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Volume 1 of 2

# ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE (SITE) HISTORICAL DATA SUMMARY

**Prepared for**

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# Section 1

# INTRODUCTION

## 1.1 OBJECTIVES AND BACKGROUND

AeroVironment Inc. was contracted by EG&G Rocky Flats, Inc. to screen, validate, analyze and graph the historical meteorological data collected at the Rocky Flats Environmental Technology Site (Site). This task was undertaken for the purpose of fulfilling requirements of the U.S. Department of Energy (DOE) and the U.S. Environmental Protection Agency (EPA) for safety and regulatory compliance.

The meteorological data have been collected primarily for the protection of the workers, the public and the environment. Additionally the data are used to assist general plant operations, engineering and construction activities and environmental studies. The following DOE directives govern how the meteorological data are collected and quality assured: DOE Order 5400.1, "General Environmental Protection Program" (1988), "Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance" (1991) and DOE Order 5500.3A, "Emergency Planning and Preparedness for Operational Emergencies" (1991).

In terms of environmental compliance, the meteorological data are used as inputs to dispersion models required by the Clean Air Act (CAA) and to support studies and clean up operations in accordance with the CAA and the National Emissions Standards for Hazardous Air Pollutants which requires the plant to limit emissions of radionuclides and beryllium. Precipitation data are collected and used to characterize surface water flow as required by the EPA.

## 1.2 HISTORICAL LOCATIONS OF WEATHER STATIONS AND DATA COLLECTED

The Site is located in the Rocky Mountain foothills between Arvada and Boulder (Figure 1.1). It is bounded by Indiana Street on the east, Colorado State Highways 128 on the north, 93 on the west and 72 to the south. The topography is rolling hills. The area is arid due to the shadow effect of the Rocky Mountains to the west.

Meteorological observations have been made at the Site since 1952 (Figure 1.2). The meteorological monitoring station was first established on the roof of Building 991. The original observations included temperature, relative humidity, precipitation, wind speed and wind direction. In January 1953, the monitoring station was moved to the roof of Building 123, where it remained until April 1975. The monitoring station was then moved to a 61-meter tower that was erected in the West Buffer Zone.

The coordinates and elevation of the West Buffer Zone location is: 39° 53' 4" north, 105° 12' 36" west and approximately 6150' above mean sea level. The locations of

FIGURE 1.1. Area map of Rocky Flats environmental technology Site and surrounding communities.

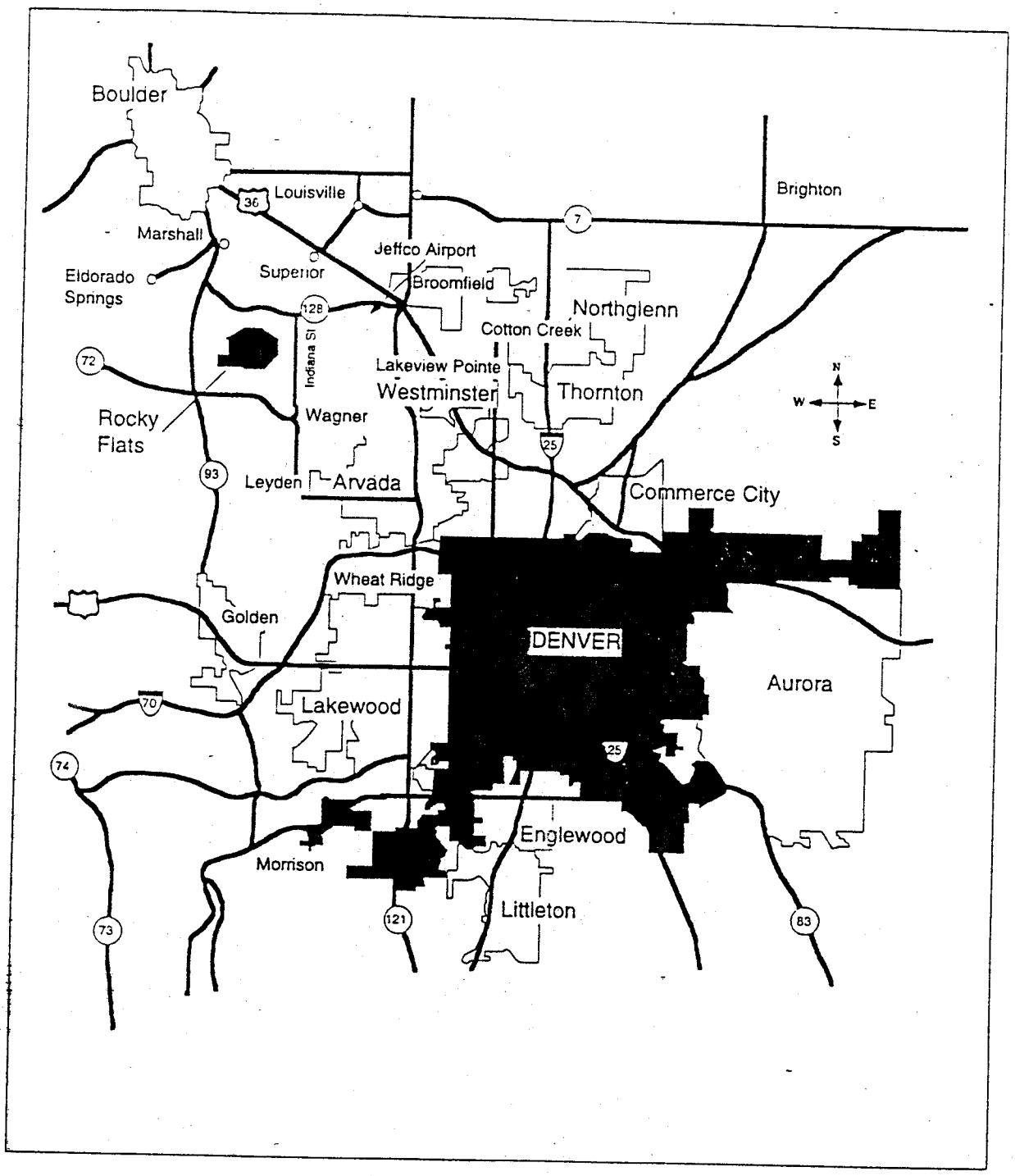
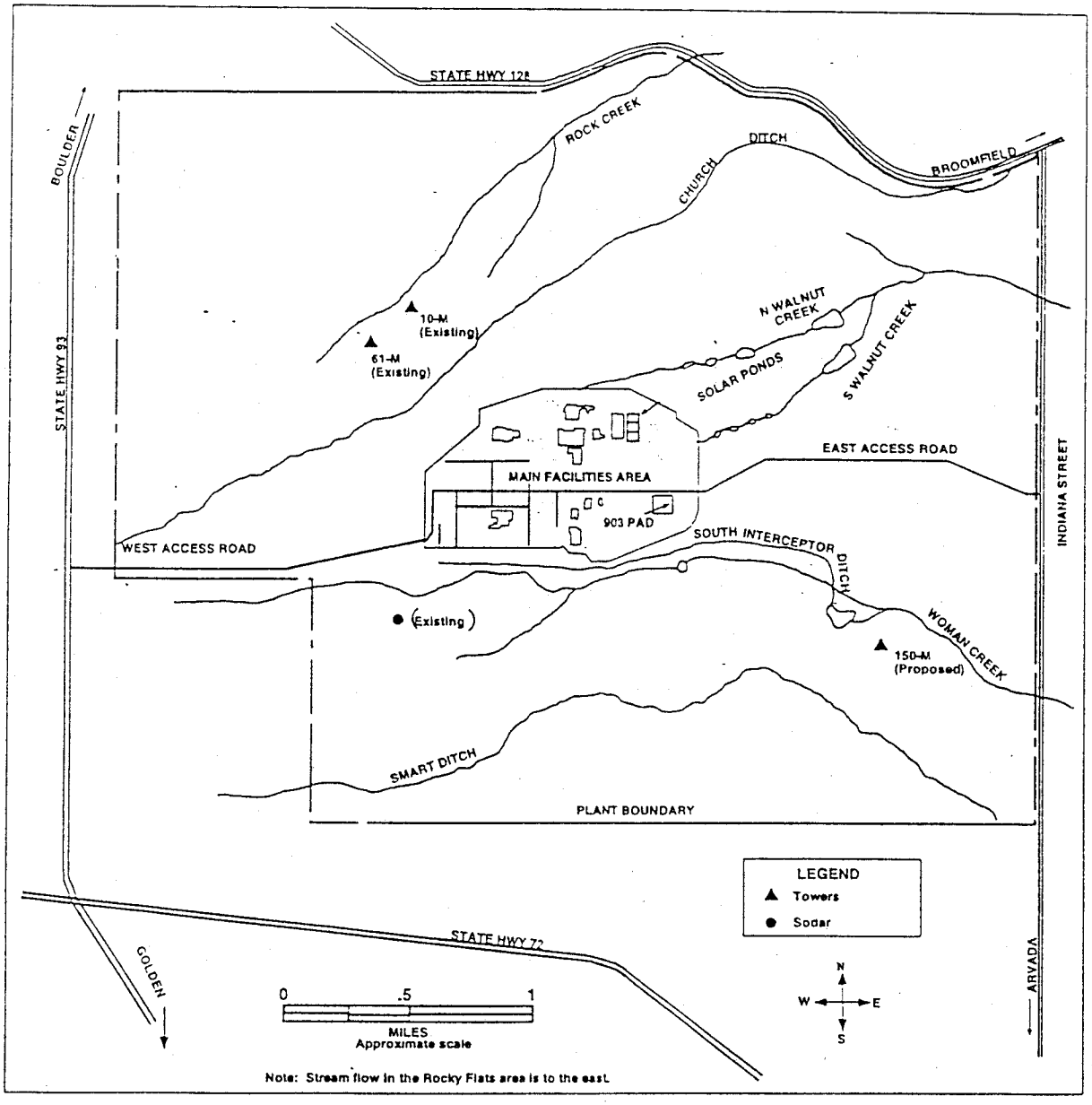


FIGURE 1.2. Existing and proposed meteorological monitoring network at Rocky Flats environmental technology Site.



Buildings 991, 123 and 771 with respect to the West Buffer Zone location are approximately 1.75 miles east, 1 mile east-southeast and 1.5 miles east, respectively.

Periodically, additional monitoring stations have been set up and operated in conjunction with various activities at the Rocky Flats facility. During 1975 to 1989, monitoring stations were set up and operated at Building 881, a utility pole at the East Gate, and a wind test site in the northwest corner of the facility. In 1989, a 10-meter tower was erected and instrumented about 50 meters northeast of the 61-meter tower. This tower and associated instrumentation were set up as a redundant system to the 61-meter tower to serve as a backup during possible emergencies. A pair of wind sensors were set up at Building 881 during 1991 to support remediation activities. Because of siting requirements which put the sensors at near-ground levels and near obstructions, the data are only representative of a very local area.

The data collected through April 1975 consisted of temperature, relative humidity, precipitation, wind speed and wind direction. These data were recorded manually in a logbook and represent instantaneous readings taken within five minutes before each hour. With the move to the present West Buffer Zone location in May 1975, multilevel measurements of wind and temperature (10, 25 and 60 meters) were added along with single level measurements of solar radiation, barometric pressure, soil temperature, soil heat flux and absolute humidity (see Figure 1.3 and Table 1.1). Measurements have continued at this location until the present, but for unknown reasons the data collected between March 1977 and December 1983 were lost. Tower data recorded on strip charts from 1984 through early 1989 were digitized, but until recently were not validated or analyzed. Much of the data (1984 to early 1989) have large gaps and questionable quality. Starting in early 1989, the data have been collected by a digital data logger. Data collected through 1991 are also of questionable quality. Starting in 1992, the data have been routinely validated in accordance with an established quality assurance (QA) program that specifies how the data are archived, screened, corrected and reviewed.

## 1.3 DATA USED IN THIS ANALYSIS

### 1.3.1 Data Sets

The meteorological data used in these analyses were collected by the primary meteorological monitoring station located at Building 123 from January 1953 to March 1975 and in the West Buffer Zone after March 1975, as well as precipitation data collected between July 1976 and September 1988 at Building 771.

The data from the first year of operation (1952) collected at the Building 991 location were not available for this analysis. Annual paper summaries for the data collected at the Building 123 and West Buffer Zone locations between January 1953 and February 1977 provided all the data used in this analysis up through December 1963 and supplemented other data available through the end of this period. Each of these annual summaries included:

FIGURE 1.3. Meteorological monitoring tower configuration.

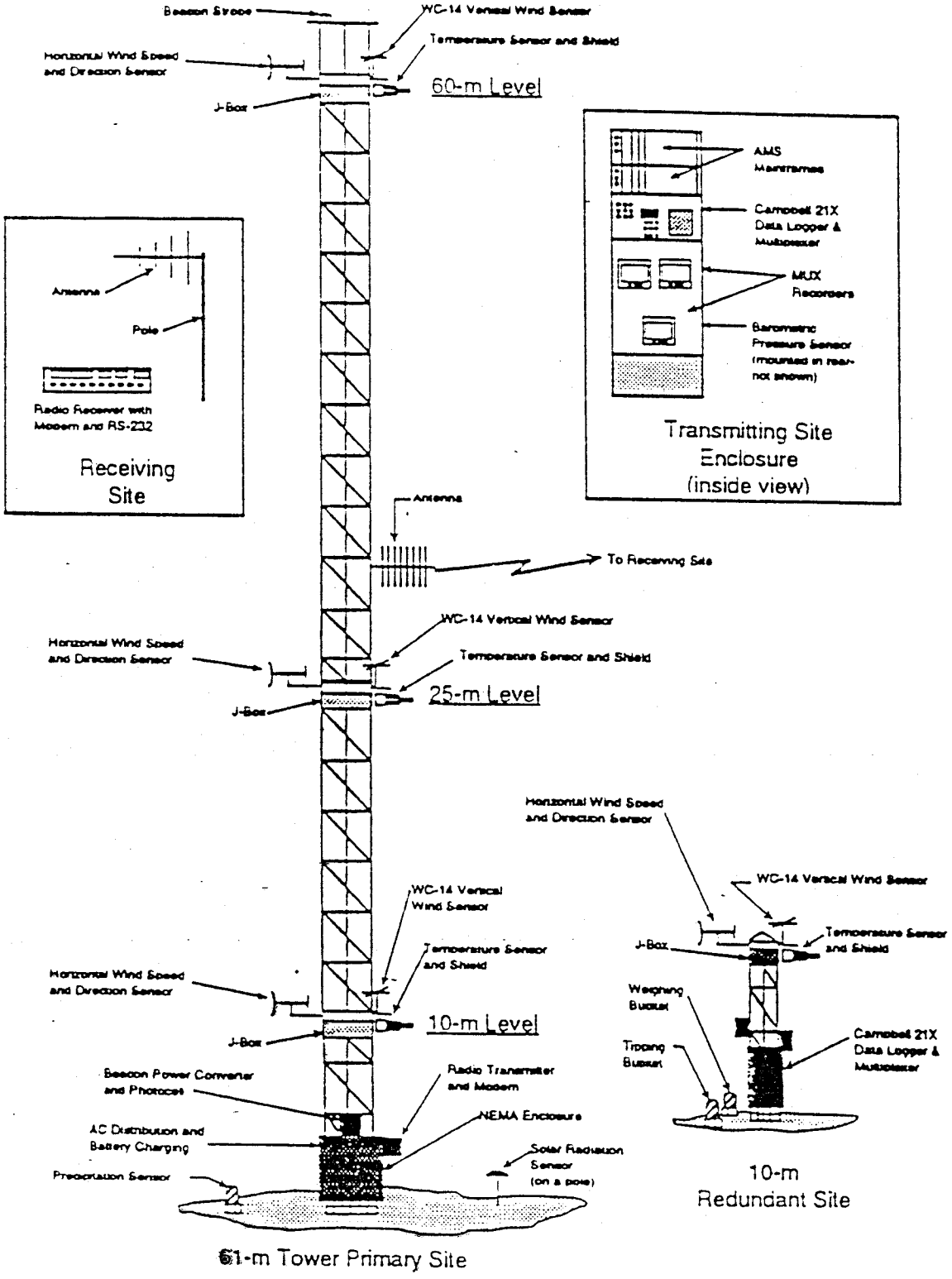


TABLE 1.1. Meteorological monitoring equipment specifications at Rocky Flats environmental technology Site.

| PARAMETER | MEASUREMENT PRINCIPAL | MANUFACTURER | MODEL NO. | RANGE |
|---|---|---|---|---|
| 61M Tower Horiz. Wind Speed * | Photochopper w/Cups | Climatronics | 100075 | 0 – 55.9 m/sec |
| 61M Tower Wind Direction * | Phase Resolver w/Vane | Climatronics. | 102139 | 0 - 360 degrees |
| 10M Tower Horiz. Wind Speed *+ | DC Tachometer w/Propeller | RM Young Co. | 05035 | 0 - 50 m/sec |
| 10M Tower Wind Direction *+ | Potentiometer w/Vane | RM Young Co. | 05035 | 0 - 355 degrees |
| Vertical Wind Speed *+ | DC Tachometer w/Propeller | Gill | 27106 | -9.9 to 9.9 m/sec |
| 61M Tower Ambient Air Temperature * | Thermistor Radiation Shield | Climatronics | 100093 TS-10 | -30 to 50 deg C NA |
| 10M Tower Ambient Air Temperature *+ | Thermistor Radiation Shield | Campbell Gill 8-Plate | 207 NA | -50 to 50 deg C NA |
| Fast Response Temperature * | Thermistor Radiation Shield | Climatronics | 100093-3 TS-10 | -30 to 50 deg C NA |
| Relative Humidity * | Capacitance Hygrometer | Rotronics | MP100 | 0 - 100% |
| Solar Radiation * | Black and White Pyranometer | Eppley | 8-48 | 0 - 1400 Watts/m^2 |
| Infrared (Longwave) Radiation * | Silicon Pyrgeometer | Eppley | PIR | 0 - 500 Watts/m^2 |
| Precipitation *+ | Tipping Bucket Gage (8") | Novalynx | 260-312/250E-12 | NA |
| Precipitation * | Tipping Bucket Gage (6") | Climatronics | BWS | NA |
| Precipitation + | Weighing Bucket Gage (12) | Belfort | 5-780-300MM | NA |
| Barometric Pressure * | Ceramic Capacitance | Setra Systems | 270 | 600 - 1100 millibars |
| Soil Heat Flux * | Thermopile | Weathermeasure | 3983 | +/- 1500 Watts/u^2 |
| Absolute Humidity * | Optical Hygrometer | Ophir Corp. | 2000 | 0 - 50 g/m^3 |
| Soil Temperature * | Thermistor | Campbell | 107 | -35 to 50 deg C |

* 61-meter tower
+ 10-meter tower

- Mean annual temperature
- Maximum annual temperature
- Minimum annual temperature
- Average annual relative humidity
- Total annual precipitation
- Greatest amount of precipitation in a single day
- Greatest depth of snowfall in a single day
- Greatest monthly mean wind speed
- Mean annual wind velocity
- Peak annual gust velocity
- Predominant annual wind direction

and graphs of:

- Monthly maximum temperature
- Mean monthly temperature
- Monthly minimum temperature
- Average monthly maximum temperature
- Average monthly minimum temperature
- Monthly heating degree days based on 65oF
- Average monthly relative humidity
- Monthly precipitation totals

From January 1964 until February 1977, monthly climatic summaries in addition to the annual summaries were provided in Excel spreadsheet format. The information provided by each of these monthly summaries was:

- Daily maximum temperature
- Daily minimum temperature
- Daily mean temperature
- Mean daily dew-point temperature
- Mean daily wind speed
- Daily maximum instantaneous wind speed
- Total daily precipitation
- Mean daily barometric pressure
- Total daily solar radiation (May 1975 to December 1993)

The 1984 through early 1989 data were originally collected on strip charts but later digitized. A digital data logger was used to collect the data after this period as one-second data. Fifteen-minute averages, maximums and minimums for each 15-minute period were calculated from these data for the entire period as follows:

- Average wind speed at 10, 25 and 61 meters
- Maximum wind speed at 10, 25 and 61 meters
- Minimum wind speed at 10, 25 and 61 meters
- Average wind direction at 10, 25 and 61 meters

- Standard deviation of the horizontal wind speed at 10, 25 and 61 meters
- Standard deviation of the wind direction at 10, 25 and 61 meters
- Average vertical wind speed at 10, 25 and 61 meters
- Maximum vertical wind speed at 10, 25 and 61 meters
- Minimum vertical wind speed at 10, 25 and 61 meters
- Standard deviation of the vertical wind speed at 10, 25 and 61 meters
- Average temperature at 10, 25 and 61 meters
- Maximum temperature at 10, 25 and 61 meters
- Minimum temperature at 10, 25 and 61 meters
- Average dew-point temperature at 10 meters
- Total precipitation
- Average solar radiation
- Maximum solar radiation
- Minimum solar radiation

### 1.3.2 Data Quality

**o Temperature**

The mean temperatures for the Building 123 and West Buffer Zone locations were almost identical. Differences were noted in the average maximum and average minimum temperatures. The range of the Building 123 average extreme temperature data was larger than the equivalent West Buffer Zone data probably because of the radiative effects of the Building 123 rooftop.

**o Relative Humidity**

The average annual relative humidity data differed between the Building 123 and West Buffer Zone by approximately 18%.

**o Wind**

The average annual wind speeds for the two locations (Building 123 and the West Buffer Zone) differed by approximately 19%. The differences are due to the difference in the roughness lengths of the two sites. The West Buffer Zone is open and flat with a roughness length on the order of centimeters. The area surrounding Building 123, on the other hand, is the area of highest building density at the Site. The buildings that surround Building 123 act to slow the wind.

The yearly and monthly maximum wind speeds differ in how they were reported for the two locations. The Building 123 maximum wind data were reported as maximum wind gusts, which according to U.S. weather observing practices, are reported when the peak wind speed reaches at least 16 knots and the variation in wind speed between the peaks and the lulls is at least 9 knots. The digitized and digital data collected at the West Buffer Zone location reports the maximum wind speeds for each 15-minute averaging period from the one-second data. It is believed that the wind gust data

collected before May 1975 is actually maximum wind speeds. For these analyses, all data were treated as maximum wind speeds and averaged together accordingly.

- **Insolation**

The monthly insolation averages were low as evidenced by the calculations for percent possible monthly insolation (Table 2.32). In this analysis, the percent possible monthly insolation decreases between January and August and increases between August and December. Data quality is the underlying reason for this counter intuitive result since the averages are based on incomplete data sets and data of questionable quality.

- **Precipitation**

Years 1984-1986 were eliminated from all precipitation calculations. Data collected during these years did not encompass the entire year. Inclusion of this partial data in the analyses would have skewed the results.

## 1.4 DATA VALIDATION PROCEDURES

Data validation was performed by AeroVironment for the 1984-1993 data set only. The 1984 to 1989 data were collected on strip charts and digitized. The data since 1989 were collected electronically and processed into 15-minute averages at the time of data collection. Because these data were available in electronic form, it was possible to run these data through screening programs that checked statistically for rates of change and meteorological representativeness. Due to the scarcity of quality control (QC) data, most of the data validation was performed by graphing the data and looking for outliers and patterns that did not fit known meteorological and physical patterns. In many cases it was not possible to decide whether the outlier or anomaly was real or bad data. Much of these data were left in the data base by agreement between the contracting officer and AeroVironment.

The 1953-1976 data set was provided in the form of paper annual summaries without supporting QC data. Likewise, the 1964-1977 data set was supplied as monthly summaries in Excel spreadsheet format without supporting QC data. An attempt was made to secure Local Climatological Data summaries and Daily Weather Maps from both the National Climatic Data Center in Ashville, North Carolina, and the Colorado State Meteorologist in order to make comparisons with either data collected at nearby monitoring sites or the large-scale meteorological flow patterns. This attempt ultimately failed due to the unavailability of these data at the local level and the high cost and long lead time required to secure these data on the National level.

### 1.4.1 1953 to 1977

The data collected during this period were not validated by AeroVironment. The data were provided without supporting QC data, which made it impossible to make the necessary comparisons. Time and budget constraints made it necessary to include these data as they were.

### 1.4.2 1984 to 1993

AeroVironment validated the data collected during this period. The monitoring station location during this period was the West Buffer Zone. The procedures used in the validation process were:

- The data were provided to AV on 90-megabyte (MB) Bernoulli disks (for MS DOS) along with all audit and service records that were used in the validation procedures.

- The data were uploaded to the AV computer and automatically loaded into the database (MicroSoft Access). Members of the data validation team did random checks of the loaded data against the digital data to ensure accurate data loading. Once the data loading had been verified, the percentage of values for data capture of the raw data were calculated. This information was then compared against the validated data base after all data edits and corrections had been performed.

- Once the loading of the data was completed, a preliminary screening routine was run. This screening checked the values for outliers (i.e., data greater than or less than specified values) and maximum and minimum rates of change between adjacent observations (i.e., values changing more or less than specific amounts between readings). An example of a "flagged" output of hourly data designed and used by AV is shown in Figure 1.4. Data that do not pass the outlier or rate of change tests were flagged by the computer for further investigation. The computer also screened the data for consistency between the various levels on the tower. For example, changes in wind speed between vertical levels (i.e., wind shear) which exceeded a specified amount were flagged for further investigation. Lapse rates were also calculated between levels to check for consistency and reasonableness (e.g., an auto-convective lapse rate would have been flagged for additional validation).

- Next, time-series plots of the data were generated and inspected by a meteorologist in order to determine periods of questionable data, occurrences of anomalous events, and any interesting patterns. An example of a time-series plot generated by AV is shown in Figure 1.5. As a cross check, local climatological data (from NOAA) was obtained to determine if the data from the tower were reasonable and within expected ranges for the geographical area. Additionally, Site audit and service records were used to construct a station instrumentation "history" for all variables at each level on the tower. This history was used to determine periods of bad and/or questionable instrument response.

Our team of meteorologists examined all of the above data and data products and determined which periods were valid and which were questionable. All periods of known instrument problems were marked for invalidation from the data base. Initially,

FIGURE 1.4. An example of a screened data output used in data validations.

TEMPERATURE [A21011]

DEGREES CENTIGRADE
LEVEL HEIGHT : 10 METERS

NATIONAL PARK SERVICE GASEOUS POLLUTANT NETWORK. #1

SITE 34 GREAT SMOKY MTNS. NP - LOOK ROCK, TN

APR. 1993

AEROVIRONMENT INC.

RAW DATA
AS OF 18/MAY/93

CLOCK HOUR [LOCAL STANDARD TIME]

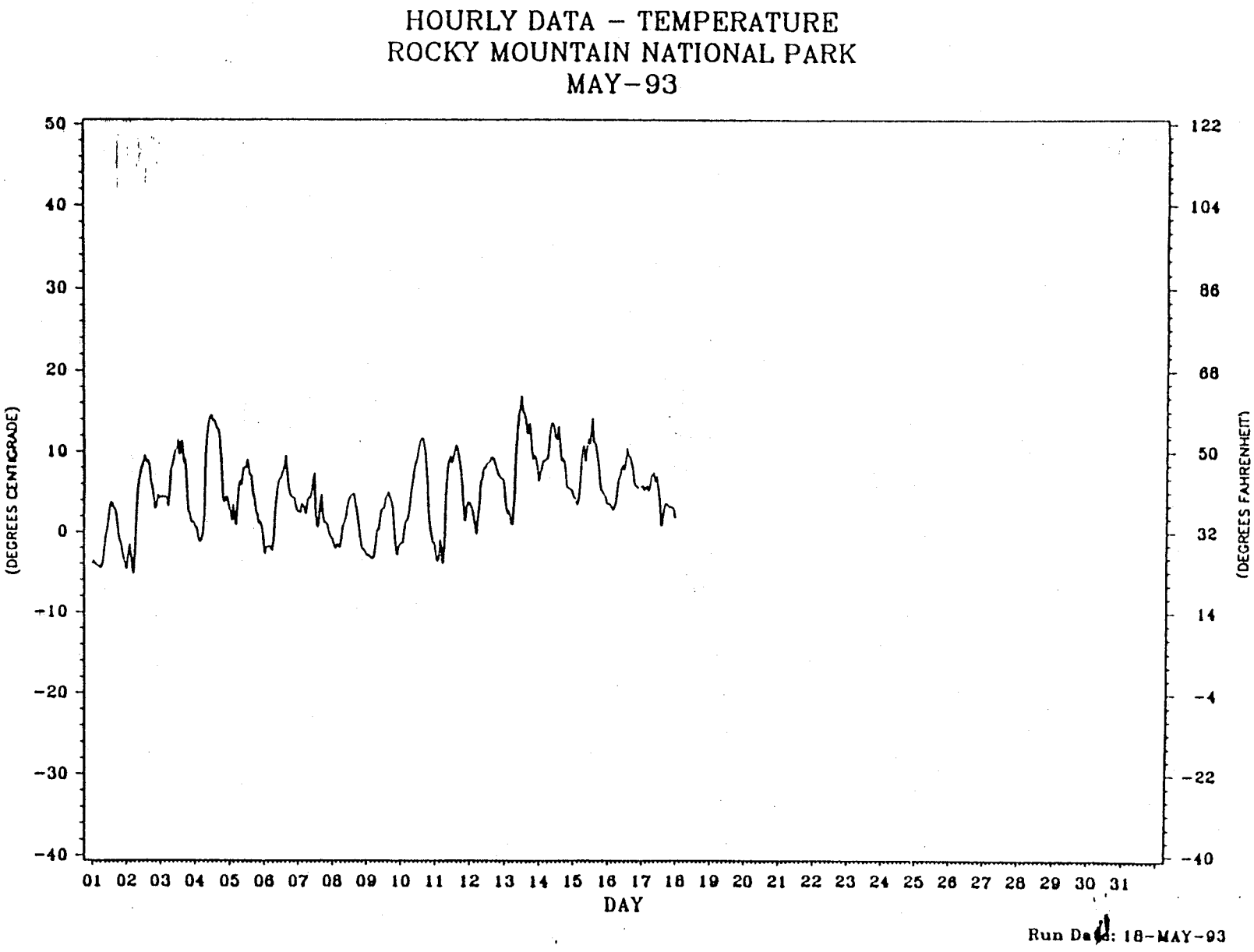
| DY | 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | MIN | MAX |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 11.3 | 10.1 | 9.4 | 8.9 | 8.4 | 7.9 | 7.3 | 7.2 | 7.3 | 7.8 | 7.7 | 8.2 | 8.5 | 8.3 | 8.3 | 7.5 | 6.1 | 5.4 | 5.0 | 4.2 | 3.9 | 3.6 | 3.0 | 2.9 | 2.9 | 11.3 |
| 2* | 2.8 | 2.3 | 1.2* | 0.6* | 0.2* | 0.7* | 1.2* | 1.5* | 1.8* | 2.1* | 2.2* | 2.3* | 2.2* | 2.0* | 1.6* | 1.5* | 1.3* | 1.4* | 1.5* | 1.6* | 1.8* | 1.8* | 1.9* | 2.0 | -2.3 | 2.8 |
| 3- | 2.1* | 2.2* | 2.2* | 2.2* | 2.4* | 2.7* | 2.9* | 2.3* | 1.4* | 0.1* | 1.8* | 4.2 | 5.3 | [PF] | [PF] | [PF] | [PF] | 9.0 | 8.0 | 7.4 | 7.1 | 6.7 | 6.6 | 6.3 | -2.9 | 9.0 |
| 4 | 6.6 | 6.4 | 6.2 | 5.9 | 6.7 | 5.5 | 5.2 | 5.5 | 7.8 | 8.3 | 7.7 | 9.4 | 9.9 | 9.7 | 9.8 | 10.3 | 9.3 | 9.3 | 8.7 | 6.6 | 5.5 | 5.1 | 5.1 | 5.8 | 5.1 | 10.3 |
| 5 | 5.8 | 5.9 | 5.7 | 5.6 | 5.3 | 5.3 | 5.4 | 6.1 | 6.3 | 6.6 | 8.4 | 7.4 | 6.9 | 7.4 | 7.7 | 7.4 | 7.3 | 7.0 | 6.7 | 6.6 | 6.7 | 6.2 | 6.5 | 5.7 | 5.3 | 8.4 |
| 6 | 5.8 | 5.5 | 5.2 | 5.5 | 5.6 | 5.3 | 5.0 | 5.0 | 4.9 | 5.1 | 5.7 | 6.1 | 6.3 | 6.5 | 7.1 | 7.3 | 7.7 | 7.9 | 7.5 | 7.5 | 7.6 | 7.3 | 7.4 | 7.4 | 4.9 | 7.7 |
| 7 | 6.7 | 7.3 | 7.9 | 8.0 | 8.0 | 7.8 | 7.3 | 7.8 | 9.0 | 9.5 | 9.6 | 11.6 | 12.9 | 13.2 | 14.0 | 15.3 | 15.3 | 15.0 | 13.8 | 12.9 | 12.3 | 12.7 | 12.4 | 12.0 | 6.7 | 15.3 |
| 8 | 11.3 | 11.2 | 10.8 | 10.5 | 10.3 | 9.5 | 9.2 | 10.2 | 11.5 | 14.3 | 14.7 | 17.4 | 17.1 | 16.1 | 15.8 | 16.7 | 17.0 | 16.5 | 15.8 | 15.3 | 14.3 | 13.7 | 13.6 | 13.6 | 9.2 | 17.4 |
| 9 | 13.4 | 12.8 | 12.2 | 12.0 | 11.7 | 11.7 | 12.0 | 11.6 | 12.4 | 12.8 | 11.6 | 9.6 | 9.2 | 9.8 | 10.0 | 10.3 | 10.4 | 11.0 | 10.8 | 10.1 | 9.1 | 7.7 | 7.5 | 7.2 | 7.2 | 13.4 |
| 10 | 6.8 | 6.5 | 5.8 | 5.5 | 5.3 | 5.0 | 4.8 | 4.6 | 5.0 | 5.8 | 7.3 | 8.7 | 10.2 | 11.3 | 12.6 | 13.8 | 14.3 | 14.5 | 13.7 | 12.4 | 12.2 | 12.0 | 11.8 | 11.6 | 4.6 | 14.5 |
| 11 | 11.7 | 11.9 | 11.6 | 11.7 | 12.1 | 12.0 | 12.1 | 13.2 | 14.7 | 16.1 | 17.9 | 19.4 | 20.7 | 21.6 | 19.8 | 21.4 | 22.1 | 21.3 | 19.9 | 18.7 | 17.6 | 17.1 | 16.0 | 15.0 | 11.6 | 22.1 |
| 12 | 14.2 | 13.9 | 14.0 | 13.6 | 13.5 | 13.2 | 12.6 | 12.4 | 13.8 | 14.7 | 15.7 | 16.8 | 17.6 | 18.4 | 18.1 | 19.0 | 19.9 | 19.8 | 18.9 | 18.4 | 18.4 | 16.9 | 16.2 | 16.0 | 12.4 | 19.9 |
| 13 | 15.7 | 16.0 | 14.8 | 14.8 | 15.6 | 15.1 | 14.6 | 15.1 | 16.0 | 18.3 | 17.2 | 18.0 | 19.0 | 19.9 | 20.7 | 20.9 | 21.3 | 20.8 | 20.1 | 19.8 | 19.6 | 19.1 | 18.8 | 18.7 | 14.6 | 21.3 |
| 14* | 18.5 | 18.0 | 17.3 | 16.3 | 16.0 | 15.4 | 15.3 | 16.2 | 17.9 | 19.2 | 20.4 | 22.1 | 24.3 | 25.7* | 26.3* | 26.3* | 25.* | 24.1 | 22.0 | 20.7 | 19.7 | 19.3 | 19.2 | 19.1 | 15.4 | 26.3 |
| 15 | 18.8 | 18.3 | 18.3 | 18.2 | 17.9 | 17.4 | 17.2 | 17.3 | 17.2 | 18.0 | 19.1 | 19.8 | 17.1 | 14.9 | 16.9 | 18.3 | 19.1 | 18.4 | 17.1 | 13.3 | 10.1 | 10.7 | 10.9 | 9.5 | 9.3 | 19.8 |
| 16* | 8.4 | 6.7 | 5.3 | 5.4 | 5.0 | 4.7 | 4.6 | 4.7 | 4.3 | 4.6 | 4.9 | 6.4 | 7.0 | 6.3 | 6.2 | 6.1 | 5.9 | 5.6 | 4.7 | 4.8 | 4.4 | 2.9 | 1.6* | 1.1* | 1.1 | 8.4 |
| 17- | 1.8* | 2.2 | 2.3 | 2.2 | 2.1 | 1.7* | 1.1* | 1.7* | 2.3 | 3.0 | 3.8 | 5.1 | 7.0 | 8.3 | 9.7 | 10.6 | 11.3 | 11.4 | 10.4 | 9.7 | 9.3 | 8.9 | 8.5 | 8.4 | 1.1 | 11.4 |
| 18 | 8.1 | 7.8 | 7.4 | 7.3 | 6.7 | 7.0 | 7.3 | 8.3 | 10.0 | 10.3 | 11.8 | 12.4 | 13.4 | 14.3 | 15.0 | 15.7 | 15.8 | 15.5 | 14.3 | 13.1 | 12.2 | 12.8 | 12.1 | 11.4 | 6.7 | 15.8 |
| 19 | 10.9 | 10.9 | 11.0 | 10.5 | 10.2 | 10.3 | 10.6 | 11.6 | 12.9 | 13.2 | 17.1 | 18.6 | 19.8 | 20.7 | 21.0 | 20.7 | 20.2 | 19.2 | 17.9 | 16.9 | 16.3 | 15.9 | 15.5 | 15.2 | 10.2 | 21.0 |
| 20 | 15.0 | 14.8 | 14.7 | 14.4 | 13.8 | 13.3 | 13.5 | 14.1 | 15.3 | 16.7 | 18.0 | 19.1 | 18.6 | 19.2 | 19.3 | 19.6 | 19.3 | 12.3 | 12.3 | 12.0 | 11.6 | 11.8 | 11.8 | 11.4 | 11.4 | 19. |
| 21* | 11.3 | 10.9 | 7.4 | 6.4 | 6.4 | 6.3 | 6.1 | 6.3 | 6.1 | 6.2 | 3.7 | 4.0 | 3.6 | 3.3 | 2.0 | 0.9* | 0.8* | 0.4* | 0.2* | 0.1* | 0.1* | 0.2* | 0.3* | 0.8 | -0.8 | 11. |
| 22- | 0.9* | 0.9* | 0.9* | 0.9* | 0.9* | 1.0* | 0.9* | 0.7* | 0.2* | 1.6* | 3.2 | 4.8 | 5.8 | 7.1 | 8.0 | 8.6 | 8.9 | 9.3 | 8.3 | 7.0 | 6.9 | 6.3 | 6.1 | 5.9 | -1.0 | 9.3 |
| 23 | 5.5 | 6.0 | 5.7 | 5.9 | 5.8 | 6.1 | 6.0 | 7.1 | 8.7 | 9.3 | 10.4 | 11.8 | 12.9 | 14.5 | 15.2 | 15.4 | 15.7 | 15.3 | 14.3 | 13.5 | 13.1 | 13.0 | 12.5 | 12.9 | 5.5 | 15.7 |
| 24 | 12.1 | 11.1 | 11.4 | 11.8 | 12.8 | 12.2 | 11.6 | 12.1 | 13.3 | 14.* | 17.9 | 19.2 | 21.3 | 21.8 | 20.3 | 20.0 | 20.5 | 20.7 | 18.9 | 17.9 | 17.1 | 16.4 | 16.0 | 15.7 | 11.1 | 21.8 |
| 25 | 15.5 | 15.4 | 15.3 | 14.9 | 14.0 | 13.1 | 13.1 | 13.9 | 16.3 | 17.4 | 19.8 | 21.9 | 23.3 | 24.9 | 25.0 | 24.5 | 22.9 | 21.4 | 19.1 | 14.8 | 13.5 | 12.5 | 11.8 | 11.2 | 11.2 | 25.0 |
| 26* | 11.1 | 11.0 | 10.7 | 10.8 | 11.1 | 10.6 | 10.0 | 9.5 | 9.2 | 9.0 | 8.7 | 7.6 | 9.8 | 10.9 | -33.9 | *16.6 | *13.0 | 812.9 | 13.2 | 11.2 | 10.6 | 10.0 | 9.3 | 8.6 | -33.9 | 13.2 |
| 27 | 7.5 | 6.9 | 6.1 | 5.8 | 6.0 | 5.8 | 5.9 | 6.3 | 7.7 | 9.8 | 11.5 | 12.8 | 13.9 | 14.9 | 16.1 | 17.0 | 16.8 | 16.6 | 15.8 | 14.7 | 14.2 | 14.1 | 13.7 | 13.2 | 5.9 | 17.0 |
| 28 | 12.9 | 12.6 | 12.5 | 11.4 | 11.1 | 11.0 | 11.2 | 12.7 | 14.4 | 13.5 | 14.7 | 15.6 | 16.7 | 18.3 | 18.6 | 19.1 | 19.1 | 18.8 | 17.9 | 16.7 | 16.7 | 16.3 | 16.0 | 15.4 | 11.0 | 19.1 |
| 29 | 14.3 | 14.2 | 14.1 | 13.2 | 13.1 | 13.0 | 13.1 | 14.3 | 15.9 | 15.8 | 16.2 | 17.3 | 18.5 | 19.5 | 20.0 | 20.7 | 20.6 | 20.2 | 18.9 | 17.0 | 17.0 | 16.6 | 16.2 | 16.2 | 13.0 | 20.7 |
| 30 | 15.5 | 15.5 | 15.6 | 15.3 | 15.0 | 14.8 | 14.8 | 16.0 | 17.7 | 17.8 | 17.0 | 17.4 | 17.2 | 18.0 | 18.5 | 17.8 | 17.3 | 16.5 | 16.1 | 16.0 | 15.9 | 15.7 | 15.5 | 15.8 | 14.8 | 18.5 |
| AV | 9.9 | 9.6 | 9.2 | 9.0 | 8.9 | 8.6 | 8.4 | 8.9 | 9.8 | 10.6 | 11.4 | 12.3 | 13.1 | 13.9 | 12.7 | 13.4 | 14.3 | 13.8 | 12.9 | 11.9 | 11.4 | 11.0 | 10.6 | 10.4 | [ | ] |
| MI | -2.1 | -2.2 | -2.2 | -2.2 | -2.4 | -2.7 | -2.9 | -2.3 | -1.8 | -2.1 | -2.2 | -2.3 | -2.3 | -2.0 | -33.3 | -16.6 | -1.3 | -1.4 | -1.5 | -1.6 | -1.8 | -1.8 | -1.9 | -2.0 | -33.3 | [ |
| MX | 18.8 | 18.3 | 18.3 | 18.2 | 17.9 | 17.4 | 17.2 | 17.3 | 17.7 | 19.2 | 20.4 | 22.1 | 24.3 | 25.7 | 26.3 | 26.3 | 25.9 | 24.1 | 22.0 | 20.7 | 19.7 | 19.3 | 19.2 | 19.1 | [ | 26.3 |

UNFLAGGED MONTHLY AVG 11.1 MONTHLY MIN -33.3 DAY 26 HR 14 [@]: RANGE CHECK MIN 2.0 MAX 25.0 [@]: MAX RATE OF CHANGE 10.0
MAX 26.3 DAY 14 HR 15 [*]: MULTIPLE FLAGS.

OUOO3 [Program: EDMS_MONTHSUM

Version: LC.12-MAY-93]

FIGURE 1.5. An example of a time-series plot generated by AeroVironment.



these invalidations were limited to obvious failures of the meteorological sensor or data acquisition system, acts of nature (e.g., freezing or wind instruments following precipitation), and maintenance. All remaining flagged values were investigated by the meteorological analysis team to determine the validity of the data. In this phase of the task, we used daily weather maps (available from 1987 to the present) to help determine the validity of apparent anomalous data. Flagged data, which the meteorological analysis team found unacceptable, were marked for invalidation from the data base. Where Site audit and service records showed systematic problems with the data, the meteorological analysis team determined if the data could be corrected (i.e., adjusted) with reasonable confidence. Data which could not be salvaged were marked for invalidation.

Once these tasks were completed, AV met with the contracting officer to discuss the findings of the meteorological analysis team and the overall status of the data base. In this meeting we provided the contracting officer with information concerning additional characteristics and peculiarities identified in the data during the validation process. We showed all periods of data that had been marked for invalidation and adjustments, along with supporting documentation. An agreement was reached concerning the final form of the data base.

In accordance with this agreement the data base was edited and corrected. All corrections and edits were reviewed by an unbiased person not involved with the validation process. When all data edits and corrections had been reviewed and confirmed, new monthly data files of validated data were created in the archive format specified by the contracting officer. The newly created data base was then supplied to the contracting officer with the old and new formats on 150 MB Bernoulli disks (for DOS).