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August 10, 1982

Director of Nuclear Reactor Regulation
United States Nuclear Regulatory Commission
Attn: Mr. Steven A. Varga, Chief
Operating Reactors Branch No. 1
Division of Licensing
Washington, DC 20555

Refenence: Beaver Valley Power Station, Unit No. 1
Docket No. 50-334, License No. DPR-66
NUREG-0654, Appendix No. 2, Revision 1

Gentlemen:

In accordance with Regulatory Guide 1.23 and NUREG 0654, please find attached a document for NRC review which describes the Duquesne Light Company Plan for upgrading the Beaver Valley Power Station meterological system.

In addition based upon our further study of this project and advice from the supplier of our Atmospheric Radioactive Effluent Release Assessment System, (ARERAS) we have decided to modify our field testing program currently scheduled for late August or September, 1982. We now plan to use Tethersonde equipment in lieu of actions 1 and 2 as identified in our July 2, 1981 letter. The field testing program is designed to provide information which is needed to determine valley flow conditions and enable development of site specific aspects of the (ARERAS) atmospheric dispersion model. Based upon the site specific information which will be utilized by the ARERAS system and the protective actions described in our Emergency Preparedness Plan, we do not believe that a second permanent meteorological tower as described in action 3 of our July 2, 1981 letter is necessary. The tethersonde testing to be conducted in early fall 1982, will identify the need for any supplemetal towers.

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Duquesne Light Company has developed an Emergency Preparedness Plan Procedure 2.6-1 which compensates for uncertainties connected with our 35 foot height sensors on the meteorological tower due to terrain and also we now utilize a desk top computer to aid Environmental Assessment and Dose Projection personnel. Through the use of this new procedure and the desk top computer, we believe that we have satisfied the intent of Action 4 of our July 2, 1981 letter. Because the use of a desk top computer provides a satisfactory way to perform dose assessment calculations, we do not plan to pursue development of a manual Class A model on the ND 6650.

In order to meet our current implementation schedule and our previously committed date for upgrading the meteorological system, we request a response within 30 days of your receipt of this letter. If no response is received, we will proceed with installing and implementing the ARERAS system. Should you have any questions regarding this subject, please contact my office.

J J Carey

J. J. Carey
Vice President, Nuclear

cc: United States Nuclear Regulatory Commission
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CONFORMANCE OF THE BEAVER VALLEY POWER STATION (BVPS) WITH NUREG-0654

1.0 INTRODUCTION

This document describes the equipment, procedures and capabilities planned for implementation at the BVPS to conform with the requirements of NUREG-0654, Appendix 2. The major components of this capability include the 500 ft. meteorological tower and the Atmospheric Radioactive Effluent Release Assessment System (ARERAS). A field program to measure meteorological parameters is planned to enable development of site specific aspects of the ARERAS atmospheric dispersion model.

2.0 DESCRIPTION OF THE SHIPPINGPORT AND BEAVER VALLEY SITE

The Shippingport Atomic Power Station and the Beaver Valley Power Station are located on the south bank of the Ohio River in the Borough of Shippingport, Beaver County, Pennsylvania, on a 486.8 acre tract of land which is owned by the Duquesne Light Company. The site is approximately one mile from Midland, Pennsylvania; 5 miles from East Liverpool, Ohio; and 25 miles from Pittsburgh, Pennsylvania. Population density in the immediate vicinity of the site is relatively low. There are no residents within a 1/2 mile radius of either plant. The population within a 5 mile radius of the plant is approximately 18,000 and the only area within that radius of concentrated population is the Borough of Midland, Pennsylvania, with a population of approximately 4,300.

The site lies in a valley along the Ohio River. It extends from the river (elevation 665 feet above sea level) to a ridge along the border south of the Shippingport and Beaver Valley Power Stations at an elevation of 1,160 feet. Plant ground level at both stations is approximately 735 feet above sea level.

The two (2) stations are situated on the Ohio River at river mile 34.8, at a location on the New Cumberland Pool that is 3.3 river miles downstream from Montgomery Lock and Dam, and 19.4 miles upstream from New Cumberland Lock and Dam. The Pennsylvania-Ohio-West Virginia border is located 5.2 river miles downstream from the site. The river flow is regulated by a series of dams and reservoirs on the Beaver, Allegheny, Monongahela and Ohio Rivers and their tributaries. Flow ranges from a minimum of 5,000 cubic feet per second (CFS) to a maximum of 100,000 CFS. The mean annual flow is approximately 25,000 CFS.

Water temperature of the Ohio River varies from 32°F to 84°F, the minimum temperatures occur in January and/or February and maximum temperatures in July and August. Water quality in the Ohio River at the site location is affected primarily by the water quality of the Allegheny, Monongahela, and Beaver rivers.

The climate of the area may be classified as humid continental. Annual precip:tation is approximately 33 inches, typical yearly temperatures vary from approximately -3 F to 95 F with an annual average temperature of 52.8 F. The predominant wind direction is typically from the southwest in summer and from the northwest in winter.

3.0 TOWER DESCRIPTION

On site primary instrumentation for the 500 ft. guyed tower includes:

1. Wind Instrumentation: Climate wind direction and speed sensors at the 35 ft., 150 ft. and 500 ft. levels.
2. Temperature Instrumentation:
   a. Rosemont RTB's at the 35 ft., 150 ft., and 500 ft. levels
   b. Endevco signal conditioners
   c. Geotech aspirated solar radiation shields to house the RTB's at the 35 ft. 150 ft. levels.
3. Dew Point Instrumentation: One Cambridge System dew point measuring unit at the 35 ft. level.
4. Precipitation Instrumentation: One Belfort tipping bucket rain guage at the surface near the tower, located approximately 20 ft. west of the tower.

The 500 ft. guyed tower also has alternate instrumentation which includes:

1. Wind Instrumentation: Teledyne Geotech wind speed and wind direction sensors at the 35 ft., 150 ft. and 500 ft. levels
2. Temperature Instrumentation:
   a. Teledyne Geotech RTB's at the 35 ft., 150 ft. and 500 ft. levels
   b. Teledyne Geotech R/ T signal conditioner and processor
   c. Teledyne Geotech aspirated radiation shields to house the RTB's at the 35 ft., 150 ft. and 500 ft. levels.

There are two meteorological shelters housing the signal conditioning equipment. One is located approximately 10 ft. east of the tower and the other is approximately 40 ft. southwest of the tower. The remote metering instrumentation for the ARERAS system shall be located in these shelters.

On site alternate power source includes:

a. Kohler Co. 30KW Fast Response Generator set
b. Kohler Co. weather housing for the generator set
c. Diesel fuel tank with 100 gallon capacity
d. Kohler Automatic Transfer Switch (located in shelter #2)

4.0 ARERAS DESCRIPTION

The ARERAS system is designed to provide a full spectrum of meteorological and radiological functions for both routine and accident conditions as discussed below.

4.1 Hardware

The system utilizes a dual CPU 32-bit word virtual memory computer with redundant disc drives for each CPU to assure reliability. The system receives analog or digital information in real-time from the redundant sensors at each level on the meteorological tower, from plant vent effluent monitors and from the 16 offsite radiation monitors. Communication of information to and from the computer locally is via color graphics terminals located in the control room, the EOF and the TSC. Remote interrogation capabilities are also provided via phone line.

4.2 Software

The software package provided in ARERAS is designed to collect, check, process and store data received via the I/O devices. Data can also be entered manually, or recalled from historical data files. This information is used to calculate atmospheric dispersion and radiation doses on a near-real-time basis. Contingency assessments may be performed when the user provides input of (1) the type of accident, (2) the extent of fuel damage, and (3) the rate of release to the environment. Both dose rates and projections are displayed from which determination of appropriate emergency actions can be made.

Both Class A and Class B atmospheric dispersion models are included in ARERAS in conformance with NUREG-0654, Appendix 2. These models are discussed in the following two subsections.

4.2.1 Class A Dispersion Model for Accidents

The Class A model is incorporated in a quick running routine that computes both dispersion and doses using the straightline Gaussian dispersion model. Its principal utility is for use in the control room to rapidly determine the initial response based on dose estimates at or near the site boundary. The Class B model (described below) would be used thereafter to provide more detailed plume information for greater distances where the valley can have a significant impact.

The Class A model incorporates the ability to (1) use data from different selected levels on the tower, (2) treat building wake, (3) allow for jet plume rise, (4) compute site boundary or peak offsite concentration and, (5) factor terrain height into elevated plume calculations. This model is applicable to the expected range of meteorological conditions and meets the NUREG-0654 requirements for situations when this type of model is applicable.

Output is of three basic types. First, isopleths of X/Q, dose rates or integrated doses superimposed on site maps can be plotted. Peak doses and other results of interest are displayed at the same time. Projected dose versus distance curves are also plotted with printed values of time-of arrival and time-to-PAG's (Protective Action Guidelines). The third type of output is in tabular form for any of the above displays for use by NRC or others who do not have graphics terminals.

4.2.2 Class B Dispersion Model for Accidents

The Class B dispersion model has greater capabilities compared with the Class A model because it must account for the effect of the valley on the dispersion. A time-dependent particle tracking scheme is included with flow conditions estimated using a modified potential flow solution. The Class B model will also have the ability to use data from different levels on the tower, to treat building wake, to allow for jet plume rise, compute site boundary and peak concentrations, to factor in terrain effects; and to present dose assessments in various output formats.

The model inputs will include meteorological data from one or more levels on the site tower along with the radioactive effluent data. A field test is planned to provide site-specific information necessary to "tune" the model.

The model is designed to be applicable for the expected range of meteorological conditions including both high wind speed unstable cases as well as the low wind speed, stable conditions that are difficult to model.

4.2.2.1 Real-Time MPF-TD Model

The Modified Potential Flow-Turbulent Diffusion (MPF-TD) model being adapted to the ARERAS computer was originally developed on a large CDC computer and has been modified to accomplish the following:

1. Incorporate wind direction shear and the effects of complex terrain into the flow and dispersion calculations.
2. Incorporate radiation dosimetry models (including finite plume shine dose) to estimate the dose rates and projected doses at any location.
3. Operate in near real-time on a smaller computer.

In the MPF-TD algorithm, the calculation of the flow field (MPF) and turbulent dispersion (TD) within this flow field are uncoupled. Therefore, the MPF model was modified to simulate flow in terrain and in opposing shear layers above terrain and the TD model was modified independently to accomodate the resulting complex flow field. The original gradient transport advection-diffusion algorithm was replaced with a model which utilizes particle tracking to determine the concentration field. This was done because the complex terrain-wind shear velocity field in the advection-diffusion equation has a significant impact on computation time.

The flow and concentrations fields can be computed as often as every 15-minutes based on wind velocity and turbulence measurements from the meteorological tower. Forecast data can also be used. A pseudo-steady state approach is used to calculate the time-dependent concentration field. A steady state solution of the modified potential flow equations allows calculation of a continuous, mass consistent velocity field for each 15 minute period. A transient solution to the turbulent diffusion model is then obtained using the time-varying velocity fields and time-varying contaminant source data.

After using the input wind directions to compute the wind field, an empirically derived correction algorithm (based upon analysis of existing historical data with recognition of sampling representativeness) would be applied to correct the wind field calculations as appropriate.

4.2.2.2 Real-Time Dispersion and Dose Models

The dispersion formulation involves a point-tracking technique. Particles are moved from the source using the mean wind plus a random component of motion linked to the turbulence. A point-tracking approach eliminates the numerical dispersion effects associated with numerical solutions of the advection-diffusion equation. These effects can become severe in the presence of vertical shear in the mean wind direction. The random components will have a standard deviation equal to the measured standard deviation of the winds or as estimated from boundary layer theory.

There are two time scales controlling the calculations; the dispersion time step and a longer dose time step. Within a dispersion time step, particles are moved and dispersed. Then the concentration field, including adjustments for depletion due to wet and dry deposition is calculated.

The large dose time steps are used to define the time scale when doses are calculated. The program loops through the isotopes and decays the concentrations according to the time elapsed since the particles were released and then calculates the doses. These doses are then stored in an array for output at desired time intervals. The dose time steps are planned to be 15 minutes; meteorology and the flow field calculation can be updated if necessary at each dose time step.

5.0 FIELD TESTS

A study of previous field tests results and summaries of available data was made to understand flow remigmes in the valley. Based on this information, site-specific algorithms would be developed for use in the MPF-TD model. One investigation concluded that although the 500 ft. tower provided an excellent characterization of valley conditions with height, additional measurements were needed to understand the nearby flow conditions. Measurements are needed through the depth of the valley at two additional locations. After evaluation of several altenatives, it was decided that the desired information could be obtained using tethersonde equipment.

This method has the advantages of mobility, ease of use and can sample wind speed, direction and temperature conditions through the valley depth. Us^ ^f two such devices simultaneously along with weather tower information would enable a b_ .ter understanding of flow conditions for use in the model.

The field test would target conditions considered most difficult to model (i.e., the low wind speed, stable cases). The test objectives would be to measure at least five such conditions over a two week period in late summer and early fall.

Use of low level temporary towers was considered to be of little value since they would measure low level drainage winds which do not represent conditions at higher levels where accident releases are more likely to occur. Measurements on the tower show decoupled conditions between the 35 ft. and 150 ft. levels.