UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 Sixth Avenue
Seattle, Washington 98101

May 18, 1993

Reply To
Attn Of: ES-097

MEMORANDUM

SUBJECT: Building Wake Effects on Volume Sources

FROM: Robert B. Wilson, Regional Meteorologist
William M. Ryan, Environmental Engineer

TO: Joseph A. Tikvart, Chief
Source Receptor Analysis Branch, OAQPS (MD-14)

We have encountered a modeling problem involving building wake effects on volume sources, for which our existing modeling guidance is inadequate. Below we describe the situation and our recommended solution. We request Model Clearinghouse concurrence with our recommendations.

Background:

We are assisting the Shoshone-Bannock Tribes in developing a $PM_{10}$ Implementation Plan for a portion of the Fort Hall Reservation in southeast Idaho, near Pocatello. One of the industrial sources on Tribal land is FMC Corporation, which produces elemental phosphorus. Within the FMC plant there are a number of activities/operations which are best characterized for dispersion modeling purposes as volume sources. Some of these volume sources are located very near large buildings, whose wake effects may influence dispersion of the $PM_{10}$ emissions.

Currently, Agency guidance is incomplete with regard to the treatment of building wake effects on the dispersion of volume source emissions located in the vicinity of a building. In determining initial lateral and vertical dimensions ($\sigma_{y0}$, $\sigma_{z0}$) for volume sources, the modeler is generally referred to Table 1-6 of Volume II of the ISC2 User's Guide. The shortcomings of this guidance are two-fold. First, recommendations for $\sigma_{y0}$ values presented in Table 1-6 fail to provide a means of estimating building effects on initial lateral dispersion. And second, while Table 1-6 does provide a building-height based estimator for initial $\sigma_{z0}$ values for sources located on or adjacent to a building, the table fails to define "adjacent." Agency guidance is quite clear that building downwash effects should be evaluated for point sources located near a building, with the area of influence of building wake effects defined in Section 1.1.5.3 of Volume II of the ISC2 User's Guide. However, based on the information presented in Table 1-6, these area of influence criteria are not considered in the evaluation of volume sources in the vicinity of a building.

We see no reason why the area of building wake effects currently defined by the Agency for point sources should not also be applied to volume sources. We believe Agency guidance should be revised to address building wake influences on all affected sources in a consistent manner. Furthermore, the guidance concerning procedures for estimating initial dispersion dimensions should be made complete.

Recommendations:

For modeling of the FMC facility, we plan to employ these criteria for characterizing volume sources near buildings:

1. "Adjacent," as applied in Table 1-6 of Volume II of the ISC2 User's Guide, will be defined as any source located within the wind direction dependent area of building wake influence (defined in Section 1.1.5.3 of the same document). If 50 percent or more of the volume source is determined to be adjacent to a building, the entire source will be modeled as an adjacent source.

2. The following guidelines for specification of initial volume source plume dimensions will be used to supplement criteria in Table 1-6 of Volume II of the ISC2 User's Guide:

| Parameter to Define | Source Type | Recommended Procedure |
|---|---|---|
| $\sigma_{y0}$ | Volume source on or adjacent to a building | If $L_s > L_b$<br>$\sigma_{y0} = L_s/4.3$<br>If $0.7\ L_b < L_s < 1.0\ L_b$<br>$\sigma_{y0} = L_b/4.3$<br>If $L_s \leq 0.7\ L_b$<br>$\sigma_{y0} = 0.7\ L_b/4.3$<br>or<br>$\sigma_{y0} = 5.0\ L_s/4.3$<br>(whichever is less) |
| $\sigma_{z0}$ | Ground-level or elevated volume source adjacent to a building | If $H_s > H_b$<br>$\sigma_{z0} = H_s/2.15$<br>If $0.7\ H_b < H_s < 1.0\ H_b$<br>$\sigma_{z0} = H_b/2.15$<br>If $H_s \leq 0.7\ H_b$<br>$\sigma_{z0} = H_b/2.15$<br>or<br>$\sigma_{z0} = 5.0\ H_s/2.15$<br>(whichever is less) |

Where : $L_s$ = lateral dimension of source
$H_s$ = vertical dimension of source
$L_b$ = projected lateral dimension of building
$H_b$ = height of building

Please contact either Rob [(206)553-1531] or Bill [(206)553-8561] if you have any questions.