Docket Nos.: 50-440
and 50-441

AUG 22 1984

Mr. Murray R. Edelman
Vice President - Nuclear Group
The Cleveland Electric Illuminating Company
P. O. Box 5000
Cleveland, Ohio 44101

Dear Mr. Edelman:

Subject: NRC Contractor Evaluation Findings of Use of Meteorology in Emergency Response at Perry Nuclear Power Plant (Units 1 and 2)

Enclosed are comments made by Dr. Isaac Vander Hoven of the National Oceanic and Atmospheric Administration (NOAA) concerning the emergency meteorological capabilities of the Perry plant. Dr. Vander Hoven is a consultant to the NRC staff and was requested to review the meteorological aspects of the report entitled, "Description of the Perry Nuclear Power Plant Emergency Offsite Dose Calculations" (NUS-4336 dated April 1983), prepared by NUS Corporation for Cleveland Electric.

It is requested that you review Dr. Vander Hoven's comments (see pp. 6 and 7 of the enclosure for his conclusions) and advise the Project Manager when we may expect to receive your response, within 7 days after receipt of this letter.

Sincerely,

/S/

B. J. Youngblood, Chief
Licensing Branch No. 1
Division of Licensing

Enclosure:
As stated

cc: See next page

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NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

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Comments on the Report

"Description of the Perry Nuclear Power Plant
Emergency Offsite Dose Calculations"
NUS Corporation Report No. NUS-4336
M.J. Wilkinson, A.E. Mitchell, L.A. Friedman
April 1983
NRC Docket Nos. 50-440 and 50-441

These comments are made by Dr. Isaac Van der Hoven of the National Oceanic and Atmospheric Administration (NOAA) in an assessment of the emergency meteorological capabilities at the Perry Nuclear Power Plant. This is in partial response to Task Order No. 3 of the Interagency Agreement No. NRC-03-81-099 between the NRC and NOAA under FIN No. B-7527.

The Perry Nuclear Power Plant site is along the southern shore of Lake Erie approximately 35 miles north of Cleveland, Ohio. Except for 45-ft bluffs at the shoreline, the local relief of the area is characterized by fairly flat terrain with cultivated farm lands interspersed with wooded lots. As of 1970, the population distribution around the plant was about 200 people within the first mile, 7,700 within the first 5 miles and a total of 68,000 within the first 10 miles of which 70 percent lived along the coastline in the WSW-SW and ENE-E sectors.

The applicant has described a "sophisticated" dose assessment model, identified by the acronym EMERGE which "incorporates a three-dimensional Gaussian, variable trajectory, split sigma, puff dispersion model". A three-dimensional Gaussian model should be capable of computing effluent concentrations for any point in an x, y, z grid. During emergency situations, however, the primary interest is surface, centerline (x, y, z = x, o, o) concentrations. The "variable trajectory" (or transport) portion of the model can utilize a network of measured winds such as those described by L.L. Wendell (1972) to describe the wind field in the area of interest, i.e., tre plume exposure EPZ. The split-sigma portion of the EMERGE model allows for separate categorization schemes for the calculation of sigma x, sigma y, and sigma z. The "puff dispersion model" determines individual puff trajectories, and measured wind fields provide the best representation of local airflow patterns (see Start and Wendell, 1974).

Apparently the applicant intends to determine an initial source term by the identification of the accident type. In addition to information about the source term, the release mode (e.g., ground level or elevated) and release characteristics (e.g., dry or wet, buoyant, or non-buoyant, continuous or puff) need to be specified to select the appropriate atmospheric dispersion model.

The principal source of meteorological information for the Perry site is an instrumented tower located about 6000 feet from the shoreline and about 4500 feet from the nearest reactor containment building. This location satisfies the recommendation of Raynor et al. (1979) that the primary tower should be in such a location that the upper measuring level is always within the internal boundary layer of a coastal site.

The applicant identifies a list of 10 "potential manual backup offsite meterological data sources" (table 7-9). The nearest such site is 27 km to the southwest. The applicant has not indicated the availability of these data in an emergency situation, whether data are available on an around-the-clock basis, or how the data will be communicated to the emergency repsonse and operation facilities. Also of concern is the quality of the additional data.

One of the described purposes of EMERGE is "to simulate the coastal meteorology of the Perry Nuclear Power Plant" by incorporating "a three-dimensional, Gaussian, split-sigma, variable trajectory, puff dispersion model." The only available, real-time meteorological measurements seem to come from the onsite meteorological tower. How is a regional wind field developed from a single wind-measuring point when winds will be varying in both time and space? The list of backup, off-site, manual wind measurement locations does not identify any source of real-time, high quality data. A number of very important questions remain unanswered. For example, how, in real time, are "local climatological effects on the trajectories such as seasonal, diurnal, and terrain-induced flow" included? Also, how will "the lake breeze phenomenon, part of the terrain-induced flows, be based on the literature and regional Great Lake data"? How can "the model produce an analysis of plume location as it varies with time and space"? Is this done from the measurements on a single 60 m tower?

The report states (p 7-27) that "specific algorithms in the dispersion model programming will define the existence of a lake breeze condition, determine the location of a lake breeze front and its movement with time, and take into account the effects of the thermal internal boundary layer and the return flow circulation." How does "the overall dispersion model result in a three-dimensional wind field which accurately accounts for varying terrain, varying atmospheric stability and other Lake Erie influences"? Although the report cites numerous references, no specific algorithms are cited, nor is it stated where the measured meterological input parameters are to be obtained on a real-time basis.

Several empirical expressions for the growth of the height of the internal boundary layer (Prophet, 1961, Raynor et al., 1974 and Venkatram, 1976) are cited in existing literature, and these can be used as bases for sea/lake breeze dispersion algorithms. The input parameters for these expressions include the following quantities: 1) wind speed at the shoreline, 2) friction velocity over downwind surfaces, 3) land temperature, 4) water temperature, 5) downwind distance, and 6) temperature lapse rate over water. Use of such "specific algorithms" to describe the lake breeze effect, appears to require more than the meteorological data from a single tower at a distance of 6000 feet from the shore.

The report states that "the stability array is used to adjust the initial wind flow field for effects of terrain". It goes on to say that "this is accomplished by varying the transparencies (measure of flow resistance) of the horizontal and vertical cell faces as a function of atmospheric stability." Terrain in the area is apparently relatively flat (Environmental Report of the Perry Nuclear Power Plant), and the reference to transparency is puzzling as is the basis for assigning numerical horizontal and vertical transparency values as a function of the Pasquill stability. An "overrelaxation factor" (which varies from 1.0 to 2.0 and in this instance was set to 1.25) is introduced; however, the meaning of the term is not clear nor is it clear on what type of measured data does it depend. Also confusing is the reference to "the resulting set of three-dimensional wind vectors agrees with wind measurements and reflects the influence of both terrain features and spatially varying stability". As described earlier, the only wind measurements available within about 20 km are the 10 and 60 m horizontal wind speed and direction on the meterological tower, which is about 6000 feet from the shoreline. In the case of a lake/land breeze, the applicant's model defines a wind field divided into eight regimes as shown in Fig. 3.2-2. These eight wind regimes appear to be based only on data from the single onsite tower. Regime D describes a return flow eventually subsiding toward the lake and becoming re-entrained into the inflow "usually at some distance up or down the coast from its original point over the plant". This type of helical circulation has also been described by Lyons (1975). However, in both cases, no algorithms are presented which would describe this complex, three-dimensional wind field on a real time basis.

An important consideration in using off-site dose readings from mobile or fixed monitors to determine the source term is the location of the readings from the plume centerline. Equally important is the averaging time of the reading. From the text in section 2.8 (pages 2-6 and 2-7), these problems do not seem to be addressed.

The following conclusions are made with regard to the meteorological aspects of emergency offsite dose calculations for the Perry Nuclear Power Plant:

1) It is not apparent how the applicant proposes to handle the measurement of a spatially variable, three-dimensional trajectory on a real-time basis in view of the fact that the only wind data available are the horizontal wind speed and direction at the 10 and 60 m levels of the onsite meteorological tower. No other wind measurement sites within the Emergency Protection Zone (a circle of 10 mile radius) are listed as being available.

2) Although the extensive use of site-specific algorithms are mentioned as input to EMERGE, none are specifically described or justified.

The following recommendations are made:

1) The report should be expanded to include a full description and justification of the meteorological algorithms in EMERGE, especially with regard to the various meteorological measurements that are utilized.

2) Supplemental measurement capability should be considered in order to provide real-time input to the various meteorological algorithms used in EMERGE.

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