State of North Carolina
Department of Natural Resources and Community Development
Division of Environmental Management
512 North Salisbury Street • Raleigh, North Carolina 27611

James G. Martin, Governor
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Air Quality Section

R. Paul Wilms
Director

April 3, 1987

Mr. Bruce Miller, Chief
Air Programs Branch
US EPA, Region IV
345 Courtland Street
Atlanta, GA 30365

Subject: Dispersion Modeling
UNAMAP VI
Building Wake Effects

Dear Mr. Miller:

Per our recent conversation, EPA modeling guidelines state that a GEP analysis should be performed for "... those major sources with known or suspected downwash problems ...". Since GEP for a single story building is approximately 45 feet (18 x 2.5 = 45), all sources with stack heights less than 50 feet should be suspected to experience downwash. Therefore, according to EPA guidance, all modeling analyses submitted to a review agency should include downwash for all sources having stack heights less than 50 feet.

A modeling analysis was performed to determine the ramifications of this EPA guideline. The NC-DEM randomly selected several small sources with stack heights less than 50 feet. The sources selected were small oil-fired boilers with heat input rates in the range from 20 to 120 million BTU/hr (a 10 million BTU/hr boiler has an allowable emission rate greater than 100 tons/year). There are hundreds of such boilers in North Carolina.

The boilers were all modelled with the ISCST dispersion model incorporating one year of meteorological data from a North Carolina NWS station (Charlotte 1976 surface data and Greensboro 1976 upper air data). The model inputs are shown in Table 1; where building dimensions were not known a 15'x65'x65' building was assumed. Since many companies with small boilers have little property, receptors were placed at 50, 100, 200, and 300 meters along 36 arcs (every 10 degrees between 0 and 360 degrees).

Modeling results are shown in Table 2(see attachment for printout). Fourteen out of the twenty-one sources modeled, showed violations of the 24-hour SO_2 NAAQS. Many of the predicted concentrations seem unrealistically high (i.e. 24-hour concentrations exceeding 1000 ug/m3).

The results of the modeling analysis, raises many questions concerning the modeling of small sources with downwash. If EPA contends that these sources should be modeled with downwash, then there could be modeled violations across the entire state. For example, all asphalt plants could show modeled violations. These modeled violations could potentially prohibit new sources from locating in North Carolina and prohibit any existing sources from expanding. The economic impact could be extraordinary. We also perceive that this problem is not exclusively a North Carolina problem. The type of small industry existing in North Carolina is obviously similar to many other states and it is expected that these other states should experience the same problem.

We therefore request that EPA address the following questions:

1. Should all such sources which may experience downwash, be modeled utilizing the downwash algorithm?
2. Is it necessary to perform downwash analysis on such off-site sources when evaluating the impact of another source?
3. If downwash is required, how should the states address the expected Region-wide impact?
4. What experience with this problem has been noted by EPA during PSD reviews in Region IV?

Your most prompt response is required since many current permit applications are contingent upon an answer to these questions. If you have any questions please call me at (919)733-3340.

Very truly yours,

N.O. Gerald, P.E.
Chief

NOG:wmc

cc: R. Paul Wilms
L. P. Benton
Bob Collum
Kevin Eldridge
Mike Sewell w/o attachment

TABLE 1. MODEL INPUTS

Source #/ Heat Input (MMBTU/H)	Stack Height (M)	Temp. (°K)	Exit Vel. (M/S)	Diam. Diam. (M)	Emiss. Rate (G/S)	Bldg. Dim. H (M)	W (M)	L (M)
3/20	4.9	455	5.0	0.60	3.42	4.6	20.0	20.0
11/25	8.5	383	8.3	0.80	7.25	4.6	20.0	20.0
12/NA	5.9	450	2.6	0.80	3.31	4.6	20.0	20.0
13/NA	9.2	533	5.6	0.80	4.01	8.5	8.5	8.5
14/NA	10.7	533	9.9	1.10	13.74	8.5	8.5	8.5
16/37	9.1	450	15.6	0.60	10.72	4.6	20.0	20.0
17/33	7.6	477	25.6	0.80	9.62	4.6	20.0	20.0
21/78	13.7	533	6.1	1.20	22.49	4.6	20.0	20.0
22/35	6.1	505	6.6	0.50	10.17	4.6	20.0	20.0
26/NA	9.1	505	7.1	2.10	24.26	4.6	20.0	20.0
29/84	6.1	533	18.4	0.80	24.34	4.6	20.0	20.0
30/30	4.6	533	10.7	0.60	8.69	4.0	20.0	20.0
34/NA	9.2	533	5.6	0.76	4.01	8.5	20.0	20.0
35/NA	10.7	533	9.9	1.10	13.74	8.5	20.0	20.0
42/NA	13.7	561	6.2	1.22	22.08	4.6	20.0	20.0
43/NA	9.2	477	5.9	0.67	3.74	6.1	20.0	20.0
44/75	16.8	533	10.6	1.22	20.50	6.1	20.0	20.0
45/34	16.8	533	19.1	0.61	9.17	6.1	20.0	20.0
101/21	6.1	322	31.6	0.30	6.09	4.6	20.0	20.0
104/12	3.7	450	12.9	0.50	3.48	4.6	20.0	20.0
108/36	9.4	533	4.1	1.50	10.43	4.6	20.0	20.0

NA - NOT AVAILABLE

TABLE 2. MODEL PREDICTED CONCENTRATIONS[a]

Source	HSH 3-hour concentration (ug/m^3)	HSH 24-hour concentration (ug/m3)
3	2148	1145
11	919	425
12	2112	1132
13	1002	526
14	1149	513
16	548	204
17	444	38
21	249	99
22	4035	2107
26	1485	197
29	2563	1121
30	2471	1296
34	1038	547
35	1149	513
42	207	83
43	689	358
44	52	19
45	73	28
101	1931	994
104	1930	953
108	1087	484

A NAAQS 3-hour standard = 1300 ug/m^3

NAAQS 24-hour standard = 365 ug/m^3