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TITLE	<b>SITE SELECTION FOR OPTICAL MONITORING EQUIPMENT (IMPROVE PROTOCOL)</b>
TYPE	<b>STANDARD OPERATING PROCEDURE</b>
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## 1.0 PURPOSE AND APPLICABILITY

This standard operating procedure (SOP) outlines site selection criteria for optical monitoring instruments operated according to IMPROVE Protocol. Documented site selection criteria and procedures assure consistent, quality data at sites that exhibit most or all of the following characteristics:

- Be located in an area representative of the air mass to be monitored
- Be removed from local pollution sources (e.g., vehicle exhaust, wood smoke, road dust, etc.)
- Have telephone lines and AC power or solar exposure available
- Allow for proper orientation of nephelometer sample inlet
- Be close to an existing aerosol monitoring station or other instruments that are being used to monitor the air mass of interest
- Be representative of the same air mass measured by associated aerosol (particle monitors) and scene (camera) instrumentation
- Have a clear, unobstructed sight path between the transmissometer components
- 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

The two (2) types of optical monitoring instruments currently operating in the IMPROVE monitoring network are Optec NGN-2 ambient nephelometers and Optec LPV-2 transmissometers. Additional, detailed instrument-specific site characteristic criteria are described in the following technical instructions (TIs):

- TI 4050-3000 *Site Selection for Optec NGN-2 Nephelometer Systems*
- TI 4050-3010 *Site Selection for Optec LPV-2 Transmissometer Systems*

This SOP serves as a guideline to facilitate the following:

- 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 optical monitoring site.
- As required, review the selected site with the project manager and the project-specific Contracting Officer's Technical Representative (COTR).

### **2.2 PROJECT MANAGER**

The project manager shall:

- Prepare 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 based on the criteria outlined in the appropriate instrument-specific technical instructions (TIs).
- 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 pertinent siting criteria and associated materials to the local contact.
- Conduct a siting visit if required (always required for transmissometer sites).
- Contact the local power and telephone companies for information concerning availability and installation.
- 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.
- Obtain permits or Environmental Impact Statements if required.
- Work with the local contact or 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:

- Locate and document potential sites upon receiving the siting criteria and associated materials from the field specialist.
- Provide the field specialist with any pertinent site-related information.
- Assist the field specialist in obtaining any site access and/or installation-related clearances or permissions.

## 3.0 REQUIRED EQUIPMENT AND MATERIALS

The following equipment and materials are generally required to complete the site selection process:

- Topographic maps of the area of interest
- Camera(s) to photograph the proposed site and area
- A list of monitoring objectives, requirements, and associated IMPROVE Protocol 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
- A Photographic Log
- Nephelometer sitings:
  - An Optec NGN-2 Nephelometer Siting Information Form
  - Installation Site Photographs and Drawing Instructions
- Transmissometer sitings:
  - Brunton compass
  - Transmitter telescope unit with tripod
  - Tape measure
  - Signal mirrors
  - Binoculars
  - Shelter option diagrams
  - Solar panel array installation configuration diagrams

## **4.0 METHODS**

This section describes site selection procedures and includes two (2) major subsections:

- 4.1 Nephelometer Site Selection Methods
- 4.2 Transmissometer Site Selection Methods

### **4.1 NEPHELOMETER SITE SELECTION METHODS**

#### **4.1.1 Locating Potential Sites**

- Obtain siting and monitoring objective criteria from the project manager.
- Locate potential sites using maps and through consultation with the local contact(s).
- Send siting package to the local contact.
- Perform a field survey, document site selection with photographs and maps, and collect information about site accessibility, security, and special requirements.
- Check returned siting package for completeness.

#### **4.1.2 Reviewing and Selecting Potential Sites**

- Evaluate potential sites after review of the siting information.
- Select the best site.

#### **4.1.3 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.
- Obtain approval from the program manager.
- If required, obtain approval from the project-specific COTR.
- Provide a detailed description of the proposed installation to the local contact and property manager.
- Obtain permission for site use and any site preparation.
- Complete permits or Environmental Impact Statements if required.
- Initiate installation protocols as described in TI 4070-3000, *Installation of Optec NGN-2 Nephelometer Systems (IMPROVE Protocol)* and TI 4070-3001, *Site Documentation for Optec NGN-2 Nephelometer Systems*.

## **4.2 TRANSMISSOMETER SITE SELECTION METHODS**

### **4.2.1 Siting Criteria**

Criteria that must be considered when siting a transmissometer system are:

- Sight path (height above ground, length, vertical angle, and azimuth)
- Air mass (the air mass along the sight path must be representative of the regional air mass)
- Location characteristics (of the individual transmissometer transmitter and receiver stations)
- Selection of appropriate shelters and solar panel arrays (solar-powered sites)

### **4.2.2 Locating Potential Sites**

- Obtain siting and monitoring objective criteria from the project manager.
- Locate potential sites using maps and through consultation with the local contact(s).
- Send siting package to the local contact.
- Perform a field survey, document site selection with photographs and maps, and collect information about site accessibility, security, and special requirements.
- Check returned siting package for completeness.
- Make a preliminary evaluation of the proposed sites.
- Schedule a siting trip and coordinate with the site operator.
- Determine the need for any clearances and document related information.
- Gather additional information and evaluate potential sites.

### **4.2.3 Reviewing and Selecting Potential Sites**

- Evaluate potential sites after review of the siting information and site visit.
- Select the best site.

### **4.2.4 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.
- Obtain approval from the program manager.



- If required, obtain approval from the project-specific COTR.
- Provide a detailed description of the proposed installation to the local contact and property manager.
- Obtain permission for site use and any site preparation.
- Complete permits or Environmental Impact Statements if required.
- Initiate installation protocols as described in TI 4070-3010, *Installation and Site Documentation of Optec LPV-2 Transmissometer Systems (IMPROVE Protocol)*.

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## 1.0 PURPOSE AND APPLICABILITY

This technical instruction (TI) describes site selection requirements for Optec NGN-2 nephelometer systems to be operated according to IMPROVE Protocol. The purpose of documented site selection requirements and procedures is to assure consistent quality data capture and minimize data loss by selecting a site that exhibits all or most of the following characteristics:

- Be located in an area representative of the air mass to be monitored
- Be removed from local pollution influences and away from obstructions that could affect the air flow in the area of the instrument
- Have AC power or solar power potential, and telephone lines or cellular communications available
- Allow for orientation of the nephelometer sample inlet towards true north
- Be representative of the same air mass measured by associated aerosol (particle monitors) and scene (camera) instrumentation
- Meet the same criteria used to site particle samplers, including:
  - Have a distance from the instrument to the nearest obstruction greater than 2.5 times the difference in heights of the instrument and the obstruction
  - Be representative of regional (not local) visibility
  - Be removed from local pollution influences (e.g., vehicle exhaust, wood smoke, road dust, etc.)
- Be secure from vandalism
- Have available servicing personnel (operator)
- Be reasonably accessible during all months of the year

This TI serves as a guideline to facilitate the following:

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

Due to variation in the site configuration of IMPROVE Protocol sites, portions of this TI may not apply to every station.

## **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 nephelometer site.
- As required, review the selected site with the project manager and the project-specific Contracting Officer's Technical Representative (COTR).

### **2.2 PROJECT MANAGER**

The project manager shall:

- Prepare 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 nephelometer station based on the criteria described in this TI.
- Review the selected site with the program manager.

### **2.3 FIELD SPECIALIST**

The field specialist shall:

- Initiate the search for potential sites by sending pertinent siting criteria and associated materials to the local contact.
- Contact the local power and telephone companies for information concerning availability and installation of AC power and telephone service.
- Obtain permission to perform any site preparation that may be required.
- Obtain permission from private or public landowners for permanent access to the nephelometer station.
- Obtain permits or Environmental Impact Statements if required by the property manager.
- Contact the existing site operator or arrange for a new site operator to service the station.
- 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:

- Locate and document potential sites upon receiving the siting criteria and associated materials from the field specialist.
- Provide the field specialist with any pertinent site-related information.
- Assist the field specialist in obtaining any site access and/or installation-related clearances or permissions.

## **3.0 REQUIRED EQUIPMENT AND MATERIALS**

The following equipment and materials are generally required to complete the site selection process:

- Topographic maps of the area of interest
- Camera(s) to photograph the proposed site and area
- A list of monitoring objectives, requirements, and associated IMPROVE Protocol 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
- An Optec NGN-2 Nephelometer Siting Information Form
- Installation Site Photographs and Drawing Instructions
- A Photographic Log

## **4.0 METHODS**

This section describing site selection criteria and 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 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.

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 nephelometer 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.
- An Optec NGN-2 Nephelometer Siting Information Form (Figure 4-1).
- A disposable 35 mm camera or a digital camera.
- Installation Site Photographs and Drawing Instructions (Figure 4-2).
- A Photographic Log (Figure 4-3).

FIELD SURVEY AND SITE  
SELECTION  
DOCUMENTATION

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

The field survey results should include a series of photographs of the area. Photographs of each site location should also be provided. The location, azimuth, and predominant scenic features should be documented on the provided Photographic Log.

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

Record any pertinent information regarding accessibility, security, special requirements, etc.

Return the camera or photographic images, Photographic Log, site location maps, and any other selection materials to ARS for final review.

CHECK RETURNED  
SITING PACKAGE

Check the returned nephelometer siting forms for completeness. Obtain any missing information from the local contact. Evaluate the photographs of each potential site. If additional photographs are required, send another camera to the local contact with instructions detailing the photographs required.



**OPTEC NGN-2 NEPHELOMETER  
SITING INFORMATION FORM**

Site Name: \_\_\_\_\_  
Your Name: \_\_\_\_\_  
Mailing Address: \_\_\_\_\_  
\_\_\_\_\_  
UPS Shipping Address (cannot be P.O. Box): \_\_\_\_\_  
\_\_\_\_\_  
Telephone: \_\_\_\_\_ Fax: \_\_\_\_\_

Associated Land  
Management Unit  
(Park, Forest, etc.): \_\_\_\_\_

**Contacts**

Primary Contact: \_\_\_\_\_ Telephone: \_\_\_\_\_  
Secondary Contact: \_\_\_\_\_ Telephone: \_\_\_\_\_  
Area Supervisor/Title: \_\_\_\_\_ Telephone: \_\_\_\_\_

Comments: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

IMPROVE Aerosol Sampler Location (if existing): \_\_\_\_\_  
Access to the Site (road type, gates/locks, vehicle requirements): \_\_\_\_\_  
\_\_\_\_\_

Elevation: \_\_\_\_\_  
Topographic Map Name (7.5" or other appropriate scale): \_\_\_\_\_

(If possible, make a photocopy of the portion of the map that includes the site and return it with this form.)

Is a Telephone Available Nearby? (distance?): \_\_\_\_\_  
Nearest Telephone Pole #, Box #, or Telephone #: \_\_\_\_\_  
Is AC Power Readily Available? (distance?): \_\_\_\_\_  
Quality of AC Power/Outages: \_\_\_\_\_  
Describe Ground or Tower Mounting Surface: \_\_\_\_\_  
Average/Max. Snow Depth at Proposed Site: \_\_\_\_\_  
Do Local Sources of Haze/Smoke Exist? (e.g., a cabin that burns wood): \_\_\_\_\_  
\_\_\_\_\_  
Distance from Local Sources: \_\_\_\_\_  
Potential for Vandalism: \_\_\_\_\_

Figure 4-1. Optec NGN-2 Nephelometer Siting Information Form.

**OPTEC NGN-2 NEPHELOMETER  
SITING INFORMATION FORM**

Power Company: Name: \_\_\_\_\_  
Contact: \_\_\_\_\_  
Address: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
Telephone: \_\_\_\_\_

Telephone Company: Name: \_\_\_\_\_  
Contact: \_\_\_\_\_  
Address: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
Telephone: \_\_\_\_\_

Other information (Is there any additional information that will help with the installation?):  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Mail Form to:

Air Resource Specialists, Inc.  
1901 Sharp Point Drive, Suite E  
Fort Collins, Colorado 80525  
Telephone: 970/484-7941  
Fax: 970/484-3423

Figure 4-1. (Continued). Optec NGN-2 Nephelometer Siting Information Form.

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## **INSTALLATION SITE PHOTOGRAPHS AND DRAWING INSTRUCTIONS**

1. Complete the attached log sheet to document all siting and installation photographs taken. Disposable or digital cameras should be returned to ARS. ARS will develop the film or download the images.

Suggested photographs include:

- a. General Area - photographs of the proposed area from various angles and distances.
  - b. Proposed location for the nephelometer support tower.
  - c. AC line power receptacle in relation to proposed nephelometer installation.
  - d. Telephone access in relation to proposed nephelometer installation.
  - e. Air quality or meteorological monitoring equipment (located nearby).
  - f. Any additional photographs you feel would be beneficial in preparing for the system installation.
  - g. Be sure to document each photograph on the Photographic Log (see Figure 4-3).
2. Make a sketch of the proposed installation site (note true north). List approximate dimensions for buildings, fenced compounds, etc. Note the distance to and height of the nearest obstructions. If possible, include a copy of a topographic map with the site indicated. Note any additional information you believe relevant or important on the sketch or on the back of the sketch.
- 

Figure 4-2. Installation Site Photographs and Drawing Instructions.



## 4.2 REVIEWING AND SELECTING POTENTIAL SITES

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

### EVALUATE THE SUITABILITY

- Overall monitoring criteria defined by the program manager
- Availability, reliability, and cost of AC power and telephone service
- Year-round site operator accessibility
- Availability of a reliable site operator
- Environmental considerations (e.g., snow depth, temperature extremes, precipitation type and amount, relative humidity, etc.) that could require deviations from the standard station configuration
- Security from potential vandalism
- Locations of obstructions or interferences
- Influence of local pollution sources
- 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

Select the best site based on the results of the evaluation. Compromises may be required. Provide the selected site description, map, and photographs 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, nephelometer station configuration, and method of installation to the property manager.

- Obtain permission to use the site and arrange for any site preparation from the property manager, land manager (public lands), or land owner (private lands).
- Compile permits or Environmental Impact Statements (EISs) if required by the property manager.
- Initiate installation protocols as described in TI 4070-3000, *Installation of Optec NGN-2 Nephelometer Systems (IMPROVE Protocol)* and TI 4070-3001, *Site Documentation for Optec NGN-2 Nephelometer Systems*.