UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

27 JAN 1981

SUBJECT: Model Clearinghouse Determination - Long Distance Terrain Impacts

FROM: Raymond Werner, Chief
Impact Assessment Section

TO: Joseph Tikvart
Monitoring and Data Analysis Division

William S. Baker, Chief
Air Programs Branch

Attached for your review are several issues that require a determination through the model clearinghouse mechanism. We have reviewed these issues and made a series of determinations regarding the impact of two large power plants on Long Island upon the air quality of Connecticut. Since the methodology we used, and propose to use in future determinations, is either not addressed clearly in the Guidelines for Air Quality Modeling or is at variance with the procedures recommended in the Guidelines, a determination of appropriate modeling techniques is required. The opinion of the air quality impact specialists in Region II is that the Guidelines did not envision this unique diffusion modeling case involving Connecticut and hence is deficient. We believe that the Region II conclusions are based upon sound and well documented dispersion theory.

Background

The Long Island Lighting Co. operates two power plants on the north shore of Long Island (see attached map). As described in the attached Federal Register notice (45 FR 59832, July 31, 1980), Region II proposed to continue to allow the use of high sulfur oil (2.8%) for three years at these facilities. Such fuel had been burned for the previous five years without an observed violation of the sulfur oxide standards in Connecticut or Long Island. Air quality data included that from a special monitoring network established to detect the maximum impacts of these facilities.

Particulates are not a major modeling issue since both plants are required to operate high efficiency electrostatic precipitators to remove particulates. In addition, since the emissions are part of the baseline, the plant's impacts are not affected by PSD increment limitations; although the amount of degradation caused by the plants may limit growth potential available to other sources.

EPA's proposed approval was based upon an air quality model which meets all of the requirements outlined in a memo dated August 17, 1980 from Dave Hawkins, Assistant Administrator for Air, Noise and Radiation. This analysis relied upon the CRSTER

EPA Form 1320-6 (Rev. 3-76)

model, employed five years of NWS meteorological data, assumed good engineering practice stack height, used a refined receptor grid, considered various operating load conditions and relied on meteorological data which contained "A" stability. The model accounted for terrain up to the physical stack height. The analysis is described in the previously referenced Federal Register notice dated July 31, 1980.

On August 28, 1980 the State of Connecticut petitioned the Administrator pursuant to Section 126 of the Clean Air Act, Interstate Impacts, alleging that the continued use of high sulfur oil caused violations of the sulfur oxide ambient air quality standard and exacerbated existing violations of the particulate ambient air quality standard. This was based upon an analysis conducted by Connecticut using the Valley model.

On December 3 and 4, 1980 the Region II office convened a public hearing to consider these arguments. Attached for your information are relevent portions of the testimony and the Federal Register notice (45 FR 72707, November 3, 1980) describing the purpose of the hearing.

Basically, the issue is whether the Valley model is the most appropriate technique for estimating the impact of the Long Island power plants upon rolling terrain over 35 kilometers away in Connecticut.

We request that you respond to recommendations of the Region II staff in this regard on a point-by-point basis. Incidently, it is explicitly understood that your response is applicable only to this situation and not in general, and that acceptance of any one hypothesis does not constitute endorsement of all the arguments advanced. The recommendations are as follows:

Hypothesis 1. The use of the EPA Valley model is not appropriate for estimating the air quality impact upon gradually rising and rolling terrain of Southern New England from two large power plants located at distances greater than 35 kilometers from those features.

° The Valley model is an untested and unvalidated model for this situation. Therefore, it enjoys no advantage over other EPA models which are similarly unvalidated. Appropriateness should be determined in this case upon the basis of theory and established meteorological principals.

1. The Valley model was developed and validated for situations in which sources impact rugged terrain which primarily consists of steep cliffs and bluffs.

2. Valley has not been validated at distances beyond 25 kilometers, (as opposed to the limiting case of 47 kilometers when Valley is applied to Connecticut).

3. Valley has not been validated for the unique situation in which the plume transects a land/sea interface, crosses greater than 15 kilometers of open water, transects another land/sea interface and travels a greater distance inland over rolling and gradually rising terrain before it impacts a terrain feature as high as the physical stack height.

- A model which relies upon assumed meteorology is less desirable and justified when representative meteorological data is available.

- A column of air which travels over 25 to 30 kilometers of flat surface will most likely be characterized by a wind profile in which wind speed increases with height. The Valley model does not provide for this.

- The terrain encountered by the plume is neither rugged nor as high as the plume. The nearest terrain as high as the stacks (600 feet) is at a distance of 35 kilometers from the sources. These features are not numerous, are isolated and do not protrude dramatically above the surrounding landscape. The highest feature within 50 kilometers of the power plants is 980 feet at a distance of 47 kilometers and this is less than the plume height which is 1100 feet.

- The assumed wind speed of Valley (2.5 meters/sec) would entail a 5 1/2 hour travel time between the source and the receptor. For a 6 hour impact interval to occur, synoptic scale (50 Km) wind speeds, direction, and stability would have to persist for almost twelve hours. This is a very unlikely climatological event in this location.

Hypothesis 2. In this particular instance it is appropriate to ignore terrain features in estimating the air quality impact upon Connecticut.

- As articulated in the discussion of hypothesis 1, terrain features within 50 kilometers of the power plants are not major or numerous.

- In this instance there are no EPA models which appear to be appropriate to calculate terrain impacts at the long distances involved. The Guideline acknowledges that at the approximate distance of the "controlling" terrain feature (47 kilometers) no guideline model can predict with confidence.

- At the long distances involved, the Guideline models will systematically overpredict due to the assumptions inherent in their use. It is unreasonable, therefore, to compound this tendency by including an additional factor which increases predicted concentrations. The assumptions which may contribute to overprediction are as follows:

  1. Wind speeds, directions, and atmospheric stability will not vary on a synoptic scale for extended periods of time. Although never a comfortable assumption, it is particularly inappropriate for this location. In particular, the climatological data does not support an assumption of persistent southeast winds.

  2. Horizontal wind shear is non-existent.

  3. Plume depletion processes are non-existent.

  4. Plume rise is not enhanced in a multiple stack situation.

  5. Enhanced dispersion due to plume rise, surface roughness and terrain are not considered.

- The Guideline does not require that terrain of this kind and at this distance be considered. While on its face the Guideline appears to require these considerations, it was never envisioned that terrain conditions such as those in this situation should require special treatment. The de facto guideline in use in EPA today and which, I believe, is comprised of the consensus and deliberate judgment of meteorologists who implement it, would not require this type of terrain to be considered. Many EPA models in widespread use, such as RAM, CDM, and others, could never be used in all but a few areas of the North American continent if every rise above stack base within 50 kilometers had to be considered, no matter how slight. The fact that these models are in widespread use suggests that the users do not consider this type of terrain is important enough to be considered. Again, the purpose of this example is not to suggest that an abuse of the Guideline be perpetuated, rather that the guideline never meant, based upon common agreement, that this type of terrain be specially treated.

Hypothesis 3A. Given that the second hypothesis cannot be supported, EPA's CRSTER model with terrain corrections up to stack height should be approved for use.

- CRSTER is an EPA recommended model.

- Very few terrain features exceed the physical stack height and these are at distances in excess of 35 kilometers.

- CRSTER in this instance is sufficiently conservative, as discussed in the second hypothesis, to more than adequately provide a margin of safety.

- CRSTER takes advantages of real meteorological data.

Hypothesis 3B. Given that the second hypothesis cannot be supported, EPA's Complex I or II model should be used.

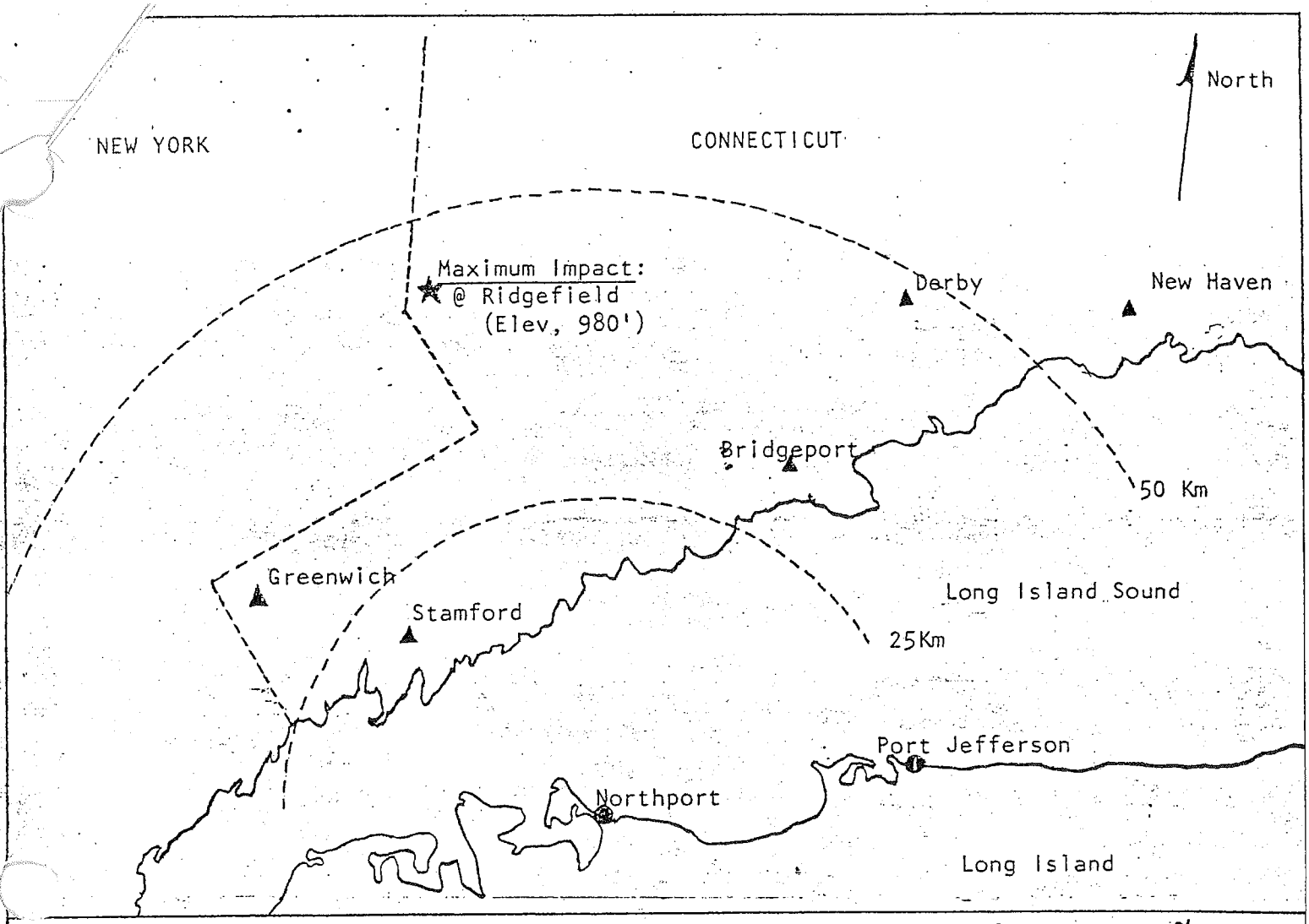
- The model was proposed for use by the EPA working group on complex terrain.

- Complex I and II take advantage of real meteorological data.

There are several additional thoughts on this matter. Primarily, any decision should be carefully justified since it is likely that a decision may have to be defended in court. The utility stands to lose 80 million dollars a year in fuel costs while Connecticut sincerely believes it is unduly impacted by upwind sources. In addition, in order to avoid litigious complications, we should receive your decision no later than February 13, 1981. We request that, as you finish addressing each of the four hypotheses you transmit your decision to us without waiting until all four are resolved. This information would allow us to proceed on our investigation of interstate impacts without having to wait, for example, on one particular difficult determination. Finally, we will maintain a close contact with you and your staff to provide you with additional material or explanations as necessary.

Attachments

cc: L. Wegman, A-133
L. Carouthers, 1DRA
J. Geiselman, 2AIR
H. Laing, EPA, Region I
V. Descamps, EPA, Region I
L. Standler, OAQPS
D. Wilson, MDAD



Scale: One inch ≅ 13.3 Km

Emission Data

	Stack Height (meters)	Emission Rate (grams/sec)	
NORTHPORT	183.3	1364.56	
"	183.3	1364.56	
	183.3*	1364.56	
	183.3*	365.10	*G.E.P. Height = 148.1 m
PORT JEFFERSON	91.44	143	
	129.54	706	
	129.54	706	