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QUALITY ASSURANCE/QUALITY CONTROL DOCUMENTATION SERIES	
TITLE	**SITE SELECTION FOR SCENE MONITORING EQUIPMENT**
TYPE	**STANDARD OPERATING PROCEDURE**
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AUTHORIZATIONS		
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REVISION HISTORY			
REVISION NO.	CHANGE DESCRIPTION	DATE	AUTHORIZATIONS
0.1	Minor text modifications.	April 1996	
1.0	Add digital camera/video system references	April 1999	

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1.0 PURPOSE AND APPLICABILITY

This standard operating procedure (SOP) outlines site selection criteria for automatic camera monitoring systems.

Documenting visibility or visual events and trends is an important aspect of evaluating existing or potential impairment in Class I and other visibility-sensitive areas. Photography is an efficient way to document these events and trends and is an effective method of communicating visibility relationships to decision-makers and to the public. Self-contained, automatic camera monitoring systems or time-lapse video monitoring systems are easily installed and operated. Camera-based monitoring, referred to as scene monitoring, is an effective, economical component of any visibility monitoring program.

An automatic camera visibility monitoring station takes 35 mm slides or high-resolution digital images of a selected vista at user-selected times throughout the day. The station can also be outfitted with an 8 mm time-lapse camera or an SVHS time-lapse recorder to record the dynamics of visibility events. Day-to-day variations in visual air quality captured on 35 mm color photographic slides, digital images, 8 mm color movie film, or SVHS videotape can be used to:

- Document how vistas appear under various visual air quality, meteorological, and seasonal conditions. Scene characteristics include observer visual range, scene contrast, color, texture, and clarity.
- Record the frequency that various visual air quality conditions occur (e.g., incidence of uniform haze, layered haze, or weather events).
- Provide a quality assurance reference for collocated measurements.
- Determine the visual sensitivity of individual areas or views to variations in ambient air quality.
- Identify areas of potential impairment.
- Estimate the optical properties of the atmosphere under certain conditions.
- Provide quality media for visually presenting program goals, objectives, and results to decision-makers and to the public.
- Provide support data for the computer image modeling of potential impairment.
- Support color and human perception research.

Slides, digital images, movie film, and videotape, however, do not provide quantitative information about the cause of visibility impairment. Aerosol and optical properties of the atmosphere must be independently monitored where cause and effect relationships are required.

In addition to visibility monitoring, time-lapse video systems can be used for a variety of purposes, including:

- Environmental monitoring such as wildlife, waterflow, and source monitoring.

- Security monitoring for remote industrial sites and storage depots.
- Construction monitoring for building sites or highway and bridge construction.
- Event monitoring for remote weather documentation or highway and airport conditions.
- Recreation monitoring for ski areas and river rafting.

This SOP serves as a guideline to facilitate:

- Locating potential sites.
- Evaluating potential sites.
- Selecting the most appropriate site from the potential sites.
- Finalizing the selected site.

2.0 RESPONSIBILITIES

2.1 PROGRAM MANAGER

The program manager shall:

- Inform the project manager of the location area and site-specific monitoring objectives for a proposed scene monitoring site.
- As required, review the selected site with the project manager and project-specific Contracting Officer's Technical Representative (COTR).

2.2 PROJECT MANAGER

The project manager shall:

- Prepare the project-specific siting and operational objectives, guidelines, and considerations.
- Review with the field specialist photographic documentation, maps, and other information to determine the suitability of a site.
- Select the site for the scene monitoring equipment based on the criteria outlined in this SOP.
- As required, review the selected site with the program manager.

2.3 FIELD SPECIALIST

The field specialist shall:

- Initiate the search for potential sites by sending the pertinent siting criteria and associated siting materials to the local contact.

- Obtain permission to perform any site preparation that may be required.
- Obtain permission from private or public landowners for permanent access to the monitoring location.
- Maintain communications with the local contact during the field survey of potential sites. Verify that all potential sites have been identified and thoroughly evaluated, and that all materials are returned for review in a timely fashion. The actual field survey of potential monitoring sites can be performed by the field specialist, by the local contact, or by both.
- Work with the local contact sponsoring agency to identify a site operator and local primary contact to service the equipment.
- Review with the project manager photographic documentation, maps, and other information to determine the suitability of a site.
- Enter all site selection information in the site-specific Quality Assurance Database.

2.4 LOCAL (ON-SITE) CONTACT

The local contact shall:

- Review the technical and monitoring requirements provided by the field specialist.
- Identify potential sites and scenic vistas.
- Maintain communications with the field specialist during the field survey of potential sites. The actual field survey can be performed by the local contact, field specialist, or both.
- Photograph and document potential sites and scenic vistas. Provide a set of processed 3 1/2" x 5" prints and all pertinent documentation to the field specialist for review. Retain a second set of prints for on-site review. If necessary, the exposed film can be mailed to the field specialist for processing.
- Document the selected site location(s) and scenic vista(s) on a topographic map.
- Identify and contact local landowners, primary contacts, and operators regarding site installation and routine maintenance requirements.

3.0 REQUIRED EQUIPMENT AND MATERIALS

Equipment and materials are generally required to complete the site selection process includes:

- Topographic maps of the area of interest.
- A camera and film to take photographs of the proposed site(s) and scenic vista(s).
- A list of monitoring objectives, requirements, and associated air quality monitoring equipment.

- A list of local sources affecting the air in the area of interest.
- Information about the availability of AC power and telephone service for time-lapse video monitoring, electronic transmission of digital images, and/or associated aerosol and/or optical monitoring equipment.

4.0 METHODS

This section describes site selection procedures and includes three (3) major subsections:

4.1 Locating Potential Sites
4.2 Reviewing and Selecting Potential Sites
4.3 Finalizing Site Selection

4.1 LOCATING POTENTIAL SITES

Site selection begins with the process of locating potential sites and scenic vistas in the monitoring area of interest. The following steps detail the approach:

OBTAIN SITING CRITERIA

The field specialist obtains specific siting criteria from the project manager. Siting criteria may include regional or site-specific program objectives, meteorological conditions of the monitoring area, and/or other considerations.

To assure consistent, quality data and minimize data loss, scene monitoring sites should be selected to have most or all of the following characteristics:

- Be located to photograph a highly-visited scenic vista or important scenic features of the visibility-sensitive area being monitored, viewing:
  - The longest viewing path possible.
  - North or away from direct sun angles, to minimize lens flare and overexposure.
- Include a vista encompassing the same air mass monitored by associated aerosol (particle monitors) and/or optical (nephelometer or transmissometer) instrumentation.
- Be removed from local pollution sources (e.g., vehicle exhaust, wood smoke, road dust, etc.).
- Be representative of regional (not local) visibility.
- Be secure from vandalism.
- Have available servicing personnel (operator).
- Be reasonably accessible during all months of the year.

LOCATE POTENTIAL SITES

Locate potential sites from maps and through consultation with local contacts familiar with the monitoring area of interest.

SEND SITING PACKAGE TO LOCAL CONTACT

Send the scene monitoring siting package to a local contact familiar with the proposed monitoring area. The siting package includes the following:

- A cover letter that includes a brief description of the monitoring area and associated program objectives (Figure 4-1)
- Technical Notes summarizing scenic monitoring, monitoring services provided, (Figures 4-2 and 4-3 respectively), and the camera system type to be used (i.e., automatic 35 mm camera system, digital camera system, 8 mm camera system, or SVHS time-lapse video system)
- A list of siting criteria for the camera system to be used
- A disposable 35 mm camera or a camera and roll of print film
- A Photographic Log (Figure 4-4) for summarizing selected monitoring locations and monitoring vistas

FIELD SURVEY AND SITE SELECTION DOCUMENTATION

The local contact should review the technical and monitoring requirements and identify potential sites and scenic vistas in relation to the protocols provided. Actual field surveys can be performed by the local contact, an ARS field specialist, or both.

The results of the field survey should include a series of overlapping photographs taken of each proposed vista (preferably with a 50-135 mm zoom lens). Supplemental photographs of each site location should also be provided. The location, azimuth, predominant scenic feature, and lens focal length used for each photograph should be documented on the provided Photographic Log (Figure 4-4).

Identify and record the selected site location(s) and scenic vista(s) on a topographic map of the area.

Record any pertinent information regarding accessibility, security, vista preference, available AC power or telephone service, special requirements, etc.

Return the film, Photographic Log, site location maps, and any other selection materials to ARS for final review.

CHECK RETURNED SITING PACKAGE

Check the returned scene monitoring documentation and Photographic Log for completeness. Obtain any missing information from the local contact or from initial site selection materials. Process any undeveloped film. Evaluate the photographs of each potential site. If additional photographs are required, send another camera or additional film to the local contact with instructions detailing the photographs required.

June 11, 1993

Christi Gordon
Pike/San Isabel National Forest
1920 Valley Drive
Pueblo, Colorado 81008

Dear Christi:

Under the direction of Rich Fisher, COTR, and Tamra Blett (Region 2), the **Pike/San Isabel National Forest** has appropriated funds to establish a scene (camera-only) visibility monitoring site to represent the Colorado Front Range.

Air Resource Specialists Inc. (ARS) has been contracted to provide site selection and initialization consultation during FY-93. It is my understanding that the photographic monitoring equipment for the site selected will be provided by Region 2, and that monitoring will not begin until FY-94. Let me know if this is incorrect. Once the site is operational ARS will provide all necessary operational supplies, and report all collected data. In consultation with ARS, you and your staff will be responsible for initial site selection, equipment installation, and day-to-day monitoring operations.

Attached are ARS Technical Notes 92-201 and 92-202, that describe visibility monitoring approaches and the optical, scene, and aerosol monitoring instrumentation supported by Air Resource Specialists, Inc. I have also attached a list of siting protocols for 35mm camera-based visibility monitoring for your consideration prior to Forest's initial siting trip(s). Please review and keep this information for future reference.

When considering scene monitoring, your first task is to consider all possible site installation points and scenic views that best represent the visual air quality in the vicinity of the Class I area, or area of concern. To expedite the site installation process, a panorama of photographs from each potential site should be taken. One or two photographs of the site location would also be helpful for installation configuration. Two rolls of 35mm print film are enclosed for your use. If possible, panoramas should be taken with a 35mm camera with a 135mm lens. Carefully document the type of camera and lens focal length used for each set of photos.

When all siting trips have been completed, make double prints of the film, label and identify prominent landmarks directly on the prints. Mail one set of panoramas to me for review along with a corresponding topographic map (or Xerox of a map). Retain the other set for your reference during phone conversations. Forest maps of the area(s) selected would also be appreciated.

Thank you for your interest in air quality monitoring. Please call if you have any questions or require additional information pertaining to the USFS Air Quality Monitoring Program. I look forward to working with you and your Air Resource staff in the future.

Sincerely,

Kristi Savig
Project Manager

KS:ks
cc: T. Blett (Region 2 Air Resource Manager)
cc: R. Fisher (Contracting Officer- Tech. Rep.)

Figure 4-1. Example Siting Package Cover Letter.

Air Resource Specialists, Inc.

Automatic Camera Visibility Monitoring System

Technical Note 92-202

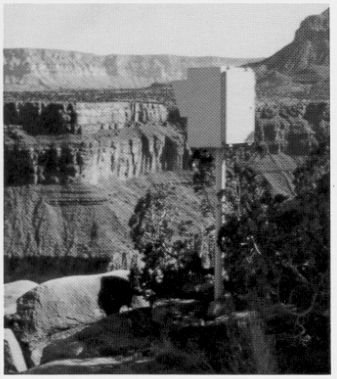

Figure 1. Automatic Camera System in a Remote Location

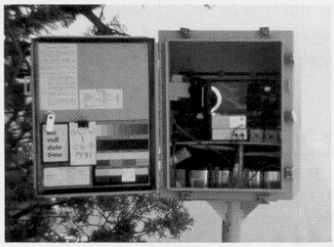

Figure 2. Station Components

Introduction

Documenting visibility events and trends is an important aspect of evaluating existing or potential impairment in Class I and other visibility sensitive areas. Photography is an efficient way to document these events and trends on a media that is a valuable analytical tool and is also easily interpreted by decision makers and the public. Self-contained, battery-powered, automatic camera visibility monitoring systems are easily installed and operated at any location. Camera-based visibility monitoring is an effective, economical component of a visibility monitoring program.

Value of Photographic Visibility Monitoring

The automatic camera visibility monitoring station takes 35mm slides of a selected vista at user-selected times throughout the day. The station can also be outfitted with an 8mm time-lapse camera to record the dynamics of visibility events. The station is self-contained and battery-powered and is easily installed, operated, and maintained.

The day-to-day variations in visual air quality captured on 35mm color slides or 8mm color movie film can be used to:

- Document how vistas appear under various visual air quality, meteorological, and seasonal conditions
- Record the frequency that various visual air quality conditions occur (e.g., incidence of uniform haze, layered haze, or weather events)
- Provide a quality assurance reference for collocated measurements
- Determine the visual sensitivity of individual areas or views to variations in ambient air quality
- Identify areas of potential impairment
- Estimate the optical properties of the atmosphere under certain conditions
- Provide quality media for visually presenting program goals, objectives, and results to decision makers and the public
- Support computer image modeling of potential impairment
- Support color and human perception research

Instrumentation

Figure 1 is a photograph of the automatic camera station in a remote mountain location. Figure 2 shows the components of a station, including a weatherproof shelter and mounting post, cameras, automatic timers, and batteries. The station can be outfitted with a variety of camera configurations, including one or two 35mm cameras or 8mm time-lapse cameras. The station is fabricated by ARS Technologies, Inc.

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Figure 4-2. Example Technical Note Summarizing ARS Scenic Monitoring.

Air Resource Specialists, Inc.

Visibility Monitoring Approaches

Technical Note 92-201

Introduction

Protection of the visibility resource in Class I wilderness areas, rural areas and urban areas is an important issue. A variety of monitoring techniques exist to document visibility conditions and to make quantitative measurements of the atmospheric properties that affect visibility. The IMPROVE Program (Interagency Monitoring of Protected Visual Environments) has partitioned visibility-related characteristics and measurements into three groups:

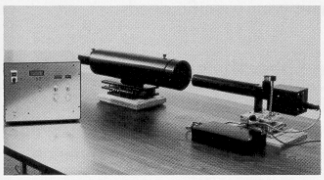
Optical: the ability of the atmosphere to scatter or absorb light passing through it. The physical properties of the atmosphere are described by extinction, scattering and absorption coefficients, plus an angular dependence of the scattering, known as the scattering phase function. Optical characteristics integrate the effects of atmospheric aerosols and gasses. Commonly applied optical monitoring instruments include transmissometers and nephelometers.

Scene: the appearance of a scene viewed through the atmosphere. Scene characteristics include observer visual range, scene contrast , color, texture, clarity and other descriptive terms. Scene characteristics change with illumination and atmospheric composition. Photographs are an effective way to document scene characteristics.

Aerosol: the physical properties of the ambient atmospheric aerosols (chemical composition, size, shape, concentration, temporal and spatial distribution and other physical properties) through which a scene is viewed. Fine particle measurements are commonly made to quantify aerosol characteristics.

The techniques most appropriately applied in a monitoring program depend on monitoring objectives and budget considerations. Air Resource Specialists, Inc. (ARS) can help you plan and develop your visibility monitoring and data analysis program. An overview of the variety of visibility-related air quality monitoring and analysis techniques supported by ARS is presented in this technical note.

Optical Monitoring



Transmissometer

ARS has been intimately involved with the development, implementation and operation of high-resolution, long-range transmissometers for visibility measurements. The Optec LPV-2 transmissometer, the only existing, operational long-range system, directly measures the ability of the atmosphere to transmit light. These measurements have an exact relationship to the total atmospheric extinction coefficient. ARS has developed the installation and operational protocols for the system and has installed and operated over 25 systems in class I areas and urban environments. ARS has also developed transmissometer analysis protocols and programs and provides a full range of system calibration and maintenance services. ARS is the recognized leader in transmissometer applications for visibility. A more complete description of transmissometer systems is provided in ARS Technical Note 92-204.

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Figure 4-3. Example Technical Note Summarizing ARS Air Quality Monitoring Services.

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Site Ventana Wilderness

Roll # 1

PHOTOGRAPHIC LOG

EXPOSURE NUMBER	DATE	TIME	DESCRIPTION/COMMENTS
			All photographs were shot with a 50 mm lens on a 35 mm camera.
From Figueroa Lookout:			
1	8/9/93	9:30 am	Guy Mountain (approx. 20 km, 21°)
2	8/9/93	9:30 am	Peak Mountain (approx. 20 km, 33°)
3	8/9/93	9:30 am	Hill 3690 (approx. 10 km, 70°)
4	8/9/93	9:30 am	Samon (approx. 31 km, 93°)
From Anderson Peak:			
1	8/12/93	1:50 pm	Ventana Cone (4727', 344°)
2	8/12/93	1:50 pm	Ventana Vista (333° - 3°)
3	8/12/93	1:50 pm	Ventana Vista
4	8/12/93	1:50 pm	Ventana Vista
5	8/12/93	1:50 pm	Anderson River Drainage (60°)

(2.13 3/93)

Figure 4-4. Example Photographic Log.

4.2 REVIEWING AND SELECTING POTENTIAL SITES

The siting package for potential sites must be reviewed to determine if any of the potential scenic vistas and their associated monitoring sites are acceptable. The following criteria should be used to evaluate the suitability of a potential site:

EVALUATE SITE SUITABILITY

- Overall monitoring criteria defined by the program manager
- Vista contains important scenic features of the area to be monitored
- Vista contains the same air mass monitored by associated aerosol and/or optical instrumentation (where applicable)
- Year-round site operator accessibility
- Availability of AC power for time-lapse video systems.
- Availability of telephone service for digital camera electronic transmission of captured images.
- Availability of a reliable site operator
- Environmental considerations (e.g., snow depth, temperature extremes, precipitation type and amount, relative humidity, etc.) that could affect camera operations or site accessibility
- Security from potential vandalism
- Locations of obstructions or interferences
- Influence of local pollution sources
- Viewing angle(s) in relation to the sun
- Type and location of any collocated instrumentation
- Local land manager or land owner cooperation
- Ease of installation, including distance to nearest town

SELECT BEST SITE

In consultation with the local contact, select the best site based on the results of the evaluation and pertinent on-site comments. Compromises may be required.

- Provide selected site description, map, and vista photograph to the project manager for final review and approval.

4.3 FINALIZING SITE SELECTION

After evaluating potential sites and selecting the most appropriate site, the following actions are required to finalize the site selection:

- Obtain approval of the selected site from the project manager.

- As required, the final site selection and related information are presented to the program manager and/or the project-specific COTR for final review and approval.

- Provide a detailed description of the selected site, scenic vista, lens focal length, method of installation, and proposed installation schedule to the property manager and selected site operator.

- Obtain permission to use the site and to arrange for any site preparation from the property manager, land manager (public lands), or land owner (private lands).

- Initiate installation protocols as described in SOP 4075, *Installation and Site Documentation for Scene Monitoring Equipment*.

- Enter all site location, scenic vista, and site operator contact information in the site-specific Quality Assurance Database.