

Scope of Work: WRAP Ambient Data Annual Report

The following scope of work is being carried out by the Colorado State University Cooperative Institute for Research in the Atmosphere (CIRA).

This scope of work covers both maintenance and continued implementation of the WRAP AMRF web site and database and development and publication of a WRAP Ambient Data Annual Report.

Task 1

CIRA will maintain and upgrade the WRAP AMRF database and web site according to the provisions stated in the existing CIRA/WGA scope of work (*Appendix 1*) from 1 October 2001 through 1 October 2002. The total cost for this is \$86,520 detailed in the Budget section below.

Task 2

CIRA will publish the first WRAP Annual Ambient Data Report electronically in March 2002. The report will be distributed through the WRAP AMRF database and web site. The report content will follow the proposed CIRA Scope of Work for the WRAP Ambient Data Annual Report (*Appendix 2*). The total estimated cost for this report is \$55,329 detailed in the proposed CIRA Scope of Work.

Total cost: \$141,849

Background & Status of current Scope of Work

The scope of work under the CIRA/WGA existing agreement for the WRAP web based air quality data integration, analysis, and delivery system is attached as Appendix 1. The scope of work identifies a three-tiered development with three specific tasks.

Tier 1: CIRA will develop a web browser allowing display of already developed IMPROVE and selected additional (mutually agreed upon by CIRA and the WRAP AMRF) meteorological and air quality information.

Tier 2: CIRA will develop and add to the web site a relational database capable of storing IMPROVE and selected additional data and metadata. A key function of the relational database will be access to and retrievals of the IMPROVE and additional data on the basis of user-selected parameters.

Tier 3: CIRA will develop an on-line analysis capability and add this to the web site.

Specific deliverables under the current contract with WGA are:

Task I – Database and web site design and mock up by 12/31/01.

Task II – Initial release of the web site by 3/15/01 and continuing upgrades and evaluations of its performance for the next three months.

Task III – Continuing support of the web site and database through 8/30/01. Also implementation of some preliminary Tier 2 capabilities during this time.

Status of the web and database

Task I has been successfully completed. (<http://vista.cira.colostate.edu/wrap>)

The web design includes the capability of delivering existing IMPROVE data and additional data that the WRAP AMRF will identify as needed. The WRAP AMRF decided that the web site database should be limited primarily to data associated with regional haze in the WRAP region. Thus, in addition to the IMPROVE data, this includes (a) optical data from the WRAP region meeting quality assurance objectives but not already included in the IMPROVE database, and (b) limited meteorological data directly relevant to the IMPROVE monitoring sites and useful for interpreting visibility in Class I areas. The web site also includes a comprehensive catalog of air quality, meteorology, and emissions data available from on-line sources linked to the web site.

Task II has been successfully completed; the web site has been publicly released and is operational. (<http://vista.cira.colostate.edu/wrap>)

The web site was released to the public on 1/31/01 and has been in continuous use since that time. Upgrades and improvements are continuing to be implemented. Current capabilities of the web site include: (a) delivery of the IMPROVE data set; (b) a wide variety of IMPROVE analysis products including graphics and reports; (c) comprehensive links to on-line air quality, meteorology and emissions data and information, and; (d) information on a variety of issues deemed relevant to the WRAP.

Task III is continuing. The project is on schedule and an on-time completion is anticipated.

Current activity is on the implementation of the initial Tier 2 capability, namely linking the web site to a relational database to implement on-line user selected data retrievals from the IMPROVE database. Currently, the entire IMPROVE database is retrievable, however, the user must select from a menu of prearranged options. User-generated query capability has been demonstrated to the AMRF and will be implemented on the web site by the end of May. Additional work to add appropriate meteorological data and information is on going. CIRA is prepared to deliver a completed database and web site in September 2001 at conclusion of the existing contract with the Western Governor's

Association to the WRAP AMRF or their designate if they chose not to exercise the options presented below.

Proposed new work

It is our understanding that the intent of the WRAP and the Western Governor's Association is to continue funding maintenance and continual upgrade of the web site. An AMRF annual report represents an additional separate, but integral activity for the database and web site. Because of this, we have chosen to respond by providing continued operation of the web site and preparation of an Annual Report by enhancing the reporting capabilities of the database and web site and developing additional analyses of the data.

Task 1

CIRA proposes to continue to maintain and upgrade the WRAP AMRF database and web site. This will involve the continuous input of new data once it is released by the relevant data owners (IMPROVE); completion of Tier 2 functionality including a web based user interface with the IMPROVE database and the identified meteorological data; and initial development of Tier 3 functionality allowing users to conduct limited on-line data processing.

Task 2

CIRA proposes to develop a "WRAP Ambient Data Annual Report" by (1) designing and implementing report generation functionality into the existing database and web site, (2) conducting additional analyses and presentations of the data and (3) generating the First Annual Report electronically and issuing it in March 2002. The report will be distributed through the WRAP AMRF web site. Assuming continued funding, this report will be improved each year based on user comments and issued each March. The March 2002 report will include the latest available quality assured IMPROVE data at least through calendar year 2000. Subsequent reports will maintain the same schedule assuming IMPROVE is able to supply its data on this schedule.

The annual data report will feature data summaries for the previous available year and trends that promote comparison of the current year's data with that from previous years. CIRA will develop analysis software allowing generation of statistical and graphical summaries of the data as outlined in the next section. Statistical summary information used to generate all tabular and graphical output for the annual report will be downloadable by the web site user. The report will consist primarily of the standard output from this software and will have only a modest amount of year-specific commentary describing any prominent features of the data products. (This data report will be used by the AMRF to develop the WRAP "Causes of Haze Report" which is planned as WRAP's primary data interpretation report to be prepared once every five-years.) CIRA will use feedback from users of the annual data report to continuously improve the scope and quality of the report over time.

CIRA will generate the annual data report following the outline included in the proposed CIRA Scope of Work for the WRAP Ambient Data Annual Report (*Appendix 2*). The WRAP AMRF will approve any deviations from this outline that CIRA feels are needed.

Budget

Task 1

CIRA will maintain the web database starting from completion of the current WGA scope of work to the end of September 2002 (10/1/01-9/30/02).

Maintenance Specifications:

1. The web site will be maintained in an operational form providing access to users and remaining responsive to user feedback on its operation.
2. Data updates to the web site and database will be provided within 30 days of delivery of new or revised by the primary data supplier. The database manager will be responsible for acquiring the data and all reformatting needed to include it in the WRAP AMRF database.
3. Limited database user support will be made available during normal business hours via email.
4. CIRA will provide data subset retrievals distributed on CD-ROM at a reasonable copying and handling charge to users requesting this because of limited web access.
5. Software revisions to enhance performance (e.g., speed, ease of use) and capabilities may be requested over time. It is recognized that some of these may require supplemental resources to accomplish.
6. Replicates made to back-up the software and data archive must be made after each data update and software revision and stored in a separate secured facility.

Completion of interactive database:

1. The WRAP database will be upgraded to include additional meteorological data identified as needed by the WRAP AMRF.
2. The capability of user-initiated queries made over the web to the database will be broadened and improved in terms of size and speed of response.
3. The database will be broadened to include any other appropriate data identified by the WRAP AMRF as being needed.

Initiation of On-line processing:

1. Limited capability of displaying data in simple graphical formats (e.g., single or multiple parameter time plots, maps, or scatter plots) for user selected data subsets.
2. Limited capability of calculating simple statistics (e.g. mean, standard deviation, various percentiles including median, 20th and 80th) for user selected data subsets.
3. Limited capability of calculating more complex statistics (e.g. correlation coefficient, and simple and multiple linear regression coefficients and confidence limits).

Detailed Budget, Task 1

PERSONNEL

<i>Salaries</i>	Months	Rate	Total
1. Fox, Doug-Project Management	1.45	9022	13,082
2. Schichtel, Bret- Implementation and Updating	1	6038	6,038
3. Web/Database Manager-TBD (10/1/01-6/30/02)	5	5000	25,000
Web/Database Manager-TBD (7/1/02-9/30/02)	3	5250	15,750
TOTAL SALARY			59,870
 <i>Fringe/Benefits</i>			
1. Fox, Doug-Project Management		19.1%	2,499
2. Schichtel, Bret-Implementation and Updating		19.1%	1,153
3. Web/Database Manager (10/1/01 -6/30/02)		19.1%	4,775
Web/Database Manager (7/1/02-9/30/02)		19.2%	3,024
TOTAL FRINGE			11,451
SUB-TOTAL PERSONNEL (Salary and Fringe)			71,321
 DOMESTIC TRAVEL			
<u>1 person, 2 days to Las Vegas for interaction with WRAP committee</u>			1,000
1. Airline		\$500	
2. Lodging		\$250	
3.Meals/Incidental Expenses		\$66	
4 Rental Car		\$100	
5. Miscellaneous		\$84	
 MATERIALS AND SUPPLIES			
Software upgrades			1,451
Hardware upgrades			1,000
 OTHER DIRECT COSTS			
Telephone, mail, copying			250
<u>Computer charges</u>			212
D. Fox (298.4 hrs @ .38/hr)		\$113	
B. Schichtel (29 hrs @.38/hr)		\$11	
Web/Database Manager (232 hrs @ .38 hr)		\$88	
TOTAL DIRECT COSTS			75,234
INDIRECT COSTS (15%)*			11,285
TOTAL PROJECT COST (Option 1)			86,520

* Colorado State University will provide special support to this project via actual cost sharing—see Proposed Budget. (15%)

Task 2

CIRA will develop and implement the capability to generate an annual data report and issue the first report on or before March 1, 2002. See attached scope of work (Appendix 2) for the details.

Detailed Budget, Task 2

PERSONNEL

<i>Salaries</i>	Months	Rate	Total
1. Fox, Doug-Design and Development	1	9022	9,022
2. Schichtel, Bret-Design and Development	1	6038	6,038
3. Data Analysis -TBD	5	3000	15,000
4. Web/Database Manager-TBD	1.5	5000	7,500
TOTAL SALARY			37,560
 <i>Fringe/Benefits</i>			
1. Fox, Doug-Design and Development		19.1%	1,723
2. Schichtel, Bret-Design and Development		19.1%	1,153
3. Data Analysis -TBD		19.1%	2,865
4. Web/Database Manager-TBD		19.1%	1,433
TOTAL FRINGE			7,174
SUB-TOTAL PERSONNEL (Salary and Fringe)			44,734

DOMESTIC TRAVEL

<u>1 person, 1 day in Phoenix for meeting with AMRF</u>		1,000
1. Airline	\$600	
2. Lodging	\$138	
3. Meals and Incidentals	\$50	
4. Rental car	\$100	
5. Miscellaneous	\$112	

MATERIALS AND SUPPLIES

New software	967
High capacity server	1,000

OTHER DIRECT COSTS

Telephone, mail, copying	250
<u>Computer charges</u>	122
D. Fox (206 hrs @ .38/hr)	\$78
B. Schichtel (29 hrs @ .38/hr)	\$11
Data Analysis (145 hrs @ .38/hr)	\$55
Web/Database Manager (44 hrs @ .38/hr)	\$17

TOTAL DIRECT COSTS	48,112
INDIRECT COSTS (15%)*	7,217

TOTAL PROJECT COST (Option 2)	55,329
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* Colorado State University will provide special support to this project via actual cost sharing—see Proposed Budget. (15%)

Western Regional Air Partnership (WRAP)
Web Based Air Quality Data Integration, Analysis and Delivery System
CIRA Scope of Work

CIRA will design, develop, implement, and maintain an air quality and meteorological data integration, analysis, and delivery system (WRAP AQDS) for the United States, west of the 100th meridian. The data delivery system will be accessible for queries via the World Wide Web.

The WRAP AQDS will be designed utilizing modern "data mart" principles and technologies. The data mart will utilize established and emerging software tools for PC hardware platforms networked under a Windows 2000 operating system. In order to both minimize cost and ensure mainstream development, "off-the-shelf" technologies will be utilized. These will include Microsoft SQL server and Access database to store the data and metadata; OLAP (On-Line Analytical Processing) to provide a multi-dimensional data access interface and a data analysis layer to the database; and Cold Fusion or equivalent functionality to construct the web site interface and provide communication between the web browser the WRAP data mart.

Development of the WRAP AQDS will be based on a three-tiered approach leading toward increasing capabilities. First, Tier 1, CIRA will develop a web browser allowing display of already developed IMPROVE and selected additional (mutually agreed upon by CIRA and the WRAP AMRF) meteorological and air quality information. Second, Tier 2, CIRA will develop and add to the web site a relational database capable of storing IMPROVE and selected additional data and metadata. A key function of the relational database will be access and retrievals of the IMPROVE and additional data on the basis of user-selected parameters. For example, the user could select IMPROVE ammonium sulfate data for 1999 at any site. Third, Tier 3, CIRA will develop on-line analysis capability and add this to the web site. This analysis capability, for example, would allow the user to retrieve, analyze and plot, IMPROVE ammonium sulfate data for 1999 with concentrations greater than 25 nanograms at five sites.

CIRA will phase the delivery of these capabilities for the WRAP Air Quality Data System as described below.

Delivery of the WRAP Air Quality Data System.

CIRA will design (**Phase I**), develop and implement (**Phase II**), and maintain (**Phase III**) a web-based data integration, analysis and delivery system. This system will be closely linked with the IMPROVE web-based data display and analysis system also under development at CIRA. However, the WRAP system will be unique and independent of the IMPROVE system. The WRAP system will be distinct in its inclusion of additional data as identified below and as selected by the WRAP AMRF.

In the first year of activity, even though the WRAP AQDS design will include broader capabilities, the system that will be initiated under **Phase II** will include Tier 1 (as described above) functionality along with limited Tier 2 functionality having following minimum features:

Capability to display graphical presentations of data.

- An interactive browser where a user can select an IMPROVE monitoring site, time range and variable then display appropriate summary graphics. As a minimum this will include the graphics included in the latest IMPROVE report. Selected IMPROVE reports and publications will also be available from the site.
- A browser providing user access to view graphics and other available analysis products from additional meteorological and/or air quality data sets. Specific data sets will be identified by CIRA in **Phase I** and presented to the WRAP AMRF for final decisions about inclusion.

Capability to download data sets.

- Officially approved and sanctioned (by the IMPROVE program) IMPROVE data will be available in a pre-selected data format for downloads.
- Officially approved calculated IMPROVE information sets, such as reconstructed fine mass, reconstructed extinction coefficients, etc. will be available for download in a pre-selected data formats.
- Additional meteorological and air quality data sets will be made available for downloading either directly from the WRAP website or indirectly from the data owners web site. Specific data sets will be identified by CIRA in **Phase I** and presented to the WRAP AMRF for final decisions about inclusion.

Presentation of Metadata

- The web site will include metadata such as notes regarding the monitoring equipment, its specific location, periods of valid data collection, etc.
- IMPROVE sites will be displayed on an interactive map of the United States. The cursor will be able to select a site and return information about the site. CIRA will propose the specific information that is returned, but final selection will be determined after discussion with the WRAP AMRF.

Tracking and reporting users and data requested.

- To improve future service and to allow user notification if changes in the data, the system manager will keep records of users of the site and any information the user downloads.

Deliverables

Phase I

1. A database design and mock-up of the WRAP AQDS web site will be submitted to the WRAP AMRF for their approval by **10/15/00**. This design will include a detailed listing of all electronically available data sets that CIRA proposes to include in the database and present on the WRAP web site. It will also outline the metadata that will be associated with all of these data sets. This information will be presented to the WRAP AMRF at a meeting where discussions between CIRA staff and the Forum will serve to finalize the database and web site designs and identify the specific data sets to be included. CIRA understands that AMRF will evaluate these data sets for their pertinence for inclusion in the database.
2. Any necessary revisions of the database and web design will be communicated to CIRA by **11/1/00** and incorporated by CIRA into the WRAP AQDS design by **12/1/2000**.

Phase II

3. The initial version of the operational database based on implementation of the approved design will be released on the web by **3/15/2001**. Depending on the complexity of the final web site design, additional features of the web site may be added over the next 3 months of operation of the site. The WRAP/AMRF will determine the priority and timing for CIRA to follow populating the database.

Phase III

4. The web site and database will be maintained, including any updates of data from the data suppliers, until **6/31/2001**. Specifications of this maintenance include:
 - a. Data updates on a quarterly basis, assuming suppliers provide new data on that frequency (e.g., one update is required during the base contract period). The database manager is responsible for acquiring the data and reformatting needed to include it in the database.
 - b. Limited database user support will be made available during normal business hours via email.
 - c. For users with limited bandwidth, the contractor will offer data subset retrievals distributed on CD-ROM at a reasonable copying and handling charge to the user.
 - d. Brief activity reports containing the number and nature of database retrievals, the status of updates of the various data sets, descriptions of problems encountered, and recommended system modifications will be delivered every six months.
 - e. Software revisions to enhance performance (e.g., speed, ease of use) and capabilities may be requested over time. It is recognized that some of these may require supplemental resources to accomplish.

- f. Replicates made to back-up the software and data archive must be made after each data update and software revision and stored in a separate secured facility.

During **Phase III**, CIRA will begin to develop Tier 2 and Tier 3 capabilities for the IMPROVE web site. CIRA anticipates that simple Tier II capabilities, an interactive relational database limited to IMPROVE data, will be available to WRAP AQDS users during this time period.

Optional and Additional capabilities

CIRA anticipates proposing maintenance of the WRAP AQDS for the five one-year extensions to the contract that the original WRAP RFP identified as likely to be available. CIRA will propose to include maintenance and optional enhancements in these extensions.

CIRA is committed to deliver enhanced Tier 2 and Tier 3 capabilities in 2002 and 2003 for the IMPROVE program. CIRA anticipates doing the same for the additional data included on the WRAP AQDS web site based on the availability of additional funding from the WRAP for these **optional capabilities**. For example, added Tier 2 capability might incorporate WRAP AMRF selected data sets into the multi-dimensional relational database. Added Tier 3 capability might include, for additional WRAP AMRF data sets, the capability of calculating statistics (e.g., mean, standard deviation, various percentiles including median, 10th and 90th) for user selected data subsets. Similar optional considerations might include the capability of calculating more complex statistics (e.g., correlation coefficient, and simple and multiple linear regression coefficients and confidence limits) for user selected data sets from among IMPROVE and additional data.

Project Personnel

CIRA will conduct this project with a team of existing staff, under the direction of Dr. Douglas G. Fox, Senior Research Scientist. Working with Dr. Fox will be three CIRA Research Associates, Dr. Bret Schichtel, Dr. James Sisler and Mr. Rodger Ames. Additional staffing will include graduate students and a designated database manager for **Phase III**.

The CIRA team includes the same individuals who will be implementing the IMPROVE database and web site under the direction of Dr. William Malm of the National Park Service. This synergy provides significant benefits for the WRAP/AMRF. The same group of analysts, designers, servers, and data archives supporting the IMPROVE steering committee will support the WRAP/AMRF. This will provide significant advantages to the WRAP/AMRF because there will be no discrepancies between IMPROVE data and WRAP data. The web site and its supporting databases will be overlapping in both design and execution. The web sites for WRAP and IMPROVE will have similar look and feel. There will be no issues of incompatibility, or of differential QA/QC because all users will be accessing the same data in the same manner.

**Western Regional Air Partnership (WRAP)
Web Based Air Quality Data Integration, Analysis and Delivery System
Ambient Data Annual Report**

CIRA Scope of Work

Overview

The WRAP Annual Ambient Data Report will be published electronically once per year and distributed through the WRAP ambient database web site. The report will feature data summaries for the previous calendar year, for example, the March 2002 report will include IMPROVE data through 2000, assuming it is available, and trend presentations based on running averages of the previous five years of data. Thus, the First Ambient Data Annual Report, issued in March 2002, will include statistical summaries of CY 2000, and running averages from CY '96, '97, '98, '99 & '00. The second Report, issued in March 2003, will include CY 2001 and averages from CY '97-'01, and so forth.

CIRA's overall approach will be to (1) design the format of the Annual report, including the types of analyses, graphics, and descriptive material it will contain; (2) develop the web capabilities and data base programming needed to support on-line generation of the annual report, and; (3) develop necessary analysis software and generate the appropriate statistical and graphical summaries of the data needed for the Annual Report. Over the years the software that generates the Report will be enhanced so that the scope of the Report will evolve over the years. Feedback from users of the Report will be a primary source of information for the direction of this evolution. The Report will consist primarily of the standard output from this software and will have only a modest amount of year-specific commentary describing some of the prominent features of these automated products. (The planned WRAP Causes of Haze Report is the primary data interpretation report that will be prepared on an every five-year schedule.)

The Report will feature summaries of data that represent the visibility-protected Class I areas (i.e. IMPROVE and some IMPROVE Protocol sites in the WRAP area), but it will also use visibility data gathered elsewhere and selected meteorological data and analysis to the extent that they help the user to understand conditions associated with Class I area haze levels. While CIRA hopes to provide WRAP and the other Regional Planning Organizations with national data analysis and reporting, the Annual Report for WRAP will specifically provide an overview of visibility conditions for the WRAP area as a whole and for individual Class I areas.

Although there are a number of data presentations currently available on the web site, the request for this report has identified new analyses and presentations that will need to be developed. In addition to five-year running averages and annual summaries, selected monthly summaries will be presented as outlined below. The Report will also include summaries of the 20% best (Group 10) and 20% worst (Group 90) aerosol extinction days (based on measured fine mass) because of their central role in the Regional Haze Rule.

Statistical summary information used to generate all tabular and graphical output for the Annual Report will be made available for download web site users.

One of the primary uses of the report will be to select subsets of the summary material that can be reformatted by users, such as states and tribes who wish to prepare their own custom reports by cutting and pasting from the Annual Report. For this reason and because of the expected substantial amount of output in this report (i.e. regional maps plus graphs and tables for all sites), CIRA will design the report such that it can be browsed by site, by data summary, and by display approach. Eventually, CIRA plans to include all of the analyses in the report in the WRAP AMRF database and make them available to users through a web interface, however, that capability will be developed as a web site improvement in coming years. Of course, all of the Annual Report's analyses, graphics, and the data used to generate them will be made available as fixed graphics and set files from the web site.

Developing the Report Contents and its Organization

In general, the Report will contain background information about the data that are included and about how the data are analyzed. It will include the data in tabular form. It will include an array of graphical presentations of the data. The graphical presentations will be accompanied by a description of the analysis used to develop them as well as an interpretation of how the presentation might be used by the reader.

Task I

- Design of the Report format, developing the descriptive material where not already available, and implementing the design format on the web site comprise *Task I*.
- Figure 1 illustrates our concept of how the Report will appear on the web site and the level of detail in the explanations we intend to provide. (See Figure 1 with appropriate buttons & explanatory material)
- The preliminary design of the Annual Report, including drafts of all the graphical presentations it will contain, will be developed within four months of project start and submitted to the WRAP AMRF for their review and approval.

Task I will be completed 6 months following their approval. This work is estimated to take 0.5 months of design effort and 1.5 months of web/database manager time.

Task II

- Developing the content for the Annual Report will constitute *Task II*. This will include developing new statistical analyses and graphics, and populating the web site with all of these new results.

Proposed report contents and organization are outlined below. Data presentations and analyses that are different from those currently available from the WRAP web site are identified and budgeted separately.

1. Background section

- a. Text describing the objectives and approach of the report;
- b. Text describing the structure and uses of the report;
- c. Map of WRAP area with various monitoring sites cross-referenced to a table of sites and Class I areas they represent;
- d. References to sites, monitoring, and data processing meta-files and other web site data and tools that can be used to better understand material presented in this report.

Most of this material is already available, it only requires designing the report format and reformatting information accordingly.

2. WRAP region contour maps (with values shown.)

Brief introductory text and figure and table captions (including, where appropriate, reference to the aerosol extinction algorithms used) for all of the following graphical contour maps developed from the current and immediate previous four years of data (i.e. 1996-2000):

- a. Measured total, fine and coarse mass aerosol concentrations;
- b. Calculated fine mass aerosol concentrations based on estimated species concentrations for sulfates, nitrates, organic carbon, elemental carbon, and fine soil using IMPROVE and EPA approved formulas;
- c. Estimated aerosol species for sulfates, nitrates, organic carbon, elemental (light absorbing) carbon and fine soil;
- d. Fractional (by percent) contribution to calculated fine mass from each of the 5 contributing species;
- e. Aerosol calculated extinction in inverse megameters, visibility in deciviews, and visual range in kilometers;
- f. Fractional (by percent) contribution to total extinction by aerosol species scattering (sulfate, nitrate, organic carbon, fine soil and coarse mass) and absorption (elemental carbon.)

Each of the above contour, maps will be generated from the five-year average seasonally (spring, summer, fall, winter) as well as annually.

Some of this material is already available on web site for the period, 1996-1998. New analyses and graphics will need to be generated with the updated data set. Seasonal contour maps will need to be created. Then, all of these will need to be installed in the WRAP database and on the web site. Since the current process CIRA uses to generate these graphic products is not totally automated, additional work is needed to develop and quality assure an appropriately high quality automatic map contour graphics generator. This analysis tool will be used by CIRA personnel to generate the report products delivered to the web site. (0.5 months design & development, 1 month data analysis)

3. Summary tables, bar chart and pie chart graphics for each monitoring site.

Monthly average and annual average tables of the calculated fine mass aerosol concentration and estimated extinction based on the latest year of data for each IMPROVE site will be presented. Bar graphs of the monthly average calculated fine mass will present the monthly average contribution to the calculated fine mass from sulfates, nitrates, organic carbon, elemental carbon and fine soil. The following four figures (similar to the presentation currently on the WRAP web site (<http://vista.cira.colostate.edu/wrap/Data/GraphicViewer/seasonal.htm>)) will be developed for each site and will include twelve bar charts representing the following:

- a. The year monthly average of calculated fine mass by species;
- b. The year monthly average of the percentage contribution to calculated fine mass by species,
- c. The year monthly average of the calculated total extinction (in inverse megameters) by species contribution, and;
- d. The year monthly average of the percentage contribution to total extinction by species contribution.

Quarterly average pie charts for each of the above will also be generated.

This material is already available on web site for the period, 1996-1998. New analyses and graphics will need to be generated with the updated data set. Then, these will need to be installed in the WRAP database and on the web site. We do not envision producing any pie charts at this time because we believe bar charts convey the information more appropriately. However, if the WRAP AMRF specifically requests pie charts, they can be produced with small additional effort. (0.5 months design & development, 0.25 months data analysis)

4. Best and worst 20% calculated extinction days for each site

Brief introductory text and figure and table captions for the following:

- a. Stacked bar plots of extinction contributions from the conventional five aerosol species for each observation day at each of the IMPROVE sites for the entire year. Each day will be color coded if it is either in the group 90 (20% worst visibility days) or group 10 (20% best visibility days) category.
- b. A table for each site presenting all of the days and associated aerosol species contributions for the best and worst 20% of the days based on calculated extinction.
- c. Contour plots of the spatial deciview pattern will be generated for each sample period in the year..

Most of these data, displays, and graphics will need to be generated for the first time by CIRA (although the stacked bar charts should be available from the NPS Denver group.) The best and worst visibility contours will need to be created. Then, all of these will need to be installed in the WRAP database and on the web site. (0.25 months design & development, 1 month data analysis)

5. Meteorological conditions corresponding to the 10 best and 10 worst days at each IMPROVE site.

Brief introductory text and figure and table captions for the following:

- a. HYSPLIT back trajectories for the 10 best and 10 worst days at each IMPROVE site will be generated from the NOAA/NCEP Eta model data assimilation tool, EDAS, data for the previous 5 days of each observation period.

The HYSPLIT trajectories will have to be calculated, assembled, organized, and displayed in an appropriate manner. Then, all of these will need to be installed in the WRAP database and on the web site. (0.25 months design & development, 0.5 months data analysis)

- b. The CAPITA Monte Carlo model data will be developed for the 10 best and 10 worst days at each IMPROVE site. This model will provide an air mass history including the precipitation, three-dimensional motion fields, temperatures and humidities experienced by the air parcels that influence the aerosol measurement.

The CAPITA Monte Carlo model needs to be upgraded and the calculations run for all of the sites. All of these data need to be organized then installed into our database and display methods developed. (0.25 months design and development, 0.5 months data analysis)

6. Year-to-year haze trends (deciview) and components of extinction trends.

This will be presented as tables of trends and maps of the IMPROVE sites with arrows indicating the direction and statistical significance of the trends for extinction (plotted as deciviews) and for each of the calculated fine mass and aerosol species contributing to group 10, group 50 and group 90 visibility. Initially these will utilize the trend analyses described in the 2000 IMPROVE report; however, the methodology will be changed to reflect EPA guidance when it is finalized.

While most of these data are available in tabular form, only the deciview trends have been graphed. All of these will need to be installed in the WRAP database and on the web site. (0.25 months design & development, 0.5 months data analysis)

7. Retrospective summary report.

A one time only report of data preceding January 2000 using the tools developed as described above will be generated for all of the current sites that have complete (all four IMPROVE channels) aerosol speciation multi-year data for each year of the five years immediately prior to 1999, i.e. 1995-1999.

Most of these data, displays and graphics will need to be generated for the first time by CIRA although the format and computer codes to do this will be developed as described above. Then, all of these will need to be installed in the WRAP database and on the web site. (0.5 months design & development, 1 month data analysis)

Summary of Tasks:

Task I

- ***Develop the format of the report and implement it on the web site. (0.5 months design, 1 month web/database manager effort)***

Task II

- ***Develop and configure data analysis according to the needs identified in each section of the report. Conduct the data analyses & implement their web availability.***
 - a. Background section
 - i. Design & development
 - b. WRAP region contour maps (with values shown.)
 - i. Design & development – 0.5 months
 - ii. Data analysis – 1 month
 - c. Summary tables and bar chart graphics for each monitoring site.
 - i. Design & development – 0.5 months
 - ii. Data analysis – 0.25 months
 - d. Best and worst 20% calculated extinction days for each site

- i. Design & development – 0.25 months
 - ii. Data analysis – 1 month
 - e. A. HYSPLIT based meteorological conditions corresponding to the 10 best and 10 worst days at each IMPROVE site.
 - i. Design & development – 0.25 months
 - ii. Data analysis – 0.5 months
 - B. Monte Carlo Simulations based meteorological conditions corresponding to the 10 best and 10 worst days at each IMPROVE site.
 - iii. Design & development – 0.25 months
 - iv. Data analysis – 0.5 months
 - f. Year-to-year haze trends (deciview) and components of extinction trends.
 - i. Design & development – 0.25 months
 - ii. Data analysis – 0.5 months
 - g. Retrospective summary report.
 - i. Design & development – 0.5 months
 - ii. Data analysis – 1 month

Total Resources:

Personnel

- Design and development (Doug Fox and Bret Schichtel, 2 months)
- Data analysis (5 months)
- Web/Database Manager (1.5 months)

Travel

- Two trips to coordinate with AMRF

Equipment

- Nonexpendable equipment
 - New high capacity server
 - New software & upgrades