U.S. ENVIRONMENTAL PROTECTION AGENCY

REGION X

1200 SIXTH AVENUE

SEATTLE, WASHINGTON 98101

JUL 29 1985

REPLY TO ATTN OF: M/S 532

MEMORANDUM

SUBJECT: Dispersion Modeling of Fugitive Emissions Sources at Bunker Limited

FROM: David C. Bray, Acting Chief David C Bray
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TO: Joseph A. Tikvart, Chief
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In attempting to model the process fugitive lead emissions from the myriad buildings and sources within the Bunker Limited lead smelter, it became clear that the traditional approach to modeling area and volume sources was not capable of simulating the actual dispersion of pollutants from the smelter to the close-in receptors. The reasons for this are obvious from an evaluation of the physical characteristics of the source-receptor relationships. The Bunker Limited lead smelter is a large and complex facility. All of the significant fugitive lead sources are located within an area approximately 1250 feet long by 560 feet wide. The ground level elevation within this area varies from approximately 2320 feet above mean sea level to 2370 feet above mean sea level. The release heights of the fugitive sources range from ground level to the tops of buildings which are 70 feet above ground level.

Since the predominant up-valley and down-valley wind directions are parallel to the long dimension of the smelter, the turbulence created by the buildings within the plant significantly affects the downwind transport of the fugitive emissions released within the smelter. Low level fugitive emissions must pass over and around downwind buildings before leaving the plant and impacting ambient air quality levels. No currently recommended air quality model accounts for the dispersive influence of structures intervening the source and receptor.

An even more important factor is the terrain between the smelter and the close-in receptors. Immediately upwind and downwind of the smelter are ridges which obtain an elevation exceeding 2400 feet above mean sea level (30 to 80 feet above the ground level elevation within the smelter). This elevation is achieved within 65 feet (to the east) and 130 feet (to the west) of the smelter, within the fenced smelter property. The critical receptors are located on the downwind side of these ridges at the same elevations as the lower part of the smelter (2320 feet above mean sea level). This means that there is over an eighty feet drop in elevation from the tops of the intervening ridges to the receptors (within a distance of 200 feet to the east and 430 feet to the west). Again, there are no currently recommended models which account for the dispersion caused by terrain obstacles between the source and the receptor (although some account for the difference in elevation between the source and the receptor). All of the models assume that the terrain is flat between the source and the receptor.

In order to better estimate the impact of the fugitive lead emissions from the lead smelter at these close-in receptors, we have attempted to develop new model input parameters for the fugitive emissions. These input parameters are specific to the source and terrain situation at the Bunker Limited lead smelter and the approach may not be appropriate or transferable to any other facility. The following paragraph discusses our selection of the model input parameters.

First, because all of the emission sources are located between the two intervening ridges and the emissions must pass up and over them to reach ambient air, we chose to treat all of the fugitive emissions within the lead smelter as a single volume source. The dimensions of this volume source encompass all of the buildings which have significant lead emissions - in this case the length of the source is 380 meters and the width is 170 meters. The volume source was located at the geographic center of the buildings with significant lead emissions (UTM coordinates: 5,265,625 N; 563,180 W). The ground level elevation of this volume source was chosen to be 732 meters above mean sea level - the height of the ridges over which the emissions must pass to reach ambient air. The height of the volume source was chosen to be 40 meters. This value represents roughly 2.5 times the average height of the buildings within the volume source. We feel that this height represents the building-induced turbulence layer through which the fugitive emissions will be mixed as they leave the smelter. This value, however, may be conservative because it does not account for the terrain-induced turbulence of the upwind and downwind ridges. Finally, the emission rate of this volume source is the sum of all fugitive emission sources within the bounds of the volume source. (Stack sources are still modeled as individual point sources.)

We feel that this single volume source more accurately represents the real physical situation with respect to transport of the fugitive emissions from the smelter to ambient air. We will be preparing a protocol to evaluate whether or not this approach significantly improves the performance of the model to predict the measured ambient concentrations, especially for the close-in receptors.

cc: G. Abel