ol style="list-style-type: none"> 3. In addition to ENV-MAQ-207, take in account that the solar array for the AIRNET System must face true south and have unobstructed access to the southern sky. Any shading of the |
|--------------------------|--|

modules by trees, buildings, wires, antennas, etc. will substantially reduce the performance of the system, and may cause eventual failure.

- Use a magnetic compass to find true south. Be sure to adjust for the magnetic declination in your area (for example, North Central New Mexico, true south is 12 degrees east of magnetic south).
- Observe the solar access to the southern sky. If there are obstructions that cannot be removed, try to find another location where the array will not be shaded.

7.2 Install Weather-Resistant Housing

- FTM
1. Bolt the 4 x 4 timbers to the legs of the housing by using the ratchet set (start bolt with hammer).
 2. Check the level of the ground surface; if needed, use shovel to level the ground (excavation permit is required).
 3. Ensure the height of the access door is in the breathing zone (about 5 to 6 feet).
 4. If necessary, place filled sand bags over supports to provide additional anchoring weight in the event of high winds.

7.3 Install Pumps and Internal Components Inside Housing

WARNING

If power has previously been supplied to the housing, ensure the main power switch to the housing is in the "OFF" position before connecting the pumps to the power supply. Place Form 2002, Lockout/Tagout Tag for Simple Lockout/Tagout Procedures on main power switch (refer to ISD P101-3, Lockout/Tagout for Hazardous Energy Control, Attachment A for appropriate steps to follow). Verify there is no power inside the housing by using the multi-meter to measure the absence of a voltage reading across the positive and negative terminal blocks inside the housing. When the absence of electrical power has been verified proceed with installing pumps and internal equipment inside the housing.

- FTM
1. Connect two T-Squared T201 heavy-duty twin head 12 volt pumps in parallel with reinforced tygon tubing, hose clamps, and the air dampening reservoirs as shown in Attachment B. Put the pumps inside the housing on the left. Secure pumps by fastening tabs on the bottom of the pumps to the floor of the housing.
 2. Install the following as shown in Attachment B:
 - Mechanical flow control valve
 - Particulate filter holder
 - 150cc rotameter with needle valve
 - If necessary, install the PVC holder for the silica gel cartridge on the floor of the housing (See Attachment C for installation of flow meter)
 - Venturi flow meter

- Timer

Use any necessary fasteners to secure equipment to the housing.

3. Attach, using necessary fasteners, two electrically shielded terminal blocks of appropriate rating (refer to Attachment A for recommended terminal blocks) inside the housing on the wall closest to the pumps and above the vents. Drill a hole through the housing below the terminal blocks and thread the cable from the battery enclosure through the hole. Terminate the positive side of the cable to the "positive" terminal block and terminate the negative side of the cable to the "negative" terminal block. Label each block as "positive" and "negative" appropriately. Use silicone sealant or a grommet to plug the hole the cable passes through to prevent moisture intrusion.
4. Connect the positive leads of both pumps to the positive terminal block and the negative leads of both pumps to the negative terminal block. Do the same for any other 12 volt equipment inside the housing.
5. Lock both sides of the housing with a padlock cored the same as the other AIRNET housing locks.
6. Label the housing with its unique station number and the power-off notice label with the group phone number.
7. Recheck the housing is level.
8. Determine the coordinates of the new location, using either map techniques or a GPS unit.

7.4 Set Up Photovoltaic Panels and and Unirac RapidRac System

FTM

1. Select a location on level ground upon which the Unirac RapidRac bay frames can rest. This location should be within close proximity of the AIRNET housing given the length of cable supplied with the solar power equipment.
NOTE: For optimum performance, the solar array must face true south and have unobstructed access to the southern sky.
2. Assemble the Unirac RapidRac support systems for the two arrays (4 panels per array) following the RapidRac G10 installation manual 601 which is attached to this SOP as Attachment D.
NOTE: Ensure the front of the panels are covered with opaque material during the installation process and prior to the electrician making all the necessary connections from the panels to the breaker panel, charge controller, battery bank, and housing.
3. Load 12 ballast blocks (26 pounds minimum per block) per array into the bay frames. There should be 6 blocks in each bay frame (i.e., 2 bay frames per array of 4 panels). Refer to the Unirac RapidRac Engineering Report for detailed calculations on how the ballast requirements were determined (Attachment E)
4. Mount battery charge controller and breaker box onto one or more of the RapidRac module brackets. It may be necessary to perform some field engineering to provide a secure

mounting surface for the controller and breaker box.

7.5 Set Up Battery Enclosure and Batteries

WARNING

Use extreme caution when working with a battery. Do not allow wrenches or other metallic objects to come in contact with both terminals simultaneously. Serious injury and destruction of the battery may occur.

- FTM
1. Place battery enclosure onto level ground or elevate on pressure treated timbers. Two people will be required to move the enclosure around.
 2. Place plastic boots over each battery terminal if not already installed. Lower each battery into the enclosure on top of the bracings being careful not to short the battery terminals across the side wall of the enclosure. Leave boots in place. The electrician will remove them and re-install them when he is ready to connect the batteries, i.e., they should be left in place if possible.

WARNING

Ensure that a fuse rated at 10 amps, 250 volts is inserted into fuse holder in line with cable running from the battery enclosure to the AIRNET station housing. Do **not** operate the station with a battery enclosure to AIRNET station housing cable that is not fuse protected.

3. Contact electrician to connect all electrical wiring for system to the housing, including cables inside battery enclosure and power up the system by turning on the photovoltaic panel breakers to start charging the batteries.
4. Remove lockout/tagout tag that was placed as described in the **WARNING** statement in section 7.3 in accordance with ISD P101-3.

7.6 Final Inspection and Initiation of Operation

- FTM
1. Allow the batteries to charge for at least five days prior to initial start-up. After approximately five days, the main power switch may be turned on to start pump operation.
 2. Calibrate the flow through the particulate filter and cartridge according to procedure MAQ-205.
 3. Recheck solar panel orientation using the compass; make sure it is facing true south. Verify that there are no obstructions that will shade the panels.
 4. Check all mounting fasteners for tightness.
 5. Document the housing installation, calibration, and start-up time and date in the field logbook.

7.7 Adding the New Station to the AIRNET System

- FTM
1. The new station's identification number and location name must be added to the appropriate records:

- Request the AIRNET data manager to add the new station (and the coordinates determined in Section 7.3 step 7) to the Access database of locations.
- Request that the Project Manager and the Chemistry Data Coordinator revise the clumping paperwork and the shipping documents for filters, tritium, and composites.

7.8 Sampling Parameters and Changing the Filter

- FTM
1. During sampling, the sampler will be run continuously (as the battery charge allows) and the samples will be collected every two weeks during the regular AIRNET sample change-out (see ENV-MAQ-202 and ENV-MAQ-204).
 2. If different sampling schedules are called for, follow the schedule specified by the Air Monitoring Project Leader. Follow the instructions of the Air Monitoring Project Leader for changing the collected particulate filter and tritium samples. Generally, the samples will be collected, labeled, and shipped in the same manner as those collected under procedures ENV-MAQ-202 and ENV-MAQ-204.

7.9 Disassembly and Transportation (as needed)

- FTM
1. Cover photovoltaic panels with opaque material and secure with tape.
 2. Contact electrician to power down system and disconnect all electrical wiring from system outside of housing, including cables inside battery enclosure.
 3. Place plastic boots over each battery terminal if not already installed. Carefully remove each battery from the enclosure and place the battery inside wood storage/transportation box in vehicle.
 4. Lift battery enclosure off ground or timbers. This will require two people to move enclosure.
 5. Remove panels from RapidRac systems and repack in original boxes.
 6. Remove charge controller and breaker box and pack for transportation.
 7. Disassemble RapidRac systems if necessary for transport..
 8. Remove housing from timbers. Internal components need not be removed if they are secured inside enclosure. Secure housing in vehicle so as to prevent it from moving around during transportation.
 9. Unbolt timbers.
 10. Load remaining items in vehicle ensuring that items will not move around during transport.

7.10 Maintenance

- FTM
1. The T-Squared pumps need to be replaced every 6 months with new pumps.

WARNING

When the removal and installation of pumps or other electrical components needs to be

performed inside the AIRNET station housing, always turn off the main power switch on the cable running from the battery enclosure to the station housing, perform lockout/tagout on the main power switch, and verify the absence of power in the housing as described in the **WARNING** statement in section 7.3. Absolutely no live electrical work is permitted inside the station housing. Any other electrical work must be performed by a qualified electrician.

8.0 RECORDS

- FTM
- The following records generated as a result of this procedure are to be submitted as records to the Records Coordinator in accordance with EP-DIR-SOP-4004:
 - Entries in the field log book (entries completed in accordance with SOP-5181)
 - New or edited records in the AIRNET station database

9.0 REFERENCES (WES PROCEDURES) [HTTP://INT.LANL.GOV/ENVIRONMENT/ALL/QA/ADEP.SHTML](http://int.lanl.gov/environment/all/qa/adeq.shtml)

- RRES-ES-Field, General Field Safety for All Employees
- ENV-MAQ-202, Environmental Sampling of Airborne Particulate Radionuclide
- ENV-MAQ-204, Sampling of Ambient Airborne Tritium
- ENV-MAQ-205, Calibration of Air Sampling Stations
- ENV-MAQ-207, Evaluation of AIRNET Sampler Sites Against Siting Criteria
- ENV-MAQ-217, Installation of New AIRNET Stations
- SOP-5181, Notebook Documentation for Waste & Environmental Services Technical Field Activities
- EP-DIR-QA-SOP-4004, Records Transmittal and Retrieval Processes

10.0 ATTACHMENTS

Attachment A: Installing and Operating the Portable Solar-Powered AIRNET Station Equipment Check List

Attachment B: Equipment Housing Installation Schematic (Example)

Attachment C: Silica Gel Cartridge Flow Meter Diagram (Example)

Attachment D: UniRac RapidRac G10 Installation Manual 601

Attachment E: UniRac RapidRac Engineering Report

11.0 REVISION HISTORY

Revision No. <i>[Enter current revision number, beginning with Rev.0]</i>	Effective Date <i>[DCC inserts effective date for revision]</i>	Description of Changes <i>[List specific changes made since the previous revision]</i>	Type of Change <i>[Technical (T) or Editorial (E)]</i>
0	4/2/2009	New Procedure	T

ATTACHMENT A

SOP-5234-A

Installation and Operating the Portable Solar-Powered AIRNET Station Equipment Checklist (Example)

Records Use only



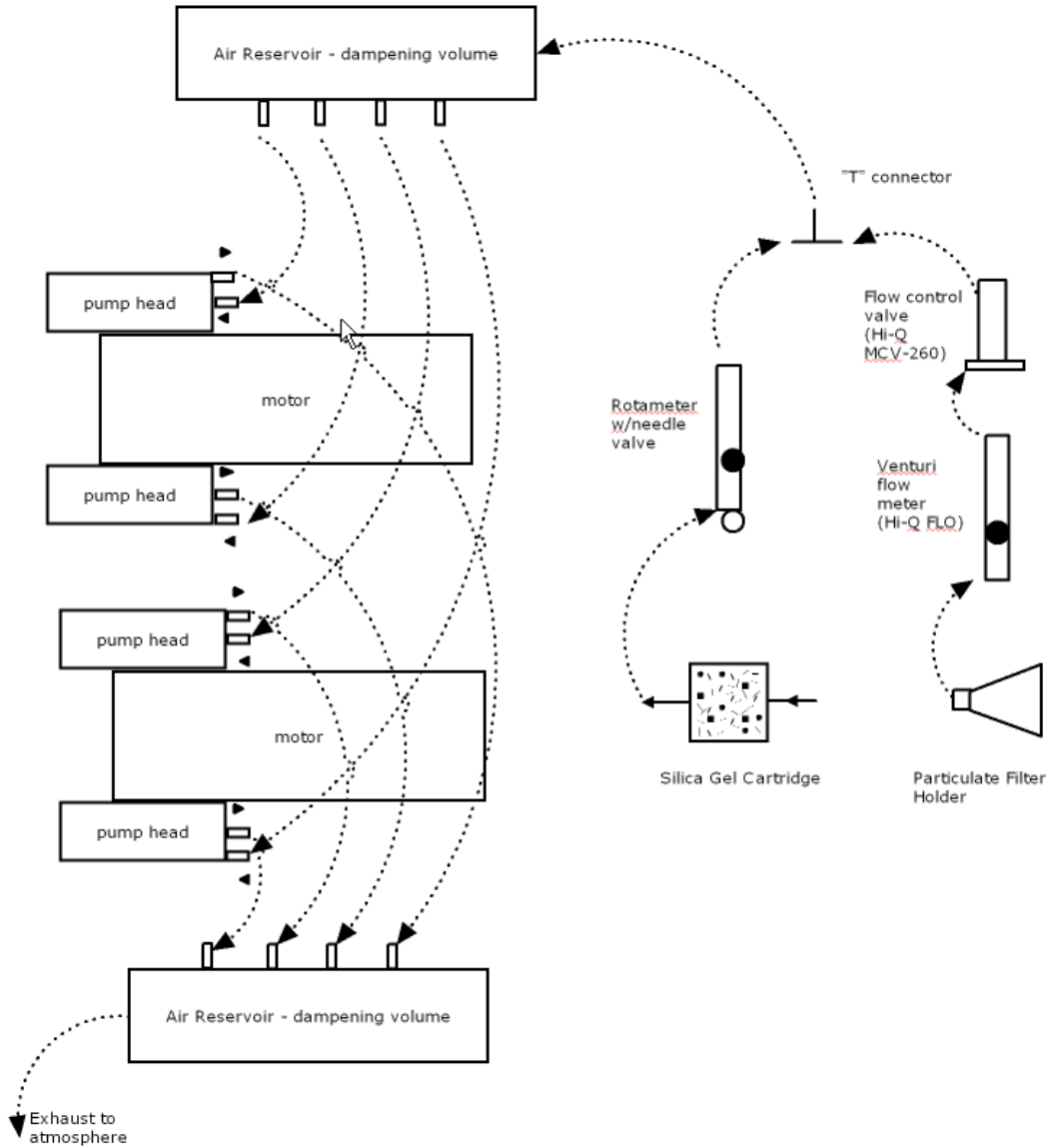
- Pre-weighed silica gel cartridge
- Filter Holder
- Calibrators (for silica gel and air filters flows)
- 2 pad locks with same key core as other station locks
- Level
- Stations label and disconnect notice
- Palm computer
- Chain-of-custody form from MAQ-204, or equivalent
- GPS Unit
- Personnel Protection Equipment (e.g. leather/protective gloves, safety glasses, safety shoes, field shoes)
- 5/16" Straight blade screw driver
- 9/64" Straight blade screw driver
- Multi-meter
- Combination Wrench Set
- 3/8" Drive Socket Set
- Hammer
- Portable battery-powered drill with 3/8" bit rated for metal drilling
- Waterproof sealant or grommet
- Electrically shielded terminal blocks rated at a minimum of 20 amps, 250 volts
- Weather-resistant adhesive labels for terminal blocks
- Pressure-treated timbers for AIRNET housing and battery enclosure
- Magnetic Compass
- Housing with pumps, flow meters, timer, reinforced tygon tubing, hose clamps, etc.
- Solar power equipment, battery enclosure, batteries
- 2 Unirac RapidRac systems with 24 ballast blocks (solid cap concrete blocks) (26 pounds minimum per block)
- Felt tip permanent marker and pen
- Cellular Phone or Radio and pager
- First Aid Kit
- Sun Screen and insect repellent (optional)

ATTACHMENT B

SOP-5234-B

Equipment Housing Installation Schematic (Example)

Records Use only

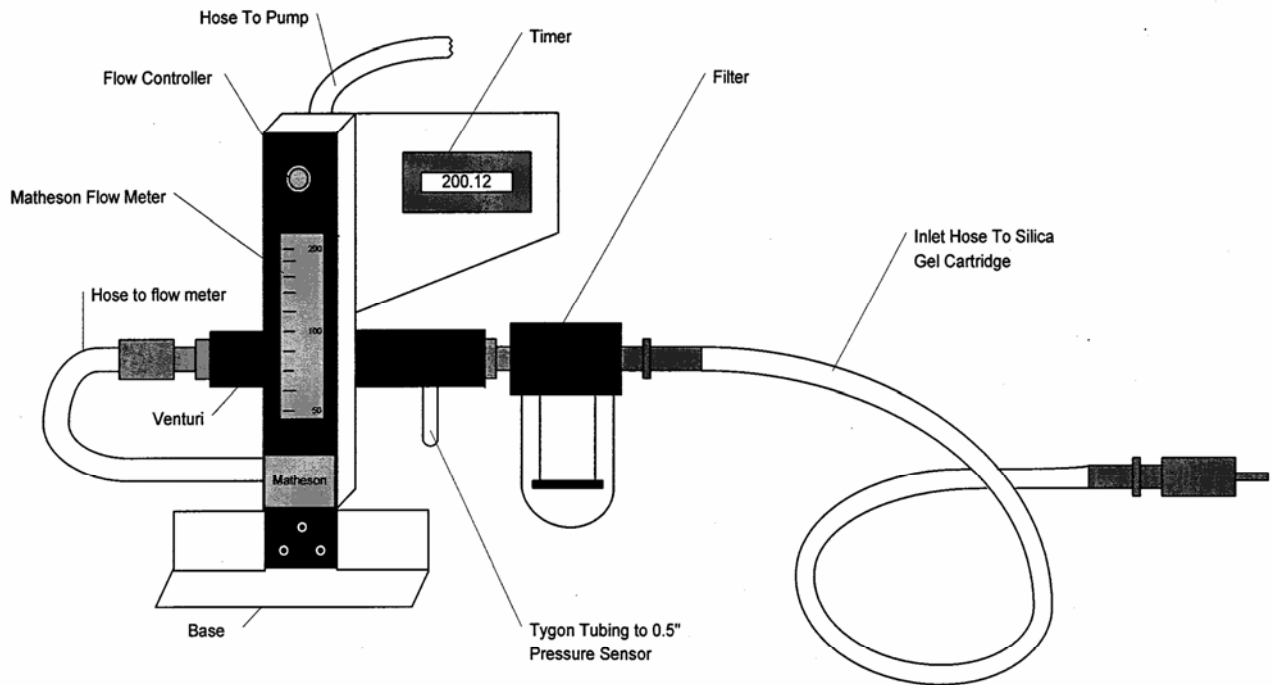


ATTACHMENT C


SOP-5234-C

Silica Gel Cartridge Flow Meter Diagram (Example)

Records Use only




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ATTACHMENT D	
<p>SOP-5234-D</p> <p style="text-align: center;">RapidRac G10 Installation Manual 601</p>	<p>Records Use only</p>  <p style="text-align: center;">Los Alamos NATIONAL LABORATORY EST. 1943</p>

To access the Installation Manual 601 select the following link:

http://www.lanl.gov/environment/all/docs/qa/ep_qa/SOP-5234-AttD.pdf

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ATTACHMENT E	
SOP-5234-E UniRac - RapidRac Engineering Report	Records Use only  EST. 1943

To access the RapidRac Engineering Report select the following link:

http://www.lanl.gov/environment/all/docs/qa/ep_qa/SOP-5234-AttE.pdf