Air Resource Specialists, Inc.
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QUALITY ASSURANCE/QUALITY CONTROL DOCUMENTATION SERIES	
TITLE	**SCENE MONITORING ARCHIVES**
TYPE	**STANDARD OPERATING PROCEDURE**
NUMBER	**4610**
DATE	**SEPTEMBER 1993**

AUTHORIZATIONS		
TITLE	NAME	SIGNATURE
ORIGINATOR	Betsy Davis-Noland	
PROJECT MANAGER	James H. Wagner	
PROGRAM MANAGER	David L. Dietrich	
QA MANAGER	Gloria S. Mercer	
OTHER		

REVISION HISTORY			
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OTHER		

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1.0 PURPOSE AND APPLICABILITY

This standard operating procedure (SOP) is a guide to archiving and maintenance of scene visibility monitoring photographic film, digital data, and support documentation.

Documenting visibility events and trends is an important aspect of evaluating existing or potential impairment in 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, battery-powered, automatic camera visibility monitoring systems are easily installed and operated at any location. Camera-based visibility monitoring, referred to as scene monitoring by the IMPROVE Program, is an effective, economical component of any visibility monitoring program.

Day-to-day variations in visual air quality captured on 35 mm color photographic slides, 8 mm color movie film, or digital images 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 computer image modeling of potential impairment.
- Support color and human perception research.

The following separate technical instructions (TIs) provide detailed information regarding scene monitoring archiving:

- TI 4610-5000 *35 mm Photographic Slide Archives*
- TI 4610-5010 *8 mm Time-Lapse Film Archives*
- TI 4610-5020 *Slide Spectrum Archives*
- TI 4610-5030 *Photographic-Based Teleradiometric Data Archives*
- TI 4610-5040 *Digital Camera Image and Data Archives*

2.0 RESPONSIBILITIES

2.1 PROJECT MANAGER

The project manager shall:

- Ensure that archives are accessible, orderly, complete, and current.
- Inform the data archivist when seasonal data have been finalized and reported and are ready to be archived.
- Document and distribute duplicate archive tapes to off-site locations.

2.2 DATA TECHNICIAN

The data technician shall:

- Place 35 mm slides and accompanying documentation in folders.
- File the slides in file cabinets by site and season.
- File 8 mm time-lapse film in storage cabinets by site and roll number.
- Maintain additional support documentation in file cabinets.
- Create an archive of digital images and data on a personal computer and CD-ROMs.

2.3 SITE OPERATOR

The site operator shall:

- Mail filled memory cards from remote digital systems and accompanying documentation to ARS.
- Create an archive of digital images and data from the on-site computer.
- Ship a copy of the archive to ARS.

2.4 DATA ARCHIVIST

The data archivist shall:

- Obtain and compile ASCII data to be archived as directed by the project manager.
- Perform periodic archives.
- Maintain data archive records.

3.0 REQUIRED EQUIPMENT AND MATERIALS

3.1 35 MM FILM STORAGE

The 35 mm slide archives are designed to allow accessibility and to maintain maximum film quality for the life of the film. Equipment and materials used include:

- 35 mm photographic slides
- Polyethylene slide protector sheets
- Manila file folders
- Hanging file folders
- Standard file cabinets

3.2 8 MM FILM STORAGE

Equipment and materials used for 8 mm film storage include:

- 8 mm film rolls
- VHS videotape (if applicable)
- Storage boxes (3.5" computer diskette storage boxes)
- Metal storage cabinets with adjustable shelves

3.3 SUPPORTING HARD COPY DOCUMENTATION

Equipment and materials used for maintaining photographic documentation archives include:

- Three-ring notebooks
- Manila file folders
- Hanging file folders
- Standard file cabinets
- Plastic magnetic tape holders
- Storage cabinets
- Slide Coding Log Sheets
- Visibility Monitoring Status/Assessment Sheets
- Master Logs
- Miscellaneous hard copy documentation

3.4 DIGITAL ARCHIVES

Scene monitoring archives of slide-derived digital data are performed on IBM-PC compatible systems. The required computer system components include the following:

- IBM compatible 386/486 computer system with VGA and minimum 80 megabyte hard disk
- Hewlett Packard Jetstore 6000 Digital Audio Tape Drive
- 4 mm DAT cartridges
- Cheyenne Software's ARCserve program
- WordPerfect software
- HP Laserjet printer

3.5 DIGITAL IMAGE AND DATA STORAGE

Equipment and materials used for digital image and data storage:

- Camera memory cards (remote digital camera systems)
- Memory card reader
- Internet connection
- CD-ROMs
- CD-writer software
- Personal computer with CD drive

4.0 METHODS

This section includes three (3) subsections:

4.1 Photographic Image Archives
4.2 Electronic File Archives
4.3 Supporting Documentation Archives

These subsections describe the procedures for archiving scene monitoring products and digital data. Archiving of film and support documentation is performed continually. Archiving of images and associated data from digital camera systems is performed monthly. Archiving of electronic files is performed on a seasonal basis, after data have been finalized and reported.

4.1 PHOTOGRAPHIC IMAGE ARCHIVES

Scene monitoring products consist of 35 mm photographs, 8 mm time-lapse film, videotape, or digital image files. Specific TIs noted in Section 1.0 will detail the procedures used for image archives.

4.2 ELECTRONIC FILE ARCHIVES

Digital images and camera system operation files from remote digital camera systems are extracted from memory cards and are archived to a PC and CD-ROM. Digital images from high-resolution digital camera systems are downloaded from Web servers via the Internet or from the system's on-site PC. Images, an error file, and the configuration file are archived to CD-ROM. Files from both these systems are archived on a monthly basis. Refer to TI 4610-5040, *Digital Camera Image and Data Archives* for detailed archive procedures.

Through the Fall 1993 season, scene monitoring digital data files from 35 mm slide analysis include quantitative slide data in the form of raw teleradiometric data (.SLD files) and processed teleradiometric data (.SVR files). In December 1994 the IMPROVE Program chose to no longer support quantitative estimates of standard visual range derived by slide-based densitometry (teleradiometric methods). Beginning with the Winter 1994 season, the following digital file types exist in relation to photographic-based quantitative or qualitative-only data requested:

- .SLD files - contain qualitative slide code data and raw densitometry (teleradiometric) data.
- .SVE files - contain processed teleradiometric data and associated uncertainty ranges in standard visual range units.
- .EXT files - contain processed teleradiometric data and associated uncertainty ranges in atmospheric extinction units.
- .SQO files - contain only qualitative scene monitoring slide code data.

ASCII files are produced for each season for each site. Archiving of all raw and processed data for a given season is performed on a seasonal basis, after data have been finalized and reported. Files are stored in the original format (non-compressed) on magnetic tape. Refer to TI 4610-5030, *Photographic-Based Teleradiometric Data Archives*, for detailed procedures used for computer archives.

4.3 SUPPORTING DOCUMENTATION ARCHIVES

Supporting documentation includes Slide Coding Log Sheets, Photographic Visibility Monitoring Status/Assessment Sheets, Master Logs, and correspondence or other miscellaneous documentation. Specific TIs as noted in Section 1.0 will detail the procedures used for these hardcopy archives.

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QUALITY ASSURANCE/QUALITY CONTROL DOCUMENTATION SERIES	
TITLE	**35 MM PHOTOGRAPHIC SLIDE ARCHIVES**
TYPE	**TECHNICAL INSTRUCTION**
NUMBER	**4610-5000**
DATE	**NOVEMBER 1993**

AUTHORIZATIONS		
TITLE	NAME	SIGNATURE
ORIGINATOR	Gloria S. Mercer	
PROJECT MANAGER	James H. Wagner	
PROGRAM MANAGER	David L. Dietrich	
QA MANAGER	Gloria S. Mercer	
OTHER		

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QUALITY ASSURANCE/QUALITY CONTROL DOCUMENTATION SERIES	
TITLE	**35 MM PHOTOGRAPHIC SLIDE ARCHIVES**
TYPE	**TECHNICAL INSTRUCTION**
NUMBER	**4610-5000**
DATE	**NOVEMBER 1993**

AUTHORIZATIONS		
TITLE	NAME	SIGNATURE
ORIGINATOR	Gloria S. Mercer	
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PROGRAM MANAGER	David L. Dietrich	
QA MANAGER	Gloria S. Mercer	
OTHER		

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1.0 PURPOSE AND APPLICABILITY

This technical instruction (TI) is a guide to the archiving and maintenance of 35 mm color photographic slides. This TI is referenced in Standard Operating Procedure 4610, *Scene Monitoring Archives*, and specifically describes all archive procedures associated with photographic slides.

2.0 RESPONSIBILITIES

2.1 PROJECT MANAGER

The project manager shall ensure that archives are accessible, orderly, complete, and current.

2.2 DATA TECHNICIAN

The data technician shall:

- Place 35 mm slides and accompanying documentation in folders.
- File the slides in file cabinets by site and season.
- Maintain additional support documentation in file cabinets.

3.0 REQUIRED EQUIPMENT AND MATERIALS

The 35 mm slide archives are designed to allow accessibility and to maintain maximum film quality for the life of the film. Equipment and materials used include:

- 35 mm photographic slides
- Polyethylene slide protector sheets
- Slide Coding Log Sheets
- Visibility Monitoring Status/Assessment Sheets
- Master Logs
- Miscellaneous hard copy documentation
- Manila file folders
- Hanging file folders
- Standard file cabinets

4.0 METHODS

This section includes three (3) subsections:

4.1 Physical Film Archives
4.2 Supporting Hard Copy Documentation Archives
4.3 Photographic Digital Data Archives

4.1 PHYSICAL FILM ARCHIVES

All 35 mm slides are labeled by site and slide number and stored chronologically in polyethylene slide sheets (such as Vue-all Slide Saver sheets). Slides for each film roll are placed in a manila file folder, along with a Slide Coding Log Sheet and the corresponding Visibility Monitoring Status/Assessment Sheet. Refer to TI 4305-4000, *Collection, Processing, and Handling of 35 mm Slide Film*, for detailed handling and labeling procedures. The manila folders for each site are labeled with the site abbreviation, roll number, and slide numbers (e.g., GRCA 148 1593-1613), then placed in hanging folders for each season. The hanging folders are placed in standard file cabinets chronologically, by season. Standard monitoring seasons are:

Winter	(December, January, and February)
Spring	(March, April, and May)
Summer	(June, July, and August)
Fall	(September, October, and November)

4.2 SUPPORTING HARD COPY DOCUMENTATION ARCHIVES

Supporting hard copy documentation for 35 mm slides includes the Visibility Monitoring Status/Assessment Sheets, Slide Coding Log Sheets, Master Logs, and data coordinator/operator correspondence. The Visibility Monitoring Status/Assessment Sheets and Slide Coding Log Sheets are filed with the corresponding 35 mm slides in the manila folder. Refer to TI 4305-4000, *Collection, Processing, and Handling of 35 mm Slide Film*, for detailed documentation procedures. All other supporting documentation is stored in hanging file folders in standard file cabinets, in chronological order by site.

4.3 PHOTOGRAPHIC DIGITAL DATA ARCHIVES

Digital data produced from 35 mm photographic slides (qualitative condition codes, slide contrast values, and standard visual range values) are archived as detailed in TI 4610-5030, *Photographic-Based Teleradiometric Data Archives*.

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QUALITY ASSURANCE/QUALITY CONTROL DOCUMENTATION SERIES	
TITLE	**HISTORICAL SLIDE SPECTRUM ARCHIVES**
TYPE	**TECHNICAL INSTRUCTION**
NUMBER	**4610-5020**
DATE	**NOVEMBER 1999**

AUTHORIZATIONS		
TITLE	NAME	SIGNATURE
ORIGINATOR	Kristi Savig	
PROJECT MANAGER	James H. Wagner	
PROGRAM MANAGER	David L. Dietrich	
QA MANAGER	Gloria S. Mercer	
OTHER		

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LIST OF FIGURES

LIST OF FIGURES (CONTINUED)

1.0 PURPOSE AND APPLICABILITY

In 1995, the IMPROVE (Interagency Monitoring of Protected Visual Environments Steering Committee formed a consensus that five years of scene monitoring at a location where visual air quality is not rapidly changing yields sufficient examples of most visual air quality conditions. To secure a representative set of observed air quality conditions, a series of slides for each site is selected from the visibility database and archived on CD-ROM. The series of slides making up this historical archive (spectrum) consists of clear sky slides that represent the range of visibility conditions observed at the site during the morning and afternoon hours, a selection of the cleanest clear sky slides to represent pristine conditions for each monitoring season, specific slides that show the most scenic views of the vista during the historical monitoring period, and selected visibility events.

The total number of slides selected for each site depends on the vista, the variability in visual air quality at the monitoring location, the period of monitoring, and completeness of the slide database. All historical slide spectrums are reproduced digitally on photo-CD, by site, to yield a long-term digital storage media. A master CD is produced for each site containing all photo-CD images as well as graphic images of the monitoring location, descriptions of the site and historical monitoring period, and plots, tables, and/or data listings of data collected at the site. Multiple copies of the master CD are produced as needed.

The 35 mm historical spectrum archives are produced to provide a representative set of historical photographic data that can be maintained at maximum archive quality for many years beyond the life of the original 35 mm film. The CD-ROM archive medium was chosen to provide end-users convenient access to the historical archive without any loss in image quality (first generation duplication).

This technical instruction (TI) is a guide to archiving 35 mm color photographic slides and associated graphic and data presentations in the form of historical slide spectrums. This TI is referenced in Standard Operating Procedure 4610, *Scene Monitoring Archives*, and specifically describes all archive procedures associated with producing a historical 35 mm slide archive.

2.0 RESPONSIBILITIES

2.1 PROJECT MANAGER

The project manager shall:

- Determine the COTR's (Contracting Officer's Technical Representative) project-specific archive and distribution requirements.
- Oversee the slide selection process, review all spectrum series and selections prior to permanent archive.
- Coordinate with the data technician and secretary to oversee the preparation of associated graphic and data presentations, and the production of master CD-ROMs.
- File and maintain all support documentation.
- Verify that completed master CD-ROMs are properly distributed.
- Archive and maintain all original historical slide series.

2.2 DATA TECHNICIAN

The data technician shall:

- Review all photographic slides available from each site and create a subset of all initial historical spectrum selections from the 35 mm film archive.
- Compile a series of morning and afternoon spectrums, pristine, scenic, layered hazes, etc., for the project manager's review.
- Scan and estimate contrast values for each slide in the morning and afternoon spectrum series.
- Compile all historical monitoring specifications and graphic data as required.
- Coordinate with the project manager and secretary for the preparation of monitoring location site descriptions and historical photographic monitoring specifications.
- Verify that all unused original slides are properly returned to the 35 mm slide archives (as described in TI 4610-5000, *35 mm Photographic Slide Archives*.

2.3 SECRETARY

The secretary shall:

- Coordinate with the project manager and data technician for complete documentation information, format, and word processing procedures.
- Word process all graphic and tabular materials into a final document.
- Produce final documents in Portable Digital Format (.PDF) for archive to CD-ROM.

3.0 REQUIRED EQUIPMENT AND MATERIALS

The slide spectrums are taken to a photographic dealer for production onto CD-ROMs. Equipment and materials needed to select spectrum slides include:

- 35 mm photographic slides
- Slide Coding Log Sheets
- Visibility Monitoring Status/Assessment Sheets
- Master Logs
- Historical photographic data request correspondence
- Polyethylene slide protector sheets
- Light table
- Hand-held lens

Equipment and materials used to compile historical monitoring specifications and associated graphic and data presentations include:

- Photographic site and target specifications
- U.S.G.S. topographic maps
- ARS Monitoring History Database records
- IMPROVE historical aerosol total reconstructed extinction data
- Windows-based personal computer with the following system requirements:
  - x86-based personal computer (486DX minimum, Pentium, or Pentium Pro recommended), CD-ROM drive, 8-bit SVGA graphics card
  - Microsoft Windows 3.1, Microsoft Windows for Workgroups, Microsoft Windows 95, or Microsoft Windows NT 3.51 or 4.0
  - Adobe Acrobat 3.01 or better (including Acrobat Exchange and Acrobat Reader), Kodak QuickSolve Browser, Microsoft Word, Lotus WordPro, and Microsoft Excel
  - 8 MB application RAM
  - 5 MB hard disk space, plus 7 MB additional temporary disk space available during installation
  - True Color (32-bit) display and 2 MB video RAM recommended for optimal viewing
- Polaroid SprintScan 35/LE Scanner
- PolaColor Insight scanning software
- ARS software OLDHAZE.EXE (image haze simulation for windows)
- ARS software CONTRAST.EXE

4.0 METHODS

Historical slide spectrum archives are produced on CD-ROM, and contain, for each monitoring site:

- Morning and afternoon spectrum slides
- Pristine slides
- Scenic view and visibility events slides
- Monitoring site specifications
- Visibility conditions summary and cumulative frequency statistics

This section includes four (4) subsections:

4.1 Selecting Slides for the Historical Spectrum
4.2 Creating Other Materials Included With the Spectrum
4.3 Producing the CD-ROM
4.4 Archiving Spectrum Materials

4.1 SELECTING SLIDES FOR THE HISTORICAL SPECTRUM

To secure a representative set of observed air quality conditions, a series of slides for each site is selected from the visibility database and archived on CD-ROM. The slide series comprising this historical archive (spectrum) consists of:

- Clear sky slides that represent the range of visibility conditions observed at the site during the morning and afternoon hours.
- Pristine condition clear sky slides to serve as masters for computer imaging or modeling applications (WinHaze, 1997).
- Scenic views and meteorological conditions observed during the historical monitoring period.
- Selected visibility events regardless of illumination conditions such as layered hazes (surface and elevated), coherent plumes, and intense visibility degradation associated with fires, meteorology, or pollution episodes.

The total number of slides selected for each site depends on the vista, the variability in visual air quality at the monitoring location, the period of monitoring, and completeness of the slide database.

4.1.1 Review of Photographic Visibility Database and Initial Slide Selections

All 35 mm color slides in the entire archive of each site and vista are reviewed. This archive usually includes slides for at least 5 years of monitoring at three times a day.

4.1.1.1 Morning and Afternoon Clear Sky Selections

Clear sky slides that represent range of visibility conditions observed at a site during the morning and afternoon hours are selected and categorized using the following criteria:

- Only clear sky slides are selected. Predominant clouds, layered haze, or fog layers should not be evident in the photographs.
- Slide exposure must be reasonable. No extremely overexposed or underexposed slides are selected for the spectrum.
- Slide exposure and scenic color must be consistent.
- Slides should be properly aligned on the selected vista. Slides where the vista is extremely off-center, or out-of-alignment should not be selected.
- If possible to determine, no slide should contain a precipitation/weather-related event or total domination of the scene by precipitation/weather.
- Slides should represent a time of day with the most consistent exposure and adequate number of clear-sky events to choose from, preferably 0900 and 1500.

Selected slides are grouped according to observation time period and consistent exposure and alignment. No more than three groupings are compiled for any time period. Each grouping is arranged, by eye, in order of best to worst visual air quality. Grouped slides are then placed in polyethylene slide protector sheets for the project manager's review and slide spectrum analysis.

Selecting an incremental series of slides consistent in composition, time of day, and exposure can be difficult due to the limited amount of data available, variable nature of meteorology, associated lighting, and film response conditions. Most visibility spectrums for the western United States consist of 10-20 slides each. Spectrums for eastern U.S. sites typically consist of 8-15 slides each.

4.1.1.2 Pristine Selections

Clear sky slides to represent pristine conditions for one or more monitoring seasons are selected in the same manner as above. An effort is made to select the cleanest of the cleanest slides to represent one or more time periods (i.e., 0900, 1200, 1500). Pristine slides often serve as the basis for image-processing and/or modeling applications such as WinHaze - Level 1 Visual Air Quality Modeler.

4.1.1.3 Scenic and Visibility Event Selections

In addition to clear sky images, slides are also selected for the historical spectrum to represent unique scenic conditions and dynamic visibility events and/or episodes. Scenic selections often include scenic qualities such as interesting cloud formations, seasonal color, or storms. Visibility event and episode selections often include layered haze, plumes, intense regional hazes, as well as periods of ongoing dynamic visibility impairment that has occurred at the site. The final number of slides selected to represent scenic and visibility events is quite variable. Most historical spectrums contain 10-30 slides in this category.

4.1.2 Slide Spectrum Analysis

4.1.2.1 History of Slide-Based Visibility Measurements

A primary goal of visibility monitoring is to quantify how well the image-forming information in a vista is transmitted through the atmosphere to an observer some distance away. Determining how well the information is transmitted and assigning a quantitative value to that information is known as quantitative visibility analysis. Historically, 35 mm color photographic slides were used to obtain quantitative estimates of "visual range", defined as how far a black object could be seen on a distant horizon. Quantitative visibility estimates from color slides are based on densitometry measurements of the sky/target contrast of selected horizon features within a photographic vista. Sky/target contrasts are measured in the 550 nm (green) wavelength. The 550 nm wavelength is used because it is the most dominant visible wavelength in the solar spectrum. These measurements are reduced and reported as visual range (km) or extinction b_{ext} values. The equations and considerations used to calculate visual range (km) and extinction from measured sky/target contrasts are based on various derivations and approximations by visibility scientists (Middleton, 1958; Malm, 1979; Allard and Tombach, 1981; ARS, 1994).

Although used in the past, quantitative estimates of b_{ext} or visual range from slides can have substantial error due primarily to naturally-occurring variations in the condition and illumination of the sky, target, and site path. Estimated errors in individual slide-based measurements also leads to a systematic bias in reported slide-based cumulative frequency values. The exact magnitude of cumulative frequency bias is not easily quantifiable; however, it is apparent that reported "clean" values are too clean, reported "dirty" values are too dirty, and median cumulative frequency values for large data sets are reasonably accurate. For this reason, the slide spectrum analysis results should be used, reported, or publicized with extreme caution.

All calculated slide spectrum visual range estimates are rounded for precision. All cumulative frequency values presented are derived from historical aerosol data summaries rather than 35 mm densitometry data summaries. It should also be noted that all visual range summaries and spectrum grouping archives should remain intact and be referenced only in relation to other slides in the same grouping.

4.1.2.2 Slide Spectrum Archive Visibility Measurements

The project manager reviews each visibility grouping selected (i.e., 0900 and 1500). One final clear sky spectrum is selected to represent each data collection period. Any supplemental groupings are retained as "runner-ups" in the circumstance that the selected set shows too many inconsistencies or is damaged (e.g., scratched) in some way.

Each final grouping is returned to the data technician for scanning and contrast calculations. Individual slides are scanned and archived as low resolution digital .TIF (or .TGA) files using the Polaroid SprintScan 35/LE scanner and associated software. Red, green, and blue wavelength pixel statistics are obtained for the selected target and sky areas of the image using image haze simulation software. Contrast measurements can then be calculated given the green target/sky pixel statistics and associated 10-step grayscale calibration curve. An automated version of all necessary contrast calculations is available in the CONTRAST.EXE batch program. All red-green-blue wavelength pixel statistics and associated contrast estimations are documented for further reference. Detailed scanning and contrast calculation procedures are outlined in Appendix A.

The project manager reviews all the estimated contrast values. Any inconsistencies in measured values and actual visual (by eye) appearance are investigated and rescanned, or thrown out of the selected spectrum grouping. All remaining spectrum slides and associated slide contrasts are charted, using the Microsoft Excel table shown in Figure 4-1. Comparisons are made between the measured contrast values of the selected spectrum and the calculated density curve, given the known target distance and estimated inherent contrast (Figure 4-2). Excess slides with repetitive contrasts are removed. If a large gap is apparent, or if the set does not uniformly represent visibility conditions from good to bad, then the "runner-up" spectrum grouping is scanned or individual "runner-up" slides are used to supplement the draft grouping.

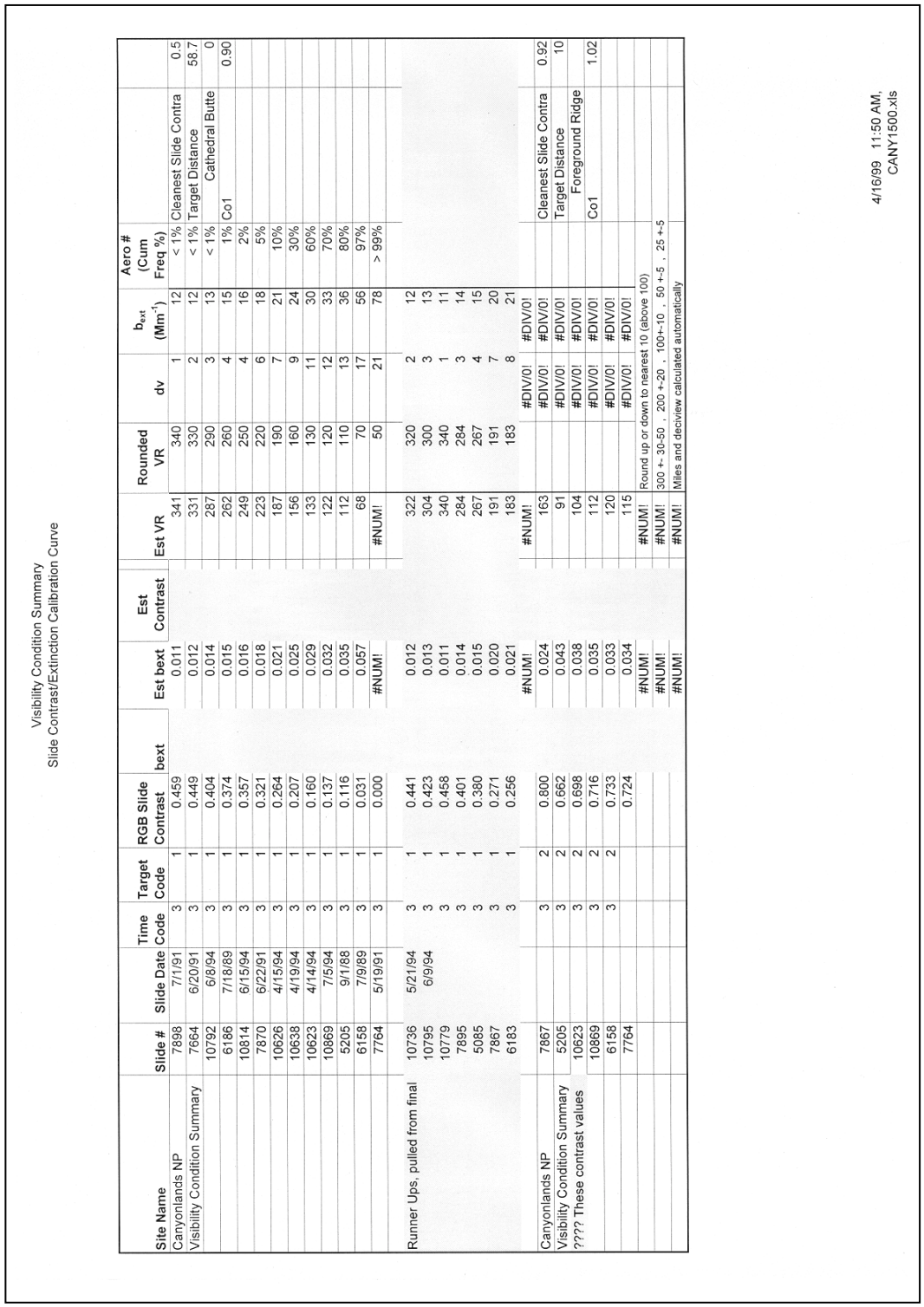
Once the final spectrum slide sets have been selected and scanned, all associated slide numbers, dates of observation, and contrast estimates are charted in the final Excel table (Figure 4-1). Given the selected target distance, pristine contrast value, calculated target inherent contrast and individual slide contrast, the visual range, deciview, and b_{ext} (Mm^{-1}) are calculated automatically within the Excel table for each documented slide.

The final step in spectrum analysis consists of determining the frequency of occurrence of the given slide's visibility condition in relation to IMPROVE aerosol data collected at the site. If no aerosol data are available, then this step is excluded and no cumulative frequency data are documented. Site-specific total reconstructed extinction (Mm^{-1}) data should be obtained from the IMPROVE aerosol data contractor in a tabular cumulative frequency format, by season and all seasons combined, for the entire period of record. An example summary of aerosol cumulative frequency data is shown in Figure 4-3. Individual spectrum b_{ext} (Mm^{-1}) values are compared with the provided aerosol cumulative frequency values for all seasons combined. Corresponding cumulative frequency values are documented in the "Aero Cum Freq %" column of the Excel table. Note: it may be necessary to carry the spectrum b_{ext} (Mm^{-1}) calculations to two decimal places in order to more closely match the provided aerosol cumulative frequency statistics. The project manager makes a final review of the data to ensure that spectrum selection also represents an even distribution of aerosol cumulative frequency data.

4.1.3 35 mm Slide Selection Archive

The primary purpose of the historical slide spectrum archive is to secure a representative set of observed air quality conditions for many years to come. Because film emulsions degrade with time, a medium other than 35 mm slide film or prints was chosen. To better preserve a portion of the original visual information, all selected slides are digitized in high-resolution format and stored on a Kodak Photo CD. Once digitized, multitudes of data management and reproduction options are available with no loss to the quality or integrity of the original digitized image.

Up to 105, 35 mm slide images can be archived on a single Kodak Photo CD in Photo CD (.PCD) format. The project manager makes a final review of all the selected spectrum groupings, pristine, scenic, layered haze, and visibility episode slides selected to represent the site. The set is checked for its overall consistency, representativeness, and exposure quality. All gray scales used for slide spectrum analysis are also included as a calibration medium for future reproduction. If more than 105 slides have been selected for archive, either the scenic or episode selections will be reduced in size or a judgement to create a two-volume CD site-specific archive will be made. All selected slides are thoroughly cleaned (air-blown and/or cleaned with film cleaner) and organized in polyethylene slide protector sheets in the following order:



Visibility Condition Summary
Slide Contrast/Extinction Calibration Curve

Site Name	Slide #	Slide Date	Time Code	Target Code	RGB Slide Contrast	bext	Est bext	Est Contrast	Est VR	Rounded VR	dv	b_{ext} (Mm^{-1})	Aero # (Cum Freq %)	
Canyonlands NP	7898	7/1/91	3	1	0.459		0.011		341	340	1	12	< 1% Cleanest Slide Contra	0.5
Visibility Condition Summary	7664	6/20/91	3	1	0.449		0.012		331	330	2	12	< 1% Target Distance	58.7
	10792	6/8/94	3	1	0.404		0.014		287	290	3	13	< 1% Cathedral Butte	0
	6186	7/18/89	3	1	0.374		0.015		262	260	4	15	1% Co1	0.90
	10814	6/15/94	3	1	0.357		0.016		249	250	4	16	2%	
	7870	6/22/91	3	1	0.321		0.018		223	220	6	18	5%	
	10626	4/15/94	3	1	0.264		0.021		187	190	7	21	10%	
	10638	4/19/94	3	1	0.207		0.025		156	160	9	24	30%	
	10623	4/14/94	3	1	0.160		0.029		133	130	11	30	60%	
	10869	7/5/94	3	1	0.137		0.032		122	120	12	33	70%	
	5205	9/1/88	3	1	0.116		0.035		112	110	13	36	80%	
	6158	7/9/89	3	1	0.031		0.057		68	70	17	56	97%	
	7764	5/19/91	3	1	0.000		#NUM!		#NUM!	50	21	78	> 99%	
Runner Ups, pulled from final	10736	5/21/94	3	1	0.441		0.012		322	320	2	12		
	10795	6/9/94	3	1	0.423		0.013		304	300	3	13		
	10779		3	1	0.458		0.011		340	340	1	11		
	7895		3	1	0.401		0.014		284	284	3	14		
	5085		3	1	0.380		0.015		267	267	4	15		
	7867		3	1	0.271		0.020		191	191	7	20		
	6183		3	1	0.256		0.021		183	183	8	21		
							#NUM!		#NUM!		#DIV/0!	#DIV/0!		
Canyonlands NP	7867		3	2	0.800		0.024		163		#DIV/0!	#DIV/0!	Cleanest Slide Contra	0.92
Visibility Condition Summary	5205		3	2	0.662		0.043		91		#DIV/0!	#DIV/0!	Target Distance	10
???? These contrast values	10623		3	2	0.698		0.038		104		#DIV/0!	#DIV/0!	Foreground Ridge	
	10869		3	2	0.716		0.035		112		#DIV/0!	#DIV/0!	Co1	1.02
	6158		3	2	0.733		0.033		120		#DIV/0!	#DIV/0!		
	7764				0.724		0.034		115		#DIV/0!	#DIV/0!		
							#NUM!		#NUM!	Round up or down to nearest 10 (above 100)				
							#NUM!		#NUM!	300 +- 30-50 , 200 +-20 , 100+-10 , 50 +-5 , 25 +-5				
							#NUM!		#NUM!	Miles and deciview calculated automatically				

4/16/99 11:50 AM,
CANY1500.xls

Figure 4-1. Example Visibility Condition Summary .

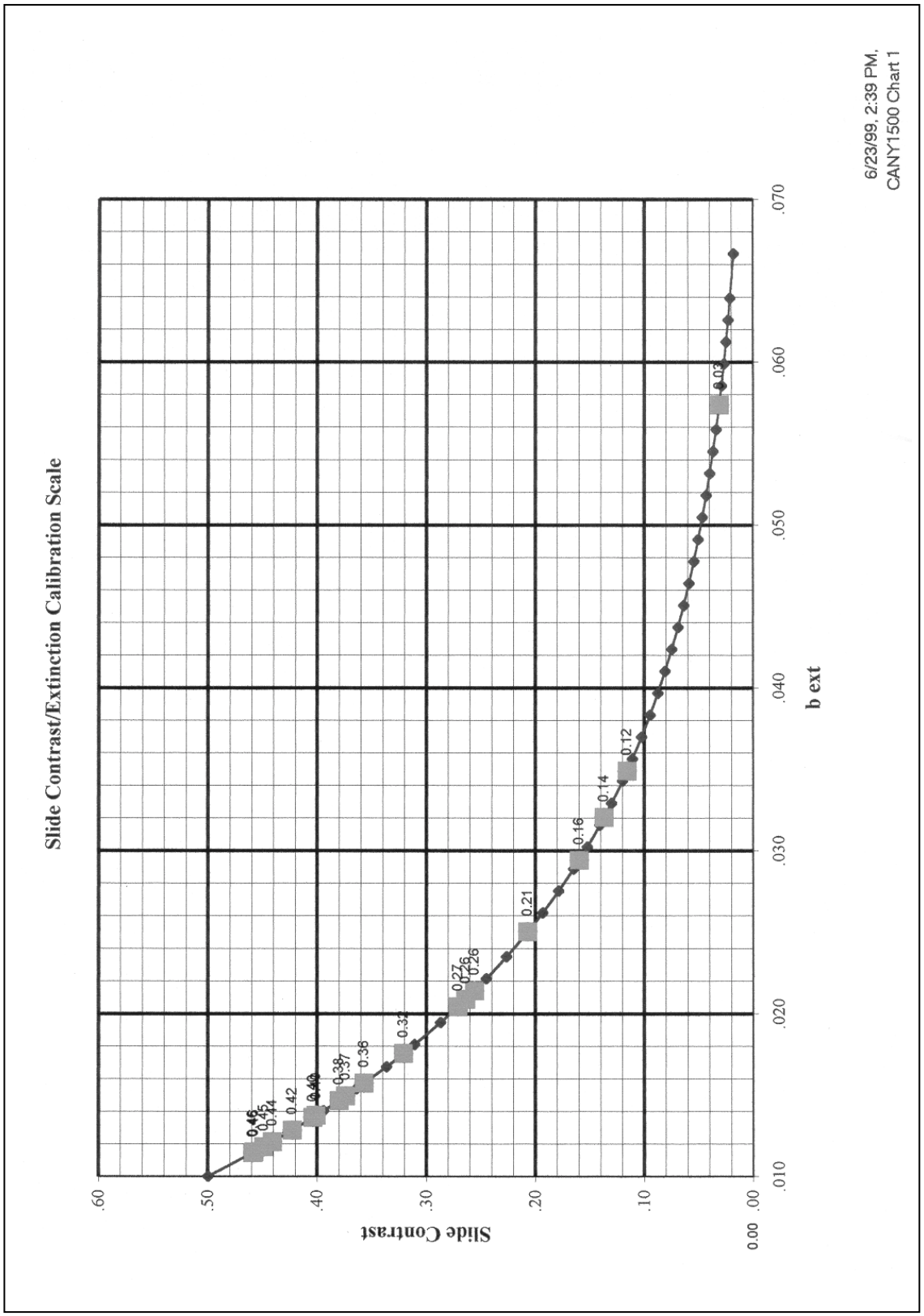


Figure 4-2. Example Slide Contrast/Extinction Calibration Scale.

3/88-2/97 **4.00**
SITE=BRID

OBS	SEASON	P_0	P_1	P_2	P_3	P_4	P_5	P_10	P_20	P_30	P_40
1	spring	13.22	13.80	14.14	15.14	15.84	16.09	17.71	20.23	22.19	23.83
2	summer	13.73	14.92	16.08	16.37	16.72	17.42	19.65	22.59	24.99	26.01
3	autumn	12.34	13.12	14.09	14.60	14.83	15.33	16.80	18.64	20.43	21.92
4	winter	12.12	12.36	12.62	12.86	13.15	13.20	13.51	14.66	15.33	16.14
5	ANNUAL	12.12	12.86	13.22	13.56	13.78	14.09	15.41	17.47	19.42	21.50

OBS	P_50	P_60	P_70	P_80	P_90	P_95	P_96	P_97	P_98	P_99	P_100
1	25.44	28.06	30.60	33.43	37.16	42.04	42.81	43.26	44.47	47.46	48.08
2	27.71	29.67	30.79	32.93	37.30	43.58	44.81	53.98	56.03	58.08	58.50
3	24.19	26.50	28.96	31.74	37.06	40.02	40.51	43.99	46.50	48.82	52.98
4	17.32	18.42	19.25	21.35	24.28	27.75	29.30	31.51	33.43	38.47	42.28
5	23.87	26.02	28.48	31.43	35.89	39.34	41.27	43.16	44.81	50.94	58.50

3/88-2/97 **5.00**
SITE=CANY

OBS	SEASON	P_0	P_1	P_2	P_3	P_4	P_5	P_10	P_20	P_30	P_40
1	spring	14.75	14.84	15.40	16.35	16.74	17.01	19.40	21.86	23.04	24.41
2	summer	17.41	19.29	20.19	20.84	20.92	21.54	24.18	25.41	26.84	28.44
3	autumn	13.03	13.16	16.79	17.23	17.40	17.45	18.35	20.71	23.17	25.20
4	winter	14.56	14.74	15.11	15.29	15.50	15.90	17.92	21.50	24.12	26.56
5	ANNUAL	13.03	14.91	15.51	16.73	17.10	17.42	19.35	22.60	24.54	26.17

OBS	P_50	P_60	P_70	P_80	P_90	P_95	P_96	P_97	P_98	P_99	P_100
1	25.94	27.33	30.27	32.99	36.81	39.98	42.29	45.36	48.01	55.58	64.12
2	29.80	31.45	32.83	35.32	41.22	45.51	47.68	51.18	52.02	53.08	63.57
3	26.70	29.21	31.79	33.68	37.87	39.00	39.14	40.11	40.75	42.61	46.89
4	29.64	32.38	36.04	42.78	53.90	60.35	61.38	64.99	69.03	73.24	79.27
5	28.11	30.31	32.37	35.37	40.73	48.01	51.26	53.84	57.73	63.57	79.27

3/88-2/97 **6.00**
SITE=CHIR

OBS	SEASON	P_0	P_1	P_2	P_3	P_4	P_5	P_10	P_20	P_30	P_40
1	spring	14.97	16.67	17.07	17.68	19.76	20.04	22.43	24.50	25.83	27.19
2	summer	18.03	23.01	23.82	24.81	25.90	26.21	27.56	30.50	33.08	35.34
3	autumn	17.72	18.36	18.53	18.55	19.32	19.82	21.99	24.64	26.21	27.93
4	winter	14.74	15.53	16.38	17.03	17.16	17.49	19.49	21.54	23.05	24.86
5	ANNUAL	14.74	16.95	17.68	18.21	18.99	19.62	21.65	24.52	26.50	28.53

OBS	P_50	P_60	P_70	P_80	P_90	P_95	P_96	P_97	P_98	P_99	P_100
1	30.03	32.44	35.05	38.19	43.48	45.93	46.55	48.19	48.79	61.31	61.33
2	38.06	39.80	42.89	47.05	53.02	56.44	58.71	59.35	65.13	89.90	95.07
3	29.38	32.32	36.16	39.11	42.61	47.03	47.46	49.77	51.26	55.18	84.86
4	27.16	28.92	30.88	34.39	38.53	43.80	46.11	46.91	50.07	53.00	61.49
5	30.80	33.64	36.89	39.89	45.45	50.07	51.31	53.63	56.41	61.33	95.07

Prepared by JS:
Thursday 12/18/97 11:13

aerodat_example.xls, 4/16/99

Figure 4-3. Example Summary of Aerosol Cumulative Frequency Data.

- Range of visibility spectrums (0900, 1200, and/or 1500)
- Layered haze
- Visibility episodes
- Pristine and scenic
- Miscellaneous original slides of interest (e.g., data requests of national interest)

If a slide repeats anywhere in the selection, a placeholder is inserted identifying the slide and its residing location in the set. Each site-specific image is archived onto a Kodak Photo CD by a Kodak processing lab. A detailed description of how the Photo CD image archive is cataloged and combined with site-specific graphic and data presentation materials is provided in Section 4.3.

4.2 CREATING OTHER MATERIALS INCLUDED WITH THE SPECTRUM

To establish a self-contained scene monitoring archive, all site-related monitoring information and spectrum analysis statistics associated with the archived images are also maintained. This section describes the procedures and formats used to compile the associated graphic and data presentation materials. The type and amount of materials archived varies depending upon the site and the client's needs. The primary items considered are outlined below.

4.2.1 Scene Monitoring Site Specifications

A Scene Monitoring Site Specification Summary, shown in Figure 4-4, is created to identify the monitoring site location and field of view, summarized by the historical spectrum images. A graphic depiction (topographic map) is included to give the user an idea of the terrain surrounding the photographic site path, as well as the location of additional air quality monitoring instruments. A tabular summary of all scene monitoring (35 mm, 8 mm, and special study) that has occurred within the region is also provided for additional reference. A "Period Reviewed" summary denotes the period of data evaluated to establish the historical range of visibility spectrums for the summarized vista.

If a site has monitored more than one photographic vista during its history, then only the vista(s) included in the spectrum analysis data summaries are included in the CD archive presentation.

4.2.2 Spectrum Visibility Condition Summary and Cumulative Frequency Statistics

A tabular summary of all slide spectrum analysis results (compiled in Section 4.1.2.2) for each range of visibility grouping is also provided in the final archive. Shown in Figure 4-5, the information summarized includes:

- Spectrum sequence number
- The representative visibility condition for each archived image, in units of deciview (dv), b_{ext} (Mm^{-1}), and VR (km).
- The frequency of occurrence of the given image's visibility condition in relation to IMPROVE aerosol data collected at the site.

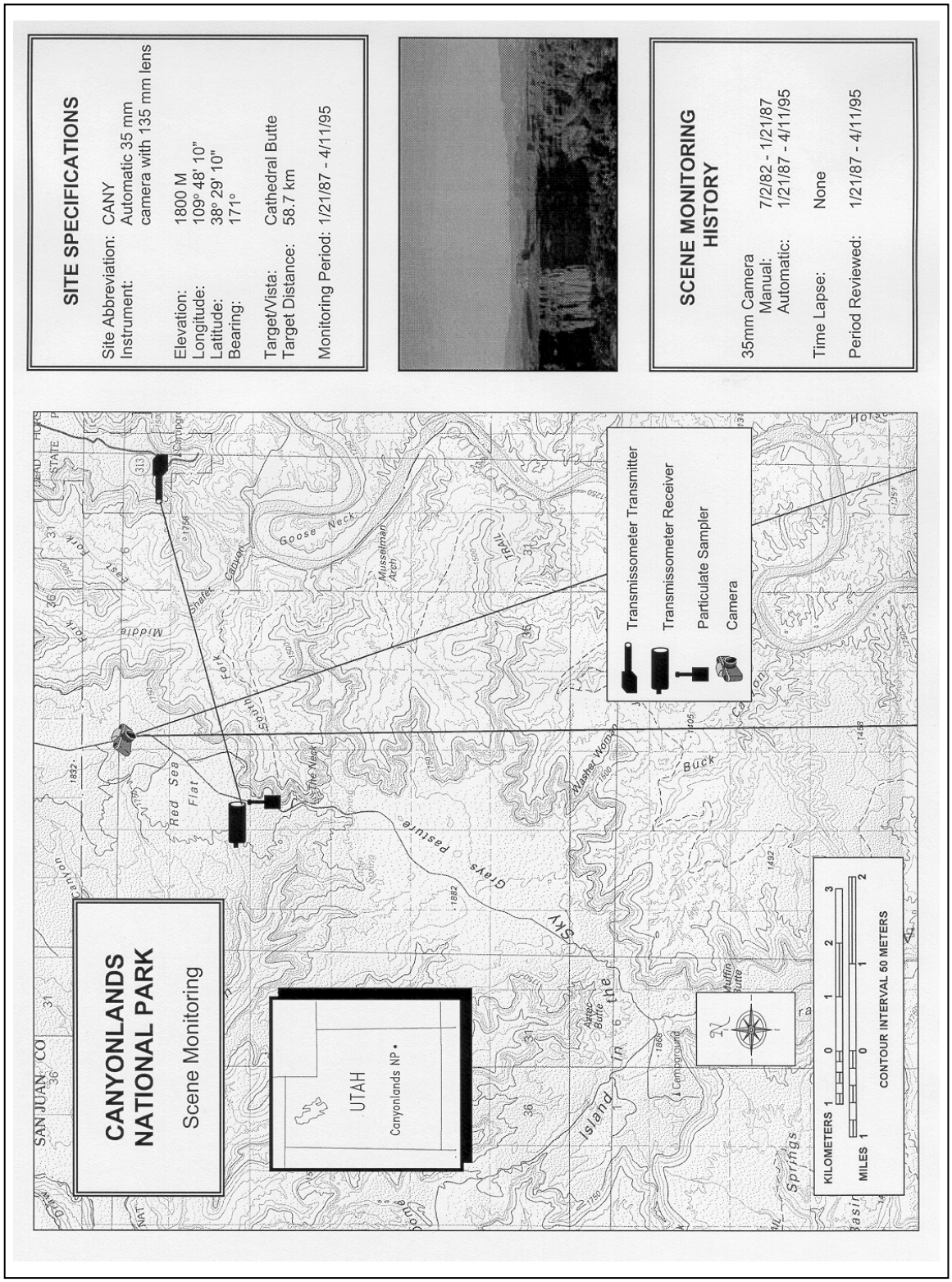


Figure 4-4. Example Scene Monitoring Site Specification Summary.

Canyonlands National Park, Utah
0900 Slide Spectrum Series (1987 – 1995)
Cumulative Frequency Summary

Spectrum Sequence #	Representative Visibility Condition Summary			Representative Cumulative Frequency of Reconstructed Extinction IMPROVE Aerosol Data (1988 – 1997)
	dv	b_{ext} (Mm^{-1})	VR (km)	
1 of 11	2	13	310	< 1%
2 of 11	3	13	300	< 1%
3 of 11	4	15	260	1%
4 of 11	5	17	230	4%
5 of 11	6	19	210	10%
6 of 11	8	23	170	20%
7 of 11	10	26	150	40%
8 of 11	11	30	130	60%
9 of 11	14	39	100	90%
10 of 11	15	46	85	90%
11 of 11	17	56	70	97%

Canyonlands National Park, Utah
1500 Slide Spectrum Series (1987 – 1995)
Cumulative Frequency Summary

Spectrum Sequence #	Representative Visibility Condition Summary			Representative Cumulative Frequency of Reconstructed Extinction IMPROVE Aerosol Data (1988 – 1997)
	dv	b_{ext} (Mm^{-1})	VR (km)	
1 of 13	1	12	340	< 1%
2 of 13	2	12	330	< 1%
3 of 13	3	13	290	< 1%
4 of 13	4	15	260	1%
5 of 13	4	16	250	2%
6 of 13	6	18	220	5%
7 of 13	7	21	190	10%
8 of 13	9	24	160	30%
9 of 13	11	30	130	60%
10 of 13	12	33	120	70%
11 of 13	13	36	110	80%
12 of 13	17	56	70	97%
13 of 13	21	78	50	> 99%

Figure 4-5. Example Summary of Slide Spectrum Analysis Results.

4.2.3 CD-ROM Archive-Related Presentation Materials

4.2.3.1 Table of Contents

A detailed CD-ROM Table of Contents is provided as shown in Figure 4-6. Included is a list of image, graphic presentation, and software files that may be searched for by the user. A complete description of each image includes: image file name, image description, slide number, date and time the image was taken, comments related to the vista or past use of the image, and the path description where the file can be found on the CD. It is necessary to maintain a unique site-specific file name, in the instance that all National Park Service data are someday combined in a one-image database. Graphic and data presentation descriptions include the software required to access the file(s) and a brief description of the information contained. The Table of Contents is compiled in an Excel file and then reformatted to Adobe Acrobat Reader format (.PDF) for the final CD-ROM archive.

A second copy of all tabular information associated with the historical spectrum images is prepared and retained in Excel. Label descriptors are reduced to 25 characters/field for a graphic pitch of 6.0, or 17 characters/field for a graphic pitch of 8.0. During the final archive process, described in Section 4.3, this Excel file is imported into the Kodak QuickSolve image database (Qbrowser). Within the Qbrowser database, each image is labeled with the abbreviated image descriptions, associated slide number, date and time, as well as any comments related to the vista or past use of the image.

4.2.3.2 Title Slide/Cover Sheet

A Title Slide file is created to serve as a header for the graphic and data presentation materials included on the CD (Figure 4-7). Included in the Title Slide is the full site name, monitoring period reviewed, and any associated contract, preparation date, or ARS archive information.

4.2.3.3 CD Cover

The CD cover, like the Title Slide, provides an informative summary of the contents of the CD (Figure 4-8). It should include the full site name, monitoring period reviewed, and any associated contract, preparation date, or ARS archive information.

4.2.3.4 CD Access Instructions

A file summarizing the CD contents, type of file formats, and access requirements is provided as a courtesy to the user. Recipients of the historical CD may or may not be familiar with computer access related information. The CDINFO document, shown in Figure 4-9, provides a brief overview of what types of image and graphic files are provided, as well as how the images can be best accessed or printed for future use. In order to view CDINFO the user must launch the provided Adobe Acrobat software and open file CDINFO.PDF.

Table of Contents							
Canyonlands National Park Permanent Photographic Archive 1987-1995 Kodak Master ID - 7314-3252-1468 (2/24/98)							
Pathname d: = CD-ROM drive	File name	Catalog #	File/Image Description			File Type	Comments
d:	CDINFO.PDF		Contents and access information related to this disk			Adobe Acrobat (Portable Digital Format)	WORD file printed in PDF format
d:	READ1st.PDF		Software and system requirements related to this disk			Adobe Acrobat (Portable Digital Format)	WORD file printed in PDF format
d:	READ1st.TXT		Software and system requirements related to this disk			ASCII Text File	
d:	CONTENTS.PDF		Detailed table of contents containing all file access information			Adobe Acrobat (Portable Digital Format)	WORD file printed in PDF format
d:	HISTDATA.PDF		Title slide, site specifications, and spectrum cumulative frequency summaries			Adobe Acrobat (Portable Digital Format)	WORD file printed in PDF format
d:\catalog	PHOTOS.CAT		Kodak Qbrowser catalog file containing reference to all archived PCD images.			Kodak QuickSolve Browser	
d:\images	IMG0001.JPG	1	Regional Haze Spectrum #1 of 11	7/2/91, 9:00	7899	JPEG Image	Cathedral Butte 1987 - 1995 (all 135mm lens unless noted otherwise)
d:\images	IMG0002.JPG	2	Regional Haze Spectrum #2 of 11	8/8/91, 9:00	8004	JPEG Image	Cathedral Butte
d:\images	IMG0003.JPG	3	Regional Haze Spectrum #3 of 11	7/9/94, 9:00	10880	JPEG Image	Cathedral Butte
d:\images	IMG0004.JPG	4	Regional Haze Spectrum #4 of 11	6/28/94, 9:00	10846	JPEG Image	Cathedral Butte
d:\images	IMG0005.JPG	5	Regional Haze Spectrum #5 of 11	8/2/94, 9:00	10953	JPEG Image	Cathedral Butte
d:\images	IMG0006.JPG	6	Regional Haze Spectrum #6 of 11	7/13/89, 9:00	6168	JPEG Image	Cathedral Butte
d:\images	IMG0007.JPG	7	Regional Haze Spectrum #7 of 11	7/20/89, 9:00	6190	JPEG Image	Cathedral Butte
d:\images	IMG0008.JPG	8	Regional Haze Spectrum #8 of 11	7/17/89, 9:00	6181	JPEG Image	Cathedral Butte
d:\images	IMG0009.JPG	9	Regional Haze Spectrum #9 of 11	7/11/89, 9:00	6162	JPEG Image	Cathedral Butte
d:\images	IMG0010.JPG	10	Regional Haze Spectrum #10 of 11	7/6/94, 9:00	10870	JPEG Image	Cathedral Butte
d:\images	IMG0011.JPG	11	Regional Haze Spectrum #11 of 11	7/5/94, 9:00	10867	JPEG Image	Cathedral Butte
d:\images	IMG0012.JPG	12	Regional Haze Spectrum #1 of 13	7/1/91, 15:00	7898	JPEG Image	Cathedral Butte
d:\images	IMG0013.JPG	13	Regional Haze Spectrum #2 of 13	6/20/91, 15:00	7864	JPEG Image	Cathedral Butte
d:\images	IMG0014.JPG	14	Regional Haze Spectrum #3 of 13	6/8/94, 15:00	10792	JPEG Image	Cathedral Butte
d:\images	IMG0015.JPG	15	Regional Haze Spectrum #4 of 13	7/18/89,15:00	6186	JPEG Image	Cathedral Butte
d:\images	IMG0016.JPG	16	Regional Haze Spectrum #5 of 13	6/15/94, 15:00	10814	JPEG Image	Cathedral Butte
d:\images	IMG0017.JPG	17	Regional Haze Spectrum #6 of 13	6/22/91, 15:00	7870	JPEG Image	Cathedral Butte
d:\images	IMG0018.JPG	18	Regional Haze Spectrum #7 of 13	4/15/94, 15:00	10626	JPEG Image	Cathedral Butte
d:\images	IMG0019.JPG	19	Regional Haze Spectrum #8 of 13	4/19/94, 15:00	10638	JPEG Image	Cathedral Butte
d:\images	IMG0020.JPG	20	Regional Haze Spectrum #9 of 13	4/14/94, 15:00	10623	JPEG Image	Cathedral Butte
d:\images	IMG0021.JPG	21	Regional Haze Spectrum #10 of 13	7/5/94, 15:00	10869	JPEG Image	Cathedral Butte
d:\images	IMG0022.JPG	22	Regional Haze Spectrum #11 of 13	9/1/88, 15:00	5205	JPEG Image	Cathedral Butte
d:\images	IMG0023.JPG	23	Regional Haze Spectrum #12 of 13	7/9/89, 15:00	6158	JPEG Image	Cathedral Butte
d:\images	IMG0024.JPG	24	Regional Haze Spectrum #13 of 13	5/19/91, 15:00	7764	JPEG Image	Cathedral Butte

1 of 2

Figure 4-6. Example Historical Spectrum CD Table of Contents.

Table of Contents							
Canyonlands National Park Permanent Photographic Archive 1987-1995 Kodak Master ID - 7314-3252-1468 (2/24/98)							
Pathname d: = CD-ROM drive	File name	Catalog #	File/Image Description			File Type	Comments
d:\images	IMG0025.JPG	25	Episodes - Layered Haze	3/23/86, 12:00	2722	JPEG Image	La Sal Mtns - Manual System 1982- 1987
d:\images	IMG0026.JPG	26	Episodes - Layered Haze	12/11/87, 9:00	3394	JPEG Image	La Sal Mtns - Manual System 1982- 1987
d:\images	IMG0027.JPG	27	Episodes - Layered Haze	1/10/87, 9:00	3481	JPEG Image	La Sal Mtns - Manual System 1982- 1987
d:\images	IMG0028.JPG	28	Episodes - Layered Haze	12/3/88, 12:00	5458	JPEG Image	Cathedral Butte
d:\images	IMG0029.JPG	29	Episodes - Layered Haze	1/20/89, 9:00	5656	JPEG Image	Cathedral Butte
d:\images	IMG0030.JPG	30	Episodes - Layered Haze	1/30/89, 12:00	5688	JPEG Image	Cathedral Butte
d:\images	IMG0031.JPG	31	Episodes - Layered Haze	1/26/92, 9:00	8495	JPEG Image	Cathedral Butte
d:\images	IMG0032.JPG	32	Episodes - Layered Haze	1/26/92, 12:00	8496	JPEG Image	Cathedral Butte
d:\images	IMG0033.JPG	33	Scenic	10/30/82, 9:00	CA255	JPEG Image	La Sal Mtns - Manual System 1982- 1987
d:\images	IMG0034.JPG	34	Scenic	1/4/83, 15:00	CA397	JPEG Image	La Sal Mtns - Manual System 1982- 1987
d:\images	IMG0035.JPG	35	Scenic	7/26/83, 15:00	CA837	JPEG Image	La Sal Mtns - Manual System 1982- 1987
d:\images	IMG0034.JPG	36	Scenic	8/17/83, 15:00	CA883	JPEG Image	La Sal Mtns - Manual System 1982- 1987
d:\images	IMG0037.JPG	37	Scenic	9/23/83, 9:00	CA967	JPEG Image	La Sal Mtns - Manual System 1982- 1987
d:\images	IMG0038.JPG	38	Scenic	10/13/83, 9:00	CA1008	JPEG Image	La Sal Mtns - Manual System 1982- 1987
d:\images	IMG0039.JPG	39	Scenic	9/21/84, 9:00	1672	JPEG Image	La Sal Mtns - Manual System 1982- 1987
d:\images	IMG0040.JPG	40	Scenic	12/11/84, 15:00	1845	JPEG Image	La Sal Mtns - Manual System 1982- 1987
d:\images	IMG0041.JPG	41	Scenic	1/30/84, 9:00	1939	JPEG Image	La Sal Mtns - Manual System 1982- 1987
d:\images	IMG0042.JPG	42	Scenic	11/6/87, 14:00	4394	JPEG Image	Cathedral Butte
d:\images	IMG0043.JPG	43	Scenic	11/14/87, 14:00	4418	JPEG Image	Cathedral Butte
d:\images	IMG0044.JPG	44	Scenic	11/23/88, 15:00	5429	JPEG Image	Cathedral Butte
d:\images	IMG0045.JPG	45	Scenic	12/23/88, 12:00	5520	JPEG Image	Cathedral Butte
d:\images	IMG0046.JPG	46	Scenic	11/5/90, 9:00	7243	JPEG Image	Cathedral Butte
d:\images	IMG0047.JPG	47	Scenic	1/8/92, 12:00	8441	JPEG Image	Cathedral Butte
d:\images	IMG0048.JPG	48	Scenic	12/19/93, 12:00	10297	JPEG Image	Cathedral Butte
d:\images	IMG0049.JPG	49	Colo. Plateau Report 4/97 - Good	7/25/89, 9:00	6205	JPEG Image	Cathedral Butte
d:\images	IMG0050.JPG	50	Colo. Plateau Report 4/97 - Medium	7/13/87, 9:00	6181	JPEG Image	Cathedral Butte
d:\images	IMG0051.JPG	51	Colo. Plateau Report 4/97 - Poor	7/5/94, 9:00	10867	JPEG Image	Cathedral Butte
d:\qbrowser	QBROWSER.EXE		Kodak QuickSolve Browser - abbreviated version			Executable file	Used to view JPEG images
d:\qbrowser	SETUP.EXE		Kodak QuickSolve Browser installation for Windows			Executable file	
d:\qbrowser	BROWSHLP.HLP		Help file, accessible through QBROWSER			Windows based help file	
d:\qbrowser	READMEQB.WRI		Software and system requirements related to Kodak QuickSolve Browser			Windows based text file	
d:\reader\win\reader	SETUP.EXE		Adobe Acrobat Reader 3.0 installation for Windows			Executable file	Used to view Portable Document Format (PDF) files
d:\reader	README.TXT		Software and system requirements related to Adobe Acrobat			ASCII Text File	

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Figure 4-6 (continued). Example Historical Spectrum CD Table of Contents.

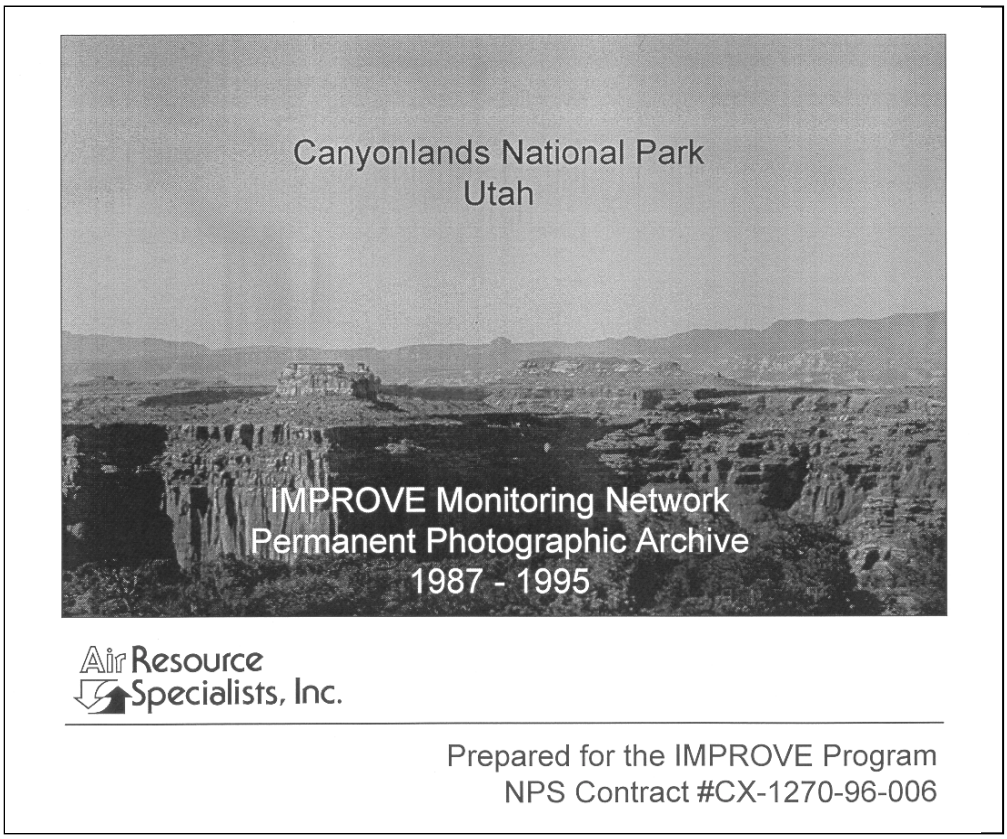
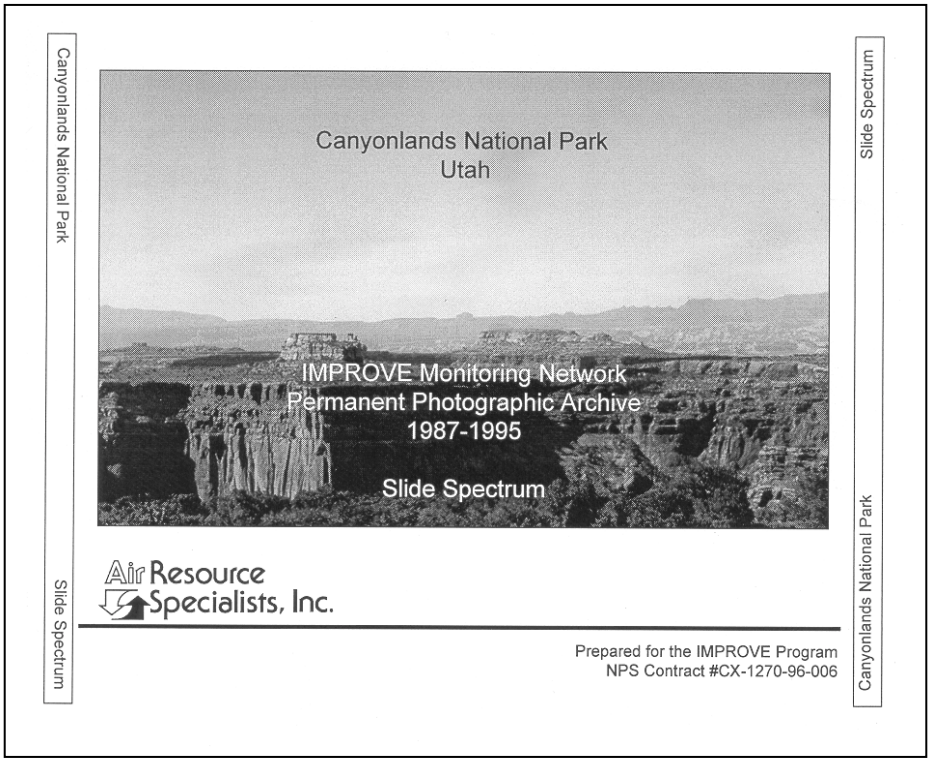


Figure 4-7. Example Title Slide.



IMPROVE Monitoring Network
Permanent Photographic Archive

This CD-ROM contains Acrobat Reader 3.0 and Kodak QuickSolve Browser (QBROWSER) software as well as a series of readme text (TXT) files, PDF (Portable Document Format) files, and JPEG and PCD (Photo CD) images. Acrobat Reader 3.0 or later must be installed prior to viewing any PDF file. Qbrowser software can be accessed directly from the CD, however optimal performance is obtained by installing Qbrowser directly on your hard drive.

System Requirements

- x86-based personal computer (486DX minimum, Pentium or Pentium Pro recommended), CD-ROM drive, 8-bit SVGA graphic card
- Microsoft Windows 3.1, Microsoft Windows for Workgroups, Microsoft Windows 95, Microsoft Windows NT 3.51 or 4.0
- 8 MB application RAM
- 5 MB hard disk space, plus 7 MB additional temporary disk space available during installation
- True Color (32-bit) display and 2 MB video RAM recommended for optimal viewing

Recommended Reading

- READ1st.TXT located on the root directory of this CD.
- CDINFO.PDF located on the root directory of this CD.

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for the IMPROVE Program
1998

Figure 4-8. Example CD Cover (Front and Back).

CD INFORMATION

CONTENTS OF THE CD

This CD includes a series of readme.txt (.TXT) files, PDF (Portable Document Format) files, and JPEG (Joint Photographic Expert Group) and PCD (Photo CD) images.

TXT Format Files
Readme.txt files describe the software and system requirements for reading the provided information. The file READ1st.TXT (or READ1st.PDF) documents software and system requirements specific to the historical photographic archive provided on this CD.

PDF Format Files
all text and graphic files, including this CD information description, the fully referenced table of contents, site specifications, and spectrum cumulative frequency summaries have been archived in PDF format. Acrobat Reader 3.0 or later must be installed prior to viewing any provided PDF format file. PDF files can be accessed using the Adobe Acrobat Reader provided in the Adobe Acrobat folder on this CD.

JPEG Format Files
All photographs have been archived in JPEG High resolution (512 X 768) format. JPEG images are recommended for viewing and Internet transmission purposes. JPEG images can be viewed with the Kodak QuickSolve Browser (QBROWSER) provided in the Qbrowser folder on this CD.

PCD Format Files
For hard-copy printing purposes, all photographs have also been provided in high resolution (2048 X 3072) Photo CD format. Photo CD (PCD) images provide the highest resolution possible for printing. To access or print these PCD images, contact a local photo processing laboratory with digital capabilities or Air Resource Specialists, Inc.

ACCESS INSTRUCTIONS

Acrobat Reader 3.0 or later must be installed prior to viewing any provided PDF format file. To install Acrobat Reader 3.0 for Windows, run the SETUP.EXE program in the Reader\Win\Reader folder (directory) of this CD-ROM. Additional directions are available in the README files located in the Acrobat Reader folders.

-- continued --

Figure 4-9. CDINFO Document Included on the CD-ROM.

ACCESS INSTRUCTIONS (Continued)

Kodak QuickSolve Browser (QBROWSER) is also included on this CD-ROM to view the provided JPEG photographic archive. It is not necessary to install any Kodak software prior to running QBROWSER; however, optimal performance is obtained if QBROWSER is installed directly on your hard drive. To install Kodak QuickSolve Browser for Windows, run the SETUP.EXE program in the Qbrowser folder (directory) of this CD-ROM. Additional information regarding Kodak QuickSolve software is available in the README file located in the Qbrowser folder.

Additional system requirements are documented in the READ1st.txt (or READ1st.PDF) files located in the root directory of this CD.

TABLE OF CONTENTS

To view the fully referenced Table of Contents double-click the CONTENTS.PDF file in the root directory, or launch the installed Acrobat Reader and open the file named CONTENTS.PDF.

SITE SPECIFICATION AND SPECTRUM CUMULATIVE FREQUENCY SUMMARIES

To view these documents, double-click the HISTDATA.PDF file in the root directory, or launch the installed Acrobat Reader and open the file named HISTDATA.PDF.

PHOTOGRAPHIC ARCHIVE

To launch the photograph browser, go to the Qbrowser folder and launch QBROWSER.EXE. From Qbrowser, open the catalog file names PHOTOS.CAT.

Figure 4-9 (Continued). CDINFO Document Included on the CD-ROM.

4.2.3.5 Hardware/Software Requirements

A document specifically addressing the hardware and software requirements necessary to access the image and graphic files is provided in the archived file READ1st, shown in Figure 4-10. The READ1st file is provided in both Acrobat (.PDF) and Text (.TXT) formats to better ensure the user success in obtaining the hardware and software requirements necessary to read the provided historical archive data. Hardware and software requirements to use the CD are provided in Figure 4-10.

4.2.4 Archive

To maintain a cohesive record of all the materials and data associated with the historical archive, all the compiled graphics and data presentation materials (outlined in Sections 4.2.1 through 4.2.3) are archived on CD-ROM with the historical spectrum images. All created files are archived in Adobe Acrobat .PDF format, using Acrobat Writer software. This format is readable on any computer format. A shareware version of Adobe Acrobat Reader 3.0 is also provided on the CD-ROM, should a user not have access to the software to view and/or print the site-specific materials.

4.3 PRODUCING THE CD-ROM

Once all the selected images have been archived in Photo CD format (Section 4.1.3), and all associated data presentations and CD-ROM archive descriptors have been archived in Acrobat format, (Section 4.2.4), the final CD-ROM archive is prepared. A final review of all archive descriptors, data files, and data presentation images should be made by the project manager prior to compilation. Computer Outfitters of Fort Collins, Colorado, currently conducts this final compilation process and produces the spectrums on CD-ROMs. The final CD-ROM spectrum archives could be performed at ARS, however, time and experience limitations have warranted that the procedure be subcontracted at this time.

Figure 4-11 outlines the organization of the compiled historical archive materials. ARS provides all files on one or more 3.5” high-density diskettes. All images are provided on one or more Photo CDs. Note that site-specific title pages, site specification graphics, and cumulative frequency summaries are compiled into one Acrobat file (HISTDATA) for the final CD-ROM archive. A thumbnail layout of the HISTDATA contents displays to the user (Figure 4-12) whenever the file is launched. From the display the user can then maximize any one of the associated graphic presentations.

Computer Outfitters creates an archive of the original spectrum images in both Photo CD and JPEG format. In addition, all JPEG files are compiled in a Kodak QuickSolve database (Qbrowser) for easy user access, sorting, and on-screen image descriptor association. If necessary, a uniform contrast adjustment is made to the databased JPEG images. Figure 4-11 shows Qbrowser labeling instructions are of primary importance in relation to what image descriptor information appears when the user launches the Qbrowser image database. A limit of four lines of information can be displayed for each image. Figure 4-13 shows the thumbnail layout that displays to the user whenever the Qbrowser catalog file (photos.cat) is launched.

READ1st.PDF

Software Requirements

Adobe Acrobat Reader 3.0

Acrobat Reader 3.0 allows anyone to view, navigate through, and print a document in the Adobe Portable Document Format (PDF).

To install Acrobat Reader 3.0 for Windows, run the SETUP.EXE program located in the Reader\Win\Reader folder (directory) of this CD-ROM. Additional directions are available in the README files located in the Acrobat Reader folders.

You may make and distribute unlimited copies of the Acrobat Reader software, including copies for commercial distribution, as long as each copy that you make and distribute includes the following:

- Acrobat Reader installer, exactly as provided by Adobe
- Acrobat Reader Electronic End User License Agreement
- Copyright and other proprietary notices included in Acrobat Reader

Once installed, full instructions on using Acrobat Reader 3.0 can be viewed in the Acrobat Reader 3.0 Online Guide. The Acrobat Reader 3.0 Online Guide can be accessed via the Acrobat Reader or Acrobat Exchange Help menu.

Kodak QuickSolve Browser

Kodak QuickSolve Browser software can be used to retrieve JPEG (JPG) images stored on the master disk.

QuickSolve Browser software allows you to:

- View provided catalog files (e.g., Photos.CAT).
- Display, copy, and print thumbnails in a Database Thumbnail Viewer window.
- Display, zoom, crop, copy, rotate, and print JPEG resolution (512 X 768) images displayed in photo windows.
- Create slide shows of your imagery.

For full instructions on using the Kodak QuickSolve Browser, go to the Qbrowser folder and launch QBROWSER.EXE. Access the Help menu within Qbrowser for a detailed listing of topics.

-- continued --

Figure 4-10. READ1st File Included on the CD-ROM.

System Requirements

- x86-based personal computer (486DX minimum, Pentium or Pentium Pro recommended), CD-ROM drive, 8-bit SVGA graphic card
- Microsoft Windows 3.1, Microsoft Windows for Workgroups, Microsoft Windows 95, Microsoft Windows NT3.51 or 4.0
- 8 MB application RAM
- 5 MB hard disk space, plus 7 MB additional temporary disk space available during installation
- True Color (32-bit) display and 2 MB video ram recommended for optimal viewing
- For viewing PDF files inside of a Web browser: Netscape Navigator 3.0 or later (3.0.1 or later recommended) or Microsoft Internet Explorer 3.0 or later. Netscape Navigator 2.0.2 can also be used with limitations; e.g. it will not allow you to submit a PDF form. You may also be able to use other Web browsers that fully support the Netscape APIs.

Other Information related to this CD

This CD-ROM contains Acrobat Reader 3.0 and Kodak QuickSolve Browser (QBROWSER) software. Acrobat Reader 3.0 or later must be installed prior to viewing any provided PDF format file. Qbrowser software can be accessed directly from the CD. It is not necessary to install QuickSolve Browser on your hard drive. Additional software related issues are addressed in the folder-specific README files provided by the software vendors.

In order to view the contents of this CD; launch any of the Adobe Acrobat files by double clicking any .PDF extension file. Photographic images can be accessed via the Kodak QuickSolve Browser: go to the Qbrowser folder and launch QBROWSER.EXE. Additional project-specific contents and access information can be viewed by opening the file titled CDINFO.PDF.

This CD was created by Air Resource Specialists, Inc. for the IMPROVE Program under contract to the National Park Service (NPS), Air Resources Division. The National Park Service is the copyright owner of all provided images. Any commercial use or duplication of this material without prior approval or licensing is forbidden. Use of the provided images should reference the IMPROVE Program. Additional information regarding the IMPROVE and NPS Air Quality Programs can be obtained by accessing the NPS AIRWeb site at http://www.aqd.nps.gov/natnet/ard/.

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for the IMPROVE Program
1998

Figure 4-10 (Continued). READ1st File Included on the CD-ROM.

Project Title: Canyonlands National Park

Date Submitted: 3/17/98 Date Reviewed: 3/27 KS

Quantity: Original + 10 copies

Date Complete: _____

ARS PO # 16853

ARS Project: IMPROVE3

Due Date: _____

ADI Computer Outfitter Invoice #: 27073CD

Writable CD File		ARS files to include (in order of appearance)			
Name	Type	File Orntn #	File Orntn #	File Orntn #	File Orntn #
CDINFO	PDF	cdinfo.pdf P/2			
READ1st	PDF	read1st.pdf P/2			
READ1st	TXT	Read1st.txt P/2			
CONTENTS	PDF	Canycont.pdf L/2			
HISTDATA	PDF	Canytitl.pdf L/1	Canyspec.pdf L/1	Canyfreq.pdf P/1	
					thumnail layout

Images: 51

Non-Cataloged Images (greyscales): 2 (#53 & 52)

Photo CD #: 7314-3252-1468

Image Density Adjustment: Y N

CD Contents Reference File: canycont.pdf

Excel CD Reference File: canycont.xls (sheet #1)

QBrowser Labeling (limit 25 char. @ 6pt, 17 char. @8pt)	Order of Appearance (limit 4 lines)
Project: Canyonlands National Park	# 1
Series #: full description	
Truncated Series Name: see Excel series value	# 2
Category – Date/Time: 7/2/91, 9:00 7899	# 3
Catalog #: comment field enter for all	
Image ID: however only display for #	# 4 only for 49, 50, & 51
Data Field #1:	
Data Field #2:	

Notes: Archive greyscales, but do not include in QBrowser catalog.
ARS Greyscales 32 step #9, 24 step #10

G:/project/improve/spectrum//adiotftfrm.doc
2/98

Figure 4-11. Example Organization of Compiled Archive Materials.

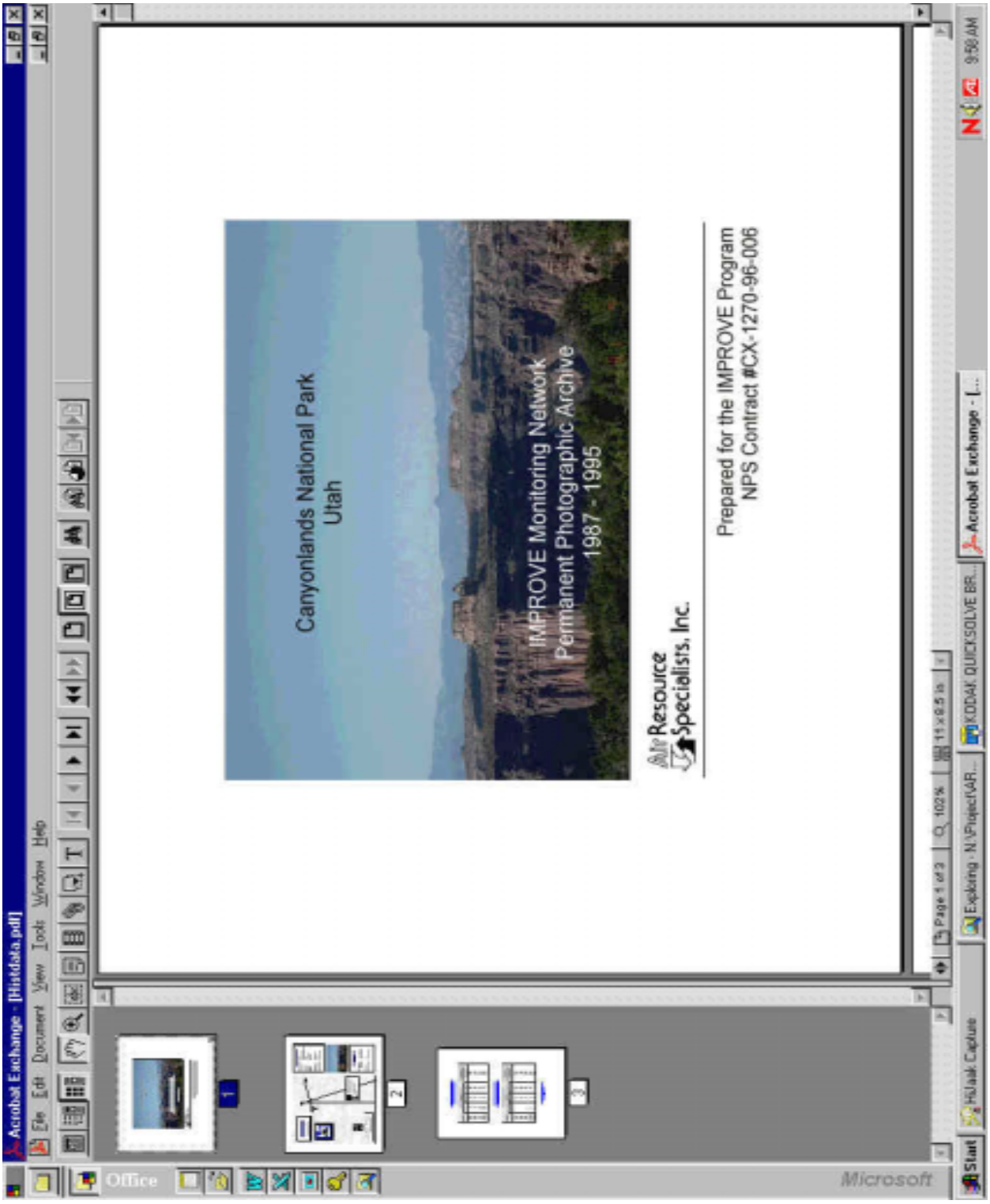

Figure 4-12. Layout of HISTDATA Acrobat File.

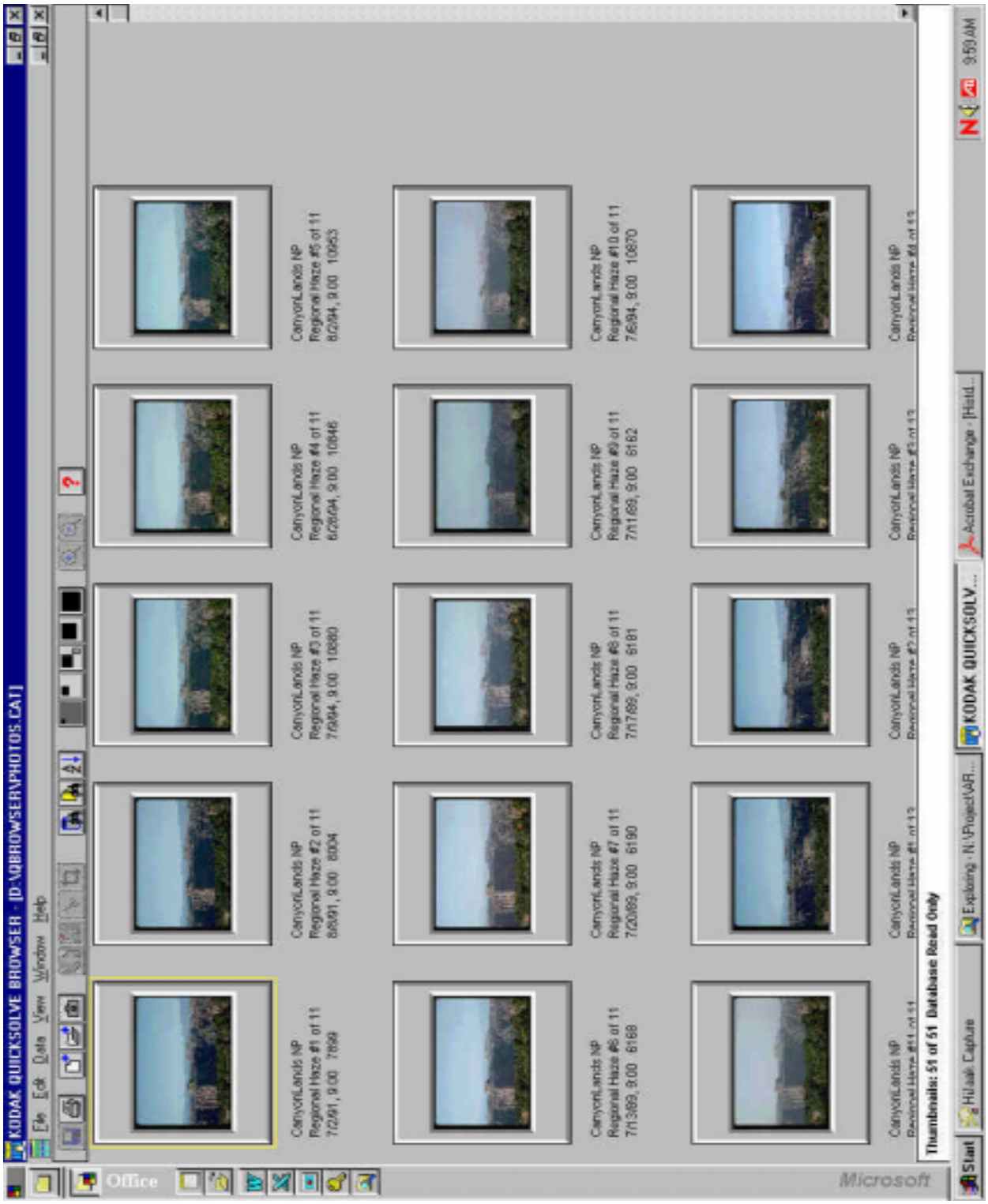

Figure 4-13. Layout of Kodak Qbrowser Catalog File (photos.cat).

One master copy of the final CD-ROM archive is prepared and reviewed. Figure 4-14 lists the file structure and contents that should be verified for each site-specific archive. Copies of the approved master are prepared and checked again. Each CD copy is labeled and fitted with the site-specific CD cover information described in Section 4.2.3. Be certain to identify the master copy separately.

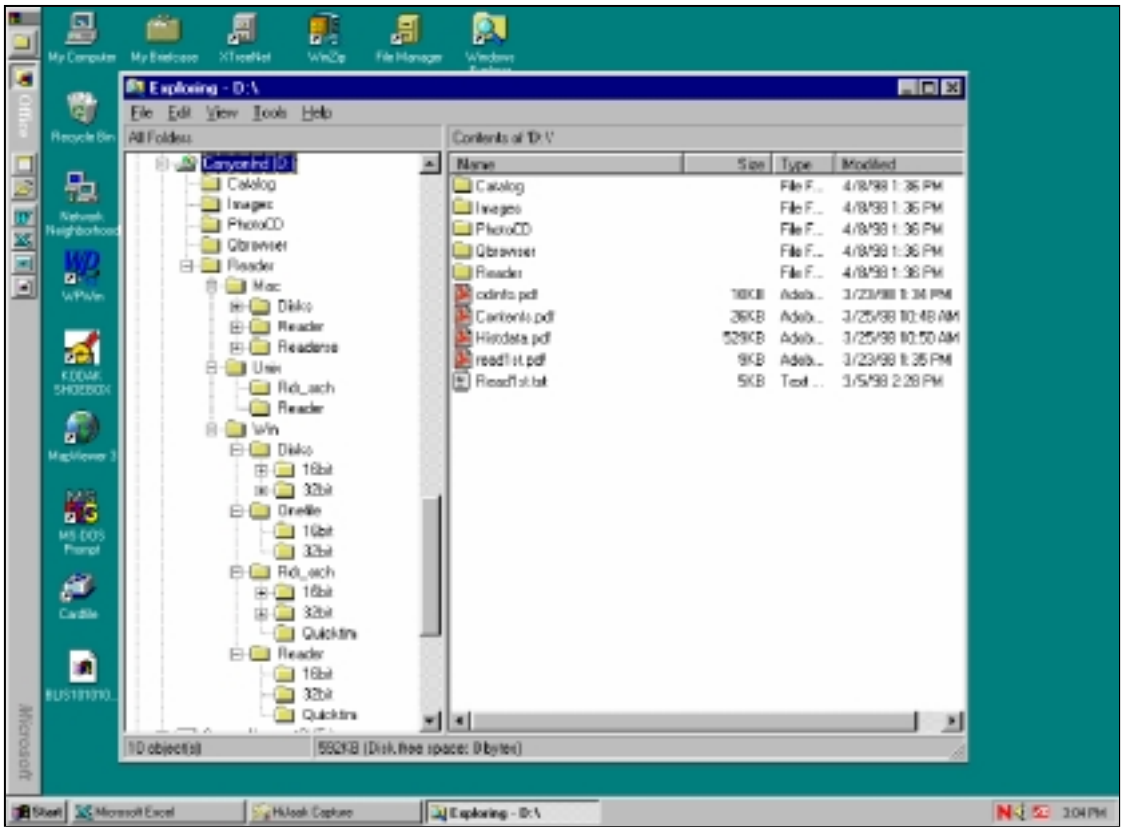

Figure 4-14. Example File Structure and Contents for Each Archive.

4.4 DISTRIBUTION

Final CD-ROM archive originals and copies are reviewed and approved by the project manager prior to preparation for distribution. When ready, ARS contacts the local project-specific COTR (e.g., Dee Morse, NPS Denver) for distribution requirements and provides the CD-ROM product(s) as directed. ARS' current distribution of NPS spectrum archives is:

Recipient	Agency	Number of Copies
Dee Morse	NPS, Air Resources Division (COTR)	5
Dr. William Malm	NPS, CIRA Division	1
Rich Damberg	EPA	1
Marc Pitchford	NOAA/EPA (IMPROVE Program Director)	1
ARS Archives		4

A letter detailing CD-ROM contents, file descriptors, access considerations, and product recipients must be prepared for shipment with the CD(s). Figure 4-15 shows an example letter used for the delivery of 6 completed CD-ROM archives. All items are packaged and shipped as directed.

4.5 ARCHIVING SPECTRUM MATERIALS

To maintain a long-term archive of the historical spectrum images and data presentation materials compiled, all materials should be organized and archived in an air-tight filing container. Materials included are organized as follows:

- Original 35 mm slide selections are stored in polyethylene slide protector sheets. Each slide is clearly marked with the slide archival number, date, and time the image was taken. At no time is an original slide permanently removed from the archival.

- Three sets of 35 mm slide duplicates are created from the original 35 mm Kodachrome slides. Each set is stored in polyethylene slide protector sheets and are labeled with the associated spectrum description, slide archival number, and date and time the image was taken. Included in the duplicate sets are copies of the gray scales used during the spectrum analysis process. These sets are created for future distribution purposes.

- One copy of all graphic and presentation materials included in the final CD-ROM archive are stored for reference in the air-tight container.

- One copy of the final CD-ROM archive is stored as the digital copy of all graphic presentation materials, and PCD and JPEG image archive. The master CD-ROM and original Photo CD are stored in the Historical Spectrum CD Archive located at ARS.

All unused images are returned to their point of origin or the permanent 35 mm slide storage area. Copies of all correspondence, purchase orders, or in-house working notes are maintained in the project-specific contract files.

A 168 mm archive tape of all slide spectrum analysis scanning files is maintained on a bi-monthly basis. Should an image need to be rescanned or reviewed, the pertinent files should be obtained from these backup tapes located in ARS' computer room.

5.0 REFERENCES

Air Resource Specialists, Inc., 1994, Preliminary Analysis of Uncertainty Associated With Extinction Estimates From 35mm Color Slide Densitometry of Natural Targets.

Allard, D., and I. Tombach, 1981, The Effects of Non-Standard Conditions on Visibility Measurement, Atmospheric Environment, 15:1847-1857.

Malm, W., 1979, Considerations in the Measurement of Visibility, APCA Journal, 29: 1042-1052.

Middleton, W.E.K., 1958, Vision Through the Atmosphere, 2nd Ed. Toronto, Canada: University of Toronto Press.

Molenar, J. (Air Resource Specialists, Inc.), 1997, WinHaze – Level 1 Visual Air Quality Modeler.

Air Resource Specialists, Inc.

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Suite E
Fort Collins, Colorado 80525
970-484-7941
FAX: 970-484-3423

December 4, 1998

Dee Morse
National Park Service, Air Resources Division
12795 W Alameda Parkway
Lakewood, CO 80228

Dear Dee,

In accordance with NPS Contract 1270-96-006, enclosed are five (5) copies of Visibility Slide Spectrum CDs for each of the following IMPROVE photographic monitoring sites:

Monitoring Location	Period Reviewed	# CD's Provided
Badlands National Park, SD	1987 - 1995	5
Chiricahua National Park, AZ (Hatchett Peak vista)	1986 - 1989	5
Chiricahua National Park, AZ (Mica Mountain vista)	1989 - 1995	5
Glacier National Park, MT	1985 – 1995	5
Rocky Mountain National Park, CO	1985 – 1995	5
Yellowstone National Park, WY	1986 – 1995	5

Please distribute these CDs to the parks, Tom Dotts (NPS), and any appropriate NPS Air Resources Division personnel at your earliest convenience. One (1) set of CDs has been shipped to Bill Malm (NPS/CIRA), Rich Damberg (EPA) c/o Vasu Kilaru, and Marc Pitchford (NOAA/EPA). Three (3) sets will remain here at Air Resource Specialists, Inc. with the original slide archives.

Digital images on each CD include: visibility condition spectrums (images selected to represent the range of visibility conditions at a site); regional haze, layered haze, and visibility episode examples; and scenic images. The number of spectrums and total number of slides selected for each spectrum vary for each site depending on the vista, the variability in visual air quality at the monitoring location, the period of monitoring, and the completeness of the slide database. Supporting documentation on each CD includes: site specifications and associated photographic monitoring history, slide spectrum visibility condition summaries (in units of $b_{ext}(Mm^{-1})$, VR, and dv), and representative cumulative frequency values of associated reconstructed extinction IMPROVE aerosol data (compiled 10/98).

Figure 4-15. Example Distribution Letter.

All images and documentation are self-contained on the provided CDs. Photographic images are provided in both JPEG (compressed 512 x 768) and high resolution PCD (2048 x 3072) format. All images are cataloged and accessible through the provided Kodak QuickSolve Browser. All graphics and documentation have been archived in portable digital format (PDF) for easy display, printing, and Internet application. Each CD also contains Acrobat Reader 3.0 and Kodak QuickSolve Browser software as well as a series of readme text (TXT) files. Acrobat Reader 3.0 must be installed prior to viewing any PDF file. The QuickSolve Browser software can be accessed directly from the CD, however optimal performance is obtained by installing it directly on your hard drive. Reference the files READ1st.TXT and CDINFO.PDF on the root directory of the provided CDs for more information.

We are excited about the numerous applications of these CDs and their use for ongoing photographic data requests of the National Park Service and IMPROVE Program. I appreciate your patience awaiting the delivery of final products. Please feel free to call me if you have any comments or problems accessing the data.

Sincerely,

Kristi Savig

Kristi Savig
Project Manager

KS:ks
Enclosure

cc: B. Malm (NPS), M. Pitchford (EPA/IMPROVE)
R. Damberg (EPA, c/o Vasu Kilaru)

Figure 4-15 (Continued). Example Distribution Letter.

APPENDIX A

SLIDE SCANNING PROCEDURES

USING THE POLAROID SPRINTSCAN 35/LE SLIDE SCANNER

A.1 SCANNING PHOTOGRAPHIC SLIDES

A.1.1 Maintenance and Start-up

Use extreme caution around the Polaroid scanner. Avoid excessive dust, food, or lint particles near the instrument; dust is the leading cause of image imperfections while scanning.

The slide chamber should be kept clean at all times. On a weekly basis before turning on the computer or scanner, lift the front scanner panel and blow canned air into the 35 mm slide chamber. To begin scanning, launch the PolaColor Insight (Version 3.1) software.

A.1.2 Scanner Calibration

The scanner needs to be calibrated each time a new slide set is introduced. All of the settings associated with the calibration/scanning job can be saved to a job file for future access. It may be necessary to calibrate the scanner more than once for large slide sets. When a set covers a wide range of visibility, the exposure will also change substantially from extremely clean (crisp, deep blue skies) to extremely dirty (bright overexposures with milk-colored skies). Each calibration will be associated with a corresponding gray scale slide and scan job file. Scanner calibration includes adjusting the settings, defining a job, creating a file, and scanning a gray scale slide. These procedures are as follows:

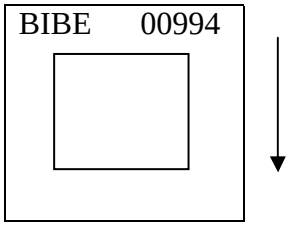
SET THE PROGRAM SETTINGS

Choose **Preferences** from the drop-down "Edit" menu and select the **Scanning** tab. Verify that *default resolution* and *perform auto exposure* are selected.

DEFINE SCAN JOB

Select a slide from the set that represents the overall coloration and exposure/visibility ranges. If the set covers a wide extreme of conditions, select one slide to represent the clean end and one to represent the dirty end.

Air-blow the slide for any dust particles. Insert the chosen slide into the 35 mm slide chamber.



Select the **Preview tab**. Set the scanning "Profile Input" to **Kodachrome** and the "Display" to **Monitor, PC**. Define the calibration (preview) crop box for the image displayed. Select the **Preview button** to cache the image. The slide will enter the chamber and be scanned. Note that there are two types of scans: the Preview scan and the Final scan. Only the Final scan creates a disk file that is used for the contrast calibration process.

DEFINE SCAN JOB (continued)

Select the **Tone** tab. Deselect the **Split View** box. Select the **Auto Exposure** button. The image will be adjusted to best calibrate the lightness and contrast corrections for scanning. Document the lightness and contrast settings defined. These can be manually adjusted during the calibration (job definition) process. Figure A-1 shows the Polaroid SprintScan software window.

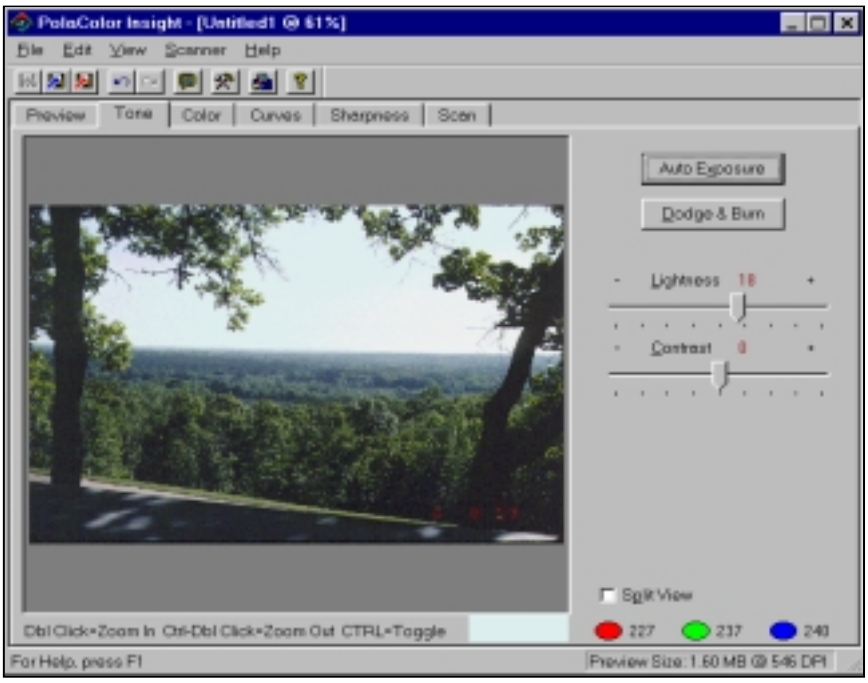


Figure A-1. Polaroid SprintScan Software Window (With Default PolaColor Insight Control Settings).

Select the **Scan** tab. All output formats are defined here. Adjust the crop box around the portion of the image to be scanned.(This should be defined by the project manager prior to scanning).

Set the image output dimensions. A width of 3” to 4” should be selected to allow for scanning/contrast estimations.

- Select a resolution of **300** dpi. (Width and height dimensions may change slightly).
- Select the **Fixed Size** box.
- Perform a final scan of the auto calibration image. Select the **Scan** button. Save the scanned image to a .TIF file with the following naming convention:

##_0011aut.tif

DEFINE SCAN JOB (continued)

Where ## represents the spectrum sequence number, *0011* represents the corresponding slide number, and *aut* denotes the slide as the auto-calibration reference.

Save the file in the site-specific subdirectory that is associated with the spectrum being scanned (e.g., CANY\900\04_0011aut.tif). Document the slide scanned and saved file name on the Slide Scanning Log. Denote "auto" in the comments section of the scanning log.

EXPORT JOB SETTINGS TO A JOB FILE

The auto-calibration described above defines the job settings for the specific site and required scanning output (scanning area). It is necessary to save the defined settings to a file that can be used for future slide scans of the same set.

Turn off the *Auto Exposure* preference to assure that all slide spectrum and gray scale scans for the set will use the same autoexposure setting as the calibration slide.

Choose **Preferences** from the drop-down "Edit" menu and select the **Scanning** tab. Change the selections to **Default Resolution** and **Use Current Tools**.

Choose **Export Settings** from the drop-down "File" menu. Save the job file with the following naming convention:

SITE0011_jjj

Where *SITE* represents the spectrum site abbreviation, *0011* represents the corresponding auto-calibration slide number, and *jjj* denotes the Julian date the job settings were defined.

Save the file for future reference in the site-specific subdirectory that is associated with the spectrum being scanned (e.g., CANY\900\CANY0011_161.bsf). Document the job name on the Slide Scanning Log.

Exit the PolaColor Insight software.

SELECT AND SCAN GRAY SCALE SLIDE

Every spectrum set and auto-calibration slide must have an associated gray scale slide scanned and archived for future reference measurements.

Select the ARS gray scale slide that will be associated with the spectrum set. Both 24-step and 32-step gray scale slides are available with calibrated transmission measurements. (Direct gray scale transmission measurements must be obtained from a fully calibrated densitometer, such as the ESE Speedmaster located at the CIRA office of the National Park Service).

SELECT AND SCAN GRAY SCALE SLIDE (continued)

Launch the PolaColor Insight software. Select **Import Settings** from the drop-down "File" menu, and import the associated job file (e.g., CANY0011_161.bsf) from the site-specific subdirectory.

Select **Preferences** from the drop-down "Edit" menu, to verify that the *Auto Exposure* is off and the scanning setting is set *to Use Current Tools*.

Air-blow and insert the gray scale slide into the 35 mm slide chamber.

Select the **Preview tab** and **Preview button**. The slide will enter the chamber and be scanned. Set the crop box around the entire gray scale image in the preview window.

Select the **Tone** tab. The image will be adjusted to the same lightness and contrast settings as the auto-calibration slide. DO NOT depress the "Auto Exposure" button.

Select the **Scan** tab. Verify that the crop box surrounds the entire gray scale image to be scanned. If necessary, deselect the fixed size box to frame the entire gray scale. You must reselect the fixed size box to hold the new frame dimensions. Scan and save the gray scale file as *g###_0011jjj.tif* in the appropriate site-specific subdirectory. Where *###* represents the ARS gray scale number, *0011* represents the associated auto-calibration slide number, and *jjj* represents the Julian date the job file was created.

(NOTE: full slide scans (i.e., the entire preview screen) create very large .TIF files. It is important to backup data created during the scanning process on a bi-monthly basis).

Denote the saved file name on the Slide Scanning Log and the specific Gray Scale Scanning Log associated with the auto-calibration.

Resetting the crop box and scanning output dimensions will alter the loaded job file. DO NOT save these altered job settings if asked to do so.

A.1.3 Scanning Selected Slides

Scanning complete spectrum sets includes loading the defined job settings (obtained during scanner calibration), performing individual scans, and saving scan files as outlined below:

LOAD JOB SETTINGS

Launch the PolaColor Insight software. Select **Import Settings** from the "File" menu and import the settings of the associated job file (e.g., CANY0011_161.bsf) from the site-specific subdirectory.

SCAN A SLIDE

Select **Preferences** from the "Edit" menu to verify that "Auto Exposure" is off and the "scanning tab" is set to *Use Current Tools*.

Air-blow and insert the chosen slide into the 35 mm slide chamber.

Select the **Preview tab** and **Preview button**. The slide will enter the chamber and be scanned. Verify that the crop box correctly frames the target/vista area defined by the project manager. (Wait while the scanner calibrates for the image).

Select the **Tone** tab. Verify that the image lightness and contrast settings match those of the auto-calibration slide. DO NOT depress the "Auto Exposure" button.

Select the **Scan** tab.

- Verify that the crop box correctly frames the target/vista area defined by the project manager. Changes to the width and height of the crop box are reflected in the "Width and Height" values boxes displayed in the viewing window.

- Select the **Scan** button. Save the scanned image to a .TIF file with the following naming convention:

##_0011.tif

Where *##* represents the spectrum sequence number and *0011* represents the corresponding slide number.

SAVE SCANNED FILE

Save the file in the site-specific subdirectory associated with the spectrum being scanned (e.g., CANY\900\05_0235.tif). Document the slide scanned and saved file name on the Slide Scanning Log.

Wait for the scanning process to complete. Remove the slide from the Polaroid SprintScan slide chamber and return the 35 mm slide to its original archive location.

SCAN ADDITIONAL SLIDES

Additional slides may be scanned by inserting a new slide into the scanning chamber and follow the same procedures as outlined above.

A.1.4 Terminating Scanning

To exit the PolaColor Insight Software, select **Exit** from the drop-down "File" menu or select the **X** in the upper-right window. Use caution if asked to change or save the default job settings. DO NOT save any job setting changes unless you are aware that the changes will be appropriately applied to the auto-calibration and gray scale scans. Convert all .TIF formatted files to .TGA files using the Adobe 5.0 Action Macro "tif to tga."

A.2 OBTAINING PIXEL STATISTICS

Red, green, and blue wavelength pixel statistics are obtained from a digital low resolution scan using ARS' Image Haze Simulation for Windows (OLDHAZE.EXE). The following procedures are used to determine the reported slide spectrum visibility measurements.

A.2.1 Spectrum Image Pixel Statistics

Specific target and sky areas to be measured should be defined by the project manager prior to scanning. Target and sky measurements are obtained as follows:

MEASURE TARGET AREA

Launch the OLDHAZE (Image Haze Simulation for Windows) software.

Select **Open Image** from the drop-down "File" menu, and open the scanned image (.TGA file) to be measured. Maximize the window size for the best viewing.

Select **Show Pixel Statistics** from the drop-down "Options" menu. Move the pixel statistics window away from the image window.

Using the visible cross-hatch (+), drag and drop a small box over the *identified target area*, as shown in Figure A-2.

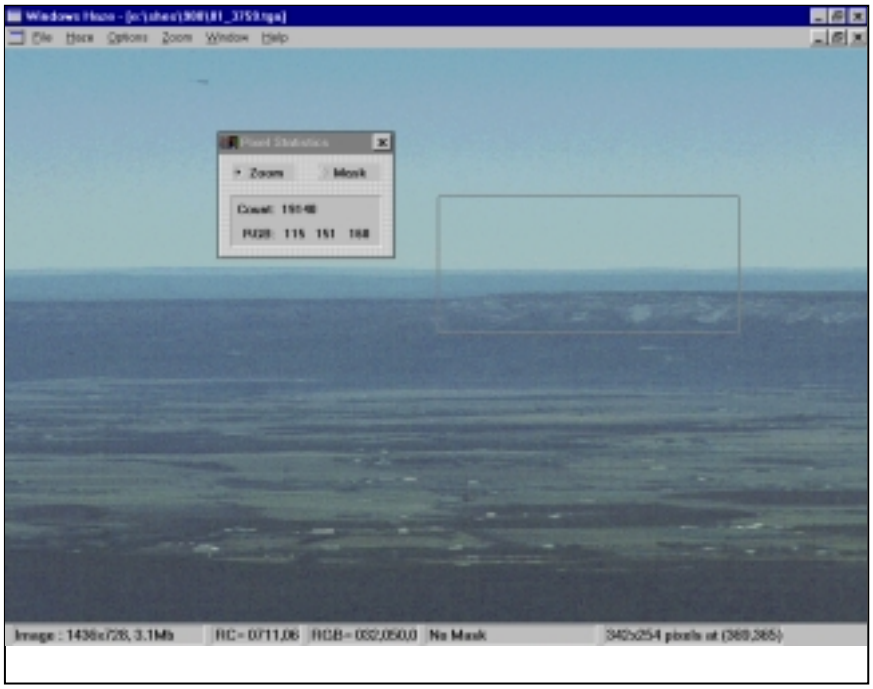


Figure A-2. Image Haze Simulation (OLDHAZE) Window. Example Display of Pixel Statistics.

Repeat this procedure two to three times to verify that a consistently exposed area is read (e.g., avoid shadowed ridges, cloud banks, etc.).

MEASURE TARGET AREA (continued)

Document the red, green, and blue numbers displayed in the viewing window in the *target column* of the Slide Spectrum Scanning Log (Figure A-3).

Click the right-mouse button to return to the full scanned image.

MEASURE SKY AREA

Using the visible cross-hatch (+) drag and drop a small box over the *identified sky area*, as shown in Figure A-2.

Repeat this procedure two to three times to verify that a consistently exposed area is read (e.g., avoid clouds, lens flare, etc.).

Document the red, green, and blue numbers displayed in the viewing window in the *sky column* of the Slide Spectrum Scanning Log (Figure A-3).

Click the **right-mouse** button to return to the full scanned image.

Up to 3 targets may be analyzed for each slide vista. Repeat the above steps for all identified target and sky areas.

A.2.2 Gray Scale Pixel Statistics

Pixel statistics must be obtained for each scanned gray scale associated the spectrum set's calibration. A Gray Scale Scanning Log should have been initiated during the calibration process described in Section A.1.

MEASURE STEP 1

Launch the OLDHAZE (Image Haze Simulation for Windows) software.

Select **Open File** from the drop-down "File" menu, and open the gray scale calibration file associated with the given site-specific spectrum set. Maximize the window size for the best viewing of the entire gray scale image.

Select **Show Pixel Statistics** from the drop-down "Options" menu. Move the pixel statistics window away from the image window.

Using the visible cross-hatch (+), drag and drop a small box over the center section of the upper-left gray scale cube (Step 1).

Document the red, green, and blue numbers shown on the "Step 1" line of the Gray Scale Scanning Log, as shown in Figure A-4.

Click the **right mouse** button to return to the full gray scale frame.

REPEAT FOR STEPS 2 THROUGH 24

Repeat the red, green, and blue measurement for each cube of the gray scale; left to right, top to bottom, Steps 1 through 24 (or 1-32).

Select **Exit** from the drop-down "File" menu to exit the OLDHAZE program.

Slide Spectrum Scanning Log
Polaroid SprintScan 35 Format

Site Name/Time: Shenandoah Dickey Ridge 0900

Job Name: SHED0023_254.bsf

Pixel Frame Dimensions/Resolution/Lightness Contrast:
4.88 x 2.19 @ 300 dpi

Date/Initials: 9/11/99 KS

	File Data		Target				Sky				
SLIDE NUMBERS	SLIDE DATE	GRAY SCALE	TARGET #	RED	GREEN	BLUE	RED	GREEN	BLUE	CONTRAST	COMMENTS
SHED0494		G24A 0	T1	53	66	100	140	162	178	-.875	
		98-24A	T2	43	49	64	152	173	186	-.940	
SHED0023			T1	68	95	121	123	150	166	-.701	auto exp
			T2	48	61	78	131	157	172	-.884	l = 14 c = 0
											manually changed
SHED0029			T1	72	105	141	119	147	172	-.593	
			T2		65			153		-.858	
SHED0303			T1	85	107	151	119	142	176	-.529	
			T2		68			144		-.817	
SHED0343			T1		134			149		-.247	
			T2		100			146		-.637	
SHED0090			T1		131			138		-.127	
			T2		105			135		-.488	
SHED0082			T2	93	121	147	118	145	166	-.374	
SHED0311		G24A 0	T2	96	120	147	131	152	176	-.472	auto exp
		98-241									l = 18 c = 0
											manually changed
SHED0279			T2	97	118	156	117	138	171	-.344	
SHED0074			T2		134	?		144	?	-.166	target not visible

Figure A-3. 35 mm Slide Image, Pixel Statistics, and Contrast Estimations (Excel format).

Gray Scale Scanning Log
Red, Green, Blue Pixel Statistics

ARS Gray Scale ID#: 98-24a Reference Site: SHED

Date Scanned/Gray Scale File: 9/11/99 g24a-0023254 Calibration Slide #: 0023

GRAY SCALE STEPS	RED	GREEN	BLUE
Step: 1	230	237	231
Step: 2	225	234	226
Step: 3		226	
Step: 4		218	
Step: 5		206	
Step: 6		191	
Step: 7	176	185	179
Step: 8		170	
Step: 9		157	
Step: 10	144	144	143
Step: 11		131	
Step: 12		120	
Step: 13		117	
Step: 14		108	
Step: 15		96	
Step: 16		87	
Step: 17	67	74	83
Step: 18		65	
Step: 19		51	
Step: 20		45	
Step: 21		37	
Step: 22		31	
Step: 23	27	27	43
Step: 24		28	

Figure A-4. Example Gray Scale Slide Spectrum Analysis Log (Excel format).

A.3 CALCULATING SLIDE CONTRASTS

All documented slide spectrum image and gray scale pixel statistics (Section A.2) are input into ARS' CONTRAST.EXE software to determine associated slide spectrum contrasts. Each set or subset of spectrum images should have an associated Gray Scale Analysis Log.

CALCULATE CONSTRASTS

Launch the CONTRAST.EXE program.

Select the **Reset Calibration Curve** tab.

Enter 10 steps of the gray scale *green pixel values* (Density Numbers) into the contrast calculation window. Note that the steps do not need to be consecutive, just sequential.

Enter the corresponding step gray scale *green density values* from the documented Gray Scale Calibration Form, as shown for ARS gray scale 98-24a in Figure A-5.

Select the **Accept Calibration Curve** tab. Note that an "unacceptable density error may occur following the calibration process. If so, re-evaluate the 10 steps chosen. Verify that the green wavelength numbers do not exceed 255. Exit the program and begin again.

REPEAT FOR EACH SLIDE

For each slide associated with the calibration gray scale continue with the following procedures.

Enter the *sky DN* (density number) pixel statistics documented for the green wavelength on the Slide Spectrum Analysis Log.

Enter the *target DN* (density number) pixel statistics documented for the green wavelength on the Slide Spectrum Analysis Log.

Select the **Calculate Contrast** tab in the contrast viewing window.

Document the resulting target contrast on the Slide Spectrum Analysis Log.

Continue to enter the sky and target density numbers for each target and slide documented on the log.

The calibration curve must be reset for the appropriate gray scale associated with each spectrum. Note that it is often necessary to exit the CONTRAST.EXE program in order to reset the calibration.

24 Step Gray Scale

98 – 24a

Step	Red	Green	Blue	Target
1	0.33	0.27	0.29	0.20
2	0.39	0.29	0.33	0.30
3	0.45	0.36	0.43	0.40
4	0.51	0.43	0.51	0.50
5	0.60	0.52	0.59	0.60
6	0.72	0.63	0.71	0.70
7	0.78	0.67	0.72	0.80
8	0.87	0.77	0.83	0.90
9	0.94	0.88	0.93	1.00
10	1.03	0.98	1.03	1.10
11	1.18	1.10	1.14	1.20
12	1.30	1.18	1.20	1.30
13	1.36	1.22	1.25	1.40
14	1.46	1.30	1.35	1.50
15	1.58	1.43	1.47	1.60
16	1.69	1.53	1.59	1.70
17	1.80	1.63	1.76	1.80
18	1.96	1.77	1.92	1.90
19	2.14	1.97	2.08	2.00
20	2.31	2.05	2.12	2.10
21	2.45	2.16	2.20	2.20
22	2.70	2.41	2.43	2.35
23	2.95	2.76	2.71	2.55
24	3.04	2.99	2.94	2.75

Figure A-5. Example ARS Gray Scale and Values.

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QUALITY ASSURANCE/QUALITY CONTROL DOCUMENTATION SERIES	
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TYPE	**TECHNICAL INSTRUCTION**
NUMBER	**4610-5040**
DATE	**JULY 2003**

AUTHORIZATIONS		
TITLE	NAME	SIGNATURE
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PROJECT MANAGER	Scott Cismoski	
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OTHER		

REVISION HISTORY			
REVISION NO.	CHANGE DESCRIPTION	DATE	AUTHORIZATIONS
0.1	Add procedures to copy Retry folder files.	July 2004	

TABLE OF CONTENTS

1.0 PURPOSE AND APPLICABILITY

This technical instruction (TI) is a guide to the archiving and maintenance of digital images and data files collected from digital camera systems. This TI is referenced in Standard Operating Procedure 4610, *Scene Monitoring Archives*, and specifically describes all archive procedures associated with digital system products. Archive methods differ for remote digital camera systems (RDCS) and Web-based, high-resolution digital camera systems (HRDC).

2.0 RESPONSIBILITIES

2.1 PROJECT MANAGER

The project manager shall ensure that archives are accessible, orderly, complete, and current.

2.2 DATA TECHNICIAN

The data technician shall:

- Create an archive of digital images and data from memory cards on a personal computer (PC) directory structure (for remote digital camera systems).
- Create an archive of digital images and data on a CD-ROM.
- File the CD and maintain additional support documentation in file cabinets.

2.3 SITE OPERATOR

The site operator:

- Mail filled memory cards and accompanying documentation to ARS.
- Ship filled memory cards to ARS.
- Create an archive of digital images and data from the on-site computer on a CD-ROM (high-resolution digital camera systems).
- Ship a copy of the archive to ARS.

3.0 REQUIRED EQUIPMENT AND MATERIALS

Equipment and materials used for digital image and data archive include:

- Camera memory cards (remote digital camera systems)
- Memory card reader (PCMCIA Compact Flash reader, adapter, or USB Flash Card reader)
- Internet connection

- CD-ROMs
- CD-writer software
- Personal computer with CD drive
- Visibility Monitoring Status/Assessment Sheets
- Master Logs
- Manila file folders
- Hanging file folders
- Standard file cabinets

4.0 METHODS

The digital image and data archive is designed for accessibility and provides a permanent storage media for images. This section includes two (2) subsections.

4.1 Digital Image and Camera Data File Archives
4.2 Supporting Hard Copy Documentation Archives

4.1 DIGITAL IMAGE AND CAMERA DATA FILE ARCHIVES

Archive methods differ for remote digital camera systems (RDCS) and high-resolution digital camera systems (HRDC). Both methods are discussed below.

4.1.1 Remote Digital Camera Systems (RDCS)

Digital images from remote digital camera systems are extracted from memory cards. The images are archived to a PC or permanent media for data review, qualitative analysis, and reporting. A PCMCIA Compact Flash reader, adapter, or USB Flash Card reader is used to download image data from memory cards to a PC. All images and files are archived as individual files. The files contain the following information:

- *.JPG* files contain the sequential image number, date, and time the images were taken.
- The *Images.dat* file contains the camera system assigned date, time, zoom, temperature, battery voltage, and software programs applied for each collected image.

The archive is made first to a PC hard disk, then to a CD-ROM. The CD-ROMs are then filed with hard copy documentation. Archives are usually made on a monthly basis.

The image files and data file are archived using the following procedures:

PLACE MEMORY CARD IN READER	Place the filled memory card into the reader and activate the memory card reading software.
EXTRACT FILES TO PC	Extract the files and copy onto a prepared directory structure on a PC hard drive.
CREATE CD	Copy files to a CD using CD writing software.
LABEL THE CD	Label the CD appropriately.

Images are also stored in the Air Quality Database as a second archive. Refer to TI 4305-4100, *Collection and Handling of Digital Images*.

4.1.2 High-Resolution Digital Camera Systems (HRDC)

Digital images from high-resolution digital camera systems are downloaded from Web servers via the Internet or from the system's on-site PC. Images, an error file, and the configuration file (ARS_DIGICAM.INI) are stored in .ZIP files, one for each day. These .ZIP files are archived to CD-ROMs. On a monthly basis the disk on the on-site camera computer must be checked to verify sufficient space is available for another month of data. If sufficient space is not available, it is necessary to delete files from the data directory and make room on the computer for future images.

The image files are archived using the following procedures:

EXIT SOFTWARE	Exit the ARS_DIGICAM software.
COPY FILES	Copy all .ZIP files from C:\ARS_DIGICAM\DATA (except the .ZIP file for today) to the CD recorder drive.
COPY RETRY FILES	Copy all .ZIP files from C:\ARS_DIGICAM\DATA\RETRY.
CREATE CD	Create a CD that contains one month of images.
COPY CD	Make a second copy of the CD in a similar manner.
VERIFY READABILITY	Verify that both CDs are readable on the PC.
DELETE FILES	Delete all .ZIP files (except the .ZIP file for today) from the directory. Also delete any error files.
LABEL CDS	Label the CDs appropriately and store in a safe place. Write the .ZIP password on the CDs for future reference.

RESTART SOFTWARE — Restart the ARS_DIGICAM software and verify correct camera and system operation.

One CD archive remains on-site and the second CD is shipped to ARS for archive. Images may also be stored in the Air Quality Database. Refer to TI 4305-4100, *Collection and Handling of Digital Images*.

4.2 SUPPORTING HARD COPY DOCUMENTATION ARCHIVES

Supporting hard copy documentation for both the remote digital camera systems (RDCS) and high-resolution digital camera systems (HRDC) includes Master Logs, data coordinator/operator correspondence, and printouts of the catalog of images. The remote systems also include Visibility Monitoring Status/Assessment Sheets. All hard copy documentation is filed with the CD-ROM in a manila folder. The folder is labeled with the site abbreviation and memory card number.

Each file is then filed chronologically and stored in a hanging folder by site and quarter. Quarters are defined as:

1st Quarter	(January, February, March)
2nd Quarter	(April, May, June)
3rd Quarter	(July, August, September)
4th Quarter	(October, November, December)

Refer to TI 4305-4100, *Collection and Handling of Digital Images* for detailed collection and documentation procedures.