METEOROLOGICAL DATA VALIDATION FOR NEW NUCLEAR PLANT UNITS COLA

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Abstract

The collection of good meteorological data has become a key factor for nuclear utilities that are looking into the future licensing of new units at existing plants or completely new plant sites (Greenfield). These data are used for many of the first calculations that need to be made for the utility to proceed with the Combined Operating License Application (COLA) that is submitted to the NRC. The validation of these data must follow 10CFR50 Appendix B QA standards. Using these data in COLAs and the resultant scrutiny by the NRC has made the validation process and handling of the data important to nuclear utilities. The validation process and what the NRC is expecting in a good validated set of data will be discussed in this paper.

Introduction

The potential for the construction of new nuclear power plants has opened up a new horizon for meteorological data collection and analyses. It is no long enough for the data to just have a 90% recovery rate; the data must now meet several other criteria. In order for the data to be used for the COLA it will need to be used by several different models and organizations with different formats and needs. The key to success is to have consistent data that will produce identical (or as close as reasonably possible) joint frequency tables (wind speed, direction and stability).

Building the Data Base

To begin our discussion we start with what makes up a good data base? Is it one year, three years, five years or as many as humanly possible (at one site I was asked to provide the last 30 years to compare with the 30 years Local Climatological Data from the National Weather Service). Based on my experience I prefer three years of data. It is usually enough to get a good average and smooth out any one year with atypical data, but not enough where a stubborn calibration problem will show up and raise questions about the entire data base's validity. Calibration problems often seem to crop up with five year data bases. Regulatory Guide 1.23 Revision 1 "Meteorological Monitoring Programs for Nuclear Power Plants" requires at least a "24-month period of data that is defendable, representative and complete. However, 3 or more years of data are preferable" for COLA filings. We have found at one site that the difference between computing X/Q's with three years of data versus five years of data was in the third significant digit. Where possible we use three years of data. As with most other things in life the more data you provide the more questions you can expect to generate.

Most, if not all of the early COLA sites are at existing nuclear plants. That means that they have been in operation for more than 20 years so they also have meteorological data for more than 20 years. Until recently there has not been sufficient staff at the NRC to monitor the meteorological programs at every operating nuclear power plant, therefore some plants did not find that maintaining the meteorological equipment was a high priority. This can lead to some interesting data sets from a site for COLA review. The easiest way to filter the data is the annual 90% data recovery test. Since a three (or five) year period of data is being used some leniency can be taken with the expected 90% annual recovery rate as long as it is met over the three (or five) year period. This 90% recovery rate must be met for the combination of wind speed, direction and delta temperature. The new plant designs mostly have ground level releases, but there is the possibility of mixed mode (partially ground, partially elevated) releases. This increases the necessity for greater than 90% recovery rates at the lower level and somewhat decreases the need for upper level instrumentation, but we strive to achieve it at both levels.

The next factor to consider is consistency of data. Do the wind roses for all years and combination of years and measurement levels look similar? Do the joint frequency distributions look similar year to year or are there anomalies such as 1% “A” stability one year and 12% for the next two years? More importantly, what is the distribution of stable hours each year? This is going to be the most important factor in determining the annual average and accident X/Qs. Going through this process several times has made it very clear that some sites have tailored their calibration procedure to make it as easy as possible to get through the procedure without finding errors. The primary objection that I have to this is the lack of calibration of delta temperatures. Many sites calibrate the temperatures that are used to calculate the delta temperature using the ± 0.5°C. standard that can usually be met. The temperature probes used to determine delta temperature are never put in a co-located bath to see if the delta temperature reading meets the ± 0.1°C requirement for delta temperature. See ANSI/ANS 3.11 “Determining Meteorological Information at Nuclear Facilities, Appendix F” for a good description of what to do for semi-annual site meteorological calibrations.

Each year of data being used needs to be examined to make sure that invalid periods are not included and that all possible valid data, including data from redundant sensors and backup towers, have been included. There are several reasons why invalid hours of data get left in the data base. The most common is that data during maintenance or calibrations when sensors are being worked on do not get invalidated. Some sites perform regular system calibration checks, such as high and low processor calibration checks that affect the data but do not edit it out of the data base. Other problems may be a little more subtle and difficult to find such as when wind speed cups are missing or wind direction vane tails are missing. In order to determine these types of problems plant records need to be examined to make sure that the data during all of these occasions are checked carefully. Examples of a tool that can be used to visually check all of the important meteorological parameters can be found in Figures 1 and 2. Figure 1 shows generally good data for all parameters with the exception of the delta temperatures that are consistently different by 0.5-1 degree during the entire week. Figure 2 shows some missing periods of date with a wide spread in delta temperatures during the first four days. But the delta temperatures were then calibrated and the last two days of data shows the delta temperatures in good agreement.

The advent of spreadsheets has made it much easier to compare various parameters and to check meteorological statistics. We understand that in an ideal world "A" stability is not expected under high wind speed conditions. With spreadsheets it is very easy to check on the number of hours with "A" stability and a wind speed above 10 mph or do it again and this time check for 12 mph. This way several checks can be made at nearly the same time to see if there is a threshold where values start changing. An example of a spreadsheet used in this process can be found in Table 1. Once it has been determined that you are not working in an ideal world an explanation needs to be found for the anomaly or consideration has to be given to take out questionable data. I personally find it hard to just take data out of a data base when it has been collected by a calibrated data collection system and no problems could be found when examining maintenance records. My favorite adage that has become overused in recent times is "it is what it is". This is what you have to work with so make the best of it. Similarly, it is the ideal world where "G" stability only occurs under low wind speed conditions. Particularly for sites that are along the coast there are frequently hours of high wind speeds. These hours need to be examined to make sure only the normal wind was blowing and that no one had a switch in the wrong position that would account for the irregularity. The automated data collection systems at National Weather Services sites have helped to eliminate observer bias and can be a very useful tool in data analyses.

Data Uses

Once the data base has been finalized there are several models for which the data will be used for input. In some cases, such as for joint frequency distributions, ARCON96 and MACC2 formatted input data and data for the NRC, the hourly data are used. It is very important to keep track of the units required for each format, whether stability is a class or delta temperature value and, if providing a delta temperature value whether it is normalized. Since one tenth of a degree per 100 meters can make the difference between stability classes it is important to retain as many decimal places as possible when converting units and normalizing delta temperatures. If the model format specifies a stability class, take the shortest possible route to determine the stability class. Do not convert units or even normalize the delta temperature value, just define the seven stability classes based on the delta height of the tower. Table 2 shows an example of a spreadsheet that was used to compare the counts of each stability class for different types of models or model inputs.

Quality Assurance

Many years ago the NRC developed a comparative program to help filter out bad data from meteorological data bases. This guidance can be found in NUREG 0917 "Nuclear Regulatory Commission Staff Computer Programs for Use with Meteorological Data" July 1982. The NRC still uses this program to look for anomalies in meteorological data bases so we make it a regular part of all data assessment. Many of the potential problems that it identifies are just things that are happening in normal day-to-day weather events such as persistence of wind direction or differences with wind direction between levels on the tower. But others such as persistence of some stability classes like "A" stability lasting for more than 15 consecutive hours can be real indicators of calibration problems. See Table 3 for an example of NUREG 0917 output.

As with any good quality assured (QA'd) data base the changes made to the data must be tracked so that if questions are raised, such as how many hours of data were substituted from the backup tower or what percentage of the stability data used sigma theta from the wind direction in order to meet the 90% recovery rate, they can be easily answered. We use a spreadsheet that has the original raw data that we have received side by side with each parameters final value. If the final value is different than the original value it is color coded to show up easily. Tabulations can also be made of the number of hours of substitution for each parameter. Table 4 shows examples of this type of spreadsheet.

Each type of calculation that is done as a part of the data validation is QA'd separately by the person who prepares the calculation, by a "checker", and by someone who applies final "approval". This three step process does not eliminate all errors in calculations but it does help to minimize them when there are three sets of eyes looking over the same data base. It requires that the input and output data files be defined which helps with the consistency factor that we are striving for. The final output for each type of calculation is either contained within the calculations paperwork or written to a CD for permanent storage. In addition to the final data base this is another form of backup for each calculation that is being done.

Data Format

In order to make sure that all of the information contained in COLAs remain in a readable format the NRC has imposed criteria for all deliverables. The guidance is contained in "Guidance for Electronic Submissions to the NRC", September 11, 2007 Revision 1. The COLAs are to be in electronic format only. The figures must be a minimum of 300 DPI. This makes it so that more figures can be put on a page and be zoomed in on without losing the clarity of the figure. An example of what an allowable wind rose looks like is shown in Figure 3.

Conclusion

Since the "accident" at TMI the idea of building new nuclear power plants in the United States was a pipe dream. However with the advent of $4 per gallon gasoline and the prospects of Global Warming even the “greens” are warming up to new clean, safe nuclear power plants. We have to use all of the tools at our disposal to do our part in making the licensing and interaction with the NRC go as smoothly as possible. While the decision on whether to build a new plant will not be based on its meteorology, the meteorological data at these proposed sites is the first step in many dispersion-related calculations that need to be performed. Getting the data right the first time can be a good step in this process.

References:

1. USNRC, 2007. Meteorological Monitoring Programs for Nuclear Power Plants, Regulatory Guide 1.23, Revision 1, Nuclear Regulatory Commission, March 2007.

2. USNRC, 1982. Nuclear Regulatory Commission Staff Computer Programs for Use with Meteorological Data, NUREG-0917, July 1982.

3. ANSI/ANS 3.11, 2005 “Determining Meteorological Information at Nuclear Facilities, ANSI/ANS 3.11, December 2005.

4. USNRC, 2007 “Guidance for Electronic Submissions to the NRC”, Revision 1 September 11, 2007.

TABLE 1
STABILITY/WIND SPEED CHECK
(Hours of "A" stability with wind speeds greater than 16.0 mph)

Julian Day	Hour	WD-10m	WS-10m	Stab	WD-60m	WS-60m
4	11	339	18.6	1	335	25.3
4	12	345	17.1	1	342	23.0
51	11	130	17.6	1	127	21.0
51	13	136	16.8	1	134	20.1
51	14	138	17.0	1	135	20.5
51	15	138	16.8	1	137	19.8
60	12	90	19.1	1	85	22.8
60	13	92	20.3	1	87	24.0
60	14	89	19.0	1	84	23.1
60	15	85	19.0	1	80	22.9
61	11	138	19.9	1	136	25.3
61	12	141	22.4	1	139	27.9
61	13	143	19.3	1	140	23.6
61	14	141	19.4	1	140	24.0
61	15	142	18.3	1	141	22.8
63	14	342	17.9	1	339	24.0
63	15	340	17.2	1	337	23.9
98	12	107	19.3	1	104	23.0
98	13	104	19.3	1	100	22.5
99	11	121	19.2	1	118	23.7
99	12	117	19.6	1	116	24.7
100	11	113	17.1	1	111	20.2
100	12	115	17.1	1	111	19.8
101	14	104	17.6	1	100	19.9
101	15	102	16.8	1	98	19.6
102	10	119	17.5	1	116	20.8
102	13	105	18.1	1	103	20.7
143	15	55	16.9	1	50	24.1
143	16	59	17.4	1	54	24.8
146	17	45	16.9	1	40	24.2
171	13	132	17.2	1	131	20.6

TABLE 2
SPREADSHEET COMPARING COUNTS FOR THREE FORMS OF DATA

	Data Set									
Format	ARCON				NRCMET		Joint Frequency			
Data Set	Unit 2	Unit 1	Unit 2	Unit 1	Unit 2	Unit 1	Unit 2	Unit 1	Unit 2	Unit 1
Height	60 m	60 m	10 m	10 m			60 m	61 m	10 m	10 m
Stability Class	Hours									
1	299	493	299	493	469	775	299	493	299	493
2	387	652	387	652	524	370	387	652	387	652
3	668	967	669	967	362	967	668	967	668	967
4	2673	3272	2680	3271	2680	3272	2673	3272	2680	3271
5	2758	2044	2776	2044	2776	2094	2758	2044	2776	2044
6	1177	807	1177	807	1177	886	1145	807	1145	807
7	694	460	694	460	694	331	726	460	726	460
9 (bad)	78	65	78	66		65	104	65	78	66
Total	8734	8760	8760	8760	8682	8760	8760	8760	8759	8760

TABLE 3
EXAMPLE OF NUREG 0917 REPORT

PROGRAM: METMIDASQA VERSION: 1.1 DATED: FEBRUARY 2006 RUN DATE: 3/8/2008 10:37:03
PAGE: 2
Hourly Wksp Met. Data Check

```
YR MO DAY HOUR
-- -- --- ----
06 01 21  15    HEIGHT= 60M   WIND FROM SECTOR    E  FOR PREVIOUS 19 HOUR PERIOD
06 01 21  16    HEIGHT= 10M   WIND FROM SECTOR    E  FOR PREVIOUS 20 HOUR PERIOD
06 01 23  18    HEIGHT= 60M   WIND FROM SECTOR  ESE  FOR PREVIOUS 18 HOUR PERIOD
06 01 28  23    HEIGHT= 60M   WIND FROM SECTOR    E  FOR PREVIOUS 19 HOUR PERIOD
06 02 01  09    60M DIRECTION IS DIFFERENT FROM 10M DIRECTION BY 87 DEGREES DURING DAY
06 02 21  08    60M DIRECTION IS DIFFERENT FROM 10M DIRECTION BY 76 DEGREES DURING DAY
06 03 02  08    60M DIRECTION IS DIFFERENT FROM 10M DIRECTION BY 124 DEGREES DURING DAY
06 03 04  10    STABILITY CLASS JUMPED FROM   E TO    A FOR UPPER SENSOR
06 03 04  10    STABILITY CLASS JUMPED FROM   E TO    A FOR LOWER SENSOR
06 03 10  20    HEIGHT= 10M   WIND FROM SECTOR   SE  FOR PREVIOUS 39 HOUR PERIOD
06 03 10  20    HEIGHT= 60M   WIND FROM SECTOR   SE  FOR PREVIOUS 28 HOUR PERIOD
06 03 15  10    STABILITY CLASS JUMPED FROM   F TO    B FOR UPPER SENSOR
06 03 15  10    STABILITY CLASS JUMPED FROM   F TO    B FOR LOWER SENSOR
06 03 18  10    STABILITY CLASS JUMPED FROM   F TO    A FOR UPPER SENSOR
06 03 18  10    STABILITY CLASS JUMPED FROM   F TO    A FOR LOWER SENSOR
06 03 19  08    60M DIRECTION IS DIFFERENT FROM 10M DIRECTION BY 86 DEGREES DURING DAY
06 04 01  04    HEIGHT= 10M   WIND FROM SECTOR    E  FOR PREVIOUS 32 HOUR PERIOD
06 04 09  04    HEIGHT= 60M   WIND FROM SECTOR    S  FOR PREVIOUS 18 HOUR PERIOD
06 04 10  14    STABILITY CLASS JUMPED FROM   A TO    E FOR UPPER SENSOR
06 04 10  14    STABILITY CLASS JUMPED FROM   A TO    E FOR LOWER SENSOR
06 04 13  02    HEIGHT= 10M   WIND FROM SECTOR   NE  FOR PREVIOUS 21 HOUR PERIOD
06 04 13  02    HEIGHT= 60M   WIND FROM SECTOR   NE  FOR PREVIOUS 21 HOUR PERIOD
06 04 20  07    60M DIRECTION IS DIFFERENT FROM 10M DIRECTION BY 93 DEGREES DURING DAY
06 04 22  14    HEIGHT= 10M   WIND FROM SECTOR   SE  FOR PREVIOUS 25 HOUR PERIOD
06 04 22  14    HEIGHT= 60M   WIND FROM SECTOR   SE  FOR PREVIOUS 25 HOUR PERIOD
06 04 23  07    60M DIRECTION IS DIFFERENT FROM 10M DIRECTION BY 111 DEGREES DURING DAY
06 05 01  03    HEIGHT= 10M   WIND FROM SECTOR   NE  FOR PREVIOUS 22 HOUR PERIOD
06 05 01  03    HEIGHT= 60M   WIND FROM SECTOR   NE  FOR PREVIOUS 22 HOUR PERIOD
06 05 06  07    60M DIRECTION IS DIFFERENT FROM 10M DIRECTION BY 166 DEGREES DURING DAY
06 05 06  08    60M DIRECTION IS DIFFERENT FROM 10M DIRECTION BY 102 DEGREES DURING DAY
06 05 16  14    PRECIPITATION OF 28.448MM FELL IN THE GIVEN 1 HOUR PERIOD
06 05 23  07    60M DIRECTION IS DIFFERENT FROM 10M DIRECTION BY 161 DEGREES DURING DAY
06 06 01  07    60M DIRECTION IS DIFFERENT FROM 10M DIRECTION BY 104 DEGREES DURING DAY
06 06 16  15    STABILITY FOR UPPER SENSOR IS    A WHILE STABILITY FOR LOWER SENSOR IS    D
06 06 19  14    STABILITY FOR UPPER SENSOR IS    A WHILE STABILITY FOR LOWER SENSOR IS    D
06 06 19  15    STABILITY FOR UPPER SENSOR IS    A WHILE STABILITY FOR LOWER SENSOR IS    D
06 06 19  16    STABILITY FOR UPPER SENSOR IS    A WHILE STABILITY FOR LOWER SENSOR IS    D
06 06 20  07    60M DIRECTION IS DIFFERENT FROM 10M DIRECTION BY 139 DEGREES DURING DAY
06 06 28  07    60M DIRECTION IS DIFFERENT FROM 10M DIRECTION BY 102 DEGREES DURING DAY
06 06 29  06    60M DIRECTION IS DIFFERENT FROM 10M DIRECTION BY 128 DEGREES DURING DAY
06 06 29  07    60M DIRECTION IS DIFFERENT FROM 10M DIRECTION BY 91 DEGREES DURING DAY
06 06 30  13    STABILITY FOR UPPER SENSOR IS    A WHILE STABILITY FOR LOWER SENSOR IS    D
06 07 01  11    STABILITY FOR UPPER SENSOR IS    A WHILE STABILITY FOR LOWER SENSOR IS    D
06 07 01  13    STABILITY FOR UPPER SENSOR IS    A WHILE STABILITY FOR LOWER SENSOR IS    D
06 07 01  15    STABILITY FOR UPPER SENSOR IS    A WHILE STABILITY FOR LOWER SENSOR IS    D
06 07 06  08    60M DIRECTION IS DIFFERENT FROM 10M DIRECTION BY 78 DEGREES DURING DAY
06 07 07  06    60M DIRECTION IS DIFFERENT FROM 10M DIRECTION BY 174 DEGREES DURING DAY
06 07 07  07    60M DIRECTION IS DIFFERENT FROM 10M DIRECTION BY 132 DEGREES DURING DAY
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TABLE 4
DATA SUBSTITUTION

Date Time	WS10M		Code		WS60M		Code		WD10M		Code		WD60M		Code		TE10A		Code		DT60M-A		Code		RAIN	
200501152200	4.10	4.10	0	0	9.70	9.70	0	0	321.00	321.00	0	0	315.00	315.00	0	0	67.80	67.80	0	0	-2.00	-2.00	0	2	0.00	0.00
200501152300	4.90	4.90	0	0	9.60	9.60	0	0	298.00	298.00	0	0	300.00	300.00	0	0	68.10	68.10	0	0	-2.50	-2.50	0	2	0.00	0.00
200501160000	6.10	6.10	0	0	11.20	11.20	0	0	306.00	306.00	0	0	307.00	307.00	0	0	67.80	67.80	0	0	-2.60	-2.60	0	2	0.00	0.00
200501160100	5.80	5.80	0	0	10.30	10.30	0	0	310.00	310.00	0	0	307.00	307.00	0	0	67.30	67.30	0	0	-2.40	-2.40	0	2	0.00	0.00
200501160200	6.80	6.80	0	0	11.70	11.70	0	0	311.00	311.00	0	0	309.00	309.00	0	0	67.00	67.00	0	0	-2.40	-2.40	0	2	0.00	0.00
200501160300	8.20	8.20	0	0	13.00	13.00	0	0	316.00	316.00	0	0	312.00	312.00	0	0	66.70	66.70	0	0	-2.50	-2.50	0	2	0.00	0.00
200501160400	8.80	8.80	0	0	12.70	12.70	0	0	332.00	332.00	0	0	328.00	328.00	0	0	66.00	66.00	0	0	-2.60	-2.60	0	2	0.00	0.00
200501160500	8.90	8.90	0	0	13.80	13.80	0	0	337.00	337.00	0	0	332.00	332.00	0	0	64.20	64.20	0	0	-2.60	-2.60	0	2	0.00	0.00
200501160600	8.60	8.60	0	0	12.30	12.30	0	0	328.00	328.00	0	0	326.00	326.00	0	0	63.30	63.30	0	0	-2.50	-2.50	0	2	0.00	0.00
200501160700	9.30	9.30	0	0	13.60	13.60	0	0	330.00	330.00	0	0	325.00	325.00	0	0	62.80	62.80	0	0	-2.80	-2.80	0	2	0.00	0.00
200501160800	9.10	9.10	0	0	14.00	14.00	0	0	337.00	337.00	0	0	334.00	334.00	0	0	62.00	62.00	0	0	-2.80	-2.80	0	2	0.00	0.00
200502032000	2.10	2.10	0	0	2.30	2.30	0	0	2.00	2.00	0	2	177.00	177.00	0	0	66.80	66.80	0	0	-0.70	-0.70	0	0	0.00	0.00
200505231000	5.70	5.70	0	0	6.40	6.40	0	0	218.00	218.00	0	0	221.00	221.00	0	0	70.30	70.30	0	0	-4.20	-4.20	0	2	0.00	0.00
200505231100	7.10	7.10	0	0	8.00	8.00	0	0	213.00	213.00	0	0	213.00	213.00	0	0	78.70	78.70	0	0	-3.80	-3.20	0	0	0.00	0.00
200506231600	6.20	6.20	0	0	9.00	9.00	0	0	13.00	13.00	0	0	5.00	5.00	0	0	71.10	71.10	0	0	4.30	4.30	0	2	0.40	0.40
200507090900	30.40	30.40	0	0	41.10	41.10	0	0	131.00	131.00	0	0	138.00	138.00	0	0	77.10	77.10	0	0	0.40	-0.50	0	0	0.43	0.43
200507101300	11.60	11.60	0	0	14.20	14.20	0	0	141.00	141.00	0	0	149.00	149.00	0	0	83.20	83.20	0	0	-0.50	-1.00	0	0	0.00	0.00
200507101400	10.20	10.20	0	0	13.00	13.00	0	0	154.00	154.00	0	0	161.00	161.00	0	0	83.20	83.20	0	0	-0.50	-0.90	0	0	0.00	0.00
200507101500	9.40	9.40	0	0	11.50	11.50	0	0	146.00	146.00	0	0	153.00	153.00	0	0	83.40	83.40	0	0	-0.60	-1.00	0	0	0.00	0.00
200507101600	9.50	9.50	0	0	11.20	11.20	0	0	137.00	137.00	0	0	145.00	145.00	0	0	83.60	83.60	0	0	-0.70	-1.10	0	0	0.00	0.00
200508010100	7.00	7.00	0	0	11.80	11.80	0	0	100.00	100.00	0	0	105.00	105.00	0	0	83.30	83.40	0	0	0.60	0.50	0	0	0.00	0.00
200508010200	10.20	10.20	0	0	15.30	15.30	0	0	109.00	109.00	0	0	115.00	115.00	0	0	84.20	84.20	0	0	0.10	0.00	0	0	0.00	0.00
200508010300	9.70	9.70	0	0	14.30	14.30	0	0	107.00	107.00	0	0	114.00	114.00	0	0	84.00	84.00	0	0	0.10	0.00	0	0	0.00	0.00
200508010400	8.60	8.60	0	0	13.60	13.60	0	0	105.00	105.00	0	0	112.00	112.00	0	0	83.60	83.60	0	0	0.30	0.20	0	0	0.00	0.00
200508010500	8.00	8.00	0	0	12.80	12.80	0	0	106.00	106.00	0	0	113.00	113.00	0	0	83.40	83.40	0	0	0.40	0.30	0	0	0.00	0.00
200508010600	7.20	7.20	0	0	11.90	11.90	0	0	102.00	102.00	0	0	110.00	110.00	0	0	83.20	83.20	0	0	0.50	0.40	0	0	0.00	0.00
200508010700	7.70	7.70	0	0	12.10	12.10	0	0	105.00	105.00	0	0	112.00	112.00	0	0	83.70	83.80	0	0	0.10	0.00	0	0	0.00	0.00

FIGURE 1
METEOROLOGICAL DATA TREND PLOT

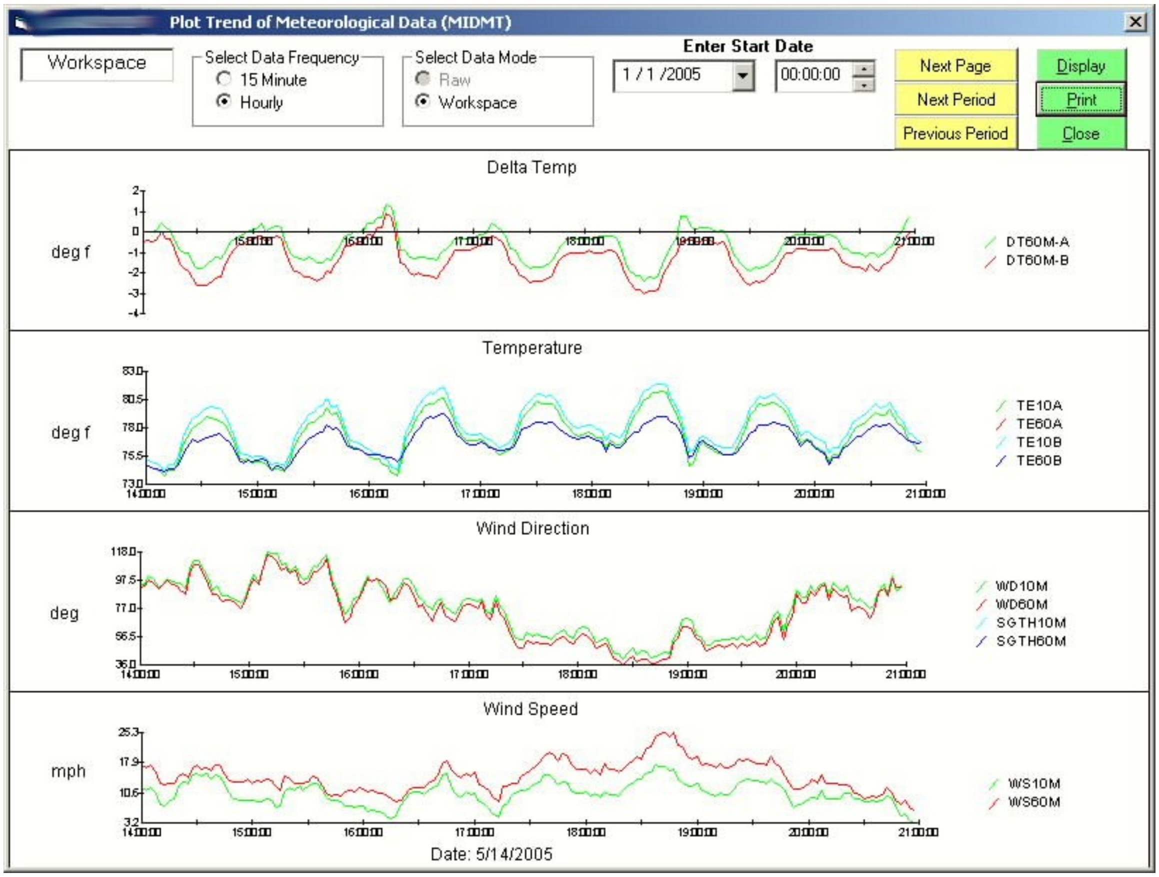

FIGURE 2
METEOROLOGICAL DATA TREND PLOT

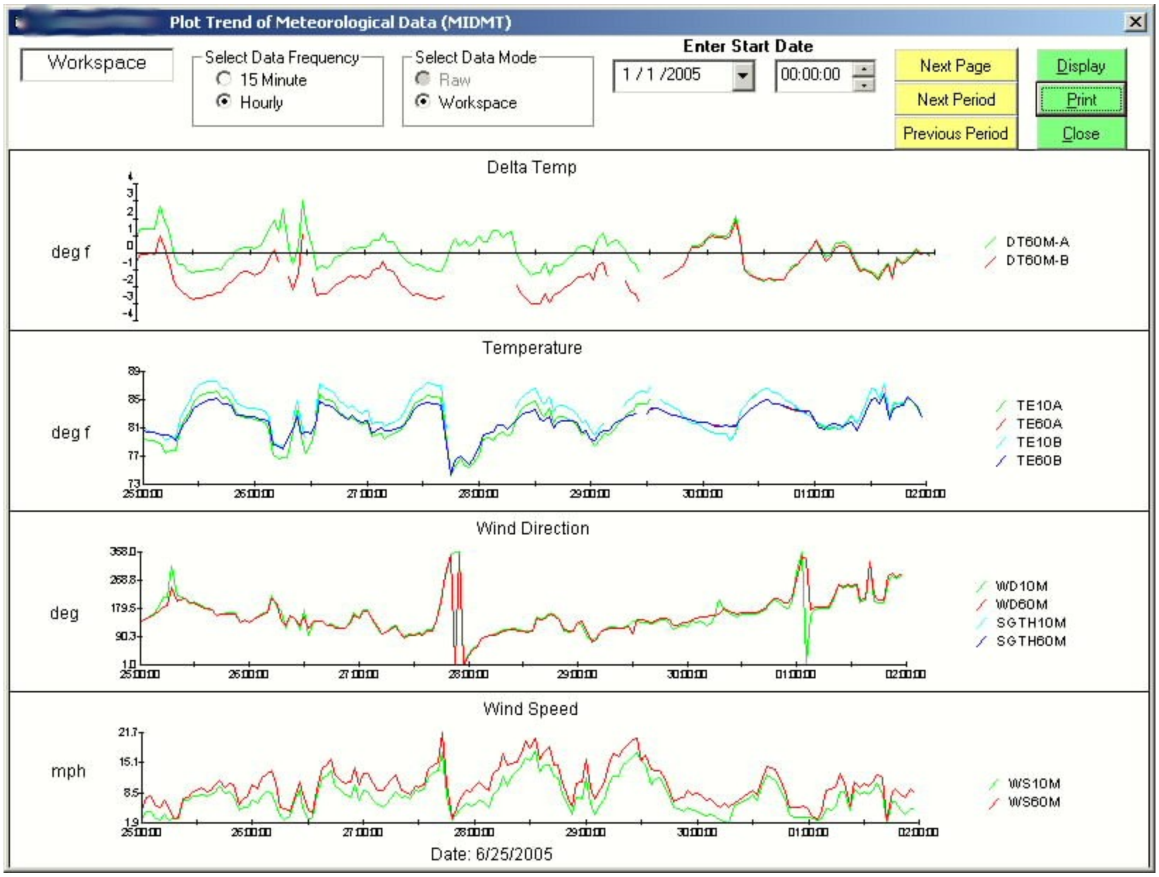

FIGURE 3
NRC REQUIRED FORMATTED DATA
(300 DPI)