PSNH PUBLIC SERVICE
Company of New Hampshire

SEABROOK STATION
Engineering Office:
1671 Worcester Road
Framingham, Massachusetts 01701
(617) - 872 - 8100

November 5, 1982

SBN-353
T.F. B7.1.2

United States Nuclear Regulatory Commission
Washington, D. C. 20555

Attention: Mr. George W. Knighton, Chief
Licensing Branch 3
Division of Licensing

References:
(a) Construction Permits CPPR-135 and CPPR-136, Docket Nos. 50-443 and 50-444
(b) USNRC Letter, dated February 12, 1982, "Request for Additional Information," F. J. Miraglia to W. C. Tallman
(c) PSNH Letter, dated March 12, 1982, "Response to 451 Series RAIs; (Accident Evaluation Branch; Met. Section)," J. DeVincentis to F. J. Miraglia
(d) PSNH Letter, dated July 12, 1982, "Amendment 45 to March 30, 1973, Application to Construct and Operate Seabrook Station Unit 1 and Unit 2; Incorporation of Requests for Additional Information (RAIs)," W. P. Johnson to F. J. Miraglia

Subject: Revised Response to RAI 451.18; (Accident Evaluation Branch; Met. Section)

Dear Sir:

We have enclosed a revised response to the subject Request for Additional Information (RAI) which you forwarded in Reference (b).

The original response to RAI 451.18 was submitted in Reference (c) and was subsequently incorporated into the FSAR [OL Application Amendment 45, Reference (d)].

The revised response to RAI 451.18 will be included in OL Application Amendment 48.

Very truly yours,

YANKEE ATOMIC ELECTRIC COMPANY

David P. Maidrand

J. DeVincentis for
Project Manager

ALL/fsf

B001

451.18 (2.3) (FSAR) The atmospheric transport and diffusion model presented in Section 2.3.5 apparently considers fumigation and trapping of elevated plumes during seabreeze and onshore gradient flow conditions using empirical criteria for the formation and geometry of the thermal internal boundary layer.

a. Provide estimates of seasonal (spring and summer) frequencies of seabreeze conditions at the Seabrook site.

b. Based on the criteria presented on pages 2.3-27 and 2.3-28 of the FSAR concerning formation of the TIBL, provide seasonal (spring and summer) frequencies of TIBL formation.

c. Provide a comparison of the topographic features examined in References 36, 37 and 39 of Section 2.3 of the FSAR for the shape of the TIBL with topographic features at the Seabrook site.

d. Provide the annual frequency of plume intercept with the TIBL for elevated releases from the primary vent stack.

e. For releases from the primary vent stack, provide a comparison of annual average relative concentration (X/Q) and relative deposition (D/Q) calculated considering fumigation and trapping with annual average X/Q and D/Q values calculated without considering fumigation and trapping.

f. Spatial and temporal variations in airflow trajectories, particularly airflow reversals during the onset of the seabreeze and curved trajectories during the decay of the seabreeze, have not been explicitly incorporated into the annual average transport and diffusion model for the Seabrook site. Recent comparisons of the results of variable-trajectory models with the results of the straight-line model at coastal nuclear plants (e.g., Perry and St. Lucie) have indicated that the straight-line model may underpredict X/Q values by factors of two to four. Provide further justification for not modifying the results of the straight-line model to consider spatial and temporal variations in airflow such as would be experienced during the onset and decay of the seabreeze.

RESPONSE: a & b. Estimated frequency of thermal internal boundary layer (TIBL) formation and sea breeze conditions at the Seabrook site for the period April 1979 - September 1979 are provided in Table 451.18-1. As outlined on SB FSAR pages 2.3-27 and 2.3-28, the following criteria were used to determine TIBL formation:

(1) <u>TIBLs Can Occur Only During Spring and Summer</u>

The examination is restricted to those periods when the land-water temperature difference can result in the formation of a TIBL. A sea breeze season extending from April through September is appropriate for the Seabrook site.

(2) TIBLs Can Occur Only During Daytime

The examination is restricted to those times when there is sufficient solar intensity to generate a TIBL. TIBLs were conservatively assumed to occur between 0800 EST and 1800 EST during the seabreeze season.

(3) The Wind Direction Must be Onshore

The overwater fetch must be sufficiently long to stabilize the air mass. Wind trajectories from the northeast clockwise through the south-southeast would have a sufficient overwater fetch to result in a stable air mass moving over the Seabrook site.

(4) The Wind Speed Must be in an Appropriate Range

Too low a wind speed will not support a TIBL. If the wind speed is too great, mechanical turbulence will overcome any thermal effects and a TIBL will not be formed. A range of wind speeds between about 4.5 and 22 miles/hour characterize the conditions of interest.

(5) Solar Radiation Must be Sufficiently Strong

Since it is the heating of the land which causes the development of a TIBL, the intensity of solar radiation is an important parameter. A minimum value of 0.35 Langleys/minute has been assumed for solar radiation. This magnitude of solar intensity occurs early and late on bright days. This value compares with peaks of about 1.2-1.3 Langleys/minute at mid-day during clear summer days.

As shown in Table 451.18-1, TIBLs were estimated to form during approximately 100 days and lasted on average 5.3 hours per day during the period April 1979 - September 1979. The highest monthly TIBL frequency, 133 hours per month, occurred during June.

Estimated frequency of sea breeze conditions for the Seabrook site during the same time period are also provided in Table 451.18-1. A sea breeze condition was defined as an hour where a localized daytime onshore flow occurred simultaneously with an opposing larger scale (but weaker) inland geostrophic wind directed offshore. Unlike gradient onshore flows, localized sea breeze onshore flows result in the development of sea breeze fronts/convergence zones and recirculation cells.

A localized sea breeze onshore flow would develop under the same conditions under which the TIBL forms; i.e., strong solar radiation and daytime land-surface temperatures rising above the ocean-surface temperatures. In order to differentiate between a true localized sea breeze and a

gradient onshore flow, Worcester NWS wind data was used to determine if a larger scale offshore geostrophic wind existed further inland. Data from Worcester (located approximately 70 miles SW of the Seabrook site) were chosen because the observations are obtained on an elevated plateau free from localized terrain effects and are taken far enough inland (45 miles from the coast) to preclude influence by any sea breeze fronts.

The criteria used to determine frequency of sea breeze conditions at the Seabrook site are as follows:

(1) Seabreezes Occur Only Under the Same Conditions Conducive to TIBL Formation

The five criteria used above to identify TIBL formation are also used to identify seabreeze conditions.

(2) There is an Opposing Offshore Pressure Gradient

Winds observed simultaneously at Worcester are offshore (from the S clockwise to NNE).

As shown in Table 451.18-1, sea breeze conditions were estimated to occur during approximately 89 days and lasted an average of 4 hours per day during the period April 1979 - September 1979. The highest monthly seabreeze frequency, 92 hours per month, occurred during July.

c. The following equation was used to represent the shape of the TIBL in the annual atmospheric transport and diffusion model (SB FSAR Section 2.3.5.2, Equation 35):

$$h_{TIBL}(X) = 8.8\left(\frac{X}{\bar{u}\Delta\theta}\right)^{1/2} \qquad (1)$$

where

h_{TIBL} = the height of TIBL above the ground surface (m),

X = the distance from the Atlantic coast along the wind trajectory (m),

$\bar{u}$ = the hourly wind speed,

$\Delta\theta$ = the potential temperature difference between top and bottom of the marine inversion,

This relationship was chosen for several reasons. The relationship was originally developed from a data base which included vertical temperature data taken over Nantucket Island, located off of the New England coast (Reference 1). Equation 1 was later verified by smoke release experiments at

the coastal New England site, Pilgrim Station, located in Plymouth, Massachusetts (Reference 2). The Pilgrim experiment also concluded that the effective vertical growth of the TIBL was independent of terrain. Observations taken of TIBL formation in the northern shore of Lake Erie (Reference 3) tested the hypothesis:

$$h_{TIBL}(X) = p(X)^{1/2} \qquad (2)$$

The values of p which are reported in Reference 3 are in the range of those values which would be calculated from:

$$p = \frac{8.8}{\overline{u}\Delta\theta} \qquad (3)$$

for reasonably anticipated values of $\overline{u}$ and $\Delta\theta$. Equation 1 was also checked against data collected during a pilot balloon and wiresonde observation experiment at another coastal New England site, Millstone Station, located in Waterford, Connecticut (Reference 4). Although details of the measurements taken at this experiment are lacking, the assumed formulations checked reasonably well (within about a factor of two) against the observations (Reference 5).

d. For the 527 hours of TIBL formation estimated to occur during the period April 1979 - March 1980, the lowest TIBL height predicted to occur over the plant primary vent stacks is 93 meters above ground level (AGL). Since the primary vent stack release height is approximately 56 meters AGL, all releases during TIBL formation occur below the TIBL. The closest the effective stack height ever approaches the TIBL during all hours of TIBL formation is 28 meters. As such, the effect the TIBL has on the annual average atmospheric dispersion estimates is to limit the vertical mixing depth during hours of TIBL formation.

e. TIBL terrain correction factors (defined as ratios of annual average relative concentrations (CHI/Q) and deposition rates calculated considering trapping versus annual average CHI/Q and deposition rates calculated without considering trapping) are presented in Tables 451.18-2 through 451.18-5. These annual average TIBL terrain correction factors were calculated for primary vent stack releases and were compiled using April 1979 - March 1980 on-site meteorology. Distances beyond 20 miles are not presented because the annual average transport and diffusion model assumes the TIBL does not extend beyond 20 miles. In addition, because one of the criterion for TIBL formation is an onshore flow, only the SW clockwise through NNW downwind sectors show TIBL terrain correction factors other than one.

Table 451.18-2 shows that TIBL terrain correction factors for the undepleted CHI/Q average approximately 1.03 for the affected downwind sectors and range from a minimum value of

0.97 (0.25 miles W) to a maximum value of 1.19 (0.75 miles NW). TIBL terrain correction factors for the depleted CHI/Q, deposition rates, and effective gamma CHI/Q show similar patterns as indicated in Tables 451.18-3 through 451.18-5. Note that a few of the TIBL terrain correction factors are slightly less than one due to the stipulation that all E, F and G stability classes measured below the TIBL during TIBL occurrences default to D stability.

f. The comparison of the results of variable trajectory models with the results of straight-line models in order to determine the effect of air flow reversals is not straight forward. One must be sure that the recirculation correction factors developed from such model comparisons are truly the result of air flow reversals and are not the result of a set of different modeling assumptions inherent in the two types of modeling approaches. For example, CHI/Q values derived from puff advection models are sensitive to the number of puffs released, advection steps used, and sampling times used per time period. A case in point is the difference in recirculation correction factors reported in the Perry and St. Lucie FSARs. The maximum recirculation correction factor reported in the Perry FSAR at a distance of 0.5 mile was 2.5 times higher than the maximum recirculation factor reported in the St. Lucie FSAR at that same distance (e.g., 4.5 versus 1.8). Such a large discrepancy in maximum recirculation correction factors may be due as much to differences in modeling assumptions as to differences in site transport and dispersion characteristics.

Annual average recirculation correction factors are still being developed for the Seabrook site using a new variable trajectory modeling approach. The variable trajectory model being developed is attempting to address some of the problems inherent in existing variable trajectory models. The new model has transport and dispersion assumptions similar to those of MESODIF-II (Reference 6) except for the following aspects:

(1) A non-steady-state integration is being performed across each plume segment in order to determine contributions to receptors transversed by plume segments during plume movements; and

(2) The vertical dispersion aspects are being modified to parallel assumptions used in the straight-line model described in SB FSAR Section 2.3.5.

The model is still in the process of being verified and documented. A preliminary set of recirculation correction factors was derived using the model and is presented in Table 451.18-6. These preliminary recirculation correction factors were derived using one year of data from the on-site meteorological tower (April 1979 - March 1980) and represent a comparison of ground level release, non-depleted CHI/Q

values between the straight-line model and preliminary results from the newly developed variable trajectory model. A finalized set of recirculation correction factors will be provided when the new variable trajectory model is completed.

References:

1. Van der Hoven, S., Atmospheric Transport and Diffusion at Coastal Sites, Nuclear Safety, 8(5):490-499 (September-October 1967).

2. Collins, G. F., Predicting Sea Breeze Fumigation from Tall Stacks at Coastal Locations, Nuclear Safety, 12(2):110-114 (March-April, 1971).

3. Weisman, B., and M. S. Hirt, Dispersion Governed by the Thermal Internal Boundary Layer, Presented at the 68th Annual Meeting of the Air Pollution Control Association, Boston, MA, June 15-20, 1975.

4. Bowne, M. E., and G. F. Collins, Summary Report - 1966 Summer Pilot Balloon and Wiresonde Observations - Millstone Point, TRC Service Corporation, Hartford, CT, March 1967.

5. Merlino, R. J., Consideration of Sea Breezes in the Calculation of Ground Level Concentrations from Nuclear Reactor Effluents, TERA Corporation, Berkeley, CA, September 1976.

6. Powell, D. C., H. L. Wegley and T. D. Fox, MESODIF-II: A Variable Trajectory Plume Segment Model to Assess Ground Level Air Concentrations and Deposition of Effluent Releases from Nuclear Power Facilities, NUREG/CR-0523 (March 1979).

TABLE 451.18-1

ESTIMATED FREQUENCY OF TIBL FORMATION AND SEA BREEZE CONDITIONS AT THE SEABROOK SITE APRIL 1979 - SEPTEMBER 1979

Month	No. of Good Hourly Obs.	TIBL Formation			Sea Breeze Conditions		
		No. of Hours	No. of Days	% of Good Hourly Obs.	No. of Hours	No. of Days	% of Good Hourly Obs.
April	687	67	15	9.8	42	12	6.1
May	660	67	13	10.2	26	8	4.0
June	718	133	22	18.5	79	21	11.0
July	735	117	22	15.9	92	22	12.5
August	740	80	16	10.8	67	15	9.1
September	720	63	12	8.8	45	11	6.3
Total (Apr-Sept)	4260	527	100	12.4	351	89	8.2

TABLE 451.18-2

ANNUAL AVERAGE TIBL TERRAIN CORRECTION FACTORS

PRIMARY VENT STACK RELEASE CHI/Q (BEFORE DEPLETION)

DOWNWIND SECTOR	NO. OBS	DISTANCE FROM RELEASE POINT (MILES) .25	.50	.75	1.00	1.50	2.00	2.50	3.00
N	386	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NNE	525	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NE	670	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ENE	763	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
E	891	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ESE	1530	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SE	858	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SSE	334	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
S	328	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SSW	221	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SW	348	1.00	1.00	1.00	1.01	1.01	1.00	1.01	1.00
WSW	316	.99	1.02	1.07	1.07	1.05	1.03	1.03	1.01
W	385	.97	1.03	1.07	1.07	1.04	1.02	1.02	1.00
WNW	351	.99	1.04	1.08	1.09	1.07	1.07	1.02	1.02
NW	411	1.00	1.10	1.19	1.17	1.09	1.07	1.07	1.06
NNW	309	1.00	1.00	1.02	1.02	1.02	1.02	1.02	1.01
AVERAGE	8626	1.00	1.01	1.02	1.02	1.02	1.01	1.01	1.01

DOWNWIND SECTOR	NO. OBS	DISTANCE FROM RELEASE POINT (MILES) 3.50	4.00	4.50	5.00	7.50	10.00	15.01	20.00
N	386	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NNE	525	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NE	670	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ENE	763	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
E	891	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ESE	1530	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SE	858	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SSE	334	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
S	328	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SSW	221	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SW	348	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
WSW	316	1.01	1.01	1.01	1.01	1.01	1.01	1.00	1.00
W	385	1.00	1.00	1.00	1.00	1.00	1.00	1.00	.99
WNW	351	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.01
NW	411	1.04	1.04	1.04	1.04	1.04	1.03	1.03	1.02
NNW	309	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
AVERAGE	8626	1.01	1.01	1.00	1.00	1.00	1.00	1.00	1.00

TABLE 451.18-3

ANNUAL AVERAGE TIBL TERRAIN CORRECTION FACTORS

PRIMARY VENT STACK RELEASE CHI/Q (AFTER DEPLETION)

DOWNWIND SECTOR	NO. OBS	DISTANCE FROM RELEASE POINT (MILES) .25	.50	.75	1.00	1.50	2.00	2.50	3.00
N	386	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NNE	525	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NE	670	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ENE	763	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
E	891	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ESE	1530	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SE	858	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SSE	334	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
S	328	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SSW	221	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SW	348	1.00	1.00	1.00	1.01	1.01	1.00	1.00	1.00
WSW	316	.99	1.03	1.07	1.07	1.05	1.03	1.03	1.01
W	385	.98	1.03	1.07	1.07	1.04	1.02	1.02	1.00
WNW	351	.99	1.04	1.09	1.09	1.07	1.07	1.02	1.02
NW	411	1.00	1.11	1.20	1.17	1.09	1.07	1.07	1.06
NNW	309	1.00	1.00	1.02	1.02	1.02	1.02	1.02	1.02
AVERAGE	8626	1.00	1.01	1.02	1.02	1.02	1.01	1.01	1.01

DOWNWIND SECTOR	NO. OBS	DISTANCE FROM RELEASE POINT (MILES) 3.50	4.00	4.50	5.00	7.50	10.00	15.01	20.00
N	386	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NNE	525	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NE	670	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ENE	763	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
E	891	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ESE	1530	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SE	858	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SSE	334	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
S	328	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SSW	221	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SW	348	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
WSW	316	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
W	385	1.00	1.00	1.00	1.00	1.01	1.01	1.00	1.00
WNW	351	1.02	1.02	1.02	1.02	1.03	1.03	1.02	1.02
NW	411	1.04	1.04	1.04	1.04	1.04	1.04	1.03	1.03
NNW	309	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
AVERAGE	8626	1.01	1.01	1.01	1.01	1.01	1.00	1.00	1.00

TABLE 451.18-4

ANNUAL AVERAGE TIBL TERRAIN CORRECTION FACTORS

PRIMARY VENT STACK RELEASE DEPOSITION RATES

DOWNWIND SECTOR	NO. OBS	DISTANCE FROM RELEASE POINT (MILES) .25	.50	.75	1.00	1.50	2.00	2.50	3.00
N	386	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NNE	525	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NE	670	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ENE	763	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
E	891	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ESE	1530	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SE	858	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SSE	334	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
S	328	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SSW	221	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SW	348	1.00	1.00	1.00	1.01	1.01	1.01	1.01	1.01
WSW	316	1.00	1.02	1.06	1.07	1.06	1.05	1.05	1.02
W	385	.98	1.03	1.07	1.08	1.06	1.04	1.04	1.02
WNW	351	.99	1.04	1.10	1.11	1.10	1.10	1.04	1.04
NW	411	1.00	1.13	1.24	1.22	1.14	1.12	1.11	1.10
NNW	309	1.00	1.01	1.02	1.03	1.03	1.03	1.03	1.03
AVERAGE	8626	1.00	1.01	1.02	1.02	1.02	1.02	1.01	1.01

DOWNWIND SECTOR	NO. OBS	DISTANCE FROM RELEASE POINT (MILES) 3.50	4.00	4.50	5.00	7.50	10.00	15.01	20.00
N	386	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NNE	525	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NE	670	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ENE	763	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
E	891	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ESE	1530	1.00	1.00	1.00	1.00	1.00	1.00	1.00	[illegible]
SE	858	1.00	1.00	1.00	1.00	1.00	1.00	1.00	[illegible]
SSE	334	1.00	1.00	1.00	1.00	1.00	1.00	1.00	[illegible]
S	328	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SSW	221	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SW	348	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
WSW	316	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02
W	385	1.01	1.01	1.01	1.02	1.02	1.02	1.02	1.01
WNW	351	1.05	1.05	1.05	1.05	1.06	1.06	1.06	1.05
NW	411	1.08	1.08	1.08	1.08	1.08	1.08	1.07	1.07
NNW	309	1.02	1.03	1.02	1.02	1.02	1.03	1.02	1.02
AVERAGE	8626	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01

TABLE 451.18-5

ANNUAL AVERAGE TIBL TERRAIN CORRECTION FACTORS

PRIMARY VENT STACK RELEASE EFFECTIVE GAMMA CHI/Q

DOWNWIND SECTOR	NO. OBS	DISTANCE FROM RELEASE POINT (MILES) .25	.50	.75	1.00	1.50	2.00	2.50	3.00
N	386	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NNE	525	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NE	670	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ENE	763	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
E	891	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ESE	1530	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SE	858	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SSE	334	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
S	328	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SSW	221	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SW	348	1.00	1.09	1.01	1.01	1.01	1.01	1.01	1.01
WSW	316	1.01	1.03	.05	1.05	1.05	1.05	1.05	1.03
W	385	1.02	1.06	. 08	1.08	1.08	1.08	1.08	1.06
WNW	351	1.02	1.07	1.11	1.12	1.13	1.13	1.08	1.07
NW	411	1.04	1.12	1.17	1.17	1.14	1.14	1.14	1.13
NNW	309	1.00	1.01	1.02	1.03	1.03	1.03	1.03	1.03
AVERAGE	8626	1.00	1.01	1.02	1.02	1.02	1.02	1.02	1.02

DOWNWIND SECTOR	NO. OBS	DISTANCE FROM RELEASE POINT (MILES) 3.50	4.00	4.50	5.00	7.50	10.00	15.01	20.00
N	386	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NNE	525	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NE	670	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ENE	763	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
E	891	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ESE	1530	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SE	858	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SSE	334	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
S	328	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SSW	221	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SW	348	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
WSW	316	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.02
W	385	1.05	1.06	1.04	1.04	1.05	1.05	1.05	1.05
WNW	351	1.08	1.08	1.08	1.09	1.09	1.10	1.10	1.09
NW	411	1.11	1.11	1.11	1.11	1.11	1.11	1.10	1.10
NNW	309	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03
AVERAGE	8626	1.02	1.02	1.02	1.02	1.02	1.01	1.01	1.01

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PRELIMINARY RECIRCULATION CORRECTION FACTORS

DOWNWIND SECTOR	DISTANCE FROM RELEASE POINT (MILES) .25	.50	.75	1.00	1.50	2.00	2.50	3.00
N	1.17	1.27	1.19	1.15	1.15	1.12	1.31	1.09
NNE	1.35	1.20	1.23	1.36	1.22	1.36	1.26	1.22
NE	1.31	1.56	1.25	1.21	1.22	1.07	1.08	1.26
ENE	1.48	1.41	1.36	1.41	1.32	1.27	1.29	1.25
E	1.06	1.09	1.08	1.09	1.14	1.09	1.06	1.05
ESE	1.27	1.26	1.26	1.26	1.31	1.32	1.30	1.32
SE	1.23	1.18	1.16	1.18	1.02	.99	1.05	.97
SSE	1.33	1.32	1.18	1.14	.88	.83	.88	.91
S	1.10	1.37	1.39	1.08	1.23	1.33	1.07	.98
SSW	1.49	1.49	1.28	1.21	.96	.94	.93	.82
SW	1.84	1.38	1.44	1.28	1.24	1.42	1.16	1.16
WSW	1.45	1.38	1.32	1.12	.99	.93	.83	.90
W	1.16	1.22	1.22	1.15	1.09	1.12	1.01	.95
WNW	1.32	1.41	1.43	1.49	1.39	1.47	1.48	1.41
NW	1.48	1.44	1.43	1.32	1.25	1.24	1.19	1.20
NNW	1.23	1.83	1.36	1.26	1.35	1.37	1.13	1.09
AVERAGE	1.30	1.32	1.26	1.23	1.18	1.17	1.14	1.13

DOWNWIND SECTOR	DISTANCE FROM RELEASE POINT (MILES) 3.50	4.00	4.50	5.00	7.50	10.00	15.01	20.00
N	.97	.97	.99	1.00	1.13	.96	.85	.71
NNE	1.19	1.16	1.10	1.07	.99	.98	.86	.81
NE	1.17	1.09	1.08	1.30	.96	.87	.84	.83
ENE	1.19	1.15	1.07	1.11	1.09	1.02	.81	.67
E	1.02	1.09	1.05	1.03	1.07	.77	.69	.55
ESE	1.36	1.33	1.31	1.31	1.13	1.05	.98	.86
SE	.99	.99	1.06	1.01	.75	.66	.62	.51
SSE	.93	.83	.76	.72	.56	.50	.50	.46
S	.98	1.02	.87	.85	.71	.71	.62	.54
SSW	.95	.85	.79	.91	.61	.48	.58	.37
SW	1.05	1.06	.99	.85	.85	.85	.71	.71
WSW	1.00	.86	.85	.76	.72	.55	.53	.38
W	.94	.91	.90	.86	.70	.64	.53	.47
WNW	1.32	1.28	1.21	1.24	1.19	1.03	.87	.79
NW	1.07	1.10	1.02	1.13	.92	.68	.60	.55
NNW	1.11	1.06	1.04	.96	.92	.88	.88	.70
AVERAGE	1.11	1.09	1.05	1.06	.94	.83	.75	.65

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DOWNWIND SECTOR	DISTANCE FROM RELEASE POINT (MILES) 25.00	30.00	35.00	40.00	45.00	50.00
N	.64	.46	.46	.40	.32	.27
NNE	.70	.72	.63	.56	.48	.43
NE	.69	.60	.50	.48	.42	.38
ENE	.61	.55	.37	.31	.27	.25
E	.44	.40	.37	.31	.25	.20
ESE	.72	.55	.53	.42	.38	.32
SE	.37	.37	.29	.27	.27	.24
SSE	.40	.29	.22	.21	.19	.18
S	.47	.43	.41	.35	.29	.26
SSW	.28	.18	.18	.15	.13	.15
SW	.61	.57	.55	.53	.51	.40
WSW	.35	.32	.29	.25	.22	.18
W	.39	.32	.26	.23	.18	.14
WNW	.68	.65	.63	.64	.62	.50
NW	.49	.40	.43	.40	.35	.28
NNW	.67	.57	.48	.45	.40	.37
AVERAGE	.55	.47	.41	.36	.32	.28