Nebraska Public Power District

GENERAL OFFICE
P. O. BOX 499, COLUMBUS, NEBRASKA 68601
TELEPHONE (402) 564-8561

LQA8100235

July 24, 1981

Mr. Karl V. Seyfrit, Director
U.S. Nuclear Regulatory Commission
Office of Inspection and Enforcement
Region IV
611 Ryan Plaza Drive
Suite 1000
Arlington, Texas 76011

RECEIVED
AUG 10 1981
U.S. NUCLEAR REGULATORY COMMISSION

Subject: Cooper Nuclear Station
Early Warning System

Reference: 1) Letter from K. V. Seyfrit to J. M. Pilant
Dated July 1, 1981, same subject

Dear Mr. Seyfrit:

Per your request, attached is an additional copy of our recent response on post TMI requirements which provides the information you requested in Reference 1. Item III.A.2 of Attachment 1 provides a description of the Cooper Nuclear Station Early Warning System.

If additional clarification is required, please contact me.

Sincerely,

Jay M. Pilant
Director of Licensing
and Quality Assurance

JMP:JDW:cmk

Attachment

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Nebraska Public Power District

GENERAL OFFICE
P. O. BOX 499, COLUMBUS, NEBRASKA 68601
TELEPHONE (402) 564-8561

LQA8100215

June 30, 1981

Mr. Darrell G. Eisenhut, Director
Division of Licensing
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Subject: Post TMI-Requirements/NUREG 0737
Cooper Nuclear Station
NRC Docket No. 50-298, DPR-46

Reference:
1) Letter from D. G. Eisenhut to All Licensees Dated October 31, 1980

2) Letter from J. M. Pilant to D. G. Eisenhut Dated December 30, 1980, "Post TMI-Requirements/Action Plan"

3) Letter from J. M. Pilant to D. G. Eisenhut Dated June 9, 1981, "Emergency Response Facilities"

4) Letter from J. M. Pilant to H. R. Denton Dated January 2, 1981, "Emergency Preparedness Plans"

Dear Mr. Eisenhut:

Reference 1 required Nebraska Public Power District to complete or address certain TMI Action Plan Requirements by July 1, 1981. Attached are discussions of the applicable items.

If additional clarification on any item is necessary, please contact me.

Sincerely,

Jay M. Pilant

Jay M. Pilant
Director of Licensing
and Quality Assurance

bcc: NRC Distribution
Emergency Plan Distribution
L. P. Schakat
W. L. Thalken
L. P. Kohles
R. O. Peterson
B. K. Grimes (NRC)
K. V. Seyfrit (NRC)

JMP:JDW:cmk

Attachment

Dupe 8107130251

NEBRASKA PUBLIC POWER DISTRICT
COOPER NUCLEAR STATION
NUREG 0737 IMPLEMENTATION
EFFORTS REQUIRED AS OF JULY 1, 1981

II.B.1 - Reactor Coolant System Vents:

The District concurs with the BWR Owner's Group position that adequate design features presently exist for the BWR at CNS. No additional design changes are planned.

II.D.1 - Performance Testing of Reactor Relief and Safety Valves:

The BWR Owner's Group will transmit the preliminary BWR S/RV test program results by letter dated July 1, 1981 from T. J. Dente to D. G. Eisenhut. The results which demonstrate the operational adequacy of the Model 7567F 2-stage Target-Rock valves at CNS will be provided as preliminary data sheets. The District's preliminary review of the test program results confirms that the test program demonstrates the valves satisfy the acceptance criteria for operability. The test conditions were defined in a letter from D. B. Waters to R. H. Vollmer dated September 17, 1980 and Owner's Group responses to NRC questions were transmitted in a letter from D. B. Waters to D. G. Eisenhut dated March 31, 1981.

II.E.4.1 - Dedicated Hydrogen Penetrations:

The CNS licensing basis does not include hydrogen recombiners or penetrations; however, at the request of the NRC the District has implemented a design change to allow containment venting for combustible gas control without opening the large primary containment purge valves.

II.E.4.2 - Containment Isolation Dependability:

Position 7 required that the containment purge and vent isolation valves close on a high radiation signal. The design of the CNS containment system is such that both redundant (motor and air operated) drywell and suppression chamber purge inlet and outlet valves close on a reactor building exhaust plenum high radiation signal. Additional details concerning these radiation monitors and valve closure were provided in letters from J. M. Pilant to T. A. Ippolito on December 18, 1979 and February 8, 1980. Additionally, the District concurs with the BWR Owner's Group evaluation of this item which was transmitted by letter from T. J. Dente (BWROG) to D. G. Eisenhut dated June 29, 1981. Based upon the existing monitoring capabilities and dose considerations additional modifications are not considered necessary.

II.F.1 - Accident Monitoring-Noble Gas Monitoring and Iodine/Particulate Sampling:

The appropriate sampling capabilities are required to be installed by January 1, 1982, and the District stated in Reference 2 that it was anticipated that our installation of these two items will not deviate

from the NRC position stated in NUREG 0737. Although the NRC requires no response to this item at this time, the District feels constrained to inform the staff that after competitively bidding the instrumentation and finding all bids non-responsive according to Nebraska State Law, additional negotiation must take place to procure the instruments. This process may result in hardware delivery such that the January 1, 1982 installation date may not be met. In any event, it is contemplated that this system will be installed and operable by the end of the spring 1982 outage.

II.F.1 - Accident Monitoring-Containment Hydrogen Instrumentation:

This item requires measurement capability over the range of 0 to 10% hydrogen concentration by January 1, 1982. The system presently installed at CNS meets all of the NUREG 0737 requirements except that one hydrogen analyzer has a range of 0-5% while the other is 0-20%. The 0-5% range instrument was installed to meet the accuracy/sensitivity requirements associated with actuation of the CNS ACAD system. This ACAD system is installed but the NRC has not as yet licensed the system for operation. For this reason, the District does not intend to alter the present system design and hydrogen monitoring capabilities.

II.F.1 - Accident Monitoring-Containment High-Range Radiation Monitor:

NUREG 0737 required that the District submit deviations, if any, from the requirements at this time. It is anticipated that the required modification will be completed by January 1, 1982 contingent upon receipt of materials. Details of the final design, which meets the NRC requirements, are available for NRC review if required.

II.K.3.13 - Separation of HPCI and RCIC System Initiation Levels:

The analysis regarding RCIC automatic reset, which was submitted to the NRC by General Electric, has been reviewed by the District, and modifications have been completed which implement the NUREG 0737 recommendations.

II.K.3.15 - Modification of Break Detection to Prevent Spurious Isolation of HPCI and RCIC Systems:

The necessary design change has been completed to eliminate any spurious isolations during a normal system start transient.

II.K.3.24 - Space Cooling for HPCI and RCIC:

The HPCI and RCIC room coolers receive power from the emergency buses and can, therefore, operate as designed during a loss of offsite power. The capacity of the coolers are such that the systems can operate for greater than two hours.

II.K.3.25 - Effect of Loss of AC Power on Recirculation Pump Seals:

A copy of the BWR Owner's Group evaluation of this event has been provided directly to the NRC by the BWR Owner's Group. The District concurs with the conclusions of this evaluation.

Two systems provide cooling to the recirculation pump seal. If either one of these systems is operating, recirculation pump operation without the second cooling system may continue with no harm to the seals. If both seal cooling systems are inoperable, the pump seals will overheat approximately 7 minutes after the total loss of cooling and seal deterioration will begin.

Based on fluid loss analysis of extremely degraded seals, the leakage is less than 70 gallons per minute. This amount of leakage will not lead to a safety concern but may degrade the seals such that they would have to be repaired prior to resuming operation. Consequently, no change in design is necessary or proposed.

II.K.3.27 - Common Reference Level for Reactor Vessel Level Instrumentation:

The modifications committed to in our response of February 27, 1981 have been completed so that all level instruments are referenced to the same point.

III.A.2 - Emergency Preparedness-Meteorological Program Description:

A functional description of the upgraded programs and schedule for installation and full operational capability is required by NUREG 0737 to be provided at this time. Attachment 2 is a preliminary development plan for the meteorological monitoring system at CNS which provides the functional description. This preliminary plan is presently undergoing review and some of the information such as instrument vendors, etc., may be subject to change.

In Reference 3 the District provided a description and schedule for the integrated computer change-out program which is required to meet other aspects of NUREG 0737. Since various functions of the meteorological monitoring systems will be performed by the new process computer at CNS, the schedule for installation and full operational capability of the met. system are best defined by the schedules provided in Reference 3.

III.A.2 - Emergency Preparedness - Early Warning System:

In Reference 4 the District submitted a definition of the Early Warning System (EWS) which was being procured in order to meet the July 1, 1981 implementation date, and NRC concurrence with the plan was requested. The following status information pertains to nine (9) fixed sirens, thirty-two (32) volunteer firemen using mobile sirens, and six (6) sheriffs' cruisers which comprise the EWS.

The total of nine fixed sirens have been installed. Of the nine, two have electric power at this time; however, one siren, at Langdon, Missouri, must be moved due to an error in location and one siren at Peru, Nebraska, may require additional work pending local authorities deciding if that siren must be moved. It is anticipated that all sirens will be operational by mid-July. All of the mobile siren equipment has been received and will be distributed to local fire departments during July. The tone encoders which control the activation of the fixed sirens have been received.

Primary control of the fixed sirens is at the Sheriff's Dispatch Office in Rock Port, Missouri, and Auburn, Nebraska. This primary control is for incidents connected to CNS. Control of mobile siren equipment will rest with the volunteer fire departments in Rock Port and Watson, Missouri; Peru, Brownville, Nemaha, and Shubert, Nebraska. This equipment will be operated by the volunteer firemen. Six of the fixed sirens are designed with a third fire signal to be used by the local government for local emergencies. These towns will also have encoders to control their siren. Local emergencies include fire and tornados.

During the installation period of the fixed sirens, and until all mobile equipment is distributed, the local Sheriff's Departments and Fire Departments will utilize existing mobile equipment as warning devices as defined in the various state and local plans submitted in Reference 4. Present plans also include use of the existing phone systems.

The siren system will be ready for testing approximately July 31, 1981 pending no further delays by the Peru authorities. All of the mobile equipment should also be received and distributed by this date.

Attachment 2

PRELIMINARY

METEOROLOGICAL MONITORING SYSTEM
DEVELOPMENT PLAN FOR
EMERGENCY PREPAREDNESS
FOR
NEBRASKA PUBLIC POWER DISTRICT
COOPER NUCLEAR STATION
BROWNVILLE, NEBRASKA

Dames & Moore

Dupe 8107130285

January 26, 1981
Job No. 07635-0[illegible]-07

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EXECUTIVE SUMMARY

Prior to commencement of work, a scope of work clarification meeting was held between Nebraska Public Power District and Dames & Moore in Columbus, Nebraska. This was followed by a site visit to Cooper Nuclear Station (CNS) by Dames & Moore to inspect the present meteorological monitoring system, power plant release points and the general terrain around the plant.

This report contains recommendations and draft plans to enable Cooper Nuclear Station to meet the meteorological portions of the emergency preparedness regulations as set down in Nuclear Regulation (NUREG) 0654, Appendix 2, and in Revision 1, Regulatory Guide 1.23. The recommendations also satisfy the requirements of Regulatory Guides 1.111, 1.145 and 1.97.

Mounting meteorological instruments on the Elevated Release Point Tower does not meet the guidelines for either instrument exposure or access for maintenance and calibration. It will therefore be necessary to provide a separate 100-meter tower in approximately the location shown on Figure 2 of the primary meteorological monitoring towers. This should carry wind speed and wind direction measurements at 10, 60, and 100 meters above ground level, temperature and dew point temperatures at 10 meters, and temperature difference between the 10- and 60- and 60- and 100-meter levels. Precipitation should be measured at the surface near the instrument shelter. This system will then provide the minimum requirements for both operational monitoring and emergency conditions when the Class A model must be used. The present 10-meter tower is satisfactory as a back-up monitoring station and should remain in place. Care should be taken to bring the height of the nearby line of trees well below instrument height. Both the primary and back-up towers

should have standard deviation of the wind direction computed statistically from 1 second samples of direction measurements at all levels.

The present data acquisition system does not provide for rapid transfer and manipulation of data in an emergency situation. It is recommended that in addition to a chart recorder system (as a back-up) each tower has its own dedicated, programmable data acquisition system (DAS), which will form 15-minute average values of all parameters, store at least the last 12 hours of such values, and be capable of calculating standard deviation of wind direction. In addition, the DAS will be capable of separate telephone interrogation by NPPD, NRC, and other emergency organizations if required. The Hewlett Packard 3054A Data Acquisition and Control System provides all three features as well as an excellent reliability and service record. Software for its operation is readily adaptable to the particular needs of CNS. A central control computer (CCC) situated in the Technical Support Center at CNS will receive data from the two DAS's at 15-minute intervals by direct line. This computer will then perform necessary calculations and run the Class A model. Parameter values and model results will then be displayed on consoles in the Technical Support Centre and the Emergency Off-site Facility. A microwave link will also be available between the CCC and the General Office Computer (GOC) in Columbus to provide back-up computer facilities. It will also be possible to transfer data by telephone line, and for the GOC to directly access the DAS at Cooper Nuclear Station should system failure occur in the CCC.

The report recommends that until the present meteorological monitoring system is upgraded (by April 1, 1982), it will remain as a simple Gaussian model, following Regulatory Guide 1.145. During this period, an augmented version of the Class A model should be prepared on the basis

of existing data, to take advantage of the upgraded data when it becomes available. This model will include features to account for impingement of the plume on the western bank river bluff and plume meander.

The outline plan is tentative at this time and is intended for discussions and modification by NPPD.

1.0 INTRODUCTION

1.1 GENERAL

This report describes the technical implementation plan by which the Cooper Nuclear Station (CNS) proposes to meet the requirements set down for the meteorological portions of Nuclear Regulation (NUREG) 0654, Appendix 2. The scope of work is based on the proposal, "Meteorological System Update to Satisfy Emergency Preparedness Requirements, Cooper Nuclear Station," dated July 11, 1980, submitted to Nebraska Public Power District (NPPD) by Dames & Moore. Phase I of this proposal was accepted by NPPD under Purchase Order No. 179104, and the scope of work was further refined and agreed on during a meeting held at Columbus, Nebraska on December 11, 1980.

1.2 OBJECTIVES

The specific objectives of the work are as follows:

1. Examine the present meteorological monitoring system at CNS and recommend the upgrading necessary to bring it into compliance with Revision 1, Regulatory Guide 1.23.
2. Provide the plans and instrument specifications for collection of the required meteorological data, a data transmission system between the monitoring instruments, CNS control room and technical support center, the off-site emergency center, and a central computer and technical facility in Columbus, Nebraska.
3. Provide a functional description of the Class A model required for minimum program operation until April 1, 1982, and describe its relation to the dose calculation methodology.
4. Describe a technical plan for achieving the requirements of NUREG 0654 and Revision 1, Regulatory Guide 1.23 according to schedule. The elements of the plan are to include detailed specification of instruments and instrument systems, Class A model description, and implementation schedule.

It was further agreed that the data acquisition system should be designed to accommodate the needs of the district-wide data monitoring program that is planned by NPPD.

1.3 REPORT OUTLINE

Sections 2.0 and 3.0 of the report set out the technical instrumentation requirements needed to upgrade the present CNS meteorological system for NUREG 0654. Section 2.0 deals with the primary instrument system on a 100-meter high tower, while Section 3.0 describes the back-up system on a 10-meter tower.

Section 4.0 details the data communication and display systems including remote access to on-site data by the Nuclear Regulatory Commission (NRC), emergency response organizations, and a central computer facility at the NPPD general office in Columbus.

Section 5.0 discusses the site-specific topographic and building wake factors that may be considered to influence atmospheric diffusion and resulting radiological concentrations in any accidental plume release from CNS.

The site-specific Class A model is developed from the considerations of Section 4.0 and described in functional terms in Section 6.0. Its relation to the dose calculation methodology used at CNS is also described. Section 7.0 briefly reviews quality assurance requirements.

1.4 DESCRIPTION OF PLANT AND ENVIRONS

1.4.1 Location and Area

The station is located in Nemaha County, Nebraska, on the west bank of the Missouri River, at river mile 532.5. This part of the river is referred to by the Corps of Engineers as the Lower Brownville Bend. Site coordinates are approximately 40°20' north latitude and 95°38' west longitude. The site consists of 1,351 acres of land owned by Nebraska Public Power District. About 205 acres of this property is located in Atchinson County, Missouri, opposite the Nebraska portion of the station site. The land area upon which the station is situated is bounded by the Missouri River on the east and by privately-owned property on the north, south, and west.

The terrain at the station site is fairly level with grade at an approximate elevation of 270 meters Mean Sea Level (MSL). An earth levee runs parallel with the Missouri River. The immediate station site area, excluding the switchyard, which is behind the levee, was filled to an elevation of 275 meters MSL, 0.3 meter higher than the top of the levee. This fill extends around the station buildings.

1.4.2 Surroundings

The reactor building lies about 1,460 meters to the east of the bluffs on the western side of the Missouri River floodplain. The western bluffs rise about 60 meters above the plant grade level and the eastern river bluffs, which are about 9 to 10 kilometers away, also rise steeply to about 60 meters above the plant grade.

The land around the power plant is used for agriculture, and the chief products are corn, wheat, alfalfa, and soybeans. Cattle and hogs are also raised.

Based on 1970 census data, the nearest developed communities to the plant are Brownville, population 174, and Nemaha, population 207. Both lie in Nebraska about 5 kilometers northwest and southwest of CNS, respectively. Phelps City, Missouri, located approximately 6.5 kilometers northeast of the plant, is the nearest settlement with industry, employing approximately 400 people in a meat packing operation.

1.4.3 Plant Description

The plant is situated on the west bank of the Missouri River with the cooling water structures and the turbine building lying between the river and the reactor building. There are five operational release points that are either contaminated or have the potential to become contaminated.

1. The elevated release point, located in a separate tower situated approximately 105 meters east-southeast of the reactor building and emitting at a height of 100 meters above plant grade;

2. The augmented radwaste building vent, located on top of the building in the southern corner, 1 meter above the roof;

3. The radwaste building vents (3), located on top of the building in the western corner, 1 to 1.5 meters above the roof;

4. The turbine generator building vents, located on top of the building at its eastern end, 2 meters above the roof, but below the height level of the attached reactor building; and

5. The reactor building vent, located on top of the building at its northern corner, 4.6 meters above the roof.

Operational dose calculations as reported under 10 CFR 50, Appendix I treat release point 1 above as an elevated release, release point 5 as a conditionally elevated release depending on meteorological conditions, and the remainder as ground-level releases since the releases occur so close to the top of their respective buildings.

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2.0 PRIMARY METEOROLOGICAL MEASUREMENT PROGRAM

The meteorological data acquisition and reporting system consists of an instrumented meteorological tower, signal conditioners, a digital data acquisition system, a central communication computer, and appropriate user displays. This section describes the functional capabilities of each of the system components.

The primary meteorological measurement system will consist of a 100-meter tower with three levels of instrumentation and a surface precipitation gauge. Data at the primary site will be recorded on both analog and digital systems. The analog records will serve both as a back-up data source and as a diagnostic tool for verification and documentation of proper measurement system performance.

The digital system will calculate and archive up to 12 hours of the most recent 15-minute averages of all monitored parameters. In addition, it will routinely telemeter current data to the central communications computer that, in turn, will distribute the data to various users.

2.1 METEOROLOGICAL PARAMETERS

The meteorological parameters of the primary system have been defined to provide respresentative data for the transport and diffusion calculations under normal and emergency operating conditions. The system consists of a 100-meter meteorological tower with three levels of instrumentation and surface precipitation.

The release points at CNS include the elevated release point (ERP, 99.4 meters AGL) and three building vents (assumed to be ground-level releases). The reactor building vent is a conditional ground-level release.

Dispersion model meteorological input parameters for elevated release situations (i.e., ERP) will consist of wind speed and wind direction monitored at the 100-meter level. Stability parameters will be derived from a 100 - 10-meter delta temperature measurement. For emergency situations when wind speed exceeds minimum criteria, σ_y will be derived from the standard deviation of the 100-meter wind direction parameter. Calculation of the standard deviation of wind direction (σ_θ) will be performed by the digital data acquisition system as discussed in Section 2.4.3.

Dispersion model input parameters for surface releases will consist of wind speed and wind direction monitored at the 10-meter level of the primary tower. Stability parameters will be derived from a 60 - 10-meter delta temperature measurement and, as described above, σ_θ of the 10-meter wind direction.

The dew point parameter will be monitored at the primary tower 10-meter level as an aid in the assessment of potential fogging conditions.

Precipitation will be monitored near the base of the primary tower as an aid in the assessment of potential wash-out conditions.

2.1.1 Instrumentation

A tabular summary of the meteorological instrumentation to be installed at CNS is presented in Table 1. Each parameter is discussed in more detail below.

TABLE 1

METEOROLOGICAL EQUIPMENT SPECIFICATIONS

PARAMETER	SENSOR VENDOR/MODEL NO.	SIGNAL CONDITIONER VENDOR/MODEL NO.	ANALOG RECORDER VENDOR/MODEL NO.	RECORDING RANGE	COMMENTS
Wind Speed	Teledyne-Geotech/1564B	Teledyne-Geotech/20.12	Esterline-Angus/L11S2S	0 to 100 mph	Cup Set: Model 170-41 Distance Constant: 1.5 m (5 ft) Threshold: 0.28 m/s (0.63 mph) Signal filter option not installed
Wind Direction	Teledyne-Geotech/1565B	Teledyne-Geotech/20.22-1 0	Esterline-Angus/L11S2S	0 to 540° azimuth	Vane: Model 53.2 (QUICK TWO) Distance Constant: 1.1 m (3.7 ft) Damping Ratio: 0.4 at 10° initial deflection Threshold: 0.3 m/s (0.7 mph) with 10° initial deflection Signal filter op'.on not installed
Temperature	Rosemount/78 Series	Teledyne-Geotech/20.32-A1	Esterline-Angus/L1102S	-30°C to +50°C	Sensor installed in Teledyne-Geotech Model 327B aspirated radiation shield with aspiration failure warning
Delta Temperature	Rosemount/78 Series	Teledyne-Geotech/20.32-B1	Esterline-Angus/L1102S	-5°C to +15°C	Sensor installed in Teledyne-Geotech Model 327 aspirated radiation shield with aspiration failure warning; delta-T derived by electronic subtraction of lower level temperature
Dew Point	Teledyne-Geotech/DP100	Teledyne-Geotech/20.22 (amplifier)	Esterline-Angus/L1102S	-30°C to +50°C	Sensor installed in Teledyne-Geotech Model 327B aspirated radiation shield with aspiration failure warning
Precipitation	Weather Measure/P511-E Weather Measure/P565W Weather Measure/Windshield	Teledyne-Geotech/40.52	Esterline-Angus/MS401C	Infinite - Recorder trace resets at 2.5"	Sensor heated during winter months to measure frozen precipitation

Wind Speed - Wind speed parameters will be measured at the 10-, 60-, and 100-meter levels of the primary tower. The sensor utilizes a solid-state photo chopper assembly, which produces a frequency output porportional to wind speed.

Wind Direction - Wind direction parameters will be measured at the 10-, 60-, and 100-meter levels of the primary tower.

The sensor utilizes a single, low-torque potentiometer (linearity ±0.5 percent). The signal conditioner electronically constructs signal output proportional to a zero to 540° azimuth. Indication error at true north (the potentiometer gap of 4° maximum) is minimized electronically by addition of a voltage equivalent to one-half the potentiometer gap. The Teledyne-Geotech "Quick Two" vane represents the best compromise of durability and performance of the three versions available.

Temperature - Ambient temperature will be measured at the 10-meter level of the primary tower. The sensor will be a platinum resistance temperature device (RTD) with excellent repeatability and long-term stability. The signal conditioner utilizes the 4-wire measurement technique and incorporates a correction circuit to reduce the second-order nonlinearity in the RTD transfer curve. The 10-meter sensor will be utilized as the lower level reference for delta temperature measurement.

The sensors will be installed in aspirated radiation shields with the sample intake oriented downward. The aspirator will contain an air flow sensor and will be installed in a manner to provide visual and digital system indications of aspirator flow failure.

Delta Temperature - Delta temperatures of 100 - 10 meters and 60 - 10 meters will be measured on the primary tower. The measurement system will use the same equipment as the ambient temperature system except that the signal conditioner will electronically perform the temperature subtraction. Flow indication will also be provided for the upper level aspirators.

Dew Point - The dew point parameter will be measured at the 10-meter level of the primary tower. The sensor utilizes the lithium chloride dew cell method of dew point measurement for long-term reliability and minimum maintenance.

Precipitation - Precipitation will be measured near the base of the primary tower with a tipping bucket instrument. The sensor will be equipped with a windshield to minimize turbulence over the collection orifice and a heater (in winter months) to enable measurement of frozen precipitation.

2.1.2 Instrument Exposure

Wind sensors at all primary tower measurement elevations will be mounted on cross-arms at the end of an instrument boom approximately 1-1/2 to 2 tower widths from the tower structure. The instrument booms will be oriented into the prevailing annual wind direction. To minimize tower structure effects, accessories such as junction boxes and work platforms will be installed below the instrument levels.

The temperature/dew point aspirator intakes will be installed 1-1/2 to 2 feet from the tower structure to minimize tower heating effects.

The precipitation sensor and windshield will be installed on the surface in a well-exposed area and in the vicinity of the system instrument shelter.

2.1.3 System Reliability

The selected instrumentation system has a well-established record of reliable operation. To further assure data availability, the system design will incorporate features to minimize data loss due to environmental effects.

During periods with potential for freezing (i.e., winter months), precipitation sensor heaters will be installed and operated on all wind speed and wind direction sensors.

To minimize both the potential and extent of damage from electrical storms, the tower system will be well grounded and all sensor signal lines will terminate to surge-arresting transient protection. Transient protection will also be installed on incoming AC power lines.

2.2 SITING OF PRIMARY SYSTEM

The location of the primary meteorological tower has been selected and has been submitted to the NRC for staff review.

2.3 ANALOG RECORDERS

All monitored parameters will be recorded via servo-type, potentiometric analog recorders to achieve high response, accuracy and reliability.

To simplify maintenance, all recorders utilize cartridge inking systems and chart paper scaled in the engineering units of the recorded parameter.

Each level of wind speed and wind direction will be recorded on an Esterline-Angus L11S2S dual-channel, continuous writing recorder. The recording format is side-by-side records on a 10-inch chart such that wind speed and wind direction recording widths are 4-1/2 inches each. Minor chart graduations are 1 mph and 10°, respectively.

Temperature and dew point parameters will be recorded on an Esterline-Angus L1102S dual-channel continuous writing recorder. The recording format allows both parameters to be recorded on a 10-inch width. Minor chart graduations are 1°C.

The delta temperature parameters will be recorded on an Esterline-Angus L1102S dual-channel, continuous writing recorder with 10-inch recording width. Minor chart graduations are 0.1°C.

The precipitation parameter will be recorded on an Esterline-Angus MS401C single-channel, continuous writing 5-cm recorder. Minor chart divisions are 0.10 inch of precipitation. However, due to the step-function recording characteristics, data reduction resolution is 0.01 inch of precipitation.

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2.4 DIGITAL DATA ACQUISITION SYSTEM

The digital data acquisition system for the meteorological measurement program is a Hewlett-Packard (HP) 3054A Data Acquisition and Control System. The principal hardware components of this system are:

1. An HP 9825T computer;
2. An HP 3497A data acquisition/control unit;

3. 10-minute uninterruptible power supply; and

4. Communications modems.

The data acquisition system (DAS) is physically located at the meteorological monitoring site and communicates with the central communication computer (CCC) via a dedicated voice-grade telephone line. In addition, the system may be remotely interrogated by either a computer or an operator with a keyboard terminal, using a dial-up voice-grade telephone line.

The DAS will routinely transmit 15-minute averaged data for all measured parameters to the CCC. The DAS will also store 15-minute averages for the most recent 12-hour period in computer memory. These data will be available for retransmission to the CCC, if necessary, or for transmission via the dial-up communications port.

2.4.1 Hardware Description

Hewlett-Packard 9825T Computer - The 9825T computer is equipped with 62 K bytes of read/write memory, an operator keyboard, a thermal printer, a 32-character LED display, and a tape cartridge drive. The operating system resides in Read-Only Memory (ROM), so that virtually all of the 62 K bytes of read/write memory are available for the data acquisition software and data storage.

The 9825T is configured with three input/output interfaces:

1 An HPIB (IEEE 488-1978) interface for communication with the data acquisition/control unit;

2. An EIA-RS232C serial interface for communication with the CCC via dedicated telephone line; and

3. An EIA-RS232C serial interface for communication with the dial-up port.

Hewlett-Packard 3497A Data Acquisition/Control Unit - The 3497A data acquisition/control unit provides for analog-to-digital conversion of up to 20 analog input signals and input of digital status information. It communicates with the 9825T computer via an HPIB (IEEE 488-1978) interface. Hardware includes a 20-channel relay multiplexer assembly, a 5-1/2-digit digital voltmeter, an optically isolated digital input assembly, and a battery backed-up time-of-year clock.

2.4.2 Software Description

Applications software for the DAS will be provided by Dames & Moore. The software is written in Hewlett-Packard's HPL programming language. HPL is a high level interpretive language that is especially suited to data acquisition and control applications. Although similar to BASIC, it is more compact and considerably faster.

The software is designed to be as flexible as possible to accommodate changes in system configuration and monitoring requirements. Addition of new meteorological parameters, or changing specifications for existing parameters, can be accomplished by an operator using interactive keyboard commands without the need to modify the software itself.

The software is written in a modular fashion in order to facilitate upgrades, addition of new features to the system, or its extension for use with a wider network.

2.4.3 Functional Description

The primary functions of the DAS are the periodic sampling and averaging of meteorological data for all measured parameters, and the transmission of the averaged data to the CCC.

Data Acquisition - The 3497A Data Acquisition/Control Unit is programmed to periodically digitize analog signal inputs for all meteorological parameters and interrupt the DAS computer after all channels are digitized. The computer reads the voltage for each channel, makes the appropriate conversion to meteorological units, and uses the value to update the running totals for the current period's average.

In addition to 15-minute average values for all parameters, the DAS also calculates 15-minute values for sigma theta (standard deviation of horizontal wind direction). The sigma values are based on samples of wind direction at 5-second or more frequent intervals, in conformance with NRC Regulatory Guide 1.23.

The DAS has the capability of checking status inputs for each parameter. These inputs will include an out-of-service status for use if the sensor is being calibrated, repaired, or is not in operation; and an aspirator flow status for temperature and delta temperature parameters. Any status indicating that data are missing or unreliable causes instantaneous values for the corresponding parameters to be omitted from the averaging process until a good status is restored. Regardless of status, instantaneous data are always available to the operator for maintenance purposes.

Data Transmission - Under normal operation, averages will be transmitted from the DAS to the CCC at 15-minute intervals (timing of

transmission is controlled by CCC). The transmission protocol will include error detection mechanisms such as check characters to ensure that data are transmitted accurately. Data will be retransmitted as necessary if errors are detected.

Additional transmissions can be initiated at any time by the CCC, including any or all 15-minute averages for the most recent 12-hour period.

Remote Interrogation - Instantaneous or averaged data can be requested at any time via the remote dial-up port of the DAS. A password scheme is utilized to prevent unauthorized access.

While the remote interrogation capabilities specified in Regulatory Guide 1.23 and NUREG 0654 will be implemented on the CCC rather than the DAS, the dial-up port of the DAS can be utilized by NPPD's general office computer as a back-up in the event communication with the CCC becomes impossible for any reason.

2.4.4 System Reliability

The DAS is designed to operate continuously for long periods of time without operator intervention. An uninterruptible power source (UPS) at the monitoring site will maintain power to the DAS for up to 10 minutes in the event of AC power loss.

If AC power is out for as long as 5 minutes, all information necessary for system recovery, including all currently stored data, is automatically written to the 9825T computer's tape cartridge unit.

If the power outage then exceeds the 10-minute capacity of the UPS, the DAS software and the recorded data will be automatically reloaded from the tape cartridge when power is restored.

The time-of-year clock in the data acquisition/control unit has a battery back-up and will maintain the correct time for more than 24 hours without AC power.

The entire data acquisition system (except the modems and the UPS) can be supported by an on-site service agreement with Hewlett-Packard. HP's on-site support ranges from routine periodic maintenance to emergency on-site repair.

2.5 SYSTEM ACCURACY

The system accuracies for all parameters have been calculated from published vendor specifications using the root sum of the squares (RSS) method. Within a parameter system, each error component is squared, the sum of the square of the error components calculated, and the error determined from the square root of the sum of squares. For the analog systems, estimates of the data reduction error are included in the system error calculation.

System accuracies, by parameter, for both analog and digital averaged data are presented in Table 2.

2.6 INSTRUMENT MAINTENANCE

The instrument maintenance program will consist of weekly system inspections, scheduled system maintenance and calibrations, and emergency repair and calibrations.

TABLE 2

CALCULATED SYSTEM ACCURACIES BY PARAMETER

	ANALOG[a] SYSTEM ERROR	REGULATORY GUIDE 1.23 REQUIREMENT	DIGITAL SYSTEM ERROR	REGULATORY GUIDE 1.23 REQUIREMENT
Wind Speed	±0.29 m/s (±0.65 mph) for wind speed <11.13 m/s	±0.33 m/s (±0.75 mph) for wind speed < 11.13 m/s	±0.11 m/s (±0.25 mph) for wind speed < 11.13 m/s	±0.22 m/s (±0.5 mph) for wind speed < 11.13 m/s
Wind Direction	±6.58° azimuth	±7.50° azimuth	±3.8° azimuth	±5° azimuth
Temperature	±0.37°C	±0.5°C	±0.16°C	±0.5°C
Delta Temperature[b]	±0.18°C	±0.15°C/50 meters	±0.16°C	±0.15°C/50 meters
Dew Point	±0.98°C	±1.5°C	±0.92°C	±1.5°C
Precipitation	±0.5% of catch at 0.5"/hr	±10% of catch	±0.5% of catch at 0.5"/hr	±10.0% of catch

[a] Includes estimated reduction error.

[b] Calculations are based upon 1-year stability specifications for sensor. However, the parameter will be recalibrated at 6-month intervals in a manner that will compensate for sensor drift, reducing operation error.

2.6.1 System Inspections

To provide for the continuing availability of reliable data, a program of weekly system inspections will be implemented. The inspection activities will be designed to verify accurate operation of the entire meteorological system from the sensors through to the remote interrogation system. Should an inspection identify potentially malfunctioning equipment, corrective action will be initiated.

The system inspection procedure will be documented on a printed checklist. The activities performed at the monitoring site will include the following checks:

1. Visual inspection of the sensors for damage or degradation;
2. Correlation of observed meteorology with recording systems indications;
3. Examination of chart records for potential instrument problems;
4. Performance of analog recorder maintenance; and
5. Verification of proper DAS functioning.

The activities performed within the plant and related facilities will include verifying:

1. Proper operation of the central communications computer;
2. That all displays are functional; and
3. That remote interrogation channels are functional.

2.6.2 System Maintenance and Calibrations

A maintenance and calibration program will be established so that all equipment is maintained at vendor recommended intervals and so that meteorological system calibrations are performed semiannually.

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Meteorological system calibrations will consist of four types of activities:

1. Multipoint, premaintenance system* accuracy checks;
2. Preventive maintenance;
3. System alignment to within defined tolerance limits; and
4. Multipoint, post-adjustment system accuracy checks.

Whenever possible and practical, system accuracy checks will be performed by precise simulation of physical quantities (e.g., siting wind direction vanes on surveyed azimuth markers, etc.) to verify that the system performs within the specified accuracies of Regulatory Guide 1.23. Specific procedures for system accuracy checks are presented in Appendix A.

All calibration activities will be documented on printed calibration forms and in the site log.

To maintain data availability, scheduled maintenance activities will be performed when back-up systems are known to be functional.

2.6.3 Emergency Maintenance

Emergency maintenance may be initiated by system inspections or by actions of system display or system data users. Upon identification of a problem (or potential problem) with the primary system, back-up procedures will be initiated. It is anticipated that in most cases emergency maintenance will be completed with minimum down-time. As discussed in Section 4.1.2, the system has sufficient redundancy that a back-up data source or procedure is available in the event of failure of any system subcomponents.

*System refers to all monitoring system components from sensor through analog recorder and DAS.

To minimize down-time in the event of equipment failure, an inventory of spare parts will be maintained at CNS. The spares inventory will include at least one replacement for each of the meteorological system components. DAS spares will include at least one of each of the modules that interface to external equipment. To further simplify maintenance of the DAS, the system software diagnostics provided with the system will allow the system technician to quickly diagnose a problem to the module level.

2.7 DATA REDUCTION AND COMPILATION

Routine operational data reduction, compilation and reporting will be performed by the NPPD General Offices Computer (GOC). The data will be transferred to the GOC, in the form of 15-minute averages, from the CCC via microwave transmission.

A software package to run on the GOC will be developed to perform the functions described in this section. Data will be processed on a monthly basis. The basic processing steps necessary are:

1. Reduce 15-minute averages to clock-hour averages;
2. Screen the data for missing, invalid, or questionable data;
3. Invalidate or correct data identified in Step 2, if necessary;
4. Generate an hourly listing of the data set;
5. Compile monthly and annual joint frequency distributions of wind speed and wind direction by atmospheric stability class, as prescribed in Regulatory Guide 1.23; and
6. Generate a magnetic tape containing the hourly averaged data, using the format described in Regulatory Guide 1.23.

The programs necessary to complete each of these steps are described below (program names are indicative only).

2.7.1 Program REDUCE

Program REDUCE reads a data file of 15-minute averaged data and generates a new data file of hourly averaged data. Hourly averages are computed as the arithmetic mean of all valid 15-minute averages for a given clock hour, with the following exceptions: (1) hourly average wind directions are computed as vector averages; and (2) hourly precipitation is totaled.

2.7.2 Program SCREEN

Program SCREEN reads a data file of hourly averages and performs the following checks:

1. Insures that no hours are skipped in the data file.
2. Checks each hourly average of each parameter against predefined maximum and minimum limits. These limits are based on climatological records and are intended to identify data that are outside the range normally expected for the site.
3. Checks consecutive hourly averages of each parameter against predefined limits for the maximum and minimum change between hours.
4. Checks hourly wind speeds and directions against predefined limits for difference between tower levels (e.g., compares 10-meter wind speed against 60-meter wind speed).
5. Compares hourly dew point temperatures at all levels against corresponding hourly ambient (dry bulb) temperatures.
6. Checks hourly delta temperature values for consistency between different height intervals (e.g., 60 - 10-m vs. 90 - 10-m).

The program generates a listing of data for all hours containing any questionable values, based on the checks above. The program makes no changes to the data file itself.

2.7.3 Program EDIT

If any of the values identified by the SCREEN program, described above, need to be invalidated or corrected, the EDIT program may be used to make the required changes to the data file. In addition to a revised data file, the program also generates a log of all changes made.

This program is also used to edit data that are deemed suspect due to maintenance or calibration records or other information showing the data to be unrepresentative of actual conditions.

2.7.4 Program LIST

Program LIST generates a formatted, labeled listing of all hourly data collected during a given month. The program also prints the maximum, minimum, and mean values for each parameter during the month.

2.7.5 Program JOINT

Program JOINT compiles joint frequency tables of wind speed and wind direction by stability class. One table is generated per stability class. The table format conforms to the requirements of Regulatory Guide 1.23.

2.7.6 Program NRCTAPE

Program NRCTAPE reformats the hourly averaged data according to the specifications of Regulatory Guide 1.23 and writes the reformatted data to magnetic tape.

2.8 BACK-UP POWER SUPPLY

The method of implementing a back-up power supply for the primary meteorological system will be defined during the system implementation phase. Among the options being considered are an on-site, gas-powered standby generator and installation of the power supply system such that switch-over to plant standby power is easily accomplished.

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3.0 BACK-UP METEOROLOGICAL MEASUREMENT PROGRAM

The back-up meteorological measurement system will consist of a 10-meter tower instrumented to measure wind speed and wind direction. Data at the back-up site will be recorded on both analog and digital systems. The analog records will serve both as a back-up data source and as a diagnostic tool for verification and documentation of proper measurement system performance.

The digital system will calculate and archive up to 12 hours of the most recent 15-minute averages of all monitored parameters. In addition, it will routinely telemeter current data to the Central Communications Computer (CCC). In the event of an outage of the primary system, the CCC will substitute back-up site data for distribution to the various users.

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3.1 METEOROLOGICAL PARAMETERS

The meteorological parameters monitored by the back-up system will consist of wind speed and wind direction at the 10-meter level. In addition, the DAS will calculate the standard deviation of the horizontal wind direction (σ_θ) over each 15-minute data averaging period. Sigma theta will be used by real-time dispersion models in emergency situations to estimate stability classification.

3.1.1 Instrumentation

The instrumentation utilized in the back-up meteorological system will be identical to that described in Section 2.1.1 for the primary system.

3.1.2 Instrument Exposure

The wind sensors for the back-up tower will be installed on the top of the existing 10-meter, self-supporting mast. There will be no mechanical structures of significant dimensions at the sensor level to affect instrument exposure.

3.1.3 System Reliability

The selected instrumentation system has a well-established record of reliable operation. To further assure data availability, the system design will incorporate features to minimize data loss due to environmental effects.

During periods with potential for freezing precipitation (i.e., winter months), sensor heaters will be installed and operated on the wind speed and wind direction sensors.

To minimize both the potential and extent of damage from electrical storms, the tower system will be well grounded and all sensor signal lines will terminate to surge-arresting transient protection. Transient protection will also be installed on incoming AC power lines.

3.2 SITING OF BACK-UP SYSTEM

The back-up meteorological system will be sited at the location of the existing 10-meter wind system, approximately 300 meters (1,000 feet) northwest of the plant building complex. The site is in level terrain with excellent exposure in all directions. There now exists a line of trees approximately 6 meters tall north of the site. These will be removed as necessary for adequate instrument exposure. The only other significant

obstruction to wind flow is the plant building complex in the east-southeast sectors. The site is sufficiently removed from the buildings so that wind measurements from the southeast sector will not be significantly affected. Further, historical on-site data show that winds from the east to southeast have a relatively low frequency.

3.3 ANALOG RECORDERS

The analog recording system for the back-up meteorological parameters will be identical to that described in Section 2.3 for the primary system wind parameters.

3.4 DIGITAL DATA ACQUISITION SYSTEM

The digital data acquisition system for the back-up meteorological measurements site is identical to that described for the primary site (Section 2.4).

3.5 SYSTEM ACCURACY

The system accuracy of each parameter of the back-up system will be identical to that calculated for like parameters of the primary system because the instrumentation is identical.

3.6 INSTRUMENT MAINTENANCE

The inspection, maintenance, and calibration programs of the back-up meteorological system will be under the same procedural requirements as those

of the primary system. Procedures will be defined to ensure that the back-up system is not removed from service while the primary system is out of service.

3.7 DATA REDUCTION AND COMPILATION

Data from the back-up system will be used only as needed to fill in data that are not available from the primary system. This data replacement will normally be made by the CCC system, which maintains continuous communications with both the primary and back-up data acquisition systems. The resultant data are then transmitted to the NPPD General Offices Computer (GOC) for further processing, which is described in Section 2.7.

3.8 BACK-UP POWER SUPPLY

The method of implementing a back-up power supply for the back-up meteorological system will be defined during the system implementation phase. Among the options being considered are an on-site, gas-powered, standby generator and installation of the power supply system such that switch-over to plant standby power is easily accomplished.

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3.9 ALTERNATE DATA SOURCE

Under certain wind conditions, the σ_θ parameter of the back-up system may not provide an accurate indication of atmospheric stability. During planned or unplanned outages of the primary data acquisition and reporting system, a voice link will be established with the National Weather Service at Omaha, Nebraska. The purpose of the link will be to enable estimation of a dispersion stability class on the basis of wind speed and insolation/cloud cover parameters.

4.0 DATA REPORTING SYSTEM

The CNS data acquisition and reporting system will consist of two meteorological monitoring systems, a central communications computer, user displays, and a back-up computing system at NPPD's general offices. The functional components are interconnected by a network of modems and dedicated communication links.

4.1 METEOROLOGICAL MONITORING SYSTEMS

Each meteorological monitoring system (primary and back-up) will consist of measurement instruments, signal conditioners, an analog recording system, and a digital data acquisition system (DAS). The DAS functions as a preprocessor and back-up data archive for the on-site measurements. The analog voltage of each monitored parameter is sampled and digitized at regular intervals, converted to physical units, and stored in a form for computation of a 15-minute average. Every 15 minutes, synchronized with the clock hour, period averages for all parameters including σ_θ are calculated and archived. Up to 12 hours of the most recent 15-minute averages are archived. The DAS flags each archived average with a status code indicating the completeness of the average (e.g., too few samples due to aspirator failure, etc.) as an indication of data validity to users.

When polled by the CCC (or via the back-up dial-in port), the DAS will transmit the requested data.

4.2 CENTRAL COMMUNICATIONS COMPUTER

The CCC is the primary means of dissemination of monitored data to the various users under both routine and emergency situations. Under normal plant operations, the CCC will interrogate the primary and back-up site data acquisition systems approximately every 15 minutes and request transmission of the latest calculated average of all monitored parameters. Data transmission will be implemented via modems and a dedicated, voice-grade communications line between the CCC and each monitoring site. The data communications rate will be 1200 baud. All data transmissions will be performed in blocks; one block contains all parameters of a specific averaging period. The protocol will include character parity and a block cyclical redundancy check (CRC) character. Provisions will be made for retransmission in the event of a parity or CRC error. The transmission request will be repeated up to three times, if necessary. After three unsuccessful tries, the CCC will assume the site id down for that averaging period and will display a warning message on the system console and on active user displays. If applicable, the CCC will substitute data from the back-up site for system display. All substituted data will be identified on user displays.

Prior to dissemination of primary or back-up site data to user displays, the CCC will inspect the status codes associated with each parameter's average. The status code will be 0 for valid data and some other digit if less than one-half the possible samples (180 values for σ_θ) were incorporated into the average of the DAS. Less than complete averages could result from occurrences such as aspirator failure, operator putting a

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parameter out of service for maintenance, digitizer time-out, etc. Should the primary site data set be incomplete, it will be disseminated to active user terminals along with back-up site data and an appropriate warning message. Of no valid samples exist for an averaging period, the displayed data field will be 9-filled.

The 15-minute data averages are routinely archived on a historical disc file that is dumped to tape monthly as an on-site historical record. At least 24 hours of 15-minute averages of all monitored parameters will be available for display or model execution.

The routine data processing for required periodic reports will be performed on NPPD's General Offices Computer (GOC). On a daily basis (or more frequently if required), the CCC transmits site data from the primary and back-up systems to the GOC via the microwave-link.

In an emergency situation, terminal users in the EOF, TSC, or on one of the dial-in ports will have the capability to command execution of a Type A model or (after the required implementation date) a Type B model. The Type A model (described in Section 5.0) will be executed in real-time on the CCC and the results displayed to the requesting user. It is anticipated that the CCC may not have sufficient capacity or speed for execution of a Type B model. Therefore, when execution is requested, the command and necessary meteorological data will be telemetered to the GOC via the dedicated microwave link. The Type B model will be executed on the GOC. Model results will be transmitted back to the CCC for display to the requesting user.

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4.3 DATA DISPLAYS

Data displays for the meteorological data acquisition and reporting system will consist of dedicated displays and dial-in communication ports for remote users. Dedicated displays will be located in the control room, emergency operations facility (EOF), and in the technical support center (TSC). A dedicated output to the nuclear data link (NDL) formatter will also be provided. All user displays (except the NDL output) will be operator interactive. Under normal operation, the displays will be routinely updated with current averaged data from the meteorological monitoring system. However, the display user may, at any time, request the display of prior data from the CCC disc archive file or request execution of the model and display of results.

The communications system for the displays will consist of dedicated serial, hard-wired, voice-grade lines and associated modems. The communications protocol will be ASCII with character parity at 1200 baud.

The control room terminal will be hard copy-type to provide historical data with minimal operator interaction; other displays will be CRT-type with display buffer for low maintenance and ease of operation.

4.4 ALTERNATE DATA REPORTING MODES

The meteorological data acquisition and dissemination system discussed above provides sufficient redundant communications paths to function in the event of failure of any of the primary system components.

4.4.1 Failure of the Primary Monitoring Site

In the event of failure of the primary meteorological monitoring system or its associated DAS, the CCC will automatically substitute data from the back-up monitoring system. The back-up site will provide accurate wind and stability measurements for use in ground-level release modeling situations. For elevated release situations, 100-meter winds will be estimated by power-law extrapolation of the 10-meter level winds. The power law equation coefficients will be determined from on-site historical data.

In the event only one or a few parameters of the primary monitoring system are out of service, the valid parameters will continue to be disseminated. For example, the 60-meter delta temperature or winds would be used if the 100-meter instruments were out of service. Back-up system data will automatically be substituted by the CCC when primary 10-meter winds are out of service.

In the event of failure of the dedicated communications channel between the primary site DAS and the CCC, the communications link will be reestablished via the dial-in communications port. The on-site DAS will be equipped with a remote keyboard feature on the dial-in port that will enable remote resetting of the computer and reloading of the program should it become necessary.

4.4.2 Failure of the CCC

During those time periods when the CCC is out of service for maintenance or other reasons, data acquisition, modeling, and dissemination will be performed by the GOC. Several microwave channels are available to

the GOC. The CCC and display modem systems will be manually switched in such a manner that for communication purposes the GOC appears functionally identical to the CCC.

5.0 LOCAL SITE CONDITIONS AND METEOROLOGY

Cooper Nuclear Station is situated in a relatively open and simple topographical location. There are no abrupt changes in surface type, and topographic features are limited to the bluffs on either side of the flood-plain. The nearest bluff rises about 50 meters above the plant grade and lies approximately 1,450 meters to the west. Valley bottom slope is very small and valley drainage winds appear unlikely.

There are three aspects of location that may affect the meteorological considerations that should be included in the Class A model and these are discussed below.

5.1 CHANNELING OF WIND FLOW

Although the topographic features around CNS are minor, it is possible that channeling of wind flow occurs with light winds and a stable atmosphere. Annual wind rose figures for the year July 1, 1976 to June 30, 1977 show that more than 50 percent of measured winds blow along the river valley. This evidence is not conclusive, since prevailing winds are somewhat similarly distributed.

It is planned that existing records will be examined in more detail during development of the augmented Class A model, which will be operational by April 1, 1982, to determine whether a channeling effect does exist, so that it can be incorporated.

5.2 WIND DIRECTION MEANDER

Under stable conditions with steady, low speed winds, plume dispersion is usually slow, but because of larger scale plume meanders.

calculated ground-level concentrations are lower than usually calculated by a simple Gaussian model. Because the CNS site is open and uniform, the usual method of accounting for this meander (Regulatory Guide 1.111) can be successfully used and will be incorporated into the Class A model.

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6.0 ATMOSPHERIC TRANSPORT AND DIFFUSION ASSESSMENT PROGRAM

6.1 DESCRIPTION OF SITE AND PREDOMINANT WIND DIRECTIONS

It is required that the Class A model, used for emergency planning and used during any emergency that may occur, will consider the site-specific characteristics of the plant.

Cooper Nuclear Station is relatively free from topographic influence and is not situated near any large water body or other feature requiring consideration of different surface roughness, heat transfer, or other discontinuity in surface characteristics.

CNS is located on the floodplain of the Missouri River. The orientation of the floodplain is approximately NNW-SSE; the average width is 8 kilometers, and it widens to about 15 kilometers just south of the plant. The east-west width of the floodplain in the vicinity of the plant is approximately 11.5 kilometers with CNS situated 1.5 kilometers from the western side. Nearly vertical, 50-meter high embankments determine the eastern and western sides of the floodplain with the terrain to the east and west of the floodplain remaining relatively constant for a long distance at the 50-meter height. The floodplain itself is virtually flat in the vicinity of the power plant; the change in elevation from south to north is approximately 7 meters over 23 kilometers.

As a result of analysis of 6 years of wind data from the on-site 100-meter tower and 1 year of data from the 10-meter tower at Omaha Airport, the predominant wind directions at the site were determined. More than 50 percent of the time the wind direction was southeast through south to southwest or northwest through north to north-northeast. The wind direction at the site was nearly independent of stability class. These predominant wind

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directions appear to be determined at the synoptic scale rather than induced by local terrain features. However, near the surface of the floodplain (i.e., below the 50-meter embankment height), it is expected that some channeling of the wind will occur under near calm conditions.

6.2 SOURCE CHARACTERISTICS

There are five potential sources of radioactive emissions from CNS. These are described in detail in Section 1.4. Briefly, they consist of:

- The elevated release point at 100 meters in height;
- Vents from the turbine, radwaste, and augmented radwaste buildings, all of which are emitted close to their building rooftops and are treated as ground-level releases; and
- The vent from the reactor building, which is discharged 5 meters above the building and is treated as a conditional ground-level release, depending on meteorological conditions.

6.3 CLASS A MODEL

Appendix 2 of NUREG 0654 specifies that the Class A model will be used to assess the short-term consequences of accidental radioactive releases to the atmosphere and to aid in the implementation of emergency response decisions. This model will use actual 15-minute average meteorological data to estimate initial transport and diffusion estimates for plume exposures within the emergency planning zone (EPZ) within 15 minutes following the classification of an incident.

CNS plans to use the standard Gaussian methodology as outlined in Regulatory Guide 1.145 with minor modifications to account for the influences

of local terrain. The data available for use by the model will differ before and after April 1, 1982, so that two model descriptions are provided.

6.3.1 Upgraded Meteorological Data System

In the event that the incident involves release of radioactive material from the elevated release point (100 meters), the Gaussian plume model will use the wind speed and direction measured at the 100-meter height. Atmospheric stability will be determined from the temperature difference between 60 meters and 100 meters or from σ_θ at 100 meters for windspeeds above the threshold value.

The height of the plume centerline above the terrain will be computed by the standard NRC methodology as described in Regulatory Guide 1.145, Section 1.3.2. This approach subtracts the terrain height from the initial plume height and is appropriate for the river valley and the nearly flat plateau region adjacent to it.

If an accidental release occurs from any of the four release points attached to the buildings, such that all surface releases are assumed, then appropriate building wake effects will be included in the calculation (per Regulatory Guide 1.145). However, the Gaussian plume model will use different sets of wind and stability data depending on the location of the receptor.

For a receptor located in the river valley, the wind speed and direction from the 10-meter tower level will be used in the Gaussian plume model. Atmospheric stability will be determined using the temperature difference between 10 meters and 60 meters from the tower or from σ_θ at 10 meters for windspeeds above the threshold value. This calculation procedure

will be used until the plume reaches an embankment on either side of the river valley.

Concentrations at locations on the elevated terrain will be computed using the wind speed and direction from the 100-meter level and temperature difference between 10 and 100 meters or σ_θ at 100 meters for windspeeds above the threshold value. These measurements more accurately represent the air flow over the 50-meter high plateaus than do the wind data measured at only 10 meters above ground level.

6.3.2 Existing Meteorological Data

Until the upgraded meteorological system becomes available on April 1, 1982, wind data will be available from 10-meter height only and temperature difference between 10 and 100 meters on the ERP tower. These data will be used in the Class A model as follows.

For an elevated release, the wind data from the 10-meter tower will be modified by a power law relationship of the form

$$U_{100} = U_{10}\ 10^{P_s}$$

where P_s is the power law constant, which is dependent on stability class. Wind direction will be corrected by incorporating a wind shear factor determined for CNS, which is also stability dependent. The appropriate wind shears were derived from data reported over the period July 1, 1976 to June 30, 1977 and are contained in Table 3.4.3 of Demonstration of Compliance with 10 CFR 50, Appendix I, Revision 1 and Supplement 2, January 9, 1978, for Cooper Nuclear Station.

Temperature difference will be taken from the existing 10-meter and 47-meter levels on the ERP tower.

For ground-level releases, the wind data will be used directly from the existing 10-meter tower, with temperature differences coming from the 10-meter to 47-meter levels on the ERP tower.

At any time, it will be possible for this routinely collected data to be substituted by more representative data that may become available (e.g., information indicating an approaching storm or a wind shift line may not yet be reflected in the site data).

6.4 RECEPTOR NETWORK

The standard array of receptors will be used (polar coordinates).

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6.5 MODEL OUTPUT

There will be no change from the standard Gaussian plume model outputs required by the NRC.

6.6 CLASS B MODEL

When the NRC has finalized its requirements for the Class B model, the methodology for this more accurate calculation procedure will be described.

6.7 DOSE CALCULATION METHODOLOGY

To be completed in consultation with NPPD after they have reviewed Section 6.0.

7.0 QUALITY ASSURANCE PROGRAM

The meteorological monitoring system at CNS will be required to conform to the Quality Assurance (QA) requirements set down in NRC Regulation 10 CFR 50, Appendix B. The monitoring system must be audited by a qualified QA organization to evaluate program quality and integrity and to assess the precision and accuracy of the instrumentation.

In summary, an operational program review must be carried out twice yearly as follows:

1. Review of expertise and level of training of personnel performing the field operations and instrument maintenance;
2. Documentation of timely and pertinent traceability of:
   a. Calibration instruments to National Bureau of Standards;
   b. Material standards to National Bureau of Standards;
3. The existence, pertinence, and use of:
   a. Written calibration procedures;
   b. Fully documented calibration records including graphs, tables, copies of traceability certificates, narrative of calibration activity;
4. Procedures followed to maintain the integrity of the sensors:
   a. History and degree of control;
   b. Design or practices that minimize or eliminate sensor interference;
   c. Mechanical integrity of the sensors;
5. Existence of operator's manuals, procedures, and recorded forms; and
6. Documentation of location of instrument as a function of time by make, model number, and serial number.

Audits of the instrument calibration, accuracy, and precision are performed on a scheduled basis.

APPENDIX A

VERIFICATION OF SYSTEM ACCURACY

This appendix describes the planned procedures for verification of system accuracy during calibration activities.

WIND SPEED

The system accuracy check for the wind speed parameter is performed by verifying that the sensor is functioning correctly and by observing the recording system's response to simulated sensor signals. The sensor cups are examined for physical damage or geometric change, which would affect accurate response. The sensor bearing quality is measured with a torque instrument to assure that the threshold is within vendor specifications. The sensor output is observed with an oscilloscope for evidence of a clean, square-wave output to verify proper functioning of the photo-chopper circuitry. Then system accuracy and linearity are measured by inserting several precisely known frequencies into the signal conditioner sensor input. Input frequencies are equivalent to 0, 10, 30, 50, and 100 mph. The system is considered to be operating properly if analog and digital recorder indications are within ±0.5 mph for the critical wind speeds 30 mph and below.

WIND DIRECTION

The system accuracy check of the wind direction parameter is performed with the sensor installed in its operating position by siting the vane on a precisely surveyed azimuth marker. A total of four check points are

achieved by selectively rotating the sensor clockwise or counter-clockwise prior to taking the reading and by siting both the point and tail of the vane toward the marker. This procedure also ensures that at least one measurement is made in the electronically generated range of 360° through 540°. Linearity of the entire sensor range is verified by mounting the sensor in a test fixture that verifies system linearity at 30° azimuth intervals over the entire recording range. The system acceptance criterion is recorder indications of ±5° of target values generated in the above test. In addition, bearing quality is checked with a torque instrument, and degradation of the sensor potentiometer is checked by rotating the sensor shaft and observing a smooth recorder response.

TEMPERATURE

The system accuracy and linearity of the temperature parameter is performed by measuring system response as the sensor is equilibrated in each of three temperature baths over the range of 0°C to 30°C. Bath temperature is measured precisely with an NBS-traceable device with a resolution of 0.1°C. The system calibration acceptance criterion is recorder indications within ±0.5°C of target temperatures.

DELTA TEMPERATURE

The system accuracy verification of the delta temperature parameter is performed by a technique similar to that for temperature. A zero delta temperature indication is verified by inserting both upper and lower sensors in each of three baths over the range of 0°C to 30°C. At each of these

points, positive and negative delta temperatures are simulated through the use of both pairs with a nominal temperature difference of 3°C to 5°C. Actual bath temperatures are monitored with NBS-traceable thermometers with a resolution of 0.1°C. The system calibration acceptance criterion is recorder indications within ±0.15°C of target test values.

DEW POINT

System accuracy of the dew point parameter is verified by two methods. Comparisons of recorder indications and Assman psychrometer observations at the monitoring level serve to document accurate operational performance. Sensor linearity is verified by a series of sensor bath checks (similar to those for temperature) in the range of 0°C to 50°C. Equivalent dew points are calculated from a vendor supplied curve of bobbin temperature versus dew point temperature. The system calibration acceptance criterion is recorder indications within ±1.5°C of calculated target values.

PRECIPITATION

System accuracy of the precipitation parameter is verified by pouring a volume of water equivalent to 2 inches of precipitation (in 0.5-inch increments) through the sensor at a rate that does not exceed 4 inches per hour. The recording system must agree with the equivalent rainfall within ±10 percent.