The Hanford Meteorological Data Collection System and Data Base

G. L. Andrews

April 1988

**Prepared for the U.S. Department of Energy
under Contract DE-AC06-76RLO 1830**

**Pacific Northwest Laboratory
Operated for the U.S. Department of Energy
by Battelle Memorial Institute**

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor Battelle Memorial Institute, nor any of their employees, makes any warranty, expressed or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof, or Battelle Memorial Institute. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof, or Battelle Memorial Institute.

PACIFIC NORTHWEST LABORATORY
operated by
BATTELLE MEMORIAL INSTITUTE
for the
UNITED STATES DEPARTMENT OF ENERGY
under Contract DE-AC06-76RLO 1830

Printed in the United States of America
Available from
National Technical Information Service
United States Department of Commerce
5285 Port Royal Road
Springfield, Virginia 22161

NTIS Price Codes
Microfiche A01

Printed Copy

Pages	Price Codes
001-025	A02
026-050	A03
051-075	A04
076-100	A05
101-125	A06
126-150	A07
151-175	A08
176-200	A09
201-225	A010
226-250	A011
251-275	A012
276-300	A013

THE HANFORD METEOROLOGICAL DATA
COLLECTION SYSTEM AND DATA BASE

G. L. Andrews

April 1988

Prepared for
the U.S. Department of Energy
under Contract DE-AC06-76RLO 1830

Pacific Northwest Laboratory
Richland, Washington 99352

SUMMARY

The Hanford Meteorological Station (HMS), operated by Pacific Northwest Laboratory (PNL), provides meteorological and climatological services to the Department of Energy in Richland and its contractors. On a 24-hour basis, the HMS measures, records, and archives meteorological data collected hourly throughout the year. The current data base consists of five components:

- wind telemetry stations
- doppler acoustic sounders (SODAR)
- 200-ft towers
- 410-ft tower at the HMS
- surface weather observations at the HMS.

The wind telemetry station data, 410-ft tower data, and surface weather observation data are permanently archived into yearly ACSII files, and the remaining components are permanently archived in binary form on magnetic tape. The future data base will consist of the same five components, but all components will be permanently archived into yearly ASCII files.

Quality assurance computer programs will be written to validate the current data base, and a data archival program will be written to improve the archival method that is currently used.

ACKNOWLEDGMENTS

The author would like to thank the staff at the Hanford Meteorological Station for their assistance during the preparation of this document. Special thanks to Dana Hoitink, the HMS project manager, for his continued support and Ora Gifford for his helpful suggestions and ideas.

CONTENTS

SUMMARY	iii
ACKNOWLEDGMENTS	v
INTRODUCTION	1
DATA COLLECTION SYSTEM AT THE HMS	3
DESCRIPTION OF THE CURRENT DATA COLLECTION SYSTEM	4
SENSORS FOR MEASURING METEOROLOGICAL VARIABLES	5
CURRENT DATA BASE AT THE HMS	7
SURFACE WEATHER OBSERVATION DATA	7
410-FT TOWER DATA	9
TELEMETRY SYSTEM DATA	11
HOURLY AND 15-MINUTE DATA	11
FUTURE DATA BASE AT THE HMS	13
QUALITY ASSURANCE PROCEDURES	13
DATA ARCHIVAL PROGRAM	15
REFERENCES	17
APPENDIX A - DESCRIPTION OF THE HOURLY AND 15-MINUTE DAILY FILE FORMATS	A.1
APPENDIX B - SENSORS LISTING AND IDENTIFICATION	B.1

INTRODUCTION

The Hanford Meteorological Station (HMS), operated by the Pacific Northwest Laboratory (PNL) for the U.S. Department of Energy in Richland, Washington, collects, measures, and archives meteorological data each hour throughout the year. The HMS is located in the northwest quadrant of the Hanford Site, approximately 1/2-mile east of the 200-West (200W) Area (Fig. 1). Hanford contractors and outside agencies use the data for a variety of applications (e.g., engineers at the Hanford Site use HMS data for engineering applications, such as calculating heating and cooling loads).

This report describes the contents, implementation, and location of the current data base and the future data base at the HMS. The history of the data collection system at the HMS and a current inventory of measured variables are also addressed, and plans for future archival and retrieval programs are identified. Detailed discussions of the data entry codes used for archival have been presented previously (Buck and Andrews 1987a, b, c; Andrews and Buck 1987a, b, c). Discussions in this report consider only the meteorological data collected and archived by the HMS; a forthcoming PNL report will discuss and describe the data collection system in more detail.

- Telemetry Locations
- △ SODAR Locations
- 200-ft Tower Locations
- ⊕ 410-ft Tower and
Surface Observation
Location

Figure 1. Distribution of the Data Collection Components on the Hanford Site

DATA COLLECTION SYSTEM AT THE HMS

The meteorological data collection system currently used at the HMS measures, records, and archives meteorological data on an hourly and 15-minute basis. As used here, the phrase "data collection system" refers to all phases of the data collection process, from the use of sensors for measuring meteorological variables to methods for archiving the data on weather forms or on the DEC VAX 11/750 computer at the HMS. "Data base" refers to the product generated by the data collection system (i.e., monthly and daily files that contain the HMS meteorological data).

The HMS was built in 1944 along with a 410-ft meteorological tower approximately 1/2-mile east of the 200W Area (see Fig. 1). At that time the data collection system consisted mainly of surface weather observations and data from several levels of the tower. The forecaster manually recorded and archived these data on weather forms. This system was used until the late 1970s when wind telemetry stations, placed at various locations on and off the Hanford Site, were added to the data collection system. The wind telemetry information was sent via radiowave to a computer (PDP 1108) at the HMS, where each hour the data were archived on magnetic tape. For permanent archival, these data were also manually recorded on weather forms. The forms are stored at the HMS library and can be checked out by contacting Ora Gifford (509/373-3216) or one of the on-duty forecasters.

In late 1985, the data collection system was again expanded to include the Emergency Response Detection System (ERDS) [now called the Emergency Management System (EMS)]. The EMS was established to provide emergency response capabilities for the Hanford Site, and is capable of handling data associated with toxic and/or radionuclide releases to the atmosphere and ground. This addition significantly increased the capabilities of the HMS data collection system. The following equipment and sensors were added:

- three 200-ft instrumented towers
- four doppler acoustic sounders
- 10 wind telemetry stations
- a Digital Equipment Corporation VAX 11/750 computer
- interfaces for transferring data to the VAX 11/750.

Programs that run on the HMS computer gather and organize the meteorological data into two data bases, one that contains hourly averages and one that contains 15-minute averages. The following is a more detailed description of the current data collection system.

DESCRIPTION OF THE CURRENT DATA COLLECTION SYSTEM

The current HMS data collection system consists of wind telemetry stations, doppler acoustic sounders (SODAR), 200-ft towers, the 410-ft tower at the HMS, and surface weather observations at the HMS. Figure 1 shows the distribution of these components within and near the Hanford Site. Within these components are instrumentation and sensors that measure, collect, and archive several meteorological variables:

- wind direction and speed (average, maximum, and minimum)
- sigma theta and sigma wind speed
- temperature difference between 60-m and 10-m (delta-temperature)
- dry bulb temperature (average, maximum, and minimum)
- dew point temperature
- atmospheric pressure
- precipitation
- solar radiation.

Currently, two methods are used to archive the meteorological data collected. For one method the forecaster manually records the data each hour on weather forms; for the other method the HMS computer automatically archives the data every hour and every 15 minutes. Table 1 indicates the archival method for each component of the data collection system. Eventually only the computer will be used to archive the data collected from the wind telemetry stations and the 410-ft tower.

For archiving data collected from the wind telemetry stations, 410-ft tower, and surface weather observations, the forecasters use data entry programs to transfer the data to the HMS computer. (The following section of this report describes the location of the files produced by the data entry codes and the file name convention). Computer-archived meteorological data are collected via microwave or dedicated line and

TABLE 1. Archival Method for Data Collected

<u>Component</u>	<u>Method of Archive</u>
Wind telemetry stations	Manual and computer
Doppler acoustic sounders	Computer
200-ft towers	Computer
410-ft tower	Manual and computer
Surface weather observations	Manual

archived on the appropriate HMS computer data base in 15-minute and hourly intervals. Each data base consists of daily files. The hourly daily files contain 24 hours of meteorological data and the 15-minute daily files contain 96 (24 X 4) 15-minute periods of data. Each hour in the daily files is divided into two blocks of data. Appendix A contains a detailed description of the hourly and 15-minute daily file formats.

SENSORS FOR MEASURING METEOROLOGICAL VARIABLES

Approximately 400 meteorological variables are measured by the HMS data collection system, and each variable is assigned a sensor identification (ID). Appendix B contains a list of those IDs. The list may be increased as more variables are added to the data collection system. Sensor IDs are used in data retrieval programs (e.g., the program GET_EMS.FOR) to access specific data. Additional IDs will be needed in programs being developed for collecting and storing specific data.

TABLE 1. Archival Method for Data Collection

Method of Archival	Comment
Hand and computer	Wind reference stations
Computer	Upbeat acoustic sensors
Computer	200-ft tower
Hand and computer	410-ft tower
Hand	Surface weather observations

Archival on the appropriate 100-ft tower data base in 15-minute intervals. Each data base consists of daily files. The hourly data files contain 24 hours of meteorological data and the 15-minute data files contain 96 (24 x 4) 15-minute periods of data. Each hour in the daily file is divided into two blocks of data. Appendix A contains a detailed description of the hourly and 15-minute data file formats.

2.1.2.3. FORMATING METEOROLOGICAL VARIABLES

Approximately 400 meteorological variables are measured by the WIS data collection system and each variable is assigned a sensor identification number. Appendix B contains a list of these IDs. The first way the measured meteorological variables are added to the data collection system is by the use of the data retrieval program (e.g., the program GET.DAT) to access specific data. Additional IDs will be needed in programs being developed for collecting and storing specific data.

CURRENT DATA BASE AT THE HMS

The HMS database that is currently being used consists of four components:

- surface weather observations
- 410-ft tower data
- telemetry system data
- 15-minute and hourly data (these data are automatically collected by the HMS computers).

Data for the first three components are kept on separate disk packs at the HMS that are identified SFCOBS for the surface weather observations, TOWER for the 410-ft tower data, and TELEM for the wind telemetry data.

Each disk pack contains yearly files of the indicated data in ASCII format, with 80 characters per record. Data are also available in handwritten form at the HMS library. The 15-minute and hourly data are kept on the system disk (DUA0:).

SURFACE WEATHER OBSERVATION DATA

Data from surface weather observations represent a variety of weather information such as cloud cover, cloud type, dry bulb temperature, wet bulb temperature, relative humidity, and atmospheric station pressure. Figure 2 is a copy of the surface weather observation form that the forecasters complete each hour. The weather variables that the forecaster records are indicated at the top of the form. Although surface weather observations exist in handwritten form from the present time back through 1944, the computer files for the surface weather observations cover the period from 1955 through the present. The computer code SFC (Andrews and Buck 1987c) is used to enter data for surface weather observations into the HMS computer. These data are stored in the [FCST.DAT] subdirectory in monthly files. The convention used in naming the monthly files is SFCOBSxxx.DAT, where xxx is the three-character abbreviation of the current month (e.g., AUG August). At the end of each year, the monthly files are consolidated into a yearly file (e.g., SFCOBS87.DAT) that is placed on the SFCOBS disk pack located in the forecast room at the HMS.

8. 10. 2004 10: 10: 20

FIGURE 2. Example of the Hourly Surface Observation Form

In FY 1986 quality assurance programs were run on each year of the surface weather observation data to correct errors and identify missing data. The programs identified numerous missing variables and some systematic errors that are being corrected.

410-FT TOWER DATA

Data from the 410-ft tower consist of wind and temperature information from various levels of the tower. Figure 3 is a copy of the form used by the forecasters to record the data. The data, which are recorded hourly, are obtained from strip charts located in the HMS forecast room. The weather variables that the forecaster records are indicated at the top of the form (negative signs indicate below-ground measurements). Although data for the 410-ft tower exist in handwritten form from the present back through 1944, the computer files for the surface weather observation cover the period from 1955 through the present. The forecasters use the computer code TOWER (Buck and Andrews 1987c) to archive the 410-ft tower information on the HMS computer. These data are stored in the [FCST.DAT] subdirectory in monthly files. The convention used in naming the monthly files is TOWERxxx.DAT, where xxx is the three-character abbreviation of the current month (e.g., AUG August). At the end of each year, the monthly files are consolidated into a yearly file (e.g., TOWER87.DAT) that is placed on the TOWER disk pack located in the forecast room at the HMS.

These data are also automatically archived by the HMS computer every hour and at 15-minute intervals. Until programs are written to check the quality assurance of that data, forecasters will continue to use the computer code TOWER to archive the data on the HMS computer.

The data for the 410-ft tower has also been reviewed by quality assurance programs; however, the amount of errors and missing data is not so extensive. The errors and missing data will be corrected.

[illegible]

ED 1600-174 (12/03)

S7 = Speed At 7 Feet
D5 = Wind Direction At 50 Feet
S5 = Speed At 50 Feet
Etc.

FIGURE 3. Example of the Hourly Tower Form

TELEMETRY SYSTEM DATA

The data from the wind telemetry system contain wind speed and wind direction information from a network of 33-ft (10-m) wind towers (see Fig. 1). Atmospheric stability and mixing level are included with the wind telemetry data. The computer code UPDATE (Athey, Allwine and Ramsdell 1981) is used by the forecasters each hour to enter the wind telemetry data on the HMS computer. These data are stored in the [FCST.DAT] subdirectory in monthly files. The convention used in naming the monthly files is TELEMxxx.DAT, where xxx is the three-character abbreviation of the current month (e.g., AUG August). At the end of each year, the monthly files are consolidated into a yearly file (e.g., TELEM87.DAT) and placed on the TELEM disk pack located in the forecast room at the HMS.

Quality assurance programs have not yet been run on the wind telemetry data. However, quality assurance codes will be run on the data and erroneous data will be corrected.

HOURLY AND 15-MINUTE DATA

Hourly and 15-minute data are automatically collected by the HMS computer. The data are stored in two separate data bases, as described previously. Both of the data bases are in binary form. Each month the hourly data base is backed-up on magnetic tapes that are stored permanently at the HMS.

Currently, the hourly and 15-minute data bases are not converted to ASCII format or grouped into similar data groups. However, the future data base will include such a conversion.

FUTURE DATA BASE AT THE HMS

The data base that will be developed for the HMS will incorporate the current data base and data from the 15-minute and hourly data bases. The future data base will have five components:

- wind telemetry data
- doppler acoustic sounders (SODAR) data
- 200-ft tower data
- 410-ft tower data
- surface weather observations data.

Data from the first four components will be acquired automatically from the hourly data base. The surface weather observations will continue to be archived by the forecasters and entered on the HMS computer using the SFC program. Data will be stored on disk packs in yearly files. The directory structure for each disk pack is shown in Figure 4. The files will be in ASCII format with 80 characters per record.

The directory labelled MISCELLANEOUS will contain forecast data, pilot balloon (PIBAL) data, and daily summary information. The forecast and daily summary data will be accumulated from the data entry codes, as previously discussed. The PIBAL data will be accumulated from the pilot balloon that is released twice a day (1200 PST and 2400 PST) at the HMS.

QUALITY ASSURANCE PROCEDURES

Two levels of quality assurance will be applied to the future data base. The first level will check for gross errors in the data as it is archived to monthly files. For example, wind direction will be checked to make sure it is within the range of 0 through 360. The second level of quality assurance will be applied each month and will provide a more rigorous check. For example, the temperature will be compared with the climatological limits for the particular month, and hour-by-hour comparisons will be made to flag large jumps (10°F) in the temperature.

Figure 4. Directory Structure of the Future Data Base

DATA ARCHIVAL PROGRAM

The data archival program will be submitted by a batch job on a daily basis, probably after midnight. The program will organize data into components (see Fig. 4) and perform gross error checks. It will then store information in monthly files on removable disk packs. These disk packs will be stored at the HMS.

REFERENCES

- Andrews, G.L. and J.W. Buck. 1987a. Hanford Meteorological Station Computer Codes Volume 2 - The PROD Computer Code. PNL-6279 Vol. 2, Pacific Northwest Laboratory, Richland, Washington.
- Andrews, G.L. and J.W. Buck. 1987b. Hanford Meteorological Station Computer Codes Volume 4 - The SUM Computer Code. PNL-6279 Vol. 4, Pacific Northwest Laboratory, Richland, Washington.
- Andrews, G.L. and J.W. Buck. 1987c. Hanford Meteorological Station Computer Codes Volume 6 - The SFC Computer Code. PNL-6279 Vol. 6, Pacific Northwest Laboratory, Richland, Washington.
- Athey, G.F., K.J. Allwine, and J.V. Ramsdell. 1981. User's Guide to the MESOI Diffusion Model and to the Utility Programs UPDATE and LOGRVU. PNL-3999, Pacific Northwest Laboratory, Richland, Washington.
- Buck, J.W. and G.L. Andrews. 1987a. Hanford Meteorological Station Computer Codes Volume 1 - The GEN Computer Code. PNL-6279 Vol. 1, Pacific Northwest Laboratory, Richland, Washington.
- Buck, J.W. and G.L. Andrews. 1987b. Hanford Meteorological Station Computer Codes Volume 3 - The TANK Computer Code. PNL-6279 Vol. 3, Pacific Northwest Laboratory, Richland, Washington.
- Buck, J.W. and G.L. Andrews. 1987c. Hanford Meteorological Station Computer Codes Volume 5 - The TOWER Computer Code. PNL-6279 Vol. 5, Pacific Northwest Laboratory, Richland, Washington.

APPENDIX A

DESCRIPTION OF THE HOURLY AND 15-MINUTE DAILY FILE FORMATS

APPENDIX A

DESCRIPTION OF THE HOURLY AND 15-MINUTE DAILY FILE FORMATS

Hourly and 15-minute daily files contain 24 hours of meteorological data. These files are structured identically. Each hour is divided into two blocks of data. Figure A.1 shows an example of one block of data. Each block of data begins with a header containing the date, hour, minute, number of sensor identifications (IDs), and a list of the sensor IDs. The header is then followed by the data associated with the sensors listed in the header. Each record of data contains a record number, internal ID, alpha/numeric description, mean value, standard deviation, and number of samples. The 15-minute files are structured in the same manner except there are ninety-six 15-minute periods of information.

The hourly and 15-minute daily files have unique filename extensions. The 15-minute daily files are identified by the .QLG filename extension and the hourly daily files are identified by the .HLG extension. The 15-minute database is stored in the [ERDSSYS.DAT.MESORAD.INPUT] subdirectory and the hourly database is stored in the [ERDSSYS.DAT.SENSORS] subdirectory. The current day hourly data base is kept in the [ERDSSYS.DAT.SENSORS] subdirectory.

A program called DEBUG resides in each database directory. DEBUG allows the user to view the contents of a daily file from either the 15-minute or hourly database. Invoke the program by typing DEBUG and depressing the RETURN key. Answer the questions as they appear on the screen. Depress the CTRL and Y key simultaneously to exit DEBUG.

Record Number	Year	Month	Day	Hour	Minute	Number of Internal Ids in Header		
11	1987	10	12	1	1	1	10	
18							17	
24							23	
51							41	
20046.			-1				57	
58							63	
64							69	
70							75	
76							81	
82								
20047.			-1				88	
89							110	
120							125	
126							131	
161							166	
167								
20048.			-1				173	
174							179	
180							185	
186							191	
192							197	
198								
20049.			-1				204	
205							210	
211							232	
233							266	
267							341	
351								
44.00000								
20051.								
44.00000								
20052.								
44.00000								
20053.								
44.00000								
20054.								
44.00000								
20055.								
44.00000								
20056.								
44.00000								
20057.								
44.00000								
20058.								
44.00000								
20059.								
44.00000								
20060.								
44.00000								
20061.								

APPENDIX B

SENSORS LISTING AND IDENTIFICATION

KEY TO ABBREVIATIONS IN THE ALPHA/NUMERIC IDENTIFICATION

<u>Abbreviation</u>	<u>Description</u>
300A	300 Area
7F	7 Foot Level
30F	30 Foot Level
50F	50 Foot Level
50SEF	50 Foot Level Southeast Corner of 410-ft Tower
100F	100 Foot Level or 100F Area
200F	200 Foot Level
250F	250 Foot Level
300F	300 Foot Level
400F	400 Foot Level
1D	100 Area Doppler (100N)
3D	300 Area Doppler
4D	400 Area Doppler (FFTF)
6D	600 Area Doppler (HMS)
200E	200 East Area
2M	2 Meter Level
10M	10 Meter Level
25M	25 Meter Level
60M	60 Meter Level
100N	100N Area
6T	600 Area Tower (HMS)
200W	200 West Area
ARMY	Army Loop Road
AT	Dry Bulb Temperature
DP	Dew Point Temperature
DT	Delta-Temperature (60m-10m)
EDNA	Old Hanford Townsite
EOC	Emergency Operation Center
FRNK	Franklin County
FFTF	Fast Flux Testing Facility

Key To Abbreviations In The Alpha/Numeric Identification (Cont'd.)

<u>Abbreviation</u>	<u>Description</u>
GABL	Gable Mountain Top
GBLW	Gable Mountain West Side
L01-L20	Level 1 through Level 20
MN	Minimum
MN24	24-hour Minimum
MX	Maximum
MX24	24-hour Maximum
PROS	Prosser Barricade
PASC	Pasco Airport
RICH	Richland Airport
RING	Ringold
RF	Precipitation
RMTN	Rattlesnake Mountain
RSPG	Rattlesnake Spring
SAGE	Sage Hill
SD	Standard Deviation
SR	Solar Radiation
WAHL	Walukee Slope
WD	Wind Direction
WPPS	WPPSS # 2
WS	Wind Speed
YAKB	Yakima Barricade
RT	River Temperature
ST	Soil Temperature
VERN	Vernita Bridge

SENSOR NUMERIC AND ALPHA/NUMERIC IDENTIFICATION

<u>Numeric Identification</u>	<u>Alpha/Numeric Identification</u>
1	WS-6T-7F
2	WS-6T-30F
3	WS-6T-50F
4	WS-6T-50SEF
5	WS-6T-100F
6	WS-6T-200F
7	WS-6T-300F
8	WS-6T-400F
9	AT-6T-30F
10	AT-6T-50F
11	AT-6T-100F
12	AT-6T-300F
13	WD-GABL
14	AT-6T-250F
15	AT-6T-400F
16	AT-6T-200F
17	WD-6T-7F
18	WD-6T-30F
19	WD-6T-50F
20	WD-6T-50SEF
21	WD-6T-200F
22	WD-6T-100F
23	WD-6T-300F
24	WD-6T-400F
25	NOT USED
26	SR-6T
27	WD-6D-L01M
28	WD-6D-L02M
29	WS-PROS

Sensor Numeric And Alpha/Numeric Identification (Cont'd.)

<u>Numeric Identification</u>	<u>Alpha/Numeric Identification</u>
30	WS-EOC
31	WS-ARMY
32	WS-RSPG
33	WS-EDNA
34	WS-200E
35	WS-200W
36	WS-WAHL
37	DP-300A
38	WS-YAKB
39	WS-1D-L01M
40	WS-WYEB
41	WS-3D-L01M
42	WS-WPPS
43	WS-FRNK
44	WS-GABL
45	WS-RING
46	WS-RICH
47	WS-SAGE
48	WS-RMTN
49	MX-WS-100A-10M
50	WS-PSC
51	WS-6D-L01M
52	WS-6D-L02M
53	WS-6D-L03M
54	WS-6D-L04M
55	WS-6D-L05M
56	WS-6D-L06M
57	WS-6D-L07M
58	WS-6D-L08M
59	WS-6D-L09M

Sensor Numeric And Alpha/Numeric Identification (Cont'd.)

<u>Numeric Identification</u>	<u>Alpha/Numeric Identification</u>
60	WS-6D-L10M
61	WS-6D-L11M
62	WS-6D-L12M
63	WS-6D-L13M
64	WS-6D-L14M
65	WS-6D-L15M
66	WS-6D-L16M
67	WS-6D-L17M
68	WS-6D-L18M
69	WS-6D-L19M
70	WD-6D-L03M
71	WD-6D-L04M
72	WD-6D-L05M
73	WD-6D-L06M
74	WD-6D-L07M
75	WD-6D-L08M
76	WD-6D-L09M
77	WD-6D-L10M
78	WD-6D-L11M
79	WD-6D-L12M
80	WS-4D-L01M
81	WD-4D-L01M
82	WS-4D-L02M
83	WS-4D-L03M
84	WS-4D-L04M
85	WS-4D-L05M
86	WS-4D-L06M
87	WS-4D-L07M
88	WD-4D-L02M
89	WD-4D-L03M

Sensor Numeric And Alpha/Numeric Identification (Cont'd.)

<u>Numeric Identification</u>	<u>Alpha/Numeric Identification</u>
90	WD-4D-L04M
91	WD-4D-L05M
92	WD-4D-L06M
93	WS-100F
94	WS-GBLW
95	WD-GBLW
96	WS-100F
97	WS-FFTF-60M
98	WS-FFTF-25M
99	WS-FFTF-10M
100	AT-FFTF-60M
101	WD-FFTF-60M
102	WD-FFTF-25M
103	WD-FFTF-10M
104	AT-FFTF-10M
105	AT-FFTF-2M
106	SD-WS-FFTF-60M
107	SD-WS-FFTF-25M
108	SD-WS-FFTF-10M
109	SD-WD-FFTF-60M
110	SD-WD-FFTF-25M
111	SD-WD-FFTF-10M
112	DT-FFTF
113	DP-FFTF
114	WS-300A-10M
115	WD-300A-25M
116	WD-300A-60M
117	WD-300A-10M
118	WS-3D-L02M
119	WS-3D-L03M

Sensor Numeric And Alpha/Numeric Identification (Cont'd.)

<u>Numeric Identification</u>	<u>Alpha/Numeric Identification</u>
120	WS-3D-L04M
121	WS-3D-L05M
122	WD-1D-LD1M
123	WD-3D-LD1M
124	WD-3D-L02M
125	WD-3D-L03M
126	WD-3D-LD4M
127	WD-3D-L05M
128	WD-3D-L06M
129	WD-3D-L07M
130	WD-3D-L08M
131	WD-3D-L09M
132	WS-100A-10M
133	WS-100A-25M
134	WS-100A-60M
135	WS-300A-25M
136	WS-300A-60M
137	WD-100A-10M
138	WD-100A-25M
139	WD-100A-60M
140	AT-100A-2M
141	AT-100A-10M
142	AT-100A-60M
143	AT-300A-2M
144	AT-300A-10M
145	AT-300A-60M
146	SD-WS-100A-10M
147	SD-WS-100A-25M
148	SD-WS-100A-60M
149	SD-WS-300A-10M

Sensor Numeric And Alpha/Numeric Identification (Cont'd.)

<u>Numeric Identification</u>	<u>Alpha/Numeric Identification</u>
150	SD-WS-300A-25M
151	SD-WS-100A-60M
152	SD-WS-100A-10M
153	SD-WD-100A-25M
154	SD-WD-100A-60M
155	SD-WD-300A-10M
156	SD-WD-300A-25M
157	SD-WD-300A-60M
158	DT-100A
159	DT-300A
160	DP-100A
161	WD-3D-L10M
162	WD-3D-L11M
163	WD-3D-L12M
164	WD-3D-L13M
165	WD-3D-L14M
166	WD-3D-L15M
167	WD-3D-L16M
168	WS-3D-L06M
169	WS-3D-L07M
170	WS-3D-L08M
171	WS-3D-L09M
172	WD-3D-L17M
173	WD-3D-L18M
174	WD-3D-L19M
175	WD-3D-L20M
176	WS-3D-L10M
177	WS-3D-L11M
178	WS-3D-L12M
179	WS-3D-L13M

Sensor Numeric And Alpha/Numeric Identification (Cont'd.)

<u>Numeric Identification</u>	<u>Alpha/Numeric Identification</u>
180	WS-3D-L14M
181	WS-3D-L15M
182	WS-3D-L16M
183	WS-3D-L17M
184	WS-3D-L18M
185	WS-3D-L19M
186	WS-3D-L20M
187	WS-1D-L02M
188	WS-1D-L03M
189	WS-1D-L04M
190	WS-1D-L05M
191	WS-1D-L06M
192	WS-1D-L07M
193	WS-1D-L08M
194	WS-1D-L09M
195	WS-1D-L10M
196	WS-6D-L20M
197	WD-6D-L13M
198	WD-6D-L14M
199	WD-6D-L15M
200	WD-6D-L16M
201	WD-6D-L17M
202	WD-6D-L18M
203	WD-6D-L19M
204	WD-6D-L20M
205	WS-1D-L11M
206	WS-1D-L12M
207	WS-1D-L13M
208	WS-1D-L14M
209	WS-1D-L15M

Sensor Numeric And Alpha/Numeric Identification (Cont'd.)

<u>Numeric Identification</u>	<u>Alpha/Numeric Identification</u>
210	WS-1D-L16M
211	WS-1D-L17M
212	WS-1D-L18M
213	WS-1D-L19M
214	WS-1D-L20M
215	WD-PROS
216	WD-EOC
217	WD-ARMY
218	WD-RSPG
219	WD-EDNA
220	WD-200W
221	WD-200E
222	WD-WAHL
223	WD-YAKB
224	WD-WYEB
225	WD-WPPS
226	WD-FRNK
227	WD-RING
228	WD-RICH
229	WD-SAGE
230	WD-RMTN
231	WS-4D-L08M
232	WS-4D-L09M
233	AT-6T-3F
234	RT-VERN
235	WD-PSC
236	MX-WS-FFTF
237	MX24-WS-FFTF
238	RF-RSPG
239	AT-RMTN-2M

Sensor Numeric And Alpha/Numeric Identification (Cont'd.)

<u>Numeric Identification</u>	<u>Alpha/Numeric Identification</u>
240	NOT USED
241	AT-EOC-2M
242	MX-AT-EOC
243	MX24-WS-300A
244	MX-WS-300A-10M
245	SD-WD-RMTN-10M
246	AT-RSPG-2M
247	MX24-WS-100N
248	MX24-WS-GBLW
249	MX24-WS-100F
250	MX-WS-GBLW
251	MX-WS-100F
252	MX-AT-RMTN
253	MN-AT-RMTN
254	MX-WS-MT
255	MX-WS-50FT
256	MX-AT-FFTF
257	MX-AT-300A
258	MX-AT-100N
259	MN-AT-100N
260	MN-AT-300A
261	MN-AT-FFTF
262	MN-AT-MT
263	MX-AT-MT
264	NOT USED
265	NOT USED
266	MX24-AT-HMS
267	MN24-AT-HMS
268	MX-WS-RMTN
269	MX24-WS-RMTN

Sensor Numeric And Alpha/Numeric Identification (Cont'd.)

<u>Numeric Identification</u>	<u>Alpha/Numeric Identification</u>
270	MX-WS-200FT
271	MX-WS-400FT
272	MX-AT-RSPG
273	MN-AT-RSPG
274	RF-YAKB
275	NOT USED
276	RF-PASC
277	RF-RICH
278	AT-YAKB-2M
279	MX-AT-YAKB
280	MN-AT-YAKB
281	AT-EDNA-2M
282	AT-200W-2M
283	AT-WAHL-2M
284	AT-WYEB-2M
285	AT-GABL-2M
286	AT-WPPS-2M
287	MX-AT-EDNA
288	MX-AT-200W
289	AT-SAGE-2M
290	MX-AT-WYEB
291	MX-AT-GABL
292	MN-AT-EDNA
293	MN-AT-2DOW
294	MX-AT-SAGE
295	MN-AT-WYEB
296	MN-AT-GABL
297	AT-ARMY-2M
298	MN-AT-ARMY
299	MX-AT-ARMY

Sensor Numeric And Alpha/Numeric Identification (Cont'd.)

<u>Numeric Identification</u>	<u>Alpha/Numeric Identification</u>
300	MN-AT-WAHL
301	MX-AT-WAHL
302	MX-AT-WPPS
303	MN-AT-WPPS
304	MN-AT-SAGE
305	MX-AT-RING
306	MX-AT-FRNK
307	MN-AT-FRNK
308	MN-AT-RING
309	AT-FRNK-2M
310	AT-RING-2M
311	MX24-AT-RMTN
312	MN24-AT-RMTN
313	MN24-AT-ARMY
314	MN24-AT-RSPG
315	MN24-AT-EDNA
316	MN24-AT-200W
317	MN24-AT-WAHL
318	MN24-AT-YAKB
319	MN24-AT-WYEB
320	MN24-AT-WPPS
321	MN24-AT-FRNK
322	MN24-AT-GABL
323	MN24-AT-RING
324	MX24-AT-ARMY
325	MX24-AT-RSPG
326	MX24-AT-EDNA
327	MX24-AT-20DW
328	MX24-AT-WAHL
329	MX24-AT-YAKB

Sensor Numeric And Alpha/Numeric Identification (Cont'd.)

<u>Numeric Identification</u>	<u>Alpha/Numeric Identification</u>
330	MX24-AT-WYEB
331	MX24-AT-WPPS
332	MX24-AT-FRNK
333	MX24-AT-GABL
334	MX24-AT-RING
335	MX24-AT-SAGE
336	MN-AT-EOC
337	MX24-AT-EOC
338	MN24-AT-EOC
339	ST-6T-1/2IN
340	ST-6T-15IN
341	ST-6T-36IN
342	AT-200E-2M
343	MX24-AT-200E
344	MN24-AT-200E
345	MN-AT-200E
346	AT-PROS-2M
347	AT-RICH-2M
348	AT-GBLW-2M
349	AT-100F-2M
350	MX-AT-PROS
351	MX-AT-200E
352	MX-AT-RICH
353	MX-AT-GBLW
354	MX-AT-100F
355	MN-AT-PROS
356	MN-AT-RICH
357	MN-AT-GBLW
358	MN-AT-100F
359	MX24-AT-PROS

Sensor Numeric And Alpha/Numeric Identification (Cont'd.)

<u>Numeric Identification</u>	<u>Alpha/Numeric Identification</u>
360	MX24-AT-RICH
361	MX24-AT-GBLW
362	MX24-AT-100F
363	MN24-AT-PROS
364	MN24-AT-RICH
365	MN24-AT-SAGE
366	MN24-AT-GBLW
367	MN24-AT-300A
368	MN24-AT-FFTF
369	MN24-AT-100A
370	MX24-AT-100A
371	MX24-AT-300A
372	MX24-AT-FFTF
373	SD-WS-GBLW-10M
374	SD-WS-100F-10M
375	SD-WD-100F-10M
376	SD-WD-GBLW-10M
377	MN24-AT-100F
378	MX-WS-PASC
379	MX24-WS-PASC
380	AT-PASC-2M
381	MN-AT-PASC
382	MX-AT-PASC
383	MN24-AT-PASC
384	MX24-AT-PASC
385	NOT USED
386	WD-VERN
387	WS-VERN
388	MX-WS-VERN
389	MX-RT-VERN

Sensor Numeric And Alpha/Numeric Identification (Cont'd.)

<u>Numeric Identification</u>	<u>Alpha/Numeric Identification</u>
390	MN-RT-VERN
391	AT-VERN-2M
392	MX-AT-VERN
393	MN-AT-VERN
394	MX24-AT-VERN
395	MN24-AT-VERN
396	MX24-RT-VERN
397	MN24-RT-VERN

DISTRIBUTION

No. of
Copies

OFFSITE

10 DOE/Office of Scientific and Technical Information

ONSITE

DOE Richland Operations Office

J. J. Sutey

39 Pacific Northwest Laboratory

G. L. Andrews (15)

K. A. Borgeson

K. L. Feuerbacher

O. P. Gifford

C. S. Glantz

M. J. Graham

J. M. Hales

P. C. Hays

D. J. Hoitink

W. D. McCormack

D. J. Newland

W. T. Pennell

P. J. Perrault

E. R. Preston

J. V. Ramsdell

G. N. Reinecke

M. N. Schwartz

L. L. Wendell

Publishing Coordination (2)

Technical Report Files (5)