Audit No. 0-745

RANCHO SECO AUDIT REPORT

Activity: Meteorological Program
Auditor(s): D. Marsh, T. Loffman
Lead Auditor: H. Canter
Signature(s): H Canter for D. Marsh

Checklist No. 53
Audit Date: Oct. 1-11,1985
Distr. Date: Oct. 17, 1985
Response Due: Nov. 28, 1985

Organizations Audited: Nuclear Operations
Emergency Planning

Individuals Contacted: M. Hardin B.Hellums
R. Bass
E. Bradley

Audit Description and Comments: This represents the first audit of the meteorological program following its inclusion on the MSRC Audit List. The governing document for this audit is Proposed Revision 1 to Regulatory Guide 1.23, as referenced by NUREG-0654, Appendix 2. (Note: The references in this audit to Section C, Part xx, refer to Section C in Proposed R.G. 1.23, Revision 1) 902

Summary: A coordinated effort is underway to improve and maintain the quality of the meteorological program, guided in part by recommendations from a recent task force report. Some hardware problems remain, which are being currently addressed, and acceptance of the MIDAS software is integral to the overall goals of the program.

Corrective Action Requested: The Manager of Nuclear Operations is requested to respond to Items 2,7,8,9,10,14,15, and 17.

Corrective Action Completed:

Manager, Quality Assurance Date

cc: D.K.K. Lowe/R.J. Rodriguez/D.G. Raasch/R. Colombo/L.R. Keilman/R.P. Oubre'/J.V. McColligan/ R.A. Dieterich/L.G. Schwieger/J.S. Sullivan/G.A. Coward/J. Field/N. Brock/R. Lawrence/ B Spencer S. Crunk S. Redeker/F Kellie/E Bradley/R Myers/J Eckhardt(NRC)/C Andognini

1. Instrumentation that is capable of measuring wind direction and wind speed at a minimum of two levels and air temperature difference between a minimum of two levels should be provided on one tower or mast. Precipitation should be measured at or near this tower. Instrumentation should be provided for measuring air temperature on at least one level of the tower or mast corresponding to at least the measurement height of the lower level of the primary air temperature difference measurement. Instrumentation should be provided for measuring ambient moisture (relative humidity, dew point, or wet bulb temperature) on at least one level of the tower or mast. (Section C, Part 1)

   Results of Audit:

   Rancho Seco has wind direction and wind speed instrumentation for both a primary and a back-up system at the 10 meter and 60 meter elevations of the met tower. Air temperature is measured at 10 meters and 60 meters, and these sensors also provide the input to the temperature difference (Δ T) channel, thereby meeting the minimum height requirement automatically. Precipitation instrumentation has recently been installed and is operable; this is located approximately 20 feet from the base of the tower. Ambient moisture instrumentation is mounted at the 10 meter elevation.

   This item is closed.

2. For making estimates of atmospheric transport and diffusion to a distance of 80 kilometers (50 mi) from the plant site, additional information may be needed. If so, it may be obtained, at least in part, from stations with well-maintained meteorological systems (e.g., National Weather Service, military stations, and any other micro-meterological stations) if these existing stations are in locations that will aid in the description of regional airflow patterns. (Section C, Part 1)

   Results of Audit:

   Regional meteorological information is available to Rancho Seco through the National Weater Service (NWS) offices located in Stockton and Sacramento (Executive Airport), and at Mather Air Force Base. The UDAC (Unified Dose Assessment Center) meteorologist from the Air Resources Board is available to assist with reduction and interpretation of data obtained from these sources. Access to the NWS via telephone and the steps to be followed are delineated in AP.506 and the appropriate phone numbers are listed on Attachment 7.5. However, it has been the experience of the consulting meteorologist that access to NWS through these phone lines is severly limited or impossible during periods of severe weather, such as those which might initially necessitate this mode of data retrieval. It is the opinion of the consulting meteorologist that consideration should be given to a back-up data retrieval system relying on modem based access to a meteorological database.

   This item is open.

3. The meteorological tower site should represent as closely as possible the same meteorological characteristics as the region which any airborne material will be released. Whenever possible, the base of the tower or mast should be sited at approximately the same elevation as the finished plant grade. The tower should be located in an area where singular natural or man-made obstructions or the heat dissipation system to be used during plant operation will have little or no influence on the meteorological measurements. The height of natural or man-made obstructions to air movement should ideally be lower than the measuring level to a horizontal distance of 10 times the measuring level height. (Section C, Part 2)

Results of Audit:

The Rancho Seco meteorological tower is located in an area east of the site buildings at an elevation approximately 60 feet above the plant grade. The closest obstructions to air movement are the site buildings themselves, at a distance from the tower of approximately 2,000 feet. Since the highest measuring level is 60 meters (197 feet), the "10 times the measuring level height" requirement is met by the current configuration.

This item is closed.

4. Instrumentation should be located on booms oriented into the prevailing wind direction at a minimum distance of two tower widths from the tower to preclude substantial influence of the tower upon the measurements. The aspirated temperature shields should either be pointed downward or laterally toward the north. (Section C, Part 2)

Results of Audit:

The Rancho Seco tower has a relatively broad base, and tower width decreases with height. At the 10 meter elevation, instrumentation is mounted on booms protruding to the west of the tower. The prevailing wind direction is approximately from the west. At the 60 meter elevation, instruments are on booms protruding to the west and east of the tower. The 60 meter instruments themselves are above the top of the tower, so perturbation of air flow by the tower is avoided.

At the 10 meter elevation, the instrument boom extends 6 feet to the side of the tower, and the tower width is 10-12 feet. The auditor was told that while this does not meet the "two-tower-width" criterion, it has been determined that the open lattice design of the tower precludes significant influence of the tower on the measurements. At the 60 meter level, the instrument arms are approximately 4 feet in length, and tower width is approximately 1 foot, so 2X tower width separation exists. The aspirated temperature shields are pointed directly downwards.

This item is closed.

5. On the primary tower, wind speed and direction should be monitored at approximately 10 and 60 meters and at a representative higher level for stack releases. Ambient temperature should be monitored at approximately 10 meters, and ambient moisture should be monitored at approxmately 10 meters and also at a height where the measurements will represent the resultant atmospheric moisture content if cooling towers are to be used for heat dissipation. Temperature difference should be measured between the 10-and 60-meter levels and between the 10-meter and a higher level that is representative of diffusion conditions from stack release points. (Section C, Part 2)

   Results of Audit:

   The requirements for all 10 meter and 60 meter measurements mentioned above are met by the Rancho Seco configuration. Due to the low stack height at Rancho Seco, which constitutes a "ground level" release, wind speed and direction and temperature difference measurements at a level higher than 60 meters are not needed. Rancho Seco does not have provision for measurement of ambient moisture at a height representative of "resultant atmospheric moisture content". Since this would require a 450 foot tower for one measurement, the existing configuration (10 meter measurement) has been accepted, and meets the primary ambient moisture requirement.

   This item is closed.

6. At a valley site, the primary meteorological tower should be located so that the meteorological measurements are representative of conditions at the potential points of release. All levels at which measurements are made should be within the same thermal internal boundary layer. (Section C, Part 2)

   Results of Audit:

   Rancho Seco lies in a broad valley which is very shallow. It is the opinion of the consulting meteorologist that topographically induced perturbations in local atmospheric conditions are sufficiently small that homogeneous conditions exist in the vicinity of the site. This being the case, the meteorological tower and associated sensors lie within the same thermal boundary layer for the purposes of meteorological sampling and characterization.

   This item is closed.

7. For data acquisition on the primary tower, a dual recording system consisting of one digital and one auxiliary analog system should be used.

   The wind speed and direction analog recorders should be of the continuous strip chart recording type. Multipoint strip chart recorders are considered to be sufficient for recording all other parameters. (Section C, Part 3)

Results of Audit:

The present configuration utilizes the NOVA computer, and has both digital and analog capability. When the MIDAS system is instituted (it is awaiting acceptance testing), the same analog system will remain, and the digital system will operate through the MIDAS/IDADS link. Rancho Seco utilizes multipoint strip chart recorders for all parameters, including wind speed and direction. Pending completion of MIDAS acceptance testing, this item must remain open.

This item is open.

8. All digital records except precipitation should consist of data sampled at intervals no longer than 60 seconds. Precipitation should be recorded on a cumulative basis at least once per hour. The standard deviation of horizontal wind direction fluctuations $\sigma\theta$, should be determined from no less than 180 instantaneous values of lateral wind direction during the recording period (e.g., if the record period is 15 minutes, values sampled at intervals of 5 seconds or less are acceptable; likewise, if the record period is 1 hour, sampling intervals of 20 seconds or less are acceptable. (Section C, Part 3)

Results of Audit:

The existing NOVA system samples data at one second intervals. The MIDAS software extracts data points from IDADS once every five seconds. This is a recent change to MIDAS, instituted specifically to allow $\sigma\theta$ determination based on 180 wind direction data points.

The recently installed precipitation instrumentation records cumulative rainfall in 0.01 inch increments up to 1.0 inch. The integrated total is displayed until 99 reservoir "dumps" have occurred, at which time the system resets. The displayed precipitation total and the system reset are not related to elapsed time.

This item is open.

9. The data from the primary meteorological system (backup system when necessary) should be displayed in the control room for use during plant operation. These data should also be displayed in the onsite technical support center and near-site emergency operations facility as needed (e.g., emergency situations, training exercises, demonstrations). These data should include wind direction and speed and an indicator of atmospheric stability for the past 12-hour period representative of each potential release level. Fifteen minutes is the maximum acceptable averaging period for these data. (Section C, Part 3)

Results of Audit:

Meteorological information from both primary and back-up systems is currently available via IDADS in the control room, the Technical Support Center (TSC) and the Emergency Operations Facility (EOF). The information accessible through IDADS includes all channels of real-time data, but not history files such as the 12-hour summary mentioned above. History files of wind direction and speed,

and atmospheric stability category based on them will be available through MIDAS once this software has passed its acceptance testing.

The averaging period utilized by the NOVA system is one hour rather than fifteen minutes. MIDAS utilizes fifteen minute averaging; once again the Regulatory Guide requirements will be met as soon as MIDAS is officially accepted. Pending completion of MIDAS acceptance testing, this item must remain open.

This item is open.

10. For digital systems, specific accuracies of time-averaged values by parameter should be:

(1) Wind direction ± 5° of azimuth, with a starting threshold of less than 0.45 m/s (1 mph). If the wind direction sensor is to be used for the collection of σθ data, the damping ratio must be 0.4 to 0.6, inclusive, with a deflection of 15 degreees and delay distance not to exceeed 2 meters.
(2) Wind speed: ± 0.22 m/s (0.5 mph) for speeds less than 11.13 m/s (25 mph), with a starting threshold of less than 0.45 (1 mph).
(3) Temperature: ± 0.5°C (0.9°F).
(4) Temperature difference: ± 0.15°C (0.27°F) per 50-meter height interval.
(5) Dew point: ± 1.5°C (2.7°F) or an equivalent accuracy for relative humidity or wet bulb temperature. These accuracies are applicable for conditions where relative humidity is in excess of 60 percent and temperature is between -30° and 30°C (-22° and 86°F), which is the region of concern for evaluation.
(6) Precipitation: By a recording rain gauge with a resolution of 0.25 mm (0.01 in.). The accuracy of the recorded value must be within ±10 percent of the total accumulated catch.
(7) Time: Within 5 minutes of actual time for all recording systems. (Section C, Part 4)

Results of Audit:

(1) Wind direction: The Weather Measure W204 wind vanes have a stated accuracy of ±1.8°, with a starting threshold of .75 mph. To ensure that the loop accuracy is within ±5°, the I&C Department uses this limit along with the sensor accuracy to calculate a maximum allowable module error. Keeping the module in calibration based on these limits "fixes" the overall system error at less than 5 degrees. the requirements of this part are met.

(2) Wind speed: The Weather Measure W203 anemometers have a stated accuracy of ±.15 mph with a starting threshold of <1 mph. The system accuracy calculated by the I&C Department is ±1 mph, however, actual errors observed during the last two calibration checks have been well below this. During calibration testing conducted on 3/23/85, the four channels displayed actual errors in wind speed of ±.34, -.06, +.16 and +.36 mph. Calibration checks conducted on 9/18/84 yielded actual errors of +.14, -.12, +.14 and -.04 mph. While the calculated system accuracy does not meet the ±.5 mph criterion, the

empirically determined errors do satisfy the criterion. This was considered by the auditor to constitute adequate compliance.

(3) Temperature: The overall system accuracy for ambient temperature measurement was calculated by the I&C Department to be ±1.0°F. This was based on the square root of the sum of squared errors for the sensors, multiplexer and signal processing module.

This calculated system accuracy applies to each channel separately, (primary and back-up channels at both 10m and 60m). The only inconsistency noted lies in the observed discrepancies between primary and back-up channels at the 60 meter elevation. The difference in indicated temperatures was approximately .5°F at the time of the audit. This aspect was being investigated during the audit period; the discrepancy is small enough however, that the previously stated single channel accuracies are not rendered less credible.

(4) Temperature difference: The system error for ΔT measurement is determined by combining the errors associated with the following - difference in matched sensor characteristics, temperature (T) modules, multiplexer, and ΔT module. With known sensor difference and multiplexer error, the allowable T-module and ΔT - module errors are calculated by the I&C Department. These module errors are then adjusted to fall within the allowable range at the time of calibration.

While the system error "fixed" by this calculational procedure seems acceptable, observations made by the consulting meteorologist during the audit period cast doubt on the accuracy of the displayed ΔT value. It was observed that a ΔT value derived by subtracting the displayed 10 meter temperature from the 60 meter temperature differed from the displayed ΔT value. This "subtraction" ΔT differed from the displayed ΔT by values ranging from -.5°F to +.5°F. Site personnel were aware of this discrepancy and were actively involved in troubleshooting the problem. As of this writing, however, it is unclear whether or not the system currently meets the accuracy requirement of ±.27°F.

(5) Dew point: For this channel the I&C Department applies the same limits to module error as with the temperature channel. The same sensor and multiplexer errors apply; thus ±1.0°F accuracy is attained through appropriate module calibrator, well within the ± 2.7°F limit.

(6) Precipitation: The recently installed rain gauge is of the "tipping bucket" variety. The collecting reservoir tips and produces a pulse for every .01" of rainfall. The calibration check performed after installation relies on counting the "tips" for a given volume of water. This test indicated an error of zero, in that ten tips were expected, and ten were observed. Errors introduced by the signal module and IDADS correspond to .006" and .0025" respectively for a 1" accumulation. Thus the system accuracy meets the ± 10% criterion.

(7) Time: Both the digital and analog recording systems for clock time are significantly more accurate than the required ±5 minutes criterion.

Of the items considered above, the only problem area from an accuracy standpoint is that of temperature difference between 10 and 60 meters. There is presently inadequate assurance that the accuracy requirement of ±.27°F is being achieved.

This item is open.

11. For analog systems, specific accuracies of time-averaged values by parameter should be the same as those above except that the accuracies for wind speed and direction records should be not more than 1.5 times those stated for the digital system. (Section C, Part 4)

Results of Audit:

In the analog system, strip chart recorders replace the Anatec multiplexer; other than this, the analog channels are identical to the digital channels and the same basic accuracies apply. Accuracy concerns identified under item 10, and corrective actions to them, therefore apply to the analog channels also. Since item 10 remains open, item 11 may be closed.

This item is closed.

12. The system should be protected against lightning and other severe environmental conditions (e.g., icing, blowing sand, salt deposition, air pollution) that may occur at the site. The meteorological measurement system and associated controlled environment housing system for the equipment should be connected to a power system that is supplied from redundant power sources. (Section C, Part 5)

Results of Audit:

The system is protected against lightning in two ways: the AC power supply is equipped with lightning arrestors, and the tower itself is grounded. Redundant power sources for the system exist in that normal plant power is backed up by a propane generator, with automatic start-up on loss of normal AC.. The back-up generator has a fuel supply sufficient for one month of continuous operation.

This item is closed.

13. Meteorological instruments should be inspected and serviced at a frequency that will minimize extended periods of outage and ensure at least an annual 90 percent joint data recovery for atmospheric stability, wind speed, and wind direction at the level that represents each effluent release point. It is essential to maintain an adequate spare parts inventory to minimize extended periods of system outage. Annual data recovery for other individual parameters should be at least 90 percent for each parameter. Redundant sensors and recorders at appropriate locations may also be used to achieve the required data recovery. (Section C, Part 5)

Results of Audit:

Data recovery for atmospheric stability, wind speed and wind direction is determined by the corporate health physicist. In 1984 the joint data recovery for these parameters was approximately 92% (based on an average of quarterly recovery figures). For the first two quarters of 1985, the data recovery rates were 95.7% and 95.4% respectively.

Recovery of raw data for the individual parameters is governed by hardware operability and out-of-service time during calibration. The cognizant I&C engineer stated that due to very low malfunction rates and the small fraction of time consumed by calibrations, raw data availability has definitely been greater than 90%.

Spare parts for the meteorological system are maintained by SMUD and Weathermeasure. Rancho Seco has spare signal processing modules for each channel on-site; Weathermeasure keeps spare sensors on hand, and as part of their contract with SMUD, is obligated to provide emergency response within 24 hours.

This item is closed.

14. The systems should be calibrated at least semi-annually to ensure meeting the system accuracies presented in this guide; the calibration results should be reflected in the compiled data base. Procedures and a log of inspection, maintenance, and calibrations should be maintained at the tower site as a controlled document and a permanent record to be made available for review. Any major modification of the system or environs should be documented and discussed with the NRC staff. (Section C, Part 5)

Results of Audit:

Calibrations and operational checks of the meteorological system are performed quarterly. Until recently, all calibrations were performed by Weathermeasure, Inc. As of June, 1985, SMUD personnel began performing the electronic calibrations under Procedure I-016 (referenced by SP200.17). Sensor checks on the tower are still performed by Weathermeasure and documented separately. The auditor reviewed the records of calibrations performed by Weathermeasure on 7/9/84, 9/18/84, 12/21/84, and 3/23/85. The first SMUD calibration, completed on 7/8/85, was also reviewed. No deficiencies in documentation were noted. The third 1985 calibration was in progress at the time of the audit.

Presently, no log of inspection and maintenance is kept at the tower site. The cognizant I&C engineer indicated to the auditor that such a log could be easily instituted. A log kept at the tower could provide a chronological record of all activities conducted at or on the tower, including calibrations, inspections, troubleshooting, corrective maintenance and modifications.

It was also brought to the auditor's attention that channels undergoing calibration are not always taken 'off scan' while work is in progress. This results in artificially generated sensor output signals being accepted by MIDAS and incorporated into history files. Taking the parameter to be affected off scan prior to calibration or testing should be a prerequisite of the procedures being followed.

This item is open.

15. The basic reduced data should be averaged over a period of 1 hour. At least 15 consecutive minutes of continuous data during each hour should be used to represent a 1-hour average. Precipitation should be totaled hourly. The basic reduced data should be compiled into monthly and annual joint frequency distributions of wind speed and wind direction by atmospheric stability class. (Section C, Part 6)

Results of Audit:

The MIDAS software extracts current values for each primary and back-up channel parameter from IDADS every 5 seconds. Data gathered in this way is compiled into both 15 minute and 1-hour averages. The 15 minute averages are derived from 180 instantaneous met. channel values. The 1-hour averages are represented by the average of 15 consecutive minutes of data, beginning 7.5

minutes before the hour and ending 7.5 minutes after the hour. This is identical to the Regulatory Guide's recommendation for arriving at 1-hour averages.

History files of all averaged data are retained in a manner that allows monthly and annual joint frequency distributions of wind speed and direction by stability class to be generated on demand. These distributions are in the format prescribed by Table 2 of the Regulatory Guide.

Precipitation is totalled up to 1", at which time the system resets; however, as mentioned in Item 8, the total displayed is independent of time. In the present configuration there is no provision for hourly totalling or creation of history files based on each hour's accumulated catch.

This item is open.

16. A quality assurance program that is consistent with the provisions of Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to 10 CFR Part 50 should be established for the meteorological measurement program in support of the operation of the nuclear power plant. (Section C, Part 7)

Results of Audit:

As a result of the recent task force report on the meteorological program, this area has been added to the list of regularly scheduled MSRC audits. Quality Assurance surveillance reports addressing the meteorological program status will also be generated as part of the continuing operational surveillance program, and incorporated in subsequent audits, if appropriate.

This item is closed.

17. Provisions should be made for remote interrogation of all utility-maintained meteorological systems during emergency situations. These systems should have the capability of being remotely interrogated simultaneously by the licensee, emergency response organizations, and the NRC without interruption of the data-gathering process. (Section C, Part 8)

Results of Audit:

Currently, and until MIDAS is accepted, interrogative ability from the EOF and TSC is limited to real-time display of meteorological parameters through IDADS, and telephone communications. Following acceptance of the MIDAS package, history files and time-averaged values of raw channel data and derived paramenters will be available by remote interrogation in the TSC and EOF. This interrogative ability in no way affects the ongoing data gathering process. Pending completion of MIDAS acceptance testing, this item must remain open.

This item is open.

18. All sites with operating nuclear power plants should have a viable backup system to obtain real-time local meteorological data. Such a system would provide meteorological information when the primary system is out of service, thus providing assurance that basic meteorological information is available during and immediately following an accidental airborne release. The backup system should provide information in a real-time mode in the event necessary parameters from the primary system are not available. Changeover from the primary system

to the backup system should occur within 5 minutes. (Section C, Part 8)

Results of Audit:

The Rancho Seco meteorological tower is equipped with backup instrumentation for all parameters at both the 10-meter and 60-meter elevations. The backup channel instrumentation is identical to, but entirely independent of the primary channel. Backup channel information may be recalled for a particular parameter in the event of a single sensor or module failure on the primary channel, or the entire primary system output may be replaced by the backup system. Changeover from the primary system to the backup system is essentially instantaneous, involving only a change in channel selection at the display console.

This item is closed.

TO: ROB MYERS

FROM: TOM LOFFMAN - CONSULTING METEOROLOGIST

RE: RANCHO SECO METEOROLOGICAL PROGRAM PROGRESS REPORT

DATE: NOV. 14, 1985

ABSTRACT

During the Spring of this year the Department Managers of the "Nuclear Family" at Rancho Seco directed that a Task Force be set up to bring the meteorological program up to compliance with Industry standards.

One of the major recommendations of the Task Force report issued April 15, 1985 was the hiring of a Meteorologist to determine the validity of the meteorological data from Rancho Seco.

I was hired as the meteorological consultant in August. My initial evaluation of the meteorological data and system at Rancho Seco lead me to conclude that there had been and still were some questions about the validity of the data.

I then began to work with SMUD personnel and contracted staff at Rancho Seco with the following objectives:

1. Determine the current status and condition of the meteorological data
2. Trace down the possible causes of the problems
3. Identify the persons responsible for making the corrective changes in the data gathering process
4. Monitor and coordinate the corrective procedures
5. Recoommend techniques and procedures for future data validation

As of this writing I am able to report that items one, two and three have been completed. Item four is nearing completion, and item five is in progress.

With respect to the current validity of the data I can say that a number of corrective actions have been taken and the accuracy of the data now being obtained from the meteorological system has been significantly improved. Only one minor problem remains. After the last problem has been corrected the task will then be to continue to monitor and evaluate the data over the course of the coming year to make sure that the data validity remains stable through all types of weather conditions.

CURRENT METEOROLOGICAL SYSTEM AT RANCHO SECO

The current system of meteorological instrumetation at Rancho Seco meets or exceeds all NRC requirements in its present configuration. Howeve, the data that has been obtained from the instruments has not always met with requirements. In particular, the recent QA Audit noted deficiencies in the Delta T accuracy, and questioned the accuracy of the primary channel temperature instruments based on comparison with the backup temperature instruments.

Determining the validity of primary channel temperature measurements by cross-checking with backup instruments far exceeds any NRC regulation, and is not standard practice at other Nuclear facilities in this country. However, since the primary and backup instruments on the meteorological tower at Rancho Seco are placed very close to each other a cross-comparison cannot be avoided. Once the last instrument problem has been solved the Rancho Seco setup will be a MODEL of data accuracy and validity - far exceeding the exacting requirements of the Regulatory Guide specifications outlined in the QA Audit.

CAUSES OF THE PROBLEMS WITH THE METEOROLOGICAL DATA

The history of and problems with the meteorological instruments and their current status is detailed in the November 1, 1985 office memorandum written by I&C Technician Mike Hardin (see attached). During the past year the I&C department has been working steadily on determining the system problems, and has successfully taken a number of steps to correct those problems. To date, most of the problems have been solved, and from a review of the data now being displayed on the IDAOS screens in the Technical Support Center (TSC), it appears as if the Delta T readings are both stable and valid. It is the hope and expectation of all involved that this data will remain stable and valid as we progress into the Winter cold and will hold in that condition through the heat of the Summer.

The final problem that needs to be solved for absolute certainty of accuracy is the consistent matching of primary and backup channel temperature measurements - and as mentioned previously, this is not a requirement of the NRC, but is a technique used by me and by I&C to determine absolute temperature accuracy.

At present, we are awaiting the installation of a set of four matched temperature sensors by Qualimetrics/Weather Measure. I know of no other Nuclear facility where this has been done. Once this has been completed, the temperatures obtained from the Rancho Seco tower should be the most accurate in the country.

In addition to the instrument accuracy problems, deficiencies were found in the MIDAS software by Realogic consultant Bob Bass. To date, these deficiencies have been corrected. It is not known whether these deficiencies have been noted and corrected by other Nuclear facilities that use the MIDAS software package, but we are confident, after extensive testing, that our MIDAS software is displaying the meteorological data without error.

PERSONS INVOLVED IN THE CORRECTIVE ACTIONS

The key individuals involved in making the corrective changes in the system are the I&C technicians and the Realogic consultants. My efforts have been directed toward identifying and coordinating these activities in a way that keeps them moving in the desired direction. I have also attempted to establish lines of communication between all persons involved in the problem solving activities. To date, I believe that all concerned individuals in these corrective actions are communicating and working together in a cooperative and concerted effort to maintain the integrity of the system.

TECHNIQUES AND PROCEDURES FOR DATA VALIDATION

One of the first discoveries I made was that the meteorological data was not readily available in a form that made data validation a simple and effective task. A meeting was held with representatives of the I&C department, the QA Audit department and Realogic, and a program was outlined for a MIDAS task that would print out the data in the needed format. Details of this meeting are described in the QA Assurance Surveillance Activities Report issued Nov. 1, 1985.

Once this program is implemented, data validation will become a very straight-foreward procedure, and it will be possible for all concerned individuals to check the data for possible problems.

Until this program is implemented, however, data validation will remain a slow and arduous procedure.

OVERALL OBSERVATIONS ON CURRENT PROGRESS

My overall observation is that progress is being made rapidly to insure compliance with all NRC requirements. Indeed, we will exceed those requirements and should attain a level of accuracy that will be difficult to match in the industry. I am pleased that progress has been very rapid, and all individuals involved are making significant gains toward the desired objectives. I am confident that we are headed in the right direction.

Another area that deserves attention, besides the instrumentation, is the NRC requirement for a backup source of data in the event of a failure of the instrument tower.

It had been assumed, that backup weather information could be obtained from the National Weather Service via a telephone call to their offices. It has been my experience that the National Weather Service is difficult, if not impossible to contact during times of severe weather. The reason for this is the limited personnel available at the National Weather Service and the needs of that personnel to handle their assigned duties rather than to answer the telephone.

I am recommending that the most reliable way to obtain backup meteorological data is through a private, computerized weather data base (such as Weather Services International, Bedford, Mass.) and accessed via computer using a modem and communications software. This backup equipment should be available both in the Technical Support Center at Rancho Seco and at the EOF (Emergency Operations Facility).

PROGRESS TOWARD COMPLETION OF TASK FORCE REPORT RECOMMENDATIONS

In reviewing the Task Force report I find that significant progress has been made in implementing the recommendations.

Specifically:

1. PROGRAM COORDINATOR: While a permanent coordinator has not yet been selected, we are making significant progress and functioning well under Rob Myers, our Interim Coordinator.
2. METEOROLOGIST: Since I have been under contract as consulting

Meteorologist this recommendation has been fulfilled.

3. MULTIPLE SOURCES: Primary and backup instruments are located on the meteorological tower side by side and hence comparisons of the instrument readings are unavoidable. Data validation using this technique, however, is not a requirement of the NRC. However, we are getting a set of four matched temperature sensors and we expect all four sensors to cross verify. Presently, accuracy and validity of single channel data is excellent and meets all NRC requirements. Our only task in that regard is to monitor the validity through the seasons.

4. Number 4 was not listed in the Task Force Report

5. DATA EVALUATION PROCEDURE: Progress is being made on a MIDAS task to print out the data in a format that will allow evaluations of the data for accuracy and validity. The needs of all persons involved in the monitoring have been provided for.

6. QA AUDIT: The QA Department performed an audit of the meteorological program on Oct. 11, 1985. Additional audits are scheduled.

7. DELTA T AND DUAL INSTRUMENTATION: As a result of the corrective actions by I&C and Realogic, the Delta T measurements have been valid for both primary and backup channels for several weeks. It appears those problems have been solved. As has been mentioned previously, the dual instrumentation at Rancho Seco is not common in the industry, and cross validation is not a requirement for NRC compliance.

8. DATA INTERPRETATION: With the meteorological consultant now on staff, the program of data interpretation is now on-going. This process will be greatly enhanced once the MIDAS data program to facilitate this is completed.

9. PRECIPITATION INSTRUMENTATION: Precipitation measuring equipment is now in place, and data is coming into the plant computer system. Further work needs to be done by Realogic to convert the data to a usable format that meets NRC requirements.

10. MIDAS AVERAGING: Completed by Realogic.

11. ANATEC MULTIPLEXER: Completed by I&C.

12. PORTABLE INSTRUMENTS: These instruments were shown to the NRC and we were in agreement on their limitations. My recommendations for obtaining backup meteorological data using a modem-based sytem were described previously. The recommended backup system should totally replace the portable instruments.

ROLE OF THE CONSULTING METEOROLOGIST

Since September I have taken an active role in the evaluation, and coordination of the activities involved in correcting the deficiencies of the meteorological program at Rancho Seco. Once these problems have been solved an evaluation of the role of the consulting meteorologist will have to be made by the Meteorological Program Coordinator.

Meteorologist this recommendation has been fulfilled.

3. MULTIPLE SOURCES: Primary and backup instruments are located on the meteorological tower side by side and hence comparisons of the instrument readings are unavoidable. Data validation using this technique, however, is not a requirement of the NRC. However, we are getting a set of four matched temperature sensors and we expect all four sensors to cross verify. Presently, accuracy and validity of single channel data is excellent and meets all NRC requirements. Our only task in that regard is to monitor the validity through the seasons.

4. Number 4 was not listed in the Task Force Report

5. DATA EVALUATION PROCEDURE: Progress is being made on a MIDAS task to print out the data in a format that will allow evaluations of the data for accuracy and validity. The needs of all persons involved in the monitoring have been provided for.

6. QA AUDIT: The QA Department performed an audit of the meteorological program on Oct. 11, 1985. Additional audits are scheduled.

7. DELTA T AND DUAL INSTRUMENTATION: As a result of the corrective actions by I&C and Realogic, the Delta T measurements have been valid for both primary and backup channels for several weeks. It appears those problems have been solved. As has been mentioned previously, the dual instrumentation at Rancho Seco is not common in the industry, and cross validation is not a requirement for NRC compliance.

8. DATA INTERPRETATION: With the meteorological consultant now on staff, the program of data interpretation is now on-going. This process will be greatly enhanced once the MIDAS data program to facilitate this is completed.

9. PRECIPITATION INSTRUMENTATION: Precipitation measuring equipment is now in place, and data is coming into the plant computer system. Further work needs to be done by Realogic to convert the data to a usable format that meets NRC requirements.

10. MIDAS AVERAGING: Completed by Realogic.

11. ANATEC MULTIPLEXER: Completed by I&C.

12. PORTABLE INSTRUMENTS: These instruments were shown to the NRC and we were in agreement on their limitations. My recommendations for obtaining backup meteorological data using a modem-based sytem were described previously. The recommended backup system should totally replace the portable instruments.

ROLE OF THE CONSULTING METEOROLOGIST

Since September I have taken an active role in the evaluation, and coordination of the activities involved in correcting the deficiencies of the meteorological program at Rancho Seco. Once these problems have been solved an evaluation of the role of the consulting meteorologist will have to be made by the Meteorological Program Coordinator.

Until that time, however, I expect to continue to monitor the progress of the corrective activities. We are presently awaiting the new temperature sensors, and once they are in operation a re-evaluation of the Delta T and system validity will have to be made. Further, the data will have to be checked under various weather conditions to insure that the validity will stand up under extremes of temperature, cloudiness and wind.

Further tasks are: the integration of the precipitation readings into the data base, and evaluating the new MIDAS meteorological data analysis program.

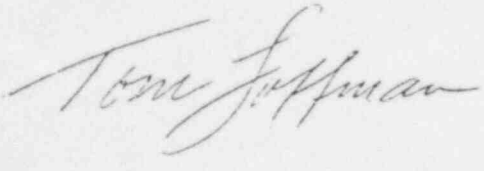
CONCLUSIONS

After a complete review of the meteorological program and instrumentation, I am pleased that significant progress has been made and is being made toward correcting all existing problems, meeting the Task Force recommendations, and providing for future data validation.

Thanks to the concerted efforts of the capable people who have been concentrating their efforts toward solving the problems of the past, we are nearing a point where the meteorological system at Rancho Seco is meeting all NRC requirements, is providing accurate and valid data, is meeting the needs of all persons involved in the program, and will be a MODEL of data accuracy and validity for the Nuclear Industry.

The problems are being solved rapidly, communication between the working members of the program is excellent, and progress toward the remaining objectives is proceding in a timely manner.

I am pleased with where we are, and where we are headed.



TOM LOFFMAN

METEOROLOGIST

NOVEMBER 14, 1985

SACRAMENTO MUNICIPAL UTILITY DISTRICT

OFFICE MEMORANDUM

TO: Ed Bradley DATE: November 1, 1985

FROM: Mike Hardin MH

SUBJECT: METEOROLOGICAL SYSTEM IMPROVEMENTS

Following is a summary of problems resolved and improvements to the Meteorological System Instruments and Data Acquisition equipment:

8/84	Weather Measure installed redesigned temperature and Delta temperature module with better stability.
10/84	Insulated meteorological equipment enclosure and added ±2°F temperature controls to heater/AC unit in order to stabilize operating environment.
10/84	Started monthly program for spraying equipment enclosure for insect control to prevent spiders and mice from fouling the electronics.
3/8/85	Replaced worn out teletype with Hewlett Packard dot-matrix type printer for NOVA computer hard copy output.
3/15/85	Moved 10 meter level "B" channel sensors to west side of tower into prevailing winds. This eliminated descrepancies between wind speed and wind direction caused by tower effect.
4/18/85	Moved 60 meter "B" temperature sensor to west side of tower in an attempt to resolve Delta temperature problem.
6/85	Replaced current loop dropping resistors to obtain better accuracy input to IDADS.
6/21/85	Implemented new procedure to have SMUD technicians calibrate system electroincs instead of Weather Measure. New procedure includes 5 point check of calibration vs. 2 point check per W/M and traceable standards used at all inputs vice module internal test devices.

9/21/85 Corrected calibration procedure to recognize that electronics compensates for RTD curve on temperature instruments.

9/21/85 Precipitation instrument installation complete.

10/23/85 Replaced all 4 temperature sensors in an attempt to resolve Delta temp. problem. 60 meter temperatures show good correspondence indicating sensor matching is critical to resolving problem.

10/24/85 Changed Anatec multiplexer calibration procedure to inject current signal at Met. station to avoid impedance changes caused by lifting wires at control room junction box. This new method provided ± .1% accuracy of mux.

10/29/85 Marv Lord of Weather Measure to obtain 4 certified, matched RTD's for temperature sensors which should resolve correspondence problems with temperatures and delta temperatures.

Changes to be made in near future:

1. MIDAS software system to be turned over and NOVA computer eliminated.

2. Implementation of direct digital communications link between Met. station and IDADS computer to eliminate current loop interface with IDADS (increase system accuracy).

3. Software changes to reduce IDADS thresh hold values which will increase MIDAS accuracy.

4. Software changes to implement IDADS "calibrate" feature which will prevent erroneous data from being used by MIDAS when Met. instruments are being tested.

5. Software changes to add computed Delta temperature values in order to study possibility of bypassing hardware Delta temp.

6. Software changes to lower instrument low error setpoint to prevent losing data within calibrated range of Met. instruments.

7. Long term software change to add self-diagnostics features utilizing data analysis for flagging possible hardware problems.

cc: R. Meyers
J. Irwin
N. Brock
B. Hellmus
C. Agee
T. Loffman