

QUALITY ASSURANCE/QUALITY CONTROL DOCUMENTATION SERIES	
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1.0 PURPOSE AND APPLICABILITY

This standard operating procedure (SOP) outlines the quality assurance and quality control actions associated with the reporting of photographic monitoring data. This SOP serves as a guide to assure high quality, consistent, data reporting for automatic camera stations operated according to IMPROVE Protocol.

The IMPROVE Program has partitioned visibility-related characteristics and measurements into three groups: optical, scene, and aerosol. This SOP pertains only to scene monitoring data reporting.

Documenting visibility events and trends is an important aspect of evaluating existing or potential impairment in Class I and other visibility-sensitive areas. Photography is an efficient way to document these events and trends 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 is an effective, economical component of any visibility monitoring program.

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

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

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

Data reports are prepared in a format that generally conforms to the *Guidelines for Preparing Reports for the NPS Air Quality Division* (AH Technical Services, 1987). Specific contents of each 35 mm or 8 mm report, however, are defined by the contracting agency. Qualitative 35 mm slide film reports provide supplemental data to further analyze collocated optical and/or aerosol monitoring equipment data. Time-lapse (8 mm) monitoring data are often used to summarize short-term special studies or site-specific visual anomalies.

The following technical instructions (TIs) provide detailed information regarding specific 35 mm and 8 mm reporting procedures:

- TI 4520-5000 *Scene Monitoring Reporting of 35 mm Slides (IMPROVE Protocol)*
- TI 4520-5010 *Scene Monitoring Reporting of 8 mm Time-Lapse Movie Film*

2.0 RESPONSIBILITIES

2.1 PROJECT MANAGER

The project manager shall:

- Determine the COTR's (Contracting Officer's Technical Representative) project- specific reporting and distribution requirements.
- Oversee preparation and finalize qualitative review discussions.
- Review draft and final data reports for completeness and accuracy.
- Verify that completed reports are properly distributed.

2.2 DATA ANALYST

The data analyst shall:

- Prepare qualitative review tables for inclusion in the data reports.
- Compile data statistics and compose text for draft reports.
- Coordinate with the secretary for report preparation.
- Review final reports for completeness and accuracy before distribution.

2.3 FIELD SPECIALIST

The field specialist shall provide current and accurate site specifications to the data analyst.

2.4 DATA COORDINATOR

The data coordinator shall:

- Provide site status and operational information to the data analyst.
- Review collected slide data to select slides representative of good, medium, and poor visibility conditions.

2.5 SECRETARY

The secretary shall:

- Word process draft and final reports.
- Coordinate with the data analyst for complete report information, format, and statistics.
- Prepare final, approved reports for photocopying and distribution.
- Distribute final reports in accordance with project-specific distribution requirements.

3.0 REQUIRED EQUIPMENT AND MATERIALS

All data reporting occurs on IBM-PC compatible systems. A word processing package capable of creating large documents with figures and tables is used (such as WordPerfect) with a letter-quality laserjet printer. Other materials include photocopy and binding machines (with required materials) or a photocopy and binding service.

4.0 METHODS

Data for each monitoring instrument type (nephelometer, transmissometer, or camera) are released in separate data reports. Data reports are prepared in a format that conforms to the *Guidelines for Preparing Reports for the NPS Air Quality Division* (AH Technical Services, 1987). Reporting consists of various text discussions and graphics presentations concerning the instrumentation and collected data. Specific contents of the seasonal and/or annual report are defined by the contracting agency COTR. This section includes four (4) subsections:

- 4.1 Seasonal Data Reporting
- 4.2 Annual Data Reporting
- 4.3 Other Reporting and Supplemental Data Products
- 4.4 Distribution

4.1 SEASONAL DATA REPORTING

Seasonal reporting is completed within three months after the end of a monitoring season. Standard meteorological monitoring seasons are defined as:

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

Scene data are typically presented in the following formats for each reporting season:

- Overview of monitoring program goals and objectives, and a description of the monitoring networks.
- Comprehensive discussion of data collection, reduction, processing, and archive procedures.
- Brief overview of monitoring configuration(s) and description of instrumentation.
- Map of all site locations and site abbreviations.
- Table of monitoring instrumentation history at each site.
- Table of site specifications and operating period for each site operational during the reporting season.
- Qualitative review summary of observed weather conditions, regional and layered haze, and plumes for each site operational during the reporting season.
- Detailed explanation of data presentations included as summary plots.
- Text discussions of observed events and visual anomalies (8 mm film reports only).
- Operation summary table listing data collection losses, problems, and problem resolution for each site.
- Discussion of events and circumstances influencing data recovery, specific for each site.

Refer to TI 4520-5000, *Scene Monitoring Reporting of 35 mm Slides (IMPROVE Protocol)*, and TI 4520-5010, *Scene Monitoring Reporting of 8 mm Time-Lapse Movie Film*, for detailed discussions regarding each type of data presentation.

4.2 ANNUAL DATA REPORTING

Annual reporting is completed within three months after the end of the last season to be reported. Scene data are typically presented in the following formats for each annual reporting period:

- Executive Summary containing specific program objectives, summary of observed visual and meteorological conditions, future considerations, and monitoring program objectives.
- Overview of monitoring program goals and objectives, and a history of the program.
- Comprehensive discussion of data collection, reduction, processing, and archive procedures.
- Brief overview of site configuration and description of instrumentation, including operator training, field servicing, and completion of status/assessment sheets.

- Map of all site locations and site abbreviations.
- Table of site specifications and operating period for each site operational during the annual reporting period.
- Brief discussion of routine field operations for each type of instrumentation, including operator training, field servicing, and completion of status/assessment sheets.
- Brief discussion of quality control procedures.
- Qualitative review summary of observed weather conditions regional and layered haze, and plumes for each site and season during the annual reporting period.
- Comprehensive discussion of observed events, visual anomalies, and probable causes (8 mm film reports only).
- Summary of scene monitoring data collected over the history of each monitoring site.
- Conclusions and future monitoring considerations derived from experience and insights gained through operation of the network and qualitative review of data collected.

Refer to TI 4520-5000, *Scene Monitoring Reporting of 35 mm Slides (IMPROVE Protocol)*, and TI 4520-5010, *Scene Monitoring Reporting of 8 mm Time-Lapse Movie Film*, for detailed discussions regarding each type of data presentation.

4.3 OTHER REPORTING AND SUPPLEMENTAL DATA PRODUCTS

Contracting agencies will periodically request additional data reports. Cases or events of special scientific, legal, or political importance to the NPS or other cooperating agencies may occur during the term of the project. New techniques, hardware, software, or other technical advances may also occur that will be applicable to the visibility monitoring program. Additional data reporting or analyses may be required to address these special circumstances and will be executed according to project-specific direction.

Contracting agencies may also request that supplemental data products be provided with seasonal and/or annual data reports. Supplemental data products may include:

- Slide duplicates representative of good, medium, and poor visibility conditions for each season that sufficient data are available for qualitative review.
- PC-compatible diskettes of seasonal slide condition code files (35 mm slide data only).
- VHS videotape of transferred 8 mm movie film data collected for the seasonal and/or annual reporting period.
- Optical (nephelometer/transmissometer) data summaries for collocated optical monitoring equipment.

4.4 DISTRIBUTION

Reports and supplemental data products are reviewed and approved by the project manager prior to preparation for distribution. When ready, ARS contacts the local project-specific COTR office for distribution requirements and provides the deliverable products as directed. The amount or type of deliverable product may vary with each report.

5.0 REFERENCES

AH Technical Services, 1987, Guidelines for Preparing Reports for the NPS Air Quality Division, September.

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1.0 PURPOSE AND APPLICABILITY

This technical instruction (TI) describes the procedures and methods for presenting and preparing written reports of 35 mm slide film. This TI is referenced from Standard Operating Procedure (SOP) 4520, *Scene Monitoring Data Reporting* and specifically describes:

- Reporting frequency and contents of seasonal 35 mm film reports.
- Reporting contents of annual 35 mm film reports.
- Provision of supplemental data products.
- Report distribution requirements.

2.0 RESPONSIBILITIES

2.1 PROJECT MANAGER

The project manager shall:

- Determine the COTR's (Contracting Officer's Technical Representative) project-specific reporting and distribution requirements.
- Oversee preparation and finalize qualitative review discussions.
- Review draft and final reports for completeness and accuracy.
- Verify that completed reports are properly distributed.

2.2 DATA ANALYST

The data analyst shall:

- Prepare qualitative review tables.
- Compile data statistics and compose text for draft reports.
- Coordinate with the secretary for report preparation.
- Review final reports for completeness and accuracy before distribution.

2.3 FIELD SPECIALIST

The field specialist shall provide current and accurate site specifications to the data analyst.

2.4 DATA COORDINATOR

The data coordinator shall:

- Provide site status and operational information to the data analyst.
- Review collected slide data to select slides representative of good, medium, and poor visibility conditions.

2.5 SECRETARY

The secretary shall:

- Word process draft and final reports.
- Coordinate with the data analyst for complete report information, format, and statistics.
- Prepare final, approved reports for photocopying and distribution.
- Distribute final reports in accordance with project-specific distribution requirements.

3.0 REQUIRED EQUIPMENT AND MATERIALS

All data reporting occurs on IBM-PC compatible systems. A word processing package capable of creating large documents with figures and tables is used (such as WordPerfect), with a letter-quality laserjet printer. Other materials include photocopy and binding machines (with required materials) or a photocopy and binding service.

4.0 METHODS

Major steps in the data collection, handling, processing, analysis, reporting, and archiving of 35 mm color slide film are presented in Figure 4-1. The specific type of data reporting described in this TI is highlighted in this figure.

Reports are prepared in a format that generally conforms to the *Guidelines for Preparing Reports for the NPS Air Quality Division* (AH Technical Services, 1987). However, specific contents of each 35 mm report are defined by the contracting agency COTR. Reporting consists of various text discussions and graphics presentations concerning operational aspects of 35 mm camera monitoring sites and film review. This section includes four (4) major subsections:

- 4.1 Seasonal Reporting
- 4.2 Annual Reporting
- 4.3 Supplemental Data Products
- 4.4 Report and Data Product Distribution

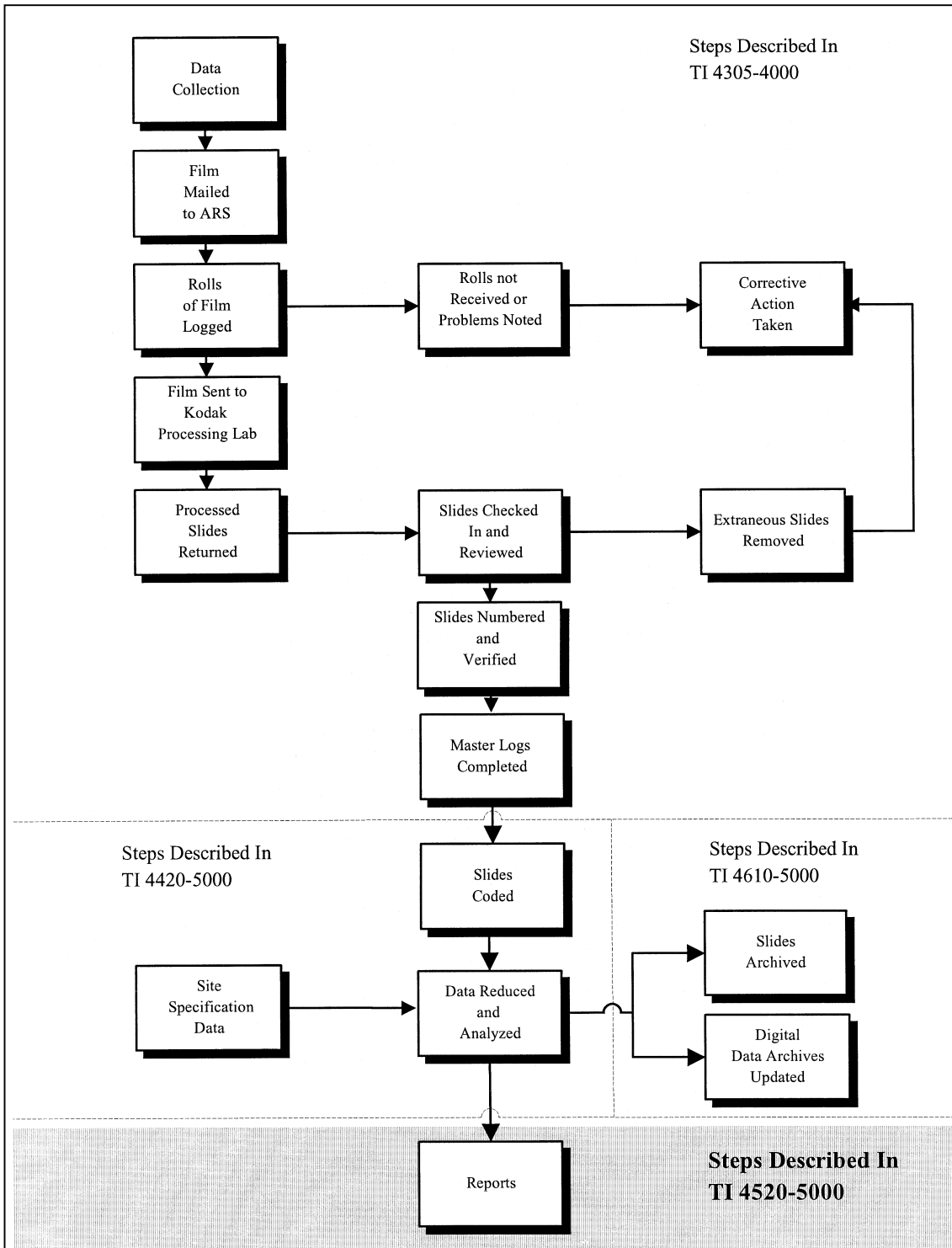


Figure 4-1. Major Steps in the Data Collection, Handling, Processing, Analysis, Reporting, and Archiving of Photographic Data.

4.1 SEASONAL REPORTING

Seasonal 35 mm film reporting is completed within three months after the end of a season. Standard meteorological monitoring seasons are defined as:

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

Seasonal reports contain four (4) major sections:

- 1.0 Introduction
- 2.0 Data Collection and Reduction
- 3.0 Photographic Data Summaries
- 4.0 References

Information and presentation formats included in each section are summarized in the following subsections.

4.1.1 Introduction

The introduction contains a conceptual overview of the purpose of the monitoring program and specific objectives and tasks of the program.

4.1.2 Data Collection and Reduction

Data collection and reduction is presented in two subsections, Site Configuration and Data Reduction.

4.1.2.1 Site Configuration

Automatic camera system components and basic system operation protocols are briefly discussed in each seasonal report. A detailed description of automatic camera system components and operation protocols are presented in Standard Operating Procedure (SOP) 4055, *Site Selection of Scene Monitoring Equipment*.

Also included is a map of the United States depicting the location of each monitoring site, and a monitoring history summary table describing each monitoring site, the type of optical and/or scene instrumentation installed, and the historical periods of operation for each instrument. An example Network Location Map and Visibility Monitoring History Table are provided as Figure 4-2 and Table 4-1, respectively.

4.1.2.2 Data Reduction

The data reduction section of each seasonal report contains two subsections that briefly describe how the slides are reduced and analyzed as well as quality control and quality assurance procedures applied during the data collection and reduction process. Qualitative analysis of 35 mm slides is only performed if specifically requested by the contracting agency.



IMPROVE SITES		NON-IMPROVE SITES TO BE OPERATED ACCORDING TO IMPROVE PROTOCOL	
SITE ABRV.	SITE NAME	SITE ABRV.	SITE NAME
1.	ACAD Acadia NP	16.	JARB Jarbidge W
2.	BIBE Big Bend NP	17.	LYBR Lye Brook W
3.	BOWA Boundary Waters Canoe Area W	18.	MACA Mammoth Cave NP
4.	BRCN Bryce Canyon NP	19.	MEVE Mesa Verde NP
5.	BRID Bridger W	20.	MORA Mount Rainier NP
6.	CANY Canyonlands NP	21.	OKEF Okefenokee NWR
7.	CARO Cape Romain NWR	22.	ROMO Rocky Mountain NP
8.	CHIR Chiricahua NM	23.	SAGO San Geronio W
9.	CRLA Crater Lake NP	24.	SHEN Shenandoah NP
10.	DENA Denali NP	25.	SHRO Shining Rock W
11.	DOSO Dolly Sods W	26.	SIPS Sipsy W
12.	EBFO Edwin B. Forsythe NWR	27.	TONT Tonto NM
13.	GLAC Glacier NP	28.	UPBU Upper Buffalo W
14.	GRCA Grand Canyon NP	29.	WEMI Weminuche W
15.	GRSM Great Smoky Mountains NP	30.	YOSE Yosemite NP

SITE NAME KEY	
NP	National Park
NM	National Monument
NS	National Seashore
NWR	National Wildlife Refuge
W	Wilderness

Figure 4-2. Example Visibility Network Location Map.

Table 4-1
Example Visibility Monitoring History Table

Network	Site Name	Teleradiometer				Camera				Transmissometer		Nephelometer	
		MANUAL Start	MANUAL End	AUTO Start	AUTO End	MANUAL Start	MANUAL End	AUTO Start	AUTO End	Start	End	Start	End
IMPROVE	Acadia NP			12/80	02/86	01/80	10/84	04/85		11/87	06/93	06/93	
IMP Pro.	Badlands NP							08/87		01/88			
IMPROVE	Bandelier NM	07/78	09/84			06/79	06/85	07/87		10/88			
IMPROVE	Big Bend NP	07/78	02/86			09/81	06/86	06/86		12/88			
IMPROVE	Boundary Waters Canoe Area W							10/85				05/93	
IMPROVE	Bridger W							09/86		07/88			
IMPROVE	Bryce Canyon NP	06/78	11/83	12/83	02/86	01/79	11/83	11/79					
IMPROVE	Canyonlands NP	09/78	02/86			07/82	01/87	01/87		12/86			
IMPROVE	Cape Romain NWR												
IMPROVE	Chiricahua NM	06/81	02/86			06/81	06/86	06/86		02/89			
IMPROVE	Crater Lake NP	07/81	09/82			08/82	09/82	06/85		09/88	09/91		
IMPROVE	Denali NP							06/88					
IMPROVE	Dolly Sods W							09/85				05/93	
IMPROVE	Edwin B. Forsythe NWR							05/92				04/93	
IMPROVE	Glacier NP	04/83	05/85	06/85	02/86	07/82	06/85	06/85		02/88			
IMPROVE	Grand Canyon NP (South Rim)	09/78	08/83	08/83	02/86	10/79	11/83	11/83		12/86			
IMPROVE	Grand Canyon NP (In-Canyon)									12/89			
IMP Pro.	Great Basin NP	06/82	02/86			06/82	05/86	05/86		08/92			
IMP Pro.	Great Sand Dunes NM							07/87					
IMPROVE	Great Smoky Mountains NP			11/83	11/85			01/84				04/93	
IMP Pro.	Guadalupe Mountains NP			02/82	02/86			06/83		11/88			
IMP Pro.	Haleakala NM							07/87					
IMP Pro.	Hawaii Volcanoes NP							10/86					
IMPROVE	Jarvis W							09/86				04/93	
IMP Pro.	Lassen Volcanic NP	06/82	11/83			08/82	11/83	06/87					
IMPROVE	Lye Brook W							05/87				08/93	
IMPROVE	Mammoth Cave NP							03/92				03/93	
IMPROVE	Mesa Verde NP	07/78	02/86			09/79	07/86	07/86		09/88	06/93		
IMPROVE	Mount Rainier NP			06/85	10/85			06/85				02/93	
IMP Pro.	National Capital-Central							12/88					
IMPROVE	Okfenokee NWR							04/92				02/93	
IMP Pro.	Petrified Forest NP							07/86		04/87			
IMP Pro.	Pinnacles NM							08/86		03/88	06/93		
IMP Pro.	Point Reyes NS							06/87					
IMP Pro.	Redwood NP							06/87					
IMPROVE	Rocky Mountain NP	06/80	02/86					10/85		11/87			
IMPROVE	San Geronio W							08/86		04/88			
IMPROVE	Shenandoah NP	05/80	11/85			05/80	10/86	10/86		12/88			
IMPROVE	Shining Rock W												
IMPROVE	Sipsey W							11/88	07/92				
IMPROVE	Tonto NM							04/89		04/89	06/93		
IMPROVE	Upper Buffalo W							11/88				02/93	
IMPROVE	Weminuche W							08/86					
IMP Pro.	Yellowstone NP	06/81	06/82			09/81	06/82	09/86		07/89	06/93		
IMPROVE	Yosemite NP	09/82	07/83	01/84	10/85	09/82	09/83	09/84		08/88			

NETWORK KEY

IMPROVE - IMPROVE site
IMP Pro. - Non-IMPROVE site to be operated according to IMPROVE Protocol

SITE NAME KEY

NP - National Park
NM - National Monument
NS - National Seashore
NWR - National Wildlife Refuge
W - Wilderness

The qualitative analysis subsection contains a brief discussion of the 35 mm slide data reduction and reporting procedures. The discussion includes a description of the slide review and coding process, as well as the compilation of the Qualitative Slide Condition/Haze Code Summary table. Refer to TI 4420-5000, *Qualitative Scene Coding and Data Reduction of 35 mm Color Slides*, for a complete description of these procedures.

The quality assurance subsection describes the quality control and quality assurance procedures applied in the photographic data collection and reduction process.

4.1.3 Photographic Data Summaries

Photographic data are presented in various forms depending on contracting agency requirements. Supplemental data products are described in Section 4.3. Each type of data summary is accompanied by an explanation. The following four (4) subsections are typically included in the seasonal report and detail each data presentation provided.

4.1.3.1 Site Specifications and Operating History

Each seasonal report contains a Site and Target Specifications Summary Table, listing complete target and site specifications for each scene monitoring site operational during the period. An example Site and Target Specifications Summary Table is provided as Table 4-2. Site specifications include the following:

- Site name and abbreviation
- Latitude, longitude, and elevation of the camera monitoring site
- Target name, target elevation, distance, azimuth, and elevation angle of the site path
- Number of observations taken per day
- Operating period during the season reported

4.1.3.2 Qualitative Slide Condition/Haze Code Summary

The Qualitative Slide Analysis Summary Table provides a site-by-site accounting of observed haze and target-concealed conditions for each site that operated during the reporting season. An example Qualitative Slide Analysis Summary Table is presented as Table 4-3.

4.1.3.3 Data Archival

This subsection contains a brief discussion of how the 35 mm slide film and digital slide condition/haze code files are archived. Refer to TI 4610-5000, *35 mm Photographic Slide Archives*, for a full discussion of 35 mm slide and digital file archiving procedures.

Table 4-2

Example Site and Target Specifications Summary Table

SITE NAME	SITE ABRV	CAMERA SYSTEM			SIGHT PATH					OBS. PER DAY	OPERATING PERIOD DURING SUMMER 1993
		LAT (°N)	LONG (°W)	ELEV (M)	TARGET NAME	ELEV (M)	DIST (KM)	AZIM (°)	ELEV ANGLE (°)		
ACADIA NP	ACAC	44°20'50"	68°13'40"	466	BLUE HILL	285	30.75	287	-0.34	3	06/01/93 - 08/31/93
BADLANDS NP	BADL	43°52'19"	102°13'51"	960	SHEEP MOUNTAIN	950	33.50	231	0.02	3	06/01/93 - 08/31/93
BANDELIER NM	BAND	35°47'20"	106°16'45"	2018	SANDIA CREST	3255	65.00	192	1.09	2	06/01/93 - 08/31/93
BIG BEND NP	BIBE	29°19'22"	103°12'27"	1165	DAGGER MOUNTAIN	1272	28.00	19	0.22	3	06/01/93 - 08/31/93
BOUNDARY WATERS CANOE AREA W	BWCA	47°56'48"	91°29'45"	515	GYPO LAKE RISE	463	30.00	316	-0.11	1	06/01/93 - 08/31/93
BRIDGER W	BRID	42°58'05"	109°44'50"	2860	MOUNT BONNEVILLE	3830	35.80	107	1.60	3	06/01/93 - 08/31/93
BRYCE CANYON NP	BRCN	37°28'00"	112°13'40"	2710	NAVAJO MOUNTAIN	3018	130.00	109	0.14	3	06/01/93 - 08/31/93
CANYONLANDS NP	CANY	38°29'10"	109°48'10"	1800	CATHEDRAL BUTTE	2420	58.70	171	0.60	3	06/01/93 - 08/31/93
CAPE ROMAIN NWR	CARO	**	**	**	**	**	**	**	**	-	-----
CHIRICAHUA NM	CHIR	32°01'00"	109°20'30"	2070	MICA MOUNTAIN	2620	117.00	281	0.27	3	06/01/93 - 08/31/93
CRATER LAKE NP	CRLA	42°54'45"	122°08'30"	2165	THE PALISADES	2057	8.88	42	-0.70	3	06/01/93 - 08/31/93
DENALI NP	DENA	63°29'25"	150°53'00"	646	MOUNT MCKINLEY	6194	47.50	189	6.66	3	06/01/93 - 08/31/93
DOLLY SODS W	DOSO	39°00'00"	79°19'25"	1265	BIG RUN #4172	1256	15.32	245	-0.03	3	06/01/93 - 08/31/93
EDWIN B. FORSYTHE NWR	EBFR	39°28'05"	74°27'13"	5	*	*	*	150	*	3	06/01/93 - 08/31/93
GLACIER NP	GLAG	48°32'10"	113°59'00"	960	GARDEN WALL	2194	29.50	46	2.39	3	06/01/93 - 08/31/93
GRAND CANYON NP	GRCT	36°02'21"	111°49'48"	2290	MOUNT TRUMBULL	2393	124.00	290	0.05	3	06/01/93 - 08/31/93
GREAT BASIN NP	GRBA	39°00'20"	114°13'10"	2085	NOTCH PEAK	2943	72.00	77	0.68	3	06/01/93 - 08/31/93
GREAT SAND DUNES NM	GRSA	37°42'10"	105°32'15"	2423	CEDAR CREEK PEAK	3360	44.50	339	1.21	3	06/01/93 - 08/31/93
GREAT SMOKY MOUNTAINS NP	GRSM	35°37'52"	83°56'38"	792	PARSON BALD	1432	14.00	157	2.62	3	06/01/93 - 08/31/93
GUADALUPE MOUNTAINS NP	GUMO	31°50'00"	104°48'30"	1650	SIERRA PRIETA	1585	43.00	226	-0.07	3	06/01/93 - 08/31/93
HALEAKALA NP	HALE	20°43'00"	156°15'13"	2947	HANAKAUHI	2715	7.57	77	-1.76	3	06/01/93 - 08/31/93
HAWAII VOLCANOES NP	HAWA	19°25'20"	155°17'10"	1220	KAIHOLENA	1158	41.25	230	-0.09	3	06/01/93 - 08/31/93

* Indicates that target specifications are not available.

** Indicates that the site has not yet been installed.

SITE NAME KEY

- NP National Park
- NM National Monument
- NS National Seashore
- NWR National Wildlife Refuge
- W Wilderness

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Table 4-3

Example Qualitative Slide Analysis Summary Table

Site Name	Site Abbr.	VISTA/TARGET	Total Observation	SUMMARIES BY NUMBER AND PERCENT (%)					
		Name		Uniform Haze	Ground-Based Layered Haze	Elevated Layered Haze	Multiple Layers	Target Concealed by Haze	Target Concealed by Weather
ACADIA NP	ACAC	BLUE HILL	161	141 (88)	1 (1)	0 (0)	0 (0)	0 (0)	20 (12)
BADLANDS NP	BADL	SHEEP MOUNTAIN	161	141 (88)	1 (1)	0 (0)	0 (0)	0 (0)	29 (18)
BANDELIER NM	BAND	SANDIA CREST	168	123 (73)	6 (4)	6 (4)	1 (1)	0 (0)	32 (19)
BIG BEND NP	BIBE	DAGGER MOUNTAIN	198	112 (57)	24 (12)	3 (2)	2 (1)	5 (3)	57 (29)
BOUNDARY WATERS	BWCA	GYPO LAKE RISE	267	245 (92)	3 (1)	1 (0)	0 (0)	0 (0)	18 (7)
BRIDGER W	BRID	MOUNT BONNEVILLE	267	245 (92)	3 (1)	1 (0)	0 (0)	0 (0)	30 (11)
BRYCE CANYON NP	BRCN	NAVAJO MOUNTAIN	254	208 (82)	4 (2)	0 (0)	0 (0)	0 (0)	42 (17)
CANYONLANDS NP	CANY	CATHEDRAL BUTTE	269	251 (93)	2 (1)	5 (2)	0 (0)	0 (0)	11 (4)
CHIRICAHUA NM	CHIR	MICA MOUNTAIN	125	103 (82)	1 (1)	0 (0)	1 (1)	0 (0)	20 (16)
CRATER LAKE NP	CRLA	THE PALISADES	99	97 (98)	0 (0)	0 (0)	0 (0)	0 (0)	2 (2)
DENALI NP	DENA	MOUNT MCKINLEY	233	144 (62)	60 (26)	1 (0)	2 (1)	19 (8)	49 (21)
DOLLY SODS W	DOSO	BIG RUN #4172	233	145 (62)	60 (26)	1 (0)	2 (1)	13 (6)	29 (12)
GLACIER NP	GLAG	GARDEN WALL	241	209 (87)	0 (0)	0 (0)	0 (0)	0 (0)	20 (8)
GRAND CANYON NP	GRCT	MOUNT TRUMBULL	57	28 (49)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
GREAT BASIN NP	GRBA	NOTCH PEAK	275	251 (91)	2 (1)	3 (1)	0 (0)	1 (0)	57 (21)
GREAT SAND DUNES NM	GRSA	CEDAR CREEK PEAK	275	252 (92)	2 (1)	3 (1)	0 (0)	0 (0)	21 (8)
GREAT SMOKEY MTNS NP	GRSM	PARSON BALD	91	85 (93)	0 (0)	0 (0)	0 (0)	0 (0)	6 (7)
HALEAKALA NP	HALE	HANAKAUHI	183	140 (77)	2 (1)	0 (0)	0 (0)	0 (0)	26 (14)
HAWAII VOLCANOES NP	HAWA	KAIHOLENA	185	129 (70)	20 (11)	1 (1)	1 (1)	0 (0)	35 (19)

4.1.3.4 Events and Circumstances Influencing Data Collection

Each seasonal report contains a discussion of the events and circumstances that influence data recovery. Operational summaries for each site are presented in a Data Collection Statistics and Operation Summary Table, provided as Table 4-4. The table includes the following:

- Site name and abbreviation
- Data collection period that the site was operational
- Number of total possible observations for the operational period
- The collection efficiency (number and percent) for the operational period
- A description of the cause or causes of data loss or problem description
- Resolutions and/or recommendation comments relating to the noted operational problems

4.1.4 References

References are presented in two subsections: Technical References, and Related Reports and Publications. Technical references are those documents that are cited in the seasonal report. Related reports and publications include all prior reports pertaining to the monitoring program, produced by Air Resource Specialists, Inc. (ARS).

4.2 ANNUAL REPORTING

Annual 35 mm reports summarize one year of standard meteorological monitoring seasons as defined by the contracting agency. Annual reporting is completed within three months after the end of the last season to be reported. Annual reports contain the eight (8) major sections listed below:

- Executive Summary
- 1.0 Introduction
- 2.0 Operational Procedures
- 3.0 Data Collection and Analysis Procedures
- 4.0 Standard Seasonal Reporting Procedures
- 5.0 Photographic Data Summaries
- 6.0 Conclusions, Recommendations, and Future Considerations
- 7.0 References

Information and data presentation formats included in each section are summarized in the following subsections.

4.2.1 Executive Summary

An executive summary is prepared that summarizes the annual report and specific program objectives for the annual monitoring period. Observed visual and meteorological conditions, as well as future considerations and monitoring program objectives are also summarized in this section for quick reference.

Table 4-4

Example Data Collection Statistics and Operation Summary Table

SITE NAME	SITE ABBRV	DATA COLLECTION PERIOD	DATA COLLECTION BY NUMBER AND PERCENT (%)			PROBLEM RESOLUTIONS/ COMMENTS
			TOTAL POSS.	COLLECTIO N EFFICIENCY	DATA COLLECTION LOSSES/ PROBLEM DESCRIPTION	
ACADIA NATIONAL PARK	ACAC	06/01/93 - 08/31/93	276	238 (86%)	Improper cable connection	Operator corrected connection
BADLANDS NATIONAL PARK	BADL	06/01/93 - 08/31/93	276	174 (63%)	Improper film loading Camera malfunction	Operator replaced camera
BANDELIER NATIONAL MONUMENT	BAND	06/01/93 - 08/31/93	184	184 (100%)		
BIG BEND NATIONAL PARK	BIBE	06/01/93 - 08/31/93	276	255 (92%)		
BOUNDARY WATERS CANOE AREA WILDERNESS	BWCA	06/01/93 - 08/31/93	92	92 (100%)		
BRIDGER WILDERNESS	BRID	06/01/93 - 08/31/93	276	258 (93%)		
BRYCE CANYON NATIONAL PARK	BRCN	06/01/93 - 08/31/93	276	226 (82%)	Late film change	Personnel shortage
CANYONLANDS NATIONAL PARK	CANY	06/01/93 - 08/31/93	276	209 (76%)	Improper film rewinding Improper cable connection	Operator corrected connection
CAPE ROMAIN NATIONAL WILDLIFE REFUGE	CARO	----				
CHIRICAHUA NATIONAL MONUMENT	CHIR	06/01/93 - 08/31/93	276	124 (45%)	Improper film loading	ARS instructed new operator
CRATER LAKE NATIONAL PARK	CRLA	06/01/93 - 08/31/93	276	269 (97%)		
DENALI NATIONAL PARK	DENA	06/01/93 - 08/31/93	276	276 (100%)		
DOLLY SODS WILDERNESS	DOSO	06/01/93 - 08/31/93	276	270 (98%)		
EDWIN B FORSYTHE NATIONAL WILDLIFE REFUGE	EBFR	06/01/93 - 08/31/93	276	274 (99%)		
GLACIER NATIONAL PARK	GLAG	06/01/93 - 08/31/93	276	276 (100%)		
GRAND CANYON NATIONAL PARK	GRCT	06/01/93 - 08/31/93	276	229 (83%)	Drained timer batteries Incorrect camera settings	Operator replaced batteries Operator corrected settings
GREAT BASIN NATIONAL PARK	GRBA	06/01/93 - 08/31/93	276	273 (99%)		
GREAT SAND DUNES NATIONAL MONUMENT	GRSA	06/01/93 - 08/31/93	276	239 (86%)	Late film changes	Personnel shortage
GREAT SMOKY MOUNTAINS NATIONAL PARK	GRSM	06/01/93 - 08/31/93	276	169 (61%)	Improper film loading Cable malfunction	Operator replaced cable
GUADALUPE MOUNTAINS NATIONAL PARK	GUMO	06/01/93 - 08/31/93	276	227 (82%)	Timer malfunction Improper film loading	Operator replaced timer
HALEAKALA NATIONAL MONUMENT	HALE	06/01/93 - 08/31/93	276	247 (89%)	Late film change	
HAWAII VOLCANOES NATIONAL PARK	HAWA	06/01/93 - 08/31/93	276	275 (99%)		
JARBIDGE WILDERNESS	JARB	06/01/93 - 08/31/93	257	85 (33%)	Incorrect camera settings	Operator corrected settings
LASSEN VOLCANIC NATIONAL PARK	LAVO	06/01/93 - 08/16/93	230	180 (78%)	Late film changes	Personnel shortage;site shut down for relocation
LYE BROOK WILDERNESS	LYBW	06/01/83 - 08/31/93	276	211 (76%)	Late film changes	Film not received at ARS until 10/12/93

4.2.2 Introduction

The introduction is presented in three subsections, Purpose of the Visibility Monitoring Program, History of the Visibility Monitoring Program, and Report Outline.

4.2.2.1 Purpose of the Visibility Monitoring Program

Similar to the seasonal reports, the annual report introduction contains a conceptual overview of the purpose of the monitoring program, including the overall goal (as presented from the Clean Air Act to federal land managers) to prevent any future and remedy any existing visibility impairment in Class I areas.

4.2.2.2 History of the Visibility Monitoring Program

The program's monitoring history is presented, including the scene, optical, and aerosol monitoring networks and monitoring technology changes over the term of the program. This section also includes a monitoring history summary table as described in Section 4.1.2.1.

4.2.2.3 Report Outline

Each annual report presents a brief discussion of the contents of the report, listing the major sections and appendices, and other delivered products that accompany the report.

4.2.3 Operational Procedures

Operational procedures are presented in five (5) subsections: General Network Description, Instrumentation and Siting Protocols, Routine Field Operations, Operator Training, and Quality Assurance.

4.2.3.1 General Network Description

This section of the annual report describes the monitoring sites that were operational during the reporting period. Included is a map of the United States depicting the location of each monitoring site operational during the annual period, and a tabular list of each monitoring site name, abbreviation, and monitoring configuration (e.g., IMPROVE, IMPROVE Protocol). An example Network Location Map is presented as Figure 4-2.

4.2.3.2 Instrumentation and Siting Protocols

Similar to the seasonal reports, automatic camera system components and basic system operation protocols are discussed in each annual report. A detailed description of automatic camera system components and operational and siting protocols are presented in SOP 4055, *Site Selection of Scene Monitoring Equipment*.

4.2.3.3 Routine Field Operations

Each annual report contains a discussion of routine field operations and scheduled and unscheduled servicing requirements. Routine field servicing requirements described are summarized in Table 4-5. Detailed discussions of routine site operator maintenance and field operations are presented in instrument-specific technical instructions (TIs). Reference SOP 4120, *Automatic Camera System Maintenance (IMPROVE Protocol)* for the TI that best describes the required automatic camera system configuration.

Table 4-5

Automatic Camera System Routine Field Procedures

Regular Maintenance performed at each film change:

- Inspect overall system and clean shelter window.
- Remove camera.
- Verify that film advanced and settings are correct.
- Rewind and remove film (complete film canister label).
- Load new film (complete film canister label).
- Inspect and clean camera lens.
- Check system batteries.
- Check camera and databack settings.
- Check timer settings.
- Photograph film documentation board.
- Replace and align camera.
- Verify system operation.
- Complete Visibility Monitoring Status/Assessment Sheet.
 - Document any equipment or monitoring discrepancies found.
 - Document all servicing or maintenance actions performed.
 - Describe weather conditions.
 - Describe visibility conditions.
- Close and lock camera enclosure.
- Mail film and the white copy of the completed Visibility Monitoring Status/Assessment Sheet to ARS.

Scheduled Maintenance performed as scheduled or as required:

- Change 35 mm databack batteries annually.
- Change 35 mm camera batteries every 6 months.
- Change 35 mm timer batteries every 6 months.

Unscheduled Maintenance performed as required:

- If the operator notes a problem, he/she calls or notifies the field specialist and/or data coordinator. If ARS notes a problem, the data coordinator calls the site operator.
- The site operator, in communication with ARS, applies troubleshooting and emergency maintenance procedures.
- If necessary, ARS express mails a replacement camera/timer system to the site.
- The site operator replaces the system and returns the malfunctioning unit to ARS.

ARS may be reached at the following numbers:

Telephone: 970/484-7941
FAX: 970/484-3423

4.2.3.4 Operator Training

Operator training procedures are presented for the monitoring program. The discussion includes monitoring program staff responsible for installations and training, scheduling of training sessions, and training procedures followed.

4.2.3.5 Quality Assurance

This subsection describes the quality control and quality assurance procedures applied in the photographic data collection and reduction process. Each annual report also contains a description of immediate and long-term corrective actions followed if monitoring problems are detected or reported.

4.2.4 Data Collection and Analysis Procedures

Data collection and analysis procedures are typically presented in three subsections: Field Documentation, Internal Documentation and Data Handling, and Qualitative Data Analysis. The data analysis section may be omitted if qualitative analysis of 35 mm slides is not requested by the contracting agency.

4.2.4.1 Field Documentation

This section of the annual report describes the identification and documentation procedures followed by site operators for each roll of 35 mm film.

4.2.4.2 Internal Documentation and Data Handling

The annual report contains a step-by-step description of data handling procedures and internal documentation used in the collection of 35 mm slide film. Detailed discussions of collection and data handling procedures can be found in TI 4305-4000, *Collection, Processing, and Handling of 35 mm Slide Film*.

4.2.4.3 Qualitative Data Analysis

This section contains a brief discussion of the 35 mm slide data reduction and reporting procedures requested by the contracting agency.

4.2.5 Standard Seasonal Reporting Procedures

Seasonal data are presented in various forms, depending on contracting agency requirements. Identical to each seasonal report, this section describes the photographic data summaries provided in each seasonal report, and the standard meteorological seasons which make up the annual report. Supplemental data products that may be provided with the annual report are described in Section 4.3 below.

4.2.5.1 Qualitative Slide Summary

This section further describes the slide review and coding process, as well as the compilation of the Qualitative Slide Analysis Summary Table. Refer to TI 4420-5000, *Qualitative Scene Coding and Data Reduction of 35 mm Color Slides*, for a complete description of these procedures.

4.2.5.2 Seasonal Archive Procedures

Each annual report contains a brief discussion of how the 35 mm slide film and digital slide condition/haze code files are archived. Refer to TI 4610-5000, *35 mm Photographic Slide Archives*, for a full discussion of 35 mm slide and digital file archiving procedures.

4.2.6 Photographic Data Summaries

Photographic data summaries for each meteorological monitoring season in the annual reporting period are combined and summarized in two sections: Site Specifications and Operation Summaries, and Qualitative Slide Condition/Haze Code Summaries.

4.2.6.1 Site Specifications and Operation Summaries

Each annual report contains a Site and Target Specifications Summary (see Table 4-2). Data Collection Statistics and Operation Summaries are also provided for each meteorological monitoring season in the annual period. Each summary table includes the site name, abbreviation, data collection period, and data collection efficiency statistics for each site operational during the reported monitoring season. An example Data Collection Statistics and Operation Summary Table is presented in Table 4-6.

4.2.6.2 Qualitative Slide Condition/Haze Code Summaries

Seasonal qualitative slide analysis summary tables for each meteorological monitoring season in the annual period are included in this section of the annual report. An example Qualitative Slide Analysis Summary Table is presented in Table 4-3.

4.2.7 Conclusions, Recommendations, and Future Considerations

Conclusions, Recommendations, and future considerations are presented in three subsections. This portion of the annual report provides a written summary of the data collected during the annual period, and details recommendations and future considerations that would enhance future network and program operations.

4.2.7.1 Conclusions

The annual report contains a written summary of all data collection, reduction, and reporting efforts during the annual period. Included are:

- Historical data collection efficiencies
- Qualitative statements regarding monitoring procedures and collection efficiencies
- Limitations of 35 mm scene monitoring
- Monitoring configuration changes made over the period
- Uses of 35 mm color slide film data
- Standards and miscellaneous protocols followed during the reporting period

Table 4-6

Example Data Collection Statistics and Operation Summary Table
as Presented in the Annual Report

SITE NAME	SITE ABBRV	DATA COLLECTION		
		Operating Period	Total Possible	Collection Efficiency
ACADIA NP	ACAC	06/01/91 - 08/31/91	276	263 (95%)
ARCHES NP	ARCH	06/01/91 - 08/31/91	276	273 (99%)
BADLANDS NP	BADL	06/01/91 - 08/31/91	276	213 (77%)
BANDELIER NM	BAND	06/01/91 - 08/31/91	184	160 (87%)
BIG BEND NP	BIBE	06/01/91 - 08/31/91	276	83 (30%)
BOUNDARY WATERS CANOE AREA W	BWCA	06/01/91 - 08/31/91	92	62 (67%)
BRIDGER W	BRID	06/01/91 - 08/31/91	276	165 (60%)
BRYCE CANYON NP	BRCN	06/01/91 - 08/31/91	276	276 (100%)
BUFFALO NR	BUFF	06/01/91 - 08/31/91	184	182 (99%)
CANYONLANDS NP	CANY	06/01/91 - 08/31/91	276	267 (97%)
CAPE ROMAIN NWR	CARO	-----		
CAPITOL REEF NP	CARE	06/01/91 - 08/31/91	276	276 (100%)
CAPULIN VOLCANO NM	CAMO	06/01/91 - 08/31/91	276	207 (75%)
CARLSBAD CAVERNS NP	CACA	06/01/91 - 08/31/91	276	272 (99%)
CHACO CULTURE NHP	CHCU	06/01/91 - 08/31/91	276	270 (98%)
CHIRICAHUA NM	CHIR	06/01/91 - 08/31/91	276	192 (70%)
COLORADO NM	COLM	06/01/91 - 08/31/91	276	268 (97%)
CRATER LAKE NP	CRLA	06/28/91 - 08/31/91	162	154 (95%)
CRATERS OF THE MOON NM	CRMO	06/01/91 - 08/31/91	276	83 (30%)
DEATH VALLEY NM	DEVA	06/01/91 - 08/31/91	276	264 (96%)
DENALI NP	DENA	06/26/91 - 08/31/91	200	137 (68%)
DINOSAUR NM	DINO	06/01/91 - 08/31/91	276	276 (100%)
DOLLY SODS W	DOSO	06/01/91 - 08/31/91	276	274 (99%)
EDWIN B. FORSYTHE NWR	EBFR	-----		
GLACIER NP	GLAG	06/01/91 - 08/31/91	276	276 (100%)
GLEN CANYON NRA	GLCA	06/01/91 - 08/31/91	276	264 (96%)
GRAND CANYON NP	GRCT	06/01/91 - 08/31/91	276	244 (88%)
GRAND TETON NP	GRTE	06/01/91 - 08/31/91	276	276 (100%)
GREAT BASIN NP	GRBA	06/01/91 - 08/31/91	276	272 (99%)
GREAT SAND DUNES NM	GRSA	06/01/91 - 08/31/91	276	274 (99%)
GREAT SMOKY MOUNTAINS NP	GRSM	06/01/91 - 08/31/91	276	259 (94%)
GUADALUPE MOUNTAINS NP	GUMO	06/01/91 - 08/31/91	276	262 (95%)
HALEAKALA NM	HALE	06/01/91 - 08/31/91	276	256 (93%)
HAWAII VOLCANOES NP	HAWA	06/01/91 - 08/31/91	276	218 (79%)
ISLE ROYALE NP	ISRO	06/01/91 - 08/31/91	276	218 (79%)
JARBIDGE W	JARB	06/01/91 - 08/31/91	276	237 (86%)
JOSHUA TREE NM	JOTR	06/01/91 - 08/31/91	276	252 (91%)
LAKE MEAD NRA	LAME	06/01/91 - 08/31/91	276	185 (67%)
LASSEN VOLCANIC NP	LAVO	06/01/91 - 08/31/91	276	276 (100%)
LAVA BEDS NM	LABE	06/01/91 - 08/31/91	276	272 (98%)
LINVILLE GORGE W	LIGO	06/01/91 - 08/31/91	276	264 (96%)
LYE BROOK W	LYBR	06/01/91 - 08/31/91	276	209 (76%)
MAMMOTH CAVE NP	MACA	-----		
MESA VERDE NP	MEVE	06/01/91 - 08/31/91	276	185 (67%)
MOUNT RAINIER NP	MORA	-----		
NATIONAL CAPITAL-CENTRAL	NACA	06/01/91 - 08/31/91	276	173 (63%)
NORTH CASCADES NP	NOCA	06/01/91 - 08/31/91	276	228 (83%)
OKEFENOKEE NWR	OKEF	-----		
OLYMPIC NM	OLYA	06/01/91 - 08/31/91	276	276 (100%)
OLYMPIC NM	OLYM	06/01/91 - 08/31/91	92	92 (100%)
PETRIFIED FOREST NP	PEFO	06/01/91 - 08/31/91	276	190 (69%)
PINNACLES NM	PINN	06/01/91 - 08/31/91	276	251 (91%)
POINT REYES NS	PORE	06/01/91 - 08/31/91	276	178 (64%)

4.2.7.2 Recommendations

Recommendations are provided by ARS and the contracting agency to offer assistance in addressing monitoring network goals and program objectives. Specific recommendations may include: network design and coverage of Class I areas, assurance of quality monitoring equipment and site operator training, and encouragement to cooperate and share findings with other federal agencies.

4.2.7.3 Future Considerations

Future considerations are provided by ARS that would enhance future network and program operations. Future considerations may include suggestions for improved data collection efficiencies, encouragement to improve communication between federal agencies as well as individual monitoring sites, and potential opportunities to improve existing 35 mm slide film archive methods.

4.2.8 References

Identical to the seasonal reports, references are presented in two subsections: Technical References, and Related Reports and Publications. Technical references are those documents that are cited in the annual report. Related reports and publications include all prior reports pertaining to the monitoring program, produced by ARS.

4.3 SUPPLEMENTAL DATA PRODUCTS

Supplemental data products are provided as requested by the contracting agency. Supplemental data products may consist of (but not limited to) representative slide duplicates, PC-compatible diskettes of qualitative slide data, and supplemental optical data summary plots (of associated optical monitoring equipment). Each of these data products are described in the following subsections.

4.3.1 Representative Slide Duplicates

The data coordinator and project manager thoroughly review all collected slide data for the season to select a series of slides that best represent good, medium, and poor visibility conditions, provided that sufficient data (more than 20% of days of the season) are available for analysis. If optical quantitative analysis values are available (from collocated nephelometer or transmissometer instruments), slides will be selected that best represent reported cumulative frequency SVR or deciview values. Duplicate slides are made as requested by the contracting agency. Each slide duplicate is labeled with corresponding slide number, date and time of observation, and representative slide category.

Accompanying all provided slide duplicates is a table of corresponding slide numbers, dates and times of observations, and written comments of any observed notable anomalies determined during the review process. An example Summary Table of Slides Representative of Observed Good, Medium, and Poor Visibility Conditions is provided as Table 4-7.

Table 4-7

Example Summary Table of
Slides Representative of Observed
Good, Medium, and Poor Visibility Conditions

Site Name	Date	Time	Slide No.	Number of Duplicates Provided	Representative Visibility Category	Observed Notable Anomalies
Bob Marshall South	07/22/90	1500	312	3	Good	
Bob Marshall South	08/04/90	1500	348	3	Medium	
Bob Marshall South	08/06/90	1500	354	3	Poor	
Bob Marshall South	09/11/90	1500	498	0		Extremely clean day
Bob Marshall South	09/04/90	0900	477	1	Episode	Phils Creek Wildfire (9/4/90 - 9/8/90)
Bob Marshall South	08/18/90	0900	390	0		Elevated smoke plume on distant horizon

4.3.2 PC-Compatible Diskettes of Seasonal Qualitative Slide Data

If requested by the contracting agency, slide condition codes are assigned to each collected slide by the data technician. Codes are recorded directly on the slides and later entered into site-specific digital files. Slide coding and qualitative summary procedures are detailed in TI 4420-5000, *Qualitative Scene Coding and Data Reduction of 35 mm Color Slides*.

Qualitative review, digital data files are provided on PC-compatible diskettes as requested by the contracting agency. A key to the slide condition code file is provided with each diskette. An example key to the qualitative-only (.SQO) data file is provided as Figure 4-3.

4.3.3 Optical (Nephelometer/Transmissometer) Data Summary Plots

Seasonal cumulative frequency and data collection statistics for collocated optical monitoring equipment (nephelometer or transmissometer) are provided with scene monitoring reports as requested by the contracting agency. All data are provided in the form of a data summary plot. An example Seasonal Transmissometer Data Summary is presented as Figure 4-4.

Detailed descriptions of the optical data summaries are provided in TI 4500-5000, *Nephelometer Data Reporting (IMPROVE Protocol)*, and TI 4500-5100, *Transmissometer Data Reporting (IMPROVE Protocol)*.

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1-4	Site abbreviation																																																															
5-9	Slide number																																																															
10-15	Slide date (year/month/day)																																																															
16	Slide time code (1=0900, 2=1200, 3=1500 Local Time)																																																															
17	Slide vista code																																																															
18-19	(Reserved for future use)																																																															
20-21	Slide condition code (two digit)																																																															
22-45	(Reserved for future use)																																																															
46-51	Date slide reviewed (year/day/month)																																																															
52-57	Time slide reviewed (hour/minute/second)																																																															
58-60	Densitometer data technician initials																																																															
61	Wavelength option (R=red, G=green, B=blue)																																																															
62-63	ASA film speed																																																															
64	(Reserved for future use)																																																															

Figure 4-3. Key to the Qualitative-Only (.SQO) Data File.

GRAND CANYON NATIONAL PARK (SOUTH RIM), ARIZONA

Transmissometer Data Summary

Summer Season: June 1, 1993 - August 31, 1993

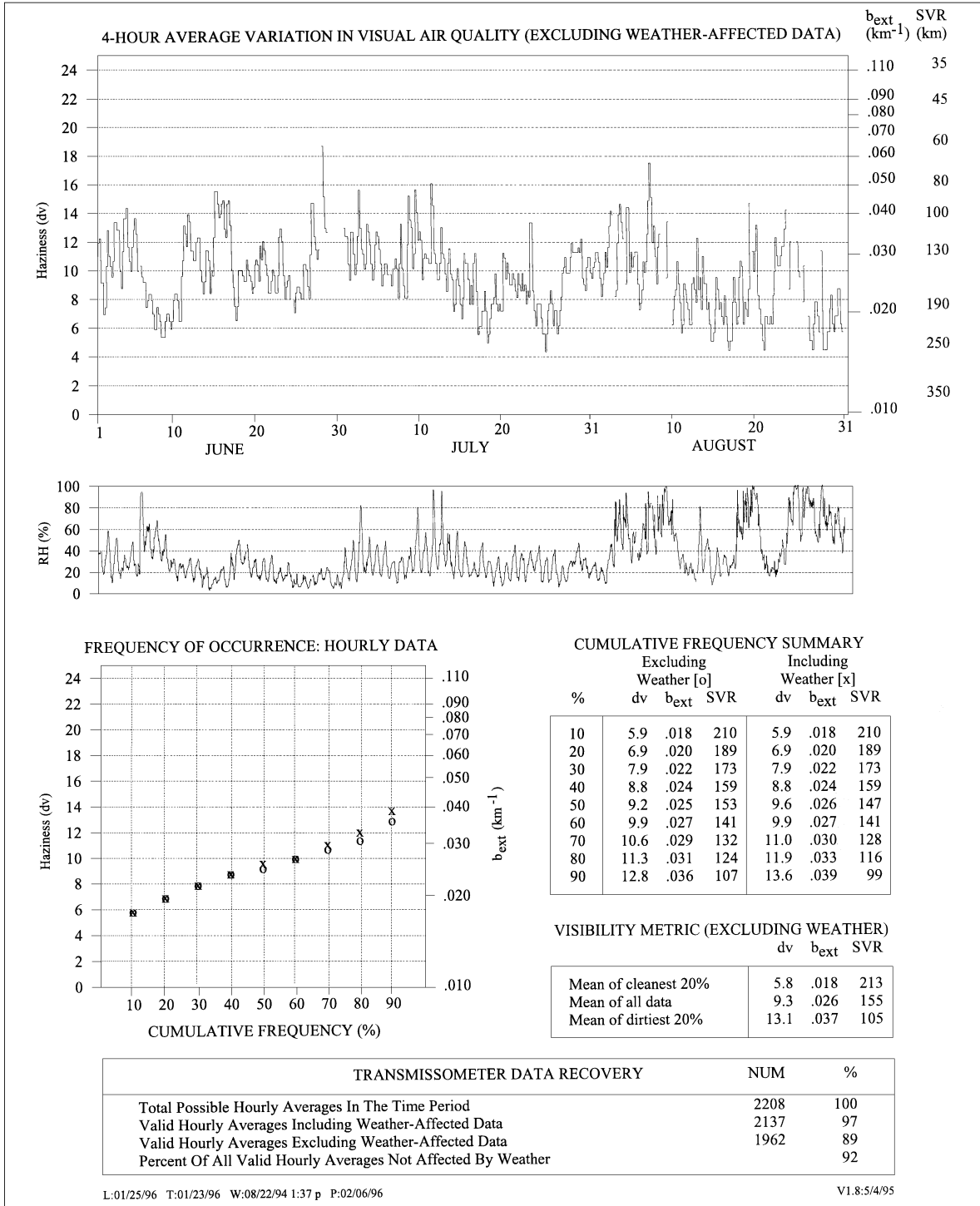


Figure 4-4. Example Seasonal Transmissometer Data Summary.

4.4 REPORT AND DATA PRODUCT DISTRIBUTION

Reports and any provided supplemental data products are reviewed and approved by the project manager prior to preparation for distribution. When ready, ARS contacts the local project-specific COTR office for distribution requirements and provides the deliverable products as directed. The amount or type of deliverable product may vary with each report.

5.0 REFERENCES

AH Technical Services, 1987, Guidelines for Preparing Reports for the NPS Air Quality Division, September.

QUALITY ASSURANCE/QUALITY CONTROL DOCUMENTATION SERIES	
TITLE	SCENE MONITORING REPORTING OF 8 MM TIME-LAPSE MOVIE FILM
TYPE	TECHNICAL INSTRUCTION
NUMBER	4520-5010
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AUTHORIZATIONS		
TITLE	NAME	SIGNATURE
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OTHER		

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1.0 PURPOSE AND APPLICABILITY

This technical instruction (TI) describes the procedures and methods for presenting and preparing written reports of 8 mm time-lapse movie film. This TI is referenced from Standard Operating Procedure (SOP) 4520, *Scene Monitoring Data Reporting* and specifically describes:

- Reporting frequency and contents of seasonal 8 mm film reports.
- Reporting contents of annual 8 mm film reports.
- Report distribution requirements.

2.0 RESPONSIBILITIES

2.1 PROJECT MANAGER

The project manager shall:

- Determine the COTR's (Contracting Officer's Technical Representative) project-specific reporting and distribution requirements.
- Oversee preparation and finalize qualitative review discussions.
- Review draft and final reports for completeness and accuracy.
- Verify that completed reports are properly distributed.

2.2 DATA ANALYST

The data analyst shall:

- Prepare qualitative review tables.
- Compile data statistics and compose text for draft reports.
- Coordinate with the secretary for report preparation.
- Review final reports for completeness and accuracy before distribution.

2.3 FIELD SPECIALIST

The field specialist shall provide current and accurate site specifications to the data analyst.

2.4 DATA COORDINATOR

The data coordinator shall provide site status and operational information to the data analyst.

2.5 SECRETARY

The secretary shall:

- Word process draft and final reports.
- Coordinate with the data analyst for complete report information, format, and statistics.
- Prepare final, approved reports for photocopying and distribution.
- Distribute final reports in accordance with project-specific distribution requirements.

3.0 REQUIRED EQUIPMENT AND MATERIALS

All data reporting occurs on IBM-PC compatible systems. A word processing package capable of creating large documents with figures and tables is used (such as WordPerfect), with a letter-quality laserjet printer. Other materials include photocopy and binding machines (with required materials) or a photocopy and binding service.

4.0 METHODS

Reports are prepared in a format that conforms to the *Guidelines for Preparing Reports for the NPS Air Quality Division* (AH Technical Services, 1987). Reporting consists of various text discussions and graphics presentations concerning operational aspects of camera monitoring sites and film review. This section includes three (3) major subsections:

- 4.1 Seasonal Reporting
- 4.2 Annual Reporting
- 4.3 Report Distribution

4.1 SEASONAL REPORTING

Seasonal 8 mm film reporting is completed within three months after the end of a monitoring season. Standard meteorological monitoring seasons are defined as:

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

Seasonal reports contain the five (5) major sections listed below:

- 1.0 Introduction
- 2.0 Film Collection and Validation
- 3.0 Qualitative Reduction
- 4.0 Film Review Summaries
- 5.0 References

The information and film presentation formats included in each section are summarized in the following subsections.

4.1.1 Introduction

The introduction contains a conceptual overview of the purpose of the monitoring program and specific objectives and tasks of the program.

4.1.2 Film Collection and Validation

Film collection and validation is presented in five subsections: Site Specifications, Site Status, Exposure Schedule, Film Tracking, and Film Archiving.

4.1.2.1 Site Specifications

Complete site specifications are detailed in a brief discussion which accompanies a photograph of each camera's view. Specifications for 8 mm camera sites include site name and abbreviation, the number of observations taken per day, and the azimuth, elevation, latitude, and longitude of the camera system. An example site photograph and specifications are provided as Figure 4-1. Site configuration is presented in a text discussion, detailing all 8 mm camera system components and general viewing orientation. The location of each 8 mm photographic site is presented on a map of the region, enabling a visual presentation of the general location of each site, their physical relation to one another, and viewing orientation. An example map is provided as Figure 4-2.

4.1.2.2 Site Status

Each seasonal report discusses the current operational status of each site, including equipment status and other factors that may be instrumental in operations, such as local weather conditions. The discussion also includes operational problems and problem resolutions during the reporting period.

4.1.2.3 Exposure Schedule

The 8 mm camera systems may have a flexible observation schedule designed specifically for the monitoring program. This exposure schedule is presented in tabular form, and displays by month, the number of daylight hours available, the beginning and ending hours of camera operation, and the required film change interval (in days). An example exposure schedule table is provided as Table 4-1.

4.1.2.4 Film Tracking

Each seasonal report provides an account of film collection by roll, in tabular form. These tables provide by site, for each roll, the roll numbers, dates and times the roll began and ended, date received at Air Resource Specialists, Inc. (ARS) from the site, date received from Kodak processing, the number of days possible on the film roll, the number of actual days captured on the film, and comments for each film roll. An example Summary of Film Tracking Table is provided as Table 4-2. Refer to TI 4305-4003, *Collection, Processing, and Handling of 8 mm Time-Lapse Movie Film*, for a complete discussion of film collection and tracking procedures.

4.1.2.5 Film Archiving

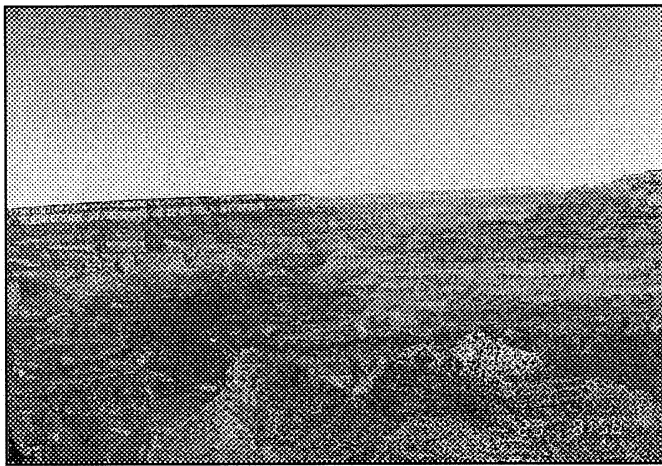
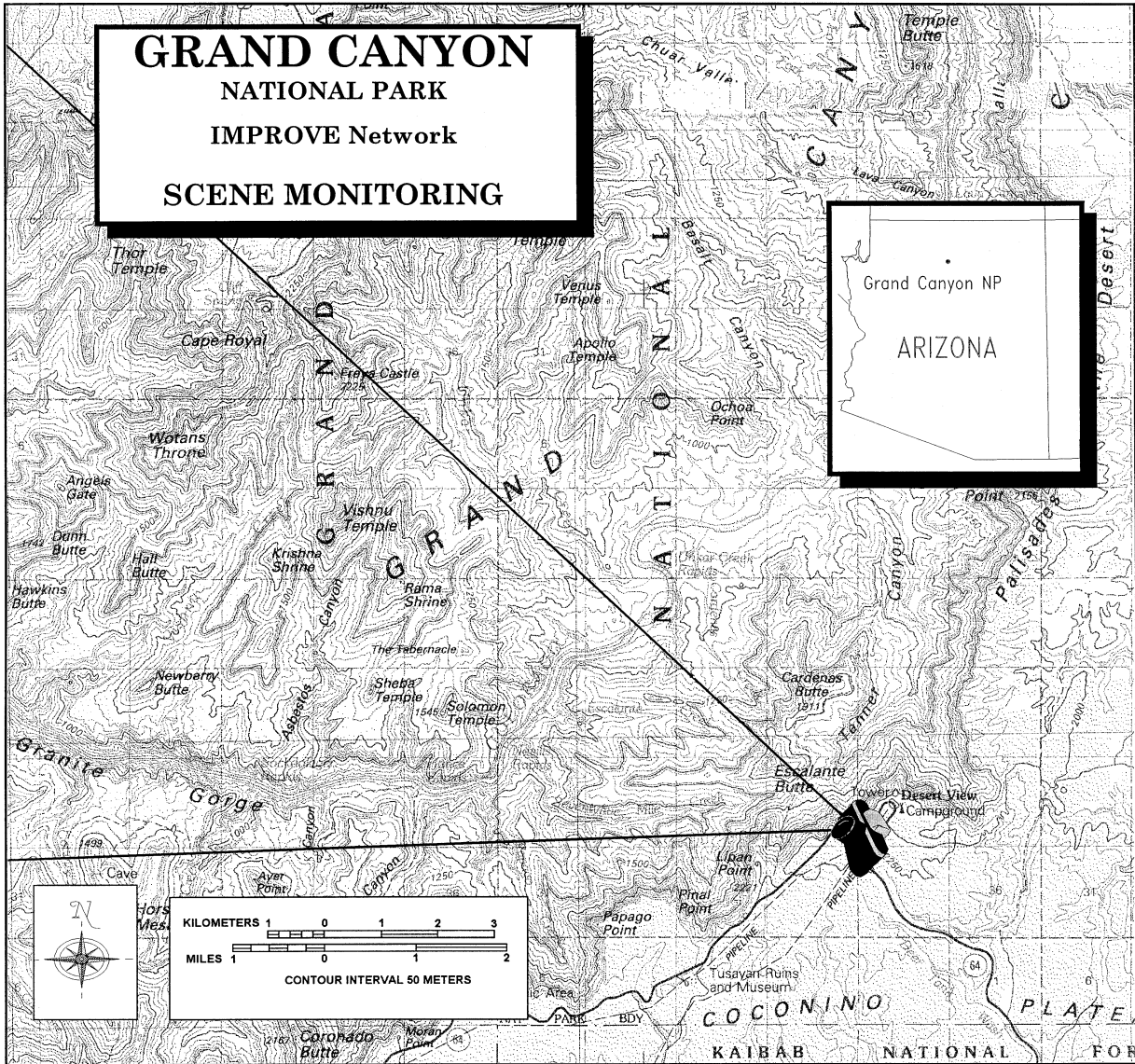
Each seasonal report contains a brief discussion of film archiving procedures. Refer to TI 4610-5010, *8 mm Time-Lapse Film Archives*, for a full discussion of archiving procedures.



Site Name: Denali National Park - North View
Site Abbreviation: DENN
Observations/Day: Varies with daylight hours

Azimuth: 25°
Elevation (m): 590 m (1935 ft)
Longitude: 148° 53' 10"
Latitude: 63° 44' 15"
Map Reference: Mount McKinley National Park (USGS) 1:250,000

Figure 4-1. Example Site Photograph and Specifications.



SITE SPECIFICATIONS	
Site Abbreviation:	GRCT
Instrument:	Automatic 35mm Camera with 50 mm lens
Elevation:	2290 m
Longitude:	111° 49' 48"
Latitude:	36° 02' 21"
Bearing:	290°
Map Reference:	Tuba City, Arizona 1:100,000 1983 36111-A1-TM-100

Figure 4-2. Example Map of Monitoring Locations and View Orientations.

Table 4-1
Example Exposure Schedule

MONTH	TWILIGHT/ DAYLIGHT	8 MM TIME-LAPSE SYSTEM			FILM CHANGE
	HOURS	TOTAL HOURS	START HOUR*	END HOUR*	INTERVAL IN DAYS
AUG	19	18	5	23	3
SEP	17	16	6	22	3
OCT	13	12	8	20	4
NOV	9	8	9	17	6
DEC	7	6	10	16	8
JAN	7	6	10	16	8
FEB	9	8	9	17	6
MAR	13	12	7	19	4
APR	17	16	6	22	3
MAY	19	18	5	23	3
JUN	24	23	3	2	2
JUL	24	23	3	2	2

* Hundred hours, using 24-hour clock with Daylight Savings Time adjustment for April through October.

Table 4-2
Example Summary of Film Tracking Table

SITE ABBRV.	ROLL NO.	DATE/TIME ON	DATE/TIME OFF	RECEIVED AT ARS	RECEIVED FROM PROCESSING	NO. DAYS POSSIBLE	NO. DAYS RECEIVED	COMMENTS
GAEL	29	03/31/93 1135	04/05/93 1020	04/13/93	04/26/93	6	6	Exposure schedule change; on at 0600-2200.
GAEL	30	04/05/93 1135	04/08/93 1100	04/13/93	04/26/93	4	4	
GAEL	31	04/08/93 1110	04/11/93 1616	04/23/93	05/05/93	4	4	
GAEL	32	04/11/93 1636	04/15/93 1325	04/23/93	05/05/93	5	5	
GAEL	33	04/15/93 1335	04/18/93 1825	04/28/93	05/10/93	4	4	Sun glare on camera lens.
GAEL	34	04/18/93 1835	04/22/93 1425	04/28/93	05/10/93	5	5	Sun glare on camera lens.
GAEL	35	04/22/93 1435	04/25/93 1620	05/14/93	06/07/93	4	4	
GAEL	36	04/25/93 1630	04/28/93 1115	05/14/93	06/07/93	4	4	
GAEL	37	04/28/93 1125	05/03/93 1230	05/14/93	06/07/93	6	5	Camera ran out of film; end of monitoring.

4.1.3 Qualitative Film Review

Each seasonal report contains a comprehensive discussion covering 8 mm time-lapse film review procedures. The review procedures are described in TI 4420-5010, *Qualitative 8 mm Time-Lapse Movie Film Review*. The discussion includes subjective analysis procedures regarding weather dynamics, observed plumes, and visual discontinuities evident on the time-lapse film. Discussion also includes natural meteorological characteristics that are specific to each site. Noted conditions are examined and compared with other views or other meteorological data (if available). Qualitative review tables for each film roll are prepared for each site, as described below.

4.1.4 Film Review Summaries

4.1.4.1 Qualitative Review Tables

Each seasonal report presents qualitative review tables for each film roll, that document date, weather conditions, presence of observed plumes, description of any observed anomaly (or observed plume) and general comments. The tables may also define anomalies visible both inside the entire camera field of view or visible inside Class I areas only. Refer to TI 4420-5010, *Qualitative 8 mm Time-Lapse Movie Film Review*, for a detailed discussion on table preparation. Example review tables are presented as Tables 4-3 and 4-4.

4.1.4.2 Discussions of Observed Events

Following the review tables, individual text discussions are presented for each observed anomaly or plume event observed on the 8 mm film during the reporting period and noted in the review tables. The anomaly discussions include the date, time, and roll number of the observed anomaly, a brief description of the anomaly, whether or not it was visible inside the Class I area, and a comprehensive discussion of general weather conditions, the characteristics and appearance of the anomaly, and the probable cause or causes of it. Supplemental meteorological data such as hourly weather observations, hourly meteorological data, and 35 mm slide observations are used if available. Refer to TI 4420-5010, *Qualitative 8 mm Time-Lapse Movie Film Review*, for detailed procedures on preparation of the discussions. An example anomaly discussion is provided as Figure 4-3.

4.1.4.3 Summary of Observed Visual Anomalies

For each reporting season, a summary of the observed anomalies or events and probable causes is presented in tabular form. The tables list the date of each observed event, the camera view(s) it was observed in, and the probable cause of the event. Tables may be created for events both within the entire camera view and within Class I areas only. An example summary table is provided as Table 4-5.

Additional discussion of observed anomalies or events involves only those events which were deemed attributable to the observed monitoring factor or pollution source. The discussion includes further insight into the cause and extent of the event. Monitoring programs that operate with several 8 mm cameras and monitor with a panoramic view can document the extent of travel of an event. A summary table is prepared that presents coherent plume or event tracking, and lists by date, the camera views (in panoramic sequence) and extent of travel of each event. An example coherent plume tracking table is presented as Table 4-6.

Table 4-3

Example Qualitative Review of 8 mm Film
(With and Without Class I Areas)

FILM DATE	WEATHER CONDITIONS	ENTIRE SCENE		CLASS I AREAS ONLY		COMMENTS
		ANOMALY VISIBLE	DESCRIPTION	ANOMALY VISIBLE	DESCRIPTION	
04/28/93	Cloudy. Northerly upper level winds.	No		No		
04/29/93	Cloudy. Northerly upper level winds.	Yes	Blowing dust or fog.	No		
04/30/93	Cloudy. Southerly lower level winds.	No		No		
05/01/93	Cloudy. Southerly upper level winds.	Yes	Smoke plume.	No		
05/02/93	Cloudy. Southerly upper and lower level winds.	No		No		

Table 4-4

Example Qualitative Review of 8 mm Film
(Entire Scene)

FILM DATE	WEATHER CONDITIONS	ANOMALY VISIBLE	DESCRIPTION	COMMENTS
01/24/93	Clear.	Yes	Fog or plume.	
01/25/93	Clear.	Yes	Fog or plume.	Sun glare on camera lens.
01/26/93	Cloudy. Westerly upper level winds.	Yes	Blowing snow or smoke.	
01/27/93	Cloudy. Southwesterly upper level winds.	Yes	Blowing snow or smoke.	Rain/snow on camera shelter window.
01/28/93	Cloudy. Southwesterly upper level winds.	No		
01/29/93	Cloudy. Southwesterly upper level winds.	No		
01/30/93	Partly cloudy. Southwesterly upper level winds.	Yes	Fog or plume.	
01/31/93	Cloudy. Southwesterly upper level winds.	No		Poor visibility due to low clouds.
02/01/93	Clear.	No		Sun glare on camera lens.

Date and Time: April 20, 1993

35 mm Slide Numbers: Denali North view (DENN #3761 - 3769)

8 mm Film Roll Numbers: Denali North view (DENN #131)
Garner Hill East, Left view (GAEL #34)
Garner Hill East, Right view (GAER #34)
Garner Hill South, Left view (GASL #34)
Garner Hill South, Right view (GASR #34)

Noted Event: Blowing dust or fog.
The Garner Hill East, left view 8 mm film depicts whitish, ground-based features resembling blowing dust. The features are visible late in the morning and early afternoon.

In Class I area: No

General Weather: Healy weather observations document good visibility with clear skies. Temperatures ranged from 34°F at 0545 and 0645 to 45°F at 1615. Light to moderate southeasterly winds occurred between 0545 and 0745. Strong southwesterly winds occurred at 0945, and turned to strong southeasterly at 1145, moderate southerly at 1615, and strong southeasterly from 1745 through the remainder of the day. Data from the ambient monitoring station at DNPP are not available.

Discussion: The Garner Hill East, left view 8 mm film depicts no plume from Unit No. 1. Faint streaks resembling blowing dust or fog appear near Unit No. 1 early in the morning and travel northward. The film depicts generally clear, windy skies.

The Denali North view 8 mm film depicts cloudy skies and moderately windy conditions. The Denali North view 35 mm photographs generally clear skies and good visibility.

Conclusion: The ground-based features appearing in the Garner Hill East, left view 8 mm film are blowing dust or glacial till from the river banks. The appearance of the feature documented in the film and weather record supports this conclusion.

Figure 4-3. Example Discussion of Observed Anomaly.

Table 4-5

Example Summary of Anomalies and Probable Causes

Probable Source of Observed Anomaly									
Date	Camera Views					Probable Cause			
	Denali North 35 mm	Denali South 35 mm	Denali North 8 mm	Garner Hill Left	Garner Hill Right	Naturally- occurring	Undetermined *	Unit No. 1	Other Sources
01/18/92			x			x			
01/20/92			x			x			
01/23/92	x		x				x		
01/23/92		x				x			
01/25/92		x					x		
01/27/92	x		x				x		
01/31/92	x		x				x		
02/03/92	x		x			x			
02/04/92	x		x			x			
02/07/92	x						x		
02/11/92	x					x			
02/14/92	x					x			
02/15/92		x				x			
02/16/92	x					x			
02/17/92		x					x		
02/22/92	x		x			x			
03/01/92					x		x		
03/3-4/92				x	x		x		
03/07/92	x					x			
03/27/92	x					x			
03/30/92		x					x		
03/31/92		x				x			
04/03/92		x					x		
04/13/92		x					x		
04/15/92		x				x			
04/19/92		x				x			
04/20/92	x					x			
04/28/92		x				x			
04/28/92			x	x	x		x		
05/05/92	x		x						x
05/06/92	x		x				x		
05/19/92	x		x						x
05/20/92	x		x						x
05/28/92	x		x						x

* The cause of undetermined anomalies is most likely naturally-occurring anomalies or weather patterns, and are not likely caused by Unit No. 1.

Table 4-6

Example Coherent Plume Tracking Table

COHERENT STEAM/ICE PLUME TRACKING					
(x indicates the existence of a coherent steam/ice plume traceable to Unit No. 1)					
Date	Visible in Class II Area				Visible in Class I Area
	Garner Hill East	Garner Hill East	Garner Hill South	Garner Hill South	
	Left View	Right View	Left View	Right View	
10/16/92	x	x	x	x	
10/17/92	x	x			
10/18/92	x	x			
10/29/92	x	x	x		
11/03/92	x	x			
11/04/92	x	x			
11/05/92	x	x	x	x	
11/06/92	x	x	x	x	
11/20/92	x	x			
12/06/92	x	x	x		
12/12/92	x	x	x	x	
12/25/92	x	x			
01/19/93	x	x	x		
01/20/93	x	x	x	x	x
01/21/93	x	x	x	x	x
01/22/93	x	x			
01/23/93	x	x			
01/24/93	x	x	x	x	x
01/25/93	x	x	x		
01/29/93	x	x			
01/30/93	x	x	x		
01/31/93	x	x			
02/01/93	x	x	x		
02/03/93	x	x	x		
02/06/93	x	x			
02/10/93	x	x			
02/17/93	x	x	x		
02/26/93	x	x			
03/04/93	x	x			
Total 29	29	27	15	7	3

4.1.5 References

References are presented in two subsections: 1) Technical References and 2) Related Reports and Publications. Technical references are those documents that are cited in the seasonal reports. Related reports and publications include all prior reports pertaining to the monitoring program, produced by ARS.

4.2 ANNUAL REPORTING

Annual reports contain the five (5) major sections listed below:

- Executive Summary
- 1.0 Introduction
- 2.0 Operational Procedures
- 3.0 Collection and Review Procedures
- 4.0 Monitoring Summary

The information and film presentation formats included in each section are summarized in the following subsections.

4.2.1 Executive Summary

An executive summary is prepared for each annual report, and presents a detailed summary of the entire 8 mm monitoring effort. It contains specific program objectives, a statistical summary of observed findings, and a summary of visual and meteorological conditions observed during the annual period. The executive summary presents observed findings that are stated in the body of the report.

4.2.2 Introduction

The introduction is presented in three subsections: Visibility Monitoring Program, Overview of the Monitoring Network, and Report Contents and Deliverable Products.

4.2.2.1 Visibility Monitoring Program

Similar to the seasonal reports, the annual report introduction contains a conceptual overview of the purpose of the monitoring program.

4.2.2.2 Overview of the Monitoring Network

Each annual report contains discussion of specific objectives of the monitoring program. Also discussed are ARS' qualifications, and specific monitoring goals.

4.2.2.3 Report Contents and Deliverable Products

Each annual report presents a brief discussion of the contents of the report, listing the major sections within the report, and other delivered products that accompany the report.

4.2.3 Operational Procedures

Operational procedures are presented in four subsections: Site Specifications, Instrumentation, Operator Training, and Field Servicing.

4.2.3.1 Site Specifications

Identical to each seasonal report, annual reports contain complete site specifications in the form of text, maps, and photographs (see Section 4.1.2.1).

4.2.3.2 Instrumentation

Site instrumentation is presented for each monitoring location. A description and listing of each camera, system components, enclosure components, and power requirements is provided for each site. Refer to TIs 4120-3200 and 4120-3210, *Routine Site Operator Maintenance Procedures for 8 mm Automatic Camera System (Minolta XL-401/601 and Minolta D12, respectively)* for details regarding instrumentation and routine site operator maintenance procedures.

4.2.3.3 Operator Training

Operator training procedures are presented for the monitoring program. Discussion includes identification of individual site operators, personnel who trained them, and what manuals were used for the training and site servicing. Refer to TIs 4120-3200 and 4120-3210 for specific routine site servicing procedures, and TIs 4120-3400 and 4120-3410, *Troubleshooting and Emergency Maintenance Procedures for 8 mm Automatic Camera System (Minolta XL 401/601 and Minolta D12, respectively)* for troubleshooting and emergency maintenance procedures.

4.2.3.4 Field Servicing

Field servicing procedures are discussed in each annual report. Discussion includes the exposure schedule (see Section 4.1.2.3), frequency of servicing visits, and what procedures were performed during the visit. Refer to TIs 4120-3200 and 4120-3210 for routine site operator maintenance procedures.

4.2.4 Collection and Review Procedures

Collection and review procedures are presented in four subsections: Exposure Schedule, Film Tracking, Qualitative Film Review, and Archive.

4.2.4.1 Exposure Schedule

The 8 mm camera systems may have a flexible observation schedule designed specifically for the monitoring program. This exposure schedule is presented in tabular form, and displays by month, the number of daylight hours available, the beginning and ending hours of camera operation, and the required film change interval (in days) (see Section 4.1.2.3).

4.2.4.2 Film Tracking

Film tracking procedures are briefly discussed in each report (see Section 4.1.2.4). Detailed discussions of collection and tracking procedures can be found in TI 4305-4003, *Collection, Processing, and Handling of 8 mm Time-Lapse Movie Film*, and TI 4420-5010, *Qualitative 8 mm Movie Film Review*.

4.2.4.3 Qualitative Film Review

Specific film review procedures are discussed in detail in each annual report, and are defined in four review stages. The first review stage contains a detailed discussion of film continuity review and problem resolution procedures, and identifies specific ARS personnel who perform this review. The review includes film labeling and initial visual review to determine proper camera and system component operation, proper exposure and alignment, and correct operating period for each film roll.

The second review stage contains a detailed discussion of preliminary continuity verification and anomaly identification procedures, and identifies specific ARS personnel who perform this stage of review. This review stage includes film review to document chronological sequence, daily meteorological conditions and patterns, and detect the presence of any anomalies. Initial evaluation of the cause or causes of each anomaly is also made, and the qualitative review tables (Tables 4-3 and 4-4) are prepared.

The third review stage contains further film reviews to evaluate the observed anomalies and prepare anomaly discussions, and identifies the ARS personnel who are responsible performing these tasks. The subjective analysis procedures during this film review stage involve identifying weather dynamics, observed plumes, and visual discontinuities evident on the time-lapse film. This review provides a preliminary indication of the types of visual effects observed within the individual vistas. Noted conditions are examined and compared with other views or other meteorological data (if available). Anomaly discussions are prepared (see Figure 4-3).

The fourth and final review stage discusses final review and report preparation procedures, and identifies the personnel who are responsible at this review stage.

4.2.4.4 Archive

Each annual report contains a brief discussion of film archiving procedures (see Section 4.1.2.5).

4.2.5 Monitoring Summary

The monitoring summary is presented in four subsections: Monitoring Considerations, Data Collection, Problems and Problem Resolution, and Classification and Summary of Observed Visual Anomalies.

4.2.5.1 Monitoring Considerations

Annual reports contain a summary of the 8 mm camera monitoring operation. The summary includes special or unique monitoring considerations, limitations of 8 mm photography, total number of observations obtained within the reporting period, exposure factors due to observations taken near dawn and dusk time periods, and other factors specific to the monitoring program.

4.2.5.2 Data Collection

Data collection statistics for the annual period are presented for each site, including the number of film rolls, days possible, days collected, and data collection efficiency percentage for the period. Text discussion includes an overall, annual collection percentage, and significant problems which caused a notable data collection loss. An example data collection statistics table is provided as Table 4-7.

Table 4-7

Example Data Capture Statistics Table

SITE	NUMBER OF FILM ROLLS	DAYS POSSIBLE	DAYS COLLECTED	DATA COLLECTION EFFICIENCY
DENN	134	473 days	404 days	85%
GARL	95	273 days	264 days	97%
GARR	95	273 days	257 days	94%
GAEL	37	201 days	197 days	98%
GAER	37	201 days	184 days	92%
GASL	37	201 days	190 days	95%
GASR	37	201 days	189 days	94%

4.2.5.3 Problems and Problem Resolution

Operational problems and problem resolutions during the reporting period are also presented both in text and tabular form, and includes local weather conditions and other factors that affect data collection. An example operational summary table is presented, and includes a summary of observation losses, operational problems, and problem resolutions for each camera site during the annual reporting period. The table includes site name, roll number, periods of data collection losses, problem description, and problem resolution. An example operational summary table is provided as Table 4-8.

4.2.5.4 Classification and Summary of Observed Visual Anomalies

Each annual report contains a comprehensive discussion that includes a summary of observed findings compiled during the annual period, which is also included in the executive summary. A statistical summary is prepared of the observed anomalies and existing visual conditions. Individual discussions of each monitoring site provide a summary of anomaly and meteorological findings on a seasonal basis.

The monitoring summary also contains those anomaly discussions, that were presented in the seasonal reports, which were notable or of special interest to the monitoring program. Similar to the seasonal reports, a table depicting the observed anomalies/events and probable causes is provided for the annual period. The table lists the date of each observed event, camera view it was observed in, and the probable cause of the event (whether naturally-occurring, undetermined, due to the monitored pollution source, or other sources). Tables are created for anomalies/events both within the entire camera view and within Class I areas only (see Table 4-5).

Table 4-8

Example Operational Summary Table

SITE	SYSTEM TYPE	ROLL #	DATA COLLECTION LOSSES	PROBLEM DESCRIPTION	PROBLEM RESOLUTIONS
DENN	8 mm	4	02/04/92 - 02/11/92	Camera turned off	Operator aware of error
		5	02/11/92 - 02/17/92	Kodalux processing error	
		17	04/03/92 - 04/07/92	Loose camera/timer cable connection	Operator tightened connection
		18	04/07/92 - 04/10/92	Drained batteries	Operator replaced batteries
		19	04/10/92 - 04/15/92	Drained batteries	Operator replaced batteries
		20	04/15/92 - 04/18/92	Drained batteries	Operator replaced batteries
		21	04/18/92 - 04/22/92	Drained batteries	Operator replaced batteries
		22	04/22/92 - 04/24/92	Drained batteries	Operator replaced batteries
		23	04/24/92 - 04/27/92	Drained batteries	Operator replaced batteries
		37	06/02/92 - 06/03/92	Shutter malfunction	Camera replaced
		87	09/11/92 - 09/14/92	Drained batteries	Operator replaced batteries
		91	09/23/92 - 09/25/92	Drained batteries	Operator replaced batteries
		92	09/26/92 - 09/28/92	Drained batteries	Operator replaced batteries
		95	10/12/92	Late film change	
		99	10/24/92 - 10/27/92	Camera malfunction	
		100	10/27/92 - 11/01/92	Camera malfunction	
101	11/01/92 - 11/03/92	Camera malfunction			
102	11/03/92 - 11/08/92	Camera malfunction	Camera replaced		
134	05/03/93	Late film change	End of monitoring		

Similar to the seasonal reports, a summary table is prepared that presents coherent plume or event tracking, and lists by date, the camera views (in panoramic sequence) and extent of travel of each event (see Table 4-6).

4.3 REPORT DISTRIBUTION

Reports are reviewed and approved by the project manager prior to preparation for distribution. When ready, ARS contacts the local project-specific COTR office for distribution requirements and provides the deliverable products as directed. The amount or type of deliverable product may vary with each report; for example, 15 seasonal reports and 5 annual reports are delivered to the NPS.

5.0 REFERENCES

AH Technical Services, 1987, Guidelines for Preparing Reports for the NPS Air Quality Division, September.

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	
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OTHER		

REVISION HISTORY			
REVISION NO.	CHANGE DESCRIPTION	DATE	AUTHORIZATIONS
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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 or 8 mm color movie film 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

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.

2.3 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

4.0 METHODS

This section includes two (2) subsections:

- 4.1 Physical Archives
- 4.2 Computer 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 digital data is performed on a seasonal basis, after data have been finalized and reported.

4.1 PHYSICAL ARCHIVES

Scene monitoring products consist of 35 mm photographs, 8 mm time-lapse film, 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 physical archives.

4.2 COMPUTER ARCHIVES

Through the Fall 1993 season, scene monitoring digital data files include quantitative scene monitoring 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.