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INVESTIGATION OF FUGITIVE DUST
VOLUME II - CONTROL STRATEGY AND REGULATORY APPROACH

U.S. ENVIRONMENTAL PROTECTION AGENCY
Office of Air and Waste Management
Office of Air Quality Planning and Standards
Research Triangle Park, North Carolina 27711

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INVESTIGATION OF FUGITIVE DUST VOLUME II - CONTROL STRATEGY AND REGULATORY APPROACH

by

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1.0 INTRODUCTION

Implementation plans for five Air Quality Control Regions in the States of New Mexico, Nevada, Arizona, and California failed to demonstrate achievement of primary or secondary suspended particulate air quality standards. In addition, the Albuquerque - Mid Rio Grande AQCR was included in the investigation since emissions from unpaved roads were identified in the SIP. A preliminary investigation by EPA indicated that all six of these AQCR's were arid areas with widespread fugitive dust problems, and that this fugitive dust either had not been considered in the implementation plans or was poorly quantified in particulate control strategy evaluations.

PEDCo-Environmental was asked to determine the fugitive dust sources having a major impact on particulate levels and to investigate control techniques and regulatory approaches which would result in attainment of the air quality standards. The resulting project was divided into three phases, which could be characterized as design, data collection, and strategy development and testing.

In Phase I, significant fugitive dust sources in the four-state study area were identified and sampling studies were designed to better quantify their relative contributions. This information was submitted for EPA review in the Phase I report on July 14. In brief summary, three fugitive dust sources were found to have regional impacts -- unpaved roads, agriculture, and construction activities -- and several others were found to create significant localized sources of particulate. Only the three major sources were investigated in the sampling studies. A total of seven field sites in the four states were proposed in the Phase I report, with three specifically for unpaved roads, two for agriculture, and two for construction.

Phase II was composed of three distinct areas of data collection performed concurrently:

1. conduct of field sampling at the seven sites to generate source impact data;

2. survey of the six AQCR's to determine the number and extent of their fugitive dust sources, from which to estimate emissions; and

3. investigation of feasible control techniques for fugitive dust, including the approximate efficiencies of the controls.

The description and presentation of results for each of these data collection efforts comprises a companion report to EPA titled, "Investigation of Fugitive Dust - Sources, Emission and Control," May, 1973.

Phase III involved the combining of selected control techniques for different fugitive dust sources into comprehensive control strategies, and the testing of alternate strategies in attempting to demonstrate achievement of air quality standards in each AQCR. Predicted reductions in emissions from use of control techniques were compared with reductions in ambient particulate concentrations necessary to reach the standards. The procedures and results of this control strategy testing are presented in this report. In addition, a series of example regulations for the control of various fugitive dust sources are included.

2.0 CONTROL STRATEGY TESTS

2.1 General Testing Rationale

The implementation plans submitted by the states for the AQCR's under investigation did not show attainment of primary and secondary particulate air quality standards. By considering fugitive dust emissions and their control in the simulated strategy analyses, the work presented in this section has attempted to demonstrate that they can be achieved. The same air quality data and key receptor sites which were used in the implementation plans have been used in the present analyses. These data are shown in Table 2-1. For further uniformity, a 1970 base year has been used wherever possible in the collection of fugitive dust emission data.

Emission reductions were predicted by applying the percentage controls found in the control techniques investigation to the emission data compiled for each region. Particulate emissions, both existing and predicted following control, from conventional sources were taken directly from the implementation plans for use in these control strategy tests.

Two different methods were employed in testing the strategies -- IPP diffusion modeling and proportional reduction (rollback). Selection of the more appropriate method was made after checking (a) availability of adequate point and area source distribution data for diffusion modeling, (b) topography of the area, and (c) that emission density was high enough to be significantly different than background if the area was to be modeled.

In the Albuquerque-Mid Rio Grande AQCR and the Phoenix and Tucson metropolitan areas, all of the above conditions for modeling were met. Because of the large areas involved, only

TABLE 2-1

AIR QUALITY DATA USED FOR
CONTROL STRATEGY TESTING

AQCR	County	Sampling Station	1970 Annual Geometric Mean, $\mu g/m^3$
San Joaquin	Kern	Bakersfield	169
	Tulare	Visalia	167
	Fresno	Fresno	97
	Kings	Hanford	98
	Stanislaus	Modesto	94
	San Joaquin	Stockton	77
Phoenix-Tucson	Maricopa	South Phoenix	265
	Pima	North Tucson	156
	Pinal	Florence	149
Albuquerque - Mid Rio Grande	Bernalillo	Albuquerque	121
El Paso-Las Cruces-Alamogordo	Dona Ana	Dona Ana	145
Nevada Intrastate	White Pine	McGill	(108)*
	Nye	Gabbs	(97)
	Churchill	Fallon	(82)
Northwest Nevada	Lyon	Fernley	(75)
	Washoe	Reno - Sparks	(99)
	Douglas	Stateline	(71)
	Lyon	Yerington	(71)

* 1972 data in parentheses

portions of these regions were included in the modeling area. The standard IPP program was used, with the model for each of the areas being satisfactorily validated with 1970 emission and air quality data.

In the San Joaquin AQCR, detailed information could not be obtained for point and area sources in "hot spots" around Bakersfield, Visalia, and Fresno. Since the majority of emissions in this AQCR were from agriculture, it was decided that distribution was not critical to reduction patterns and that rollback would be an equally accurate evaluation technique. For the other three AQCR's, there were very few emissions from point and area particulate sources, and fugitive dust emission density was also relatively low. Therefore, the possibility of modeling was eliminated and rollback was used. Emission reductions in the four regions utilizing rollback calculations were done either by county or for a smaller area immediately surrounding the sampling site.

2.2 Control Strategies to be Tested

Strategies were devised by project personnel by fitting the most appropriate available control to each source category. The degree of control imposed was also influenced by the relative contribution of a source category to total particulate emissions. Uniform control methods were generally applied throughout an AQCR, although more strenuous controls were possibly required in the areas with highest measured concentrations.

Three strategies were tested for each AQCR -- the first (control strategy A) with moderate control, the second (B) with what was judged to be the best available technology, and a third of comparable stringency but uniform for all AQCR's (C). These are summarized in Tables 2-2, 2-3, and 2-4.

TABLE 2-2

SUMMARY OF CONTROL STRATEGY A

Source	Control
Unpaved Roads	Chemical stabilization of 10 percent of roads, paving of 5% of roads. Speed limit of 25 mph.
Agriculture	Continuous cropping or limited irrigation (where agriculture is a significant source)
Construction	Watering
Tailings Piles	Chemical or vegetative stabilization
Aggregate Storage	Chemical spray
Feedlots	Watering by truck or sprinkling system

TABLE 2-3

SUMMARY OF CONTROL STRATEGY B

Source	Control
Unpaved Roads	Pave roads with more than 150 vehicles/day in Albuquerque, Phoenix-Tucson, El Paso, San Joaquin AQCR'S; pave roads carrying 15% of vehicle miles in Nevada Intrastate and Northwest Nevada
	Speed limit of 20 mph.
Agriculture	Continuous cropping or limited irrigation (where agriculture is a significant source)
Construction	Watering and Chemical soil stabilization of completed cuts and fills
Tailings Piles	Combined chemical - vegetation stabilization
Aggregate Storage	Chemical spray
Feedlots	Watering by truck or sprinkling system

TABLE 2-4

SUMMARY OF CONTROL STRATEGY C

Source	Control
Unpaved Roads	Pave 10% of roads Speed limit 20 mph. in city limits, 25 mph. in rural areas
Agriculture	Continuous cropping or limited irrigation
Construction	Watering and chemical soil stabilization of completed cuts and fills
Tailings Piles	Combined chemical - vegetative stabilization
Aggregate Storage	Chemical spray
Feedlots	Watering by truck or sprinkling system

For areas which did not achieve at least the primary standard with one of these strategies, one additional control technique was applied: the use of chemical soil stabilizers on actively tilled agricultural lands.

2.3 Results

Albuquerque-Mid Rio Grande was the first region tested by modeling. The area modeled included all of Bernalillo County (location of metropolitan Albuquerque) and adjacent strips of the other two counties in the AQCR, Valencia and Sandoval. The initial attempt at validation gave a correlation of 0.75 with 8 receptor sites. Two of the data points were badly out of line with the line of best fit. These two sites were the only ones outside the Rio Grande River valley. After modifying the model to account for differences in elevation between the river valley and mesa zones, correlation increased to 0.90. The ratio between calculated and observed values (slope of the line of best fit) was 1.57 and the y-intercept was 9 $\mu g/m^3$ after subtracting background. This was thought to be an excellent model of such a highly variable system as fugitive dust emissions. Utilizing these data, an isopleth map was constructed (Figure 2-1) depicting the suspended particulate levels in Albuquerque prior to fugitive dust control. When the three control strategies were applied to the fugitive dust emissions, the maximum indicated particulate concentrations in the area modeled were 64, 61, and 61 $\mu g/m^3$ geometric mean for strategies A, B, and C, respectively. An isopleth map of predicted regional air quality with strategy B is shown in Figure 2-2.

The Phoenix-Tucson AQCR was modeled in two separate parts, for the two major metropolitan areas in which achievement of

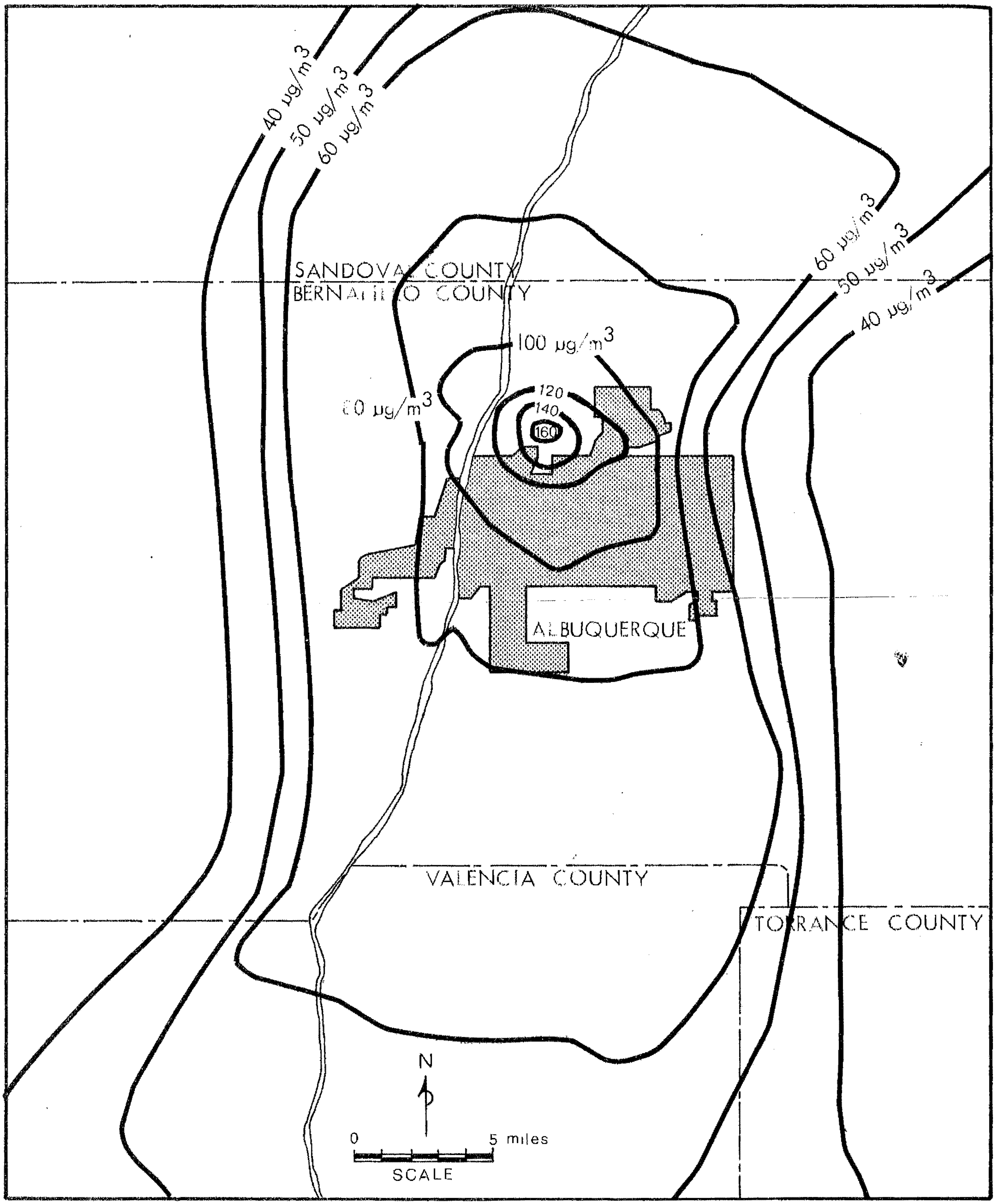

Figure 2-1 Predicted Particulate Concentrations in Albuquerque Area Prior to Fugitive Dust Control.

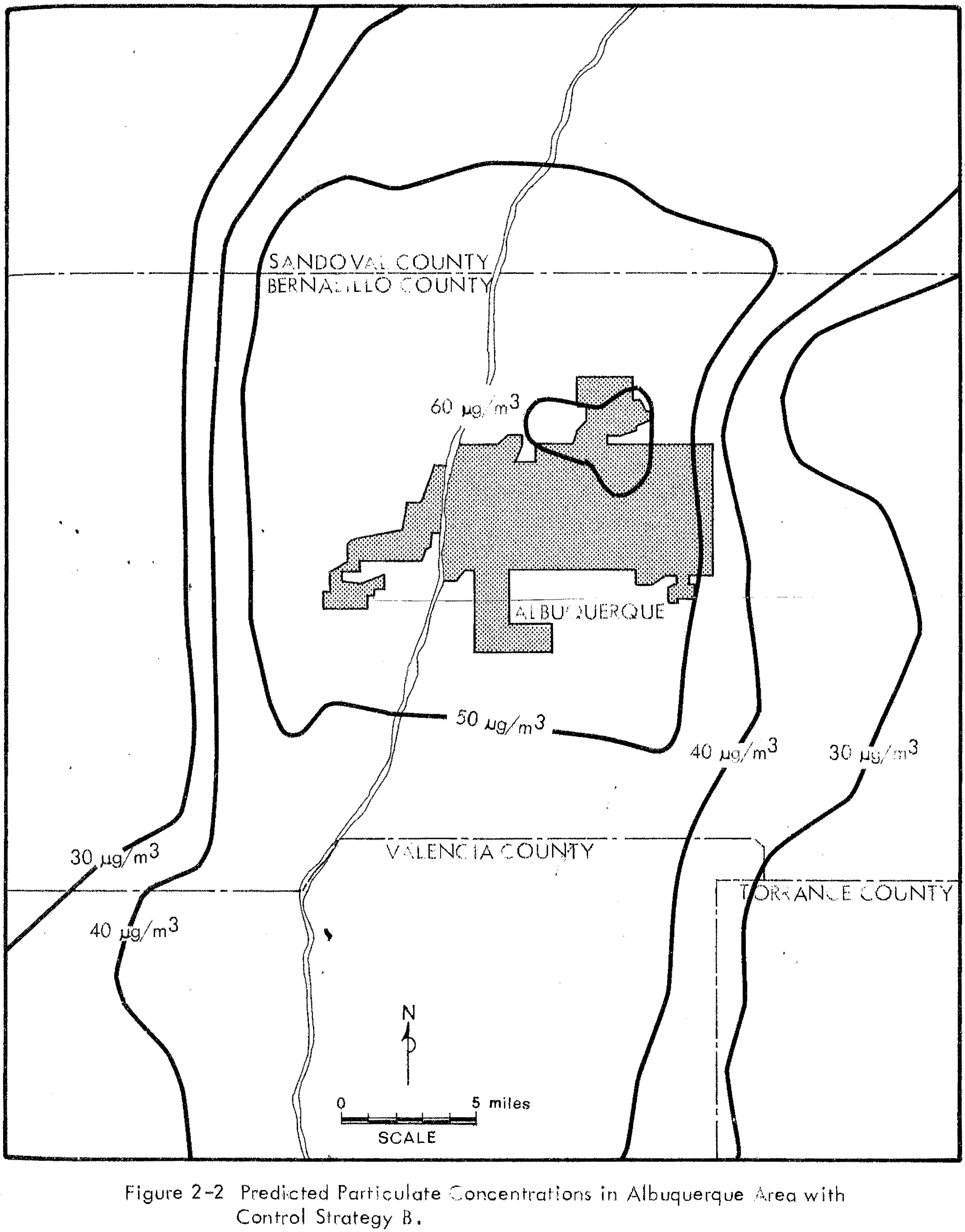

Figure 2-2 Predicted Particulate Concentrations in Albuquerque Area with Control Strategy B.

standards could not be demonstrated. This dual approach was required because of the distinct topographical difference between the two urban areas. Also, the sensitivity of the mathematical diffusion model is enhanced by reducing the size of the investigated region. In the validation runs, correlation with observed values was relatively low in one case, i.e., 0.45 for Phoenix, while an acceptable value of 0.70 was found for Tucson. Elimination of one of the outlying data points on the plot of calculated vs. observed values for Phoenix increased the correlation of 0.79 and changed the slope of the line of best fit to 0.64. The sampling site associated with the eliminated data point did not appear to be representative of the area in which it was located because it was situated on a small mountain. With this change, both of the models were thought to be acceptable (see Figures 2-3 and 2-5 for Pre-controlled Conditions), so emission reductions from the three control strategies were applied. In the Tucson area, resultant maximum concentrations were 77, 63, and 63 $\mu g/m^3$ (annual geometric mean) for the three strategies. The area exceeding 60 $\mu g/m^3$ under strategy B was limited to a few square miles and was caused by a point source rather than fugitive dust emissions. A 94 percent control on this remote mining operation instead of the presently required 90 percent would achieve the 60 $\mu g/m^3$ level in this "hot spot" indicated by the model. The isopleth map for control B is shown in Figure 2-4.

In the Phoenix area, however, the same three strategies caused maximum particulate levels to decrease only to 114, 94, and 95 $\mu g/m^3$ geometric mean. The results of strategy B are shown in Figure 2-6. Large parts of Maricopa County were shown to exceed the primary standards for any of the three strategies. A review of the sources contributing to receptor sites above the standards revealed that the major sources in every case were agricultural emissions. Available control techniques clearly did not have a high enough percentage reduction in agricultural emissions to achieve the standards in the Phoenix area. A 65 percent control of agricultural emissions was

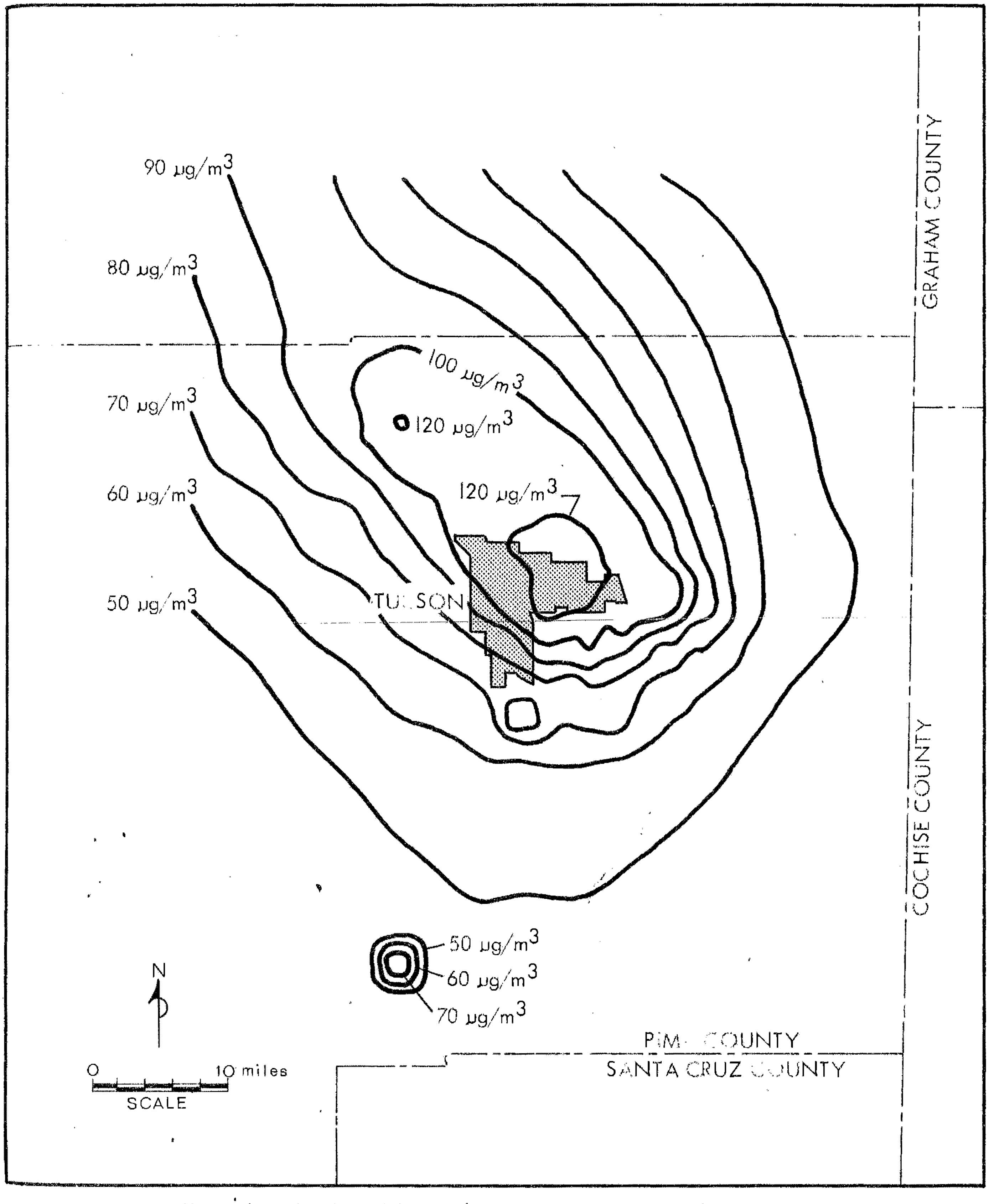

Figure 2-3 Predicted Particulate Concentrations in Tucson Area Prior to Fugitive Dust Control.

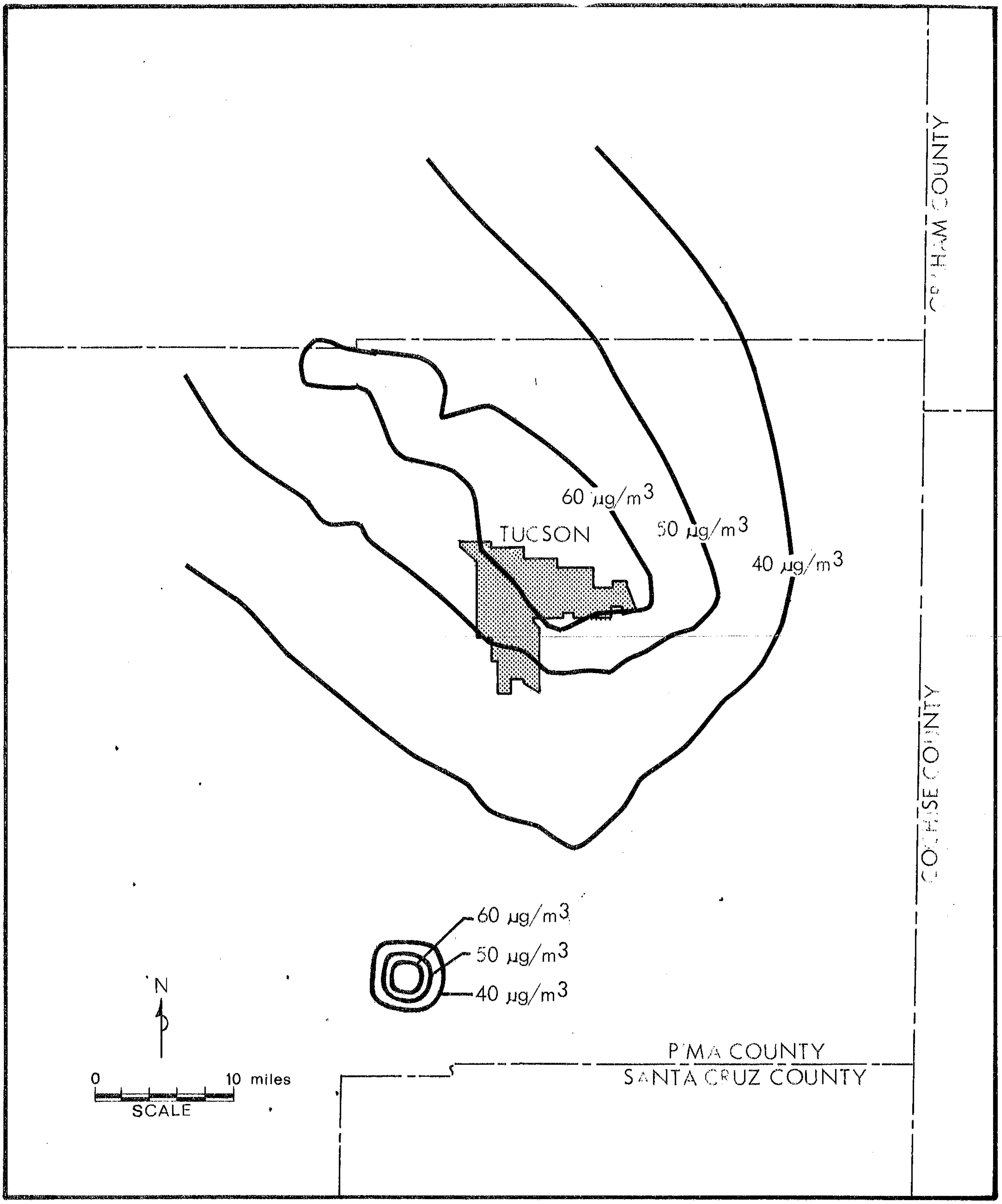

Figure 2-4 Predicted Particulate Concentrations in Tucson Area with Control Strategy B.

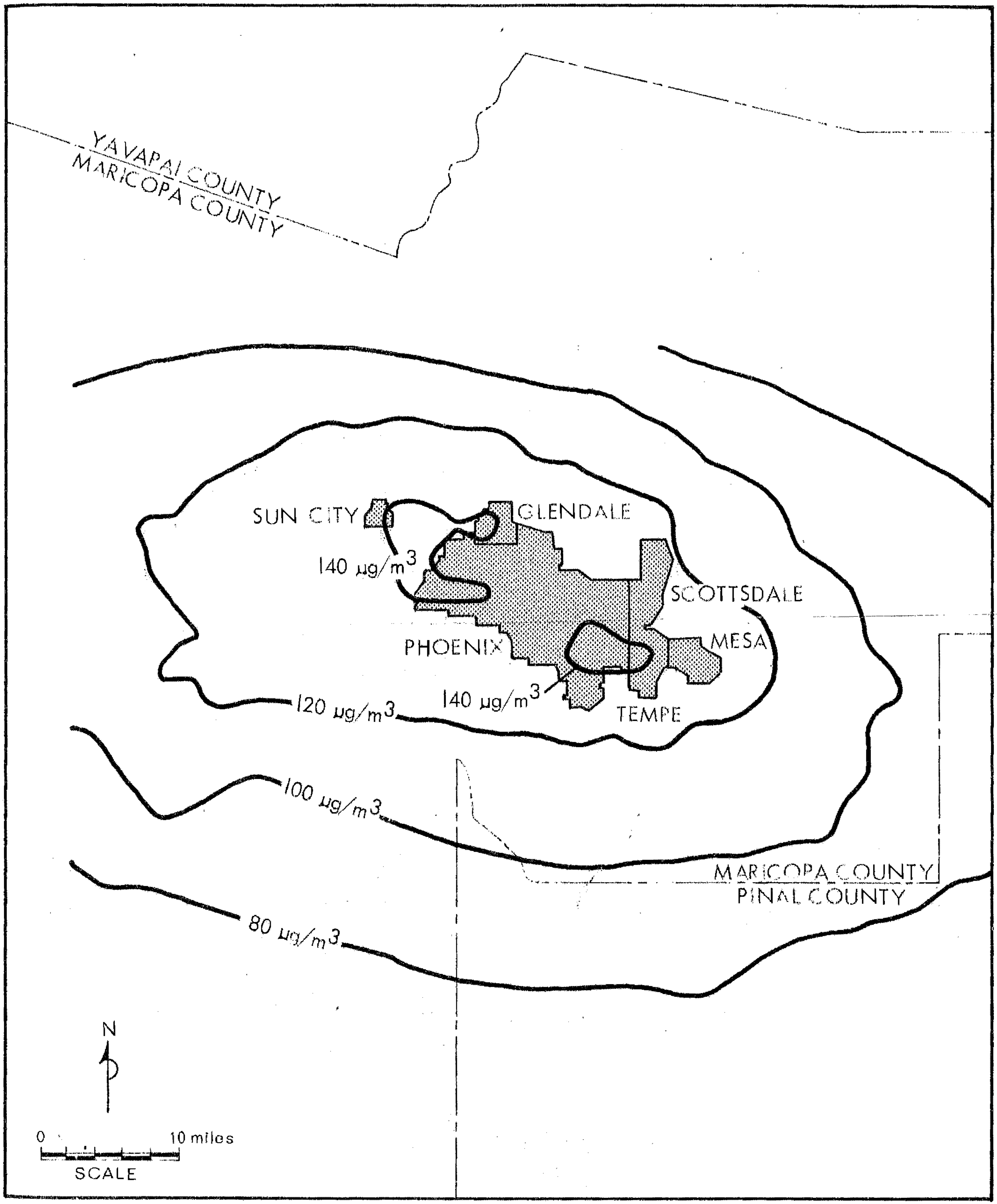

Figure 2-5 Predicted Particulate Concentrations in Phoenix Area Prior to Fugitive Dust Control.

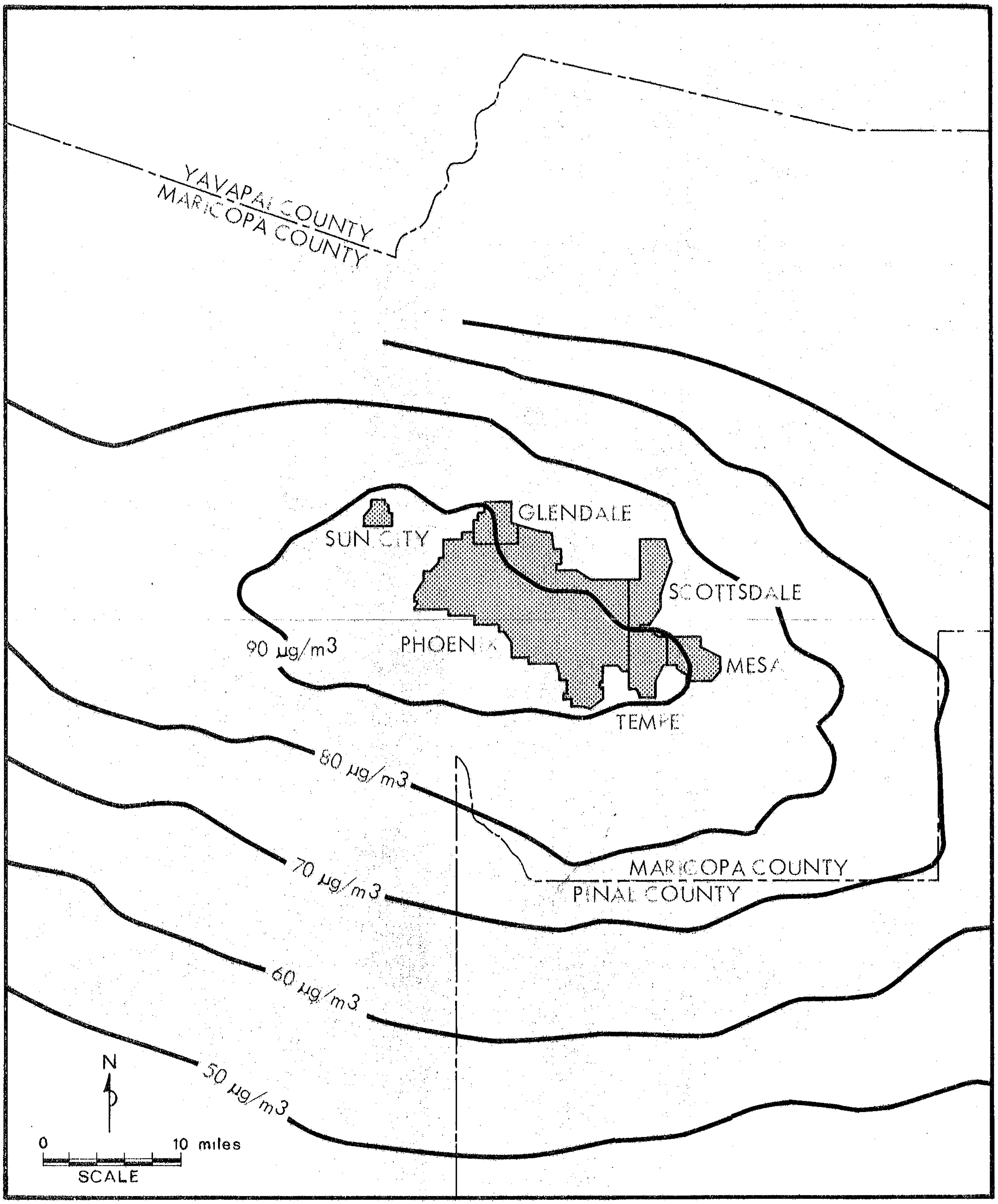

Figure 2-6 Predicted Particulate Concentrations in Phoenix Area with Control Strategy B.

applied in a follow-up run of the model for Phoenix in addition to the other controls for strategy B. This value was obtained as the combined effect of chemical stabilization of newly planted cropland (a costly technique not yet proven in full-scale field testing) plus continuous cropping and/or limited irrigation of fallow land to reduce emissions in seasons other than the prime farming season. This control strategy predicted a maximum concentration of 72 $\mu g/m^3$ geometric mean, (see Figure 2-7). Control strategy tests were not undertaken for the other three counties of the region, since their existing particulate measurements are lower than in Maricopa and Pima Counties. Region-wide adoption of strategy B controls should also achieve standards in these three counties.

In the remainder of the regions, control strategy evaluations were by the proportional reduction method. Roll-back calculations in the San Joaquin AQCR were made for each of the six counties in which there was an air quality sampling site reading above the primary standard. Emission reduction calculations for control strategy B are shown in Table 2-5. These are compared with the percent reductions necessary to achieve primary and secondary standards in the same table. The secondary standard is reached in only one of the six counties, and the primary standard is still exceeded in Kern and Tulare Counties. Corresponding calculations for strategy A gave unacceptable reductions in all but San Joaquin County; C and B were indistinguishable strategies for this AQCR. A review of the emission contributions and the reductions obtained by source category in Table 2-5 indicated that, as in Maricopa County in the Phoenix-Tucson AQCR, agricultural emissions were primarily responsible for the predicted high particulate concentrations after control of fugitive dust. Application of the 65 percent control from use of chemical stabilizers, etc., brought down the maximum predicted concentrations in Tulare County to 75 $\mu g/m^3$ and in Kern County to 77 $\mu g/m^3$. Therefore, achievement of the

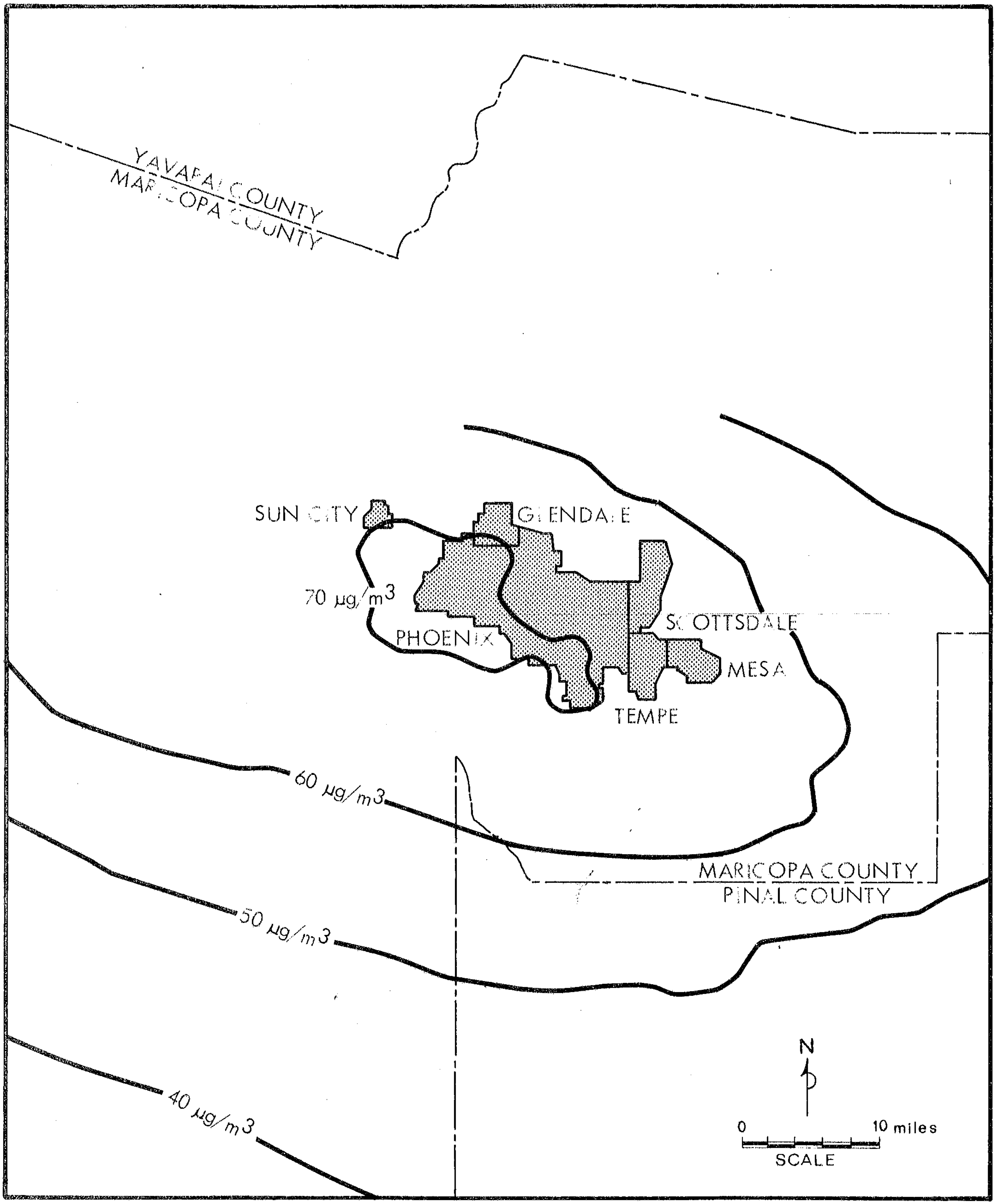

Figure 2-7 Predicted Particulate Concentrations in Phoenix Area with Control Strategy B plus 65% Control of Agricultural Emissions.

TABLE 2-5

CONTROL STRATEGY CALCULATIONS FOR SAN JOAQUIN

County	Kern	Tulare	Fresno	Kings	Stanislaus	San Joaquin
Pollutant Reductions						
Max. ann. geom. mean, μg/m^3	169	167	97	98	94	77
Background, μg/m^3	25	25	25	25	25	25
% Reduction necessary to achieve primary standard	65%	65%	31%	31%	28%	4%
% Reduction necessary to achieve secondary standard	75%	75%	51%	51%	49%	33%
Emission Reductions						
Emissions - Existing						
Unpaved Roads	3300	3530	70040	36900	540	8840
Agriculture	288290	185000	117300	133000	23600	29000
Aggregate Storage	900	-	1620	-	230	860
Feedlots	1320	240	410	360	560	-
Construction	4870	-	16200	-	2100	8390
Point Sources	17849	7556	17995	5439	3285	8140
Area Sources	767	621	1752	913	730	1168
	317296	196947	225317	176612	31045	56398
Emissions - Controlled						
Unpaved Roads	1650	1480	29400	15500	230	3720
Agriculture	224000	143000	90500	96000	18300	22500
Aggregate Storage	90	-	160	-	20	90
Feedlots	260	50	80	70	110	-
Construction	1720	-	5680	-	730	740
Point Sources	8942	4380	10512	5000	767	2920
Area Sources	730	621	1460	219	730	1022
	237392	149531	137792	116789	20887	30992
Optional Strategy Emissions	114553*	68001*				
% Reduction Obtained	25% 64%*	24% 65%*	39%	34%	33%	55%
Estimated Max. Air Quality Levels in 1975	133 77*	131 75*	69	73	71	48

* Strategy B+, includes 65% control of agriculture

primary standards can be demonstrated throughout the region, however this would require the use of untested techniques for fugitive dust control. Achievement of the secondary standards appear to be most unlikely regardless of the application of identified control techniques.

For the second AQCR in New Mexico (El Paso-Las Cruces-Alamogordo), most of the air quality measurements were already well below the secondary standard. The one high reading of 145 $\mu g/m^3$ in Dona Ana County was in a predominantly agricultural area in the Rio Grande River valley. A county-wide reduction in emissions according to strategy B resulted in a 37 percent reduction in emissions, as shown in Table 2-6. The percent reductions in ambient levels needed to reach the primary and secondary standards were calculated to be 58 and 71 percent, respectively. Therefore, these calculations also confirmed that the only areas in which fugitive dust emissions cannot be controlled to the extent necessary to at least achieve the primary standards are those with highly concentrated farmlands.

Rollback calculations in the two AQCR's in Nevada were performed on emissions occurring within a three mile radius of sampling stations exceeding the secondary standard. This smaller area was specified instead of counties because the air quality readings at the stations with the exception of the Reno-Sparks station, were considered to be more representative of air quality in the immediate vicinity than county-wide air quality. Four of the seven sites in the state exceeding the standard (see Table 2-1) are greatly influenced by nearby large particulate point sources, and all seven are located in commercial or residential areas of a town.

Detailed on-site surveys of these seven sites were made to inventory all significant particulate emission sources within the three mile radius. In order that the air quality data would correspond with the time period of these emission

Table 2-6

CONTROL STRATEGY CALCULATIONS FOR
EL PASO-LAS CRUCES-ALAMOGORDO AQCR

	DONA ANA COUNTY
Pollutant Reductions	
Max. ann. geom. mean, $\mu g/m^3$	145
Background, $\mu g/m^3$	25
% Reduction necessary to achieve primary	58%
% Reduction necessary to achieve secondary	71%
Emission Reductions	
Emissions - Existing	
Unpaved Roads	23,700
Agriculture	48,000
Aggregrate Storage	430
Tailings/Feedlots	-
Construction	2,350
Point Source	115
Area Source	567
	75,162
Emissions - Controlled	
Unpaved Roads	10,000
Agriculture	37,200
Aggregrate Storage	43
Tailings/Feedlots	-
Construction	822
Point Sources	76
Area Sources	567
	48,708
Optional Strategy	28,308*
% Reduction Obtained	35% 62%*
Estimated Max. Air Quality Level in 1975	103 71*

* Strategy B+, includes 65% control of agriculture

surveys, 1972 air quality data were used in the rollback calculations. The 1972 annual geometric means for the stations are generally lower than 1970 levels because of emission reductions already achieved on some sources impacting on the sites. Rollback calculations for the three areas in the Nevada Intrastate AQCR and four areas in the Northwest Nevada AQCR are shown in Tables 2-7 and 2-8, respectively.

In the Nevada Intrastate AQCR, control of non-fugitive sources above is shown to achieve necessary emission reductions to reach the primary standard throughout the region. Control of conventional sources is shown to achieve the secondary standard in the vicinity of Gabbs, while control of conventional sources plus fugitive dust from tailings will provide air quality levels consistent with the secondary standard at McGill. However, attainment of the secondary standard at Fallon cannot be demonstrated by the rollback calculations, largely due to a lack of large sources within the three mile radius of the station.

In Northwest Nevada, a combination of conventional source control measures and fugitive dust control results in attainment of the primary standard throughout the region and the secondary standard at all but the Fernley location. Paving of streets in Fernley would be required to meet the secondary standard there. Paving of roads carrying 15 percent of the vehicle miles would also be necessary in Washoe County as part of the control strategy.

In summary, stringent fugitive dust control strategies are required in all six regions. Even these strategies do not attain the primary standard in certain intense agricultural areas in three of the AQCR's, although it is able to reach the primary or secondary standards in other parts of these regions. In the other three AQCR's, the evaluations indicate that the secondary standard will probably be achieved throughout the regions.

TABLE 2-7

CONTROL STRATEGY CALCULATIONS FOR NEVADA INTRASTATE AQCR

County	White Pine	Nye	Churchill
Sampling Station	McGill	Gabbs	Fallon
Pollutant Reductions			
Annual geometric mean, μg/m^3	108	97	82
Background, μg/m^3	25	25	25
% Reduction necessary to achieve primary standard	40%	31%	12%
% Reduction necessary to achieve secondary standard	57%	51%	39%
Emission Reductions			
Emissions - Existing*			
Unpaved Streets	170	38	7
Agriculture	-	-	16
Tailings	4360	(included w/ pt. sources)	-
Point Sources	4810	30801	39
	9340	30839	62
Emissions - Controlled*			
Unpaved Streets	170	38	7
Agriculture	-	-	16
Tailings	508	(included w/ pt. sources)	-
Point Sources	3166	1232	25
	3844	1260	48
% Reduction Obtained	58%	96%	23%
Estimated max. air quality level in 1975 μg/m^3	<60	<60	69

* Emissions within a 3-mile radius of the sampling station

CONTROL STRATEGY CALCULATIONS FOR NORTHWEST NEVADA AQCR

County	Lyon	Lyon	Washoe	Douglas
Sampling Station	Fernley	Yerington	Reno-Sparks	Stateline
Pollutant Reductions				
Annual geometric mean, μg/m^3	75	71	99	71
Background, μg/m^3	25	25	25	25
% Reduction necessary to achieve primary standard	0	0	32%	0
% Reduction necessary to achieve secondary standard	30%	24%	53%	24%
Emission Reductions				
Emissions - Existing *				
Unpaved Roads	45	20	77,700	-
Aggregate storage	12	-	143	-
Tailings	-	312	-	-
Construction	-	-	-	50
Point Sources	727	379	3,156	-
Area Sources	-	-	1,268	-
	784	711	82,267	50
Emissions - Controlled*				
Unpaved Roads	45	20	38,850	-
Aggregate Storage	12	-	14	-
Tailings (already controlled)	-	312	-	-
Construction	-	-	-	0
Point Sources	536	200	553	-
Area Sources	-	-	1,268	-
	593	532	40,685	0
% Reduction Obtained	25%	25%	51%	100%
Estimated max. air quality level in 1975, μg/m^3	63	<60	61	<60

* Emissions within a 3-mile radius of the sampling station, except county-wide emissions for Washoe County.

The cost of implementing the strategies has not been estimated in this report. However, the cost data presented in the Phase I/II document reveals that paving will be the most costly control excluding, of course, the application of chemical stabilization to vast agricultural areas. In regions where the secondary standard will be achieved, a scheduled paving program which reduces ambient levels to the primary standard by 1975 and to the secondary by 1977 or thereafter may be more feasible economically.

3.0 PROPOSED REGULATORY APPROACHES

Representative regulations covering control techniques found to be necessary have been drafted and are presented below. These will require in-depth review by involved legal staff and insertion of appropriate terms to make them specific to individual jurisdictions. Also, conditional exclusions may be necessary, particularly for watering regulations. For example, watering could be omitted when temperatures are below 50°F or when a rainfall of more than 0.1 inch has been recordec (neither of these numbers is backed by data). However, exclusion clauses have not been included in the example regulations for fear of creating opportunities for circumventic

3.1 Regulation for the Control of Particulate Matter: Unpaved Roads

- The political subdivisions responsible for the constructic and maintenance of unpaved roads within the ______________ ______________ shall be required to pave all unpaved roac with an average daily traffic (ADT) volume of more than 150 vehicles with a quality of paving equal to or better than a 3" bituminous surface or be otherwise treated by a method approved by ______________ to provide at least equivalent protection to that of a 3" bituminous surface, against the emissions of particulate matter into the atmosphere resulting from vehicle travel on the road. Suc equivalent protection may include the rerouting of traffic and or closing of unpaved roads.

- The political subdivisions responsible for the constructic and maintenance of unpaved roads within the ______________ ______________ shall establish and enforce:

  (i) A maximum speed limit of 20 miles per hour within the City of ______________.

  (ii) A maximum speed limit of 25 miles per hour in all other areas of the region.

- No person shall construct any new public road, alley or parking lot within the ______________________ without causing the surface over which the vehicles will travel to be paved with a 3" bituminous surface and cause the shoulders of such roads to be constructed or treated in a manner which will prevent particulate matter from becoming airborne.

- No person within the _________________________ shall construct any new private parking lot which may be used for more than 15 vehicle movements per day without causing the surface over which the vehicles will travel to be paved with a 3" bituminous surface.

3.2 <u>Regulation for Control of Particulate Matter</u>: <u>Agriculture</u>

- Any person who owns or is in charge of any actively tilled agricultural land within the ______________________ shall manage and use such land in a manner so as to prevent particulate matter from becoming airborne, to the maximum extent practical.

- Any person who owns or is in charge of any actively tilled land of more than 500 acres within the ____________________ _____________ shall submit to ____________________________ for approval a detailed soil management plan for compliance with the requirements of (d)(1). If the __________________ disapproves, the reasons for such will be furnished to the owner or operator submitting the plan. Approvals may be for such period as the ______________ may specify. Such soil management plans may be revised upon application to the ______________ for revision.

- A detailed soil management plan may include, but is not limited to, one or more of the following measures:

  (i) Maintaining a crop cover at all times

  (ii) Planting of vegetative ground covers

  (iii) Maintaining a ground cover of crop residue

  (iv) Periodic irrigation

  (v) Application of chemical soil stabilizers

  (vi) Strip cropping

  (vii) Inter-row plantings

(viii) Use of windbreaks

(ix) Mulching

(x) Planting of crops that do not result in wind erosion of soil.

3.3 Regulation for the Control of Particulate Matter: Material Storage

° No person within the ______________________ shall cause or permit any material to be handled, transported or stored unless the particulate matter emissions are controlled by such measures as enclosures, covers, spraying with an approved dust suppressant or other methods approved by ________________________.

3.4 Regulation for the Control of Particulate Matter: Tailings Ponds

° No person with the __________________________ shall cause or permit the storage or disposal of materials from the mining, quarrying or processing of ores or minerals unless the particulate matter emissions are controlled by such measures as chemical stabilization, vegetative growth, cover with a non-erodible material such as smelter slag or other equivalent methods as approved by __________________.

3.5 Regulation for the Control of Particulate Matter: Feedlots

° No person within the _____________________ shall cause or permit the operation of an animal feedlot of greater than one acre without controlling emissions of particulate matter by daily watering of the feedlot with an application rate of at least .5 gallon per square yard or by other methods approved by _________________. Such applications of water need not be made when rainfall provides an equivalent application of water. Precautions shall be taken to prevent water run off from creating a water pollution problem.

3.6 Regulations for the Control of Particulate Matter: Construction

° No person within the ______________________ shall engage in the clearing or leveling of land, earthmoving, excavation, demolition, or the movement of trucks or construction equipment over cleared land or temporary access or haul roads without watering all such access or haul roads at the construction site for dust suppression at least twice daily with a minimum watering rate for each application of .5 gallons per square yard, or by other equivalent methods approved by the ____________. Such applications of water need not be made when rainfall provides an equivalent application of water.

- The owner or operator of land areas which have been cleared or excavated within the ______________________ shall take measures to prevent particulate matter from becoming airborne. Such measures may include, but are not limited to (1) planting vegetative cover, (2) providing mulch cover, (3) treating such areas with a chemical soil stabilizer or any equivalent method approved by ____________ at the completion of the clearing, or excavating activity or during temporary periods of inactivity to prevent exposed soil from becoming airborne as particulate matter. These areas shall be retreated or replanted as required.

3.7 Regulatory Considerations

The implications of imposing regulations whose eventual impact on air quality levels is not substantially defined, and, whose health and welfare ramifications could be extensive, require evaluation of many factors.

In the case of fugitive dust, control of emissions from agricultural operations by the application of chemical soil stabilizers must certainly be carefully considered. Factors which mitigate against a requirement for this control technology include:

- A herbicide must be co-applied with the chemical stabilizer in order to retard weed growth which would force the farmer to disturb the induced soil crust, thus defeating the purpose of the application, Preliminary research indicates that the herbicides do not retard crop seedling growth but, possible uptake in the plant as well as inhalation during spraying operations may produce injurious human health effects which will far outweigh those gained by reducing airborne soil levels.

- The permanency of these spray-on adhesives on receptor crop lands has not been established. It is possible that for some soil classifications this technique is either ineffective or will require development of new chemical products.

- Since most of the compounds suggested for this application are either water soluble or form agglomerates which can be washed-out by rain or irrigation, their possible effect on water quality must be determined.

- The economic impact of this technology is substantial. Best cost estimates for purchase and spray application of currently available soil adhesives range from $40 to $60 per acre. And, the process must be repeated each time a new crop is started. In the San Joaquin Valley, for example, use of this approach would require approximately fifty (50) million dollars per each crop cycle.

Another possible approach to the control of fugitive dust from farming is to prohibit the use of a certain amount of acreage by employing a system similar to the "Soil-Bank". However, this concept would only lead to a substantial loss in farm employment with the resultant decline in community health levels which always accompanies a depressed economic situation. Even more serious, in this case, would be the loss in agricultural production from the San Joaquin area. Removing approximately half of its productive effort would severely jeopardize the food supply of the entire West Coast.

In consideration of the above factors, an appropriate course may be to promulgate the proposed regulations, recognizing that in some areas the Primary Standard may not be achieved by 1975. However, during the intervening period of the next two-three years a viable program must be initiated to include:

- Education of farmers in good operational practices aimed at reducing airborne particulates.
- Increased emphasis on land use planning.
- Determination of the health effects of particulate emissions generated from agricultural operations.
- Development of alternate control technologies for the prevention of fugitive dust emissions.

While the improvement in air quality resulting from these programs is difficult to quantify, their implementation can only serve to improve the ambient levels of suspended particulate while enhancing soil management practices.

4.0 SUMMARY AND CONCLUSIONS

It was demonstrated in the Phase I/II Report that Fugitive dust emissions are much greater than particulate emissions from conventional point and area sources in each of the six Air Quality Control Regions inventoried. Further, the relative importance of specific fugitive dust source categories varies considerably from one region to anotner. While agricultural emissions overshadow all other sources in two of the regions and are a large contributor in a third, it must be noted that these regions contain some of the most intensively farmed land in the U.S. In the other four AQCR's, fugitive dust from unpaved roads and construction are prominent sources of suspended particulates.

Most of the fugitive dust controls investigated are applications of one of three basic techniques -- watering, chemical stabilization, or reduction of surface wind speed across exposed sources. For exposed roads, tracks, and lots, control techniques include paving and traffic control for unpaved roads. Feasible control methods and their approximate efficiencies for each fugitive dust source are summarized in Table 4-2 of the Phase I/II report.

The same general set of control methods must be employed in each AQCR, even though the relative contributions from specific source categories vary within each region. The effective strategy contains provisions for:

- paving of highly traveled unpaved roads,
- speed limits on remaining unpaved roads,
- no construction of new unpaved roads,
- maintenance of tilled agricultural land continuously in either cash crops or cover crops,
- frequent irrigation during brief fallow periods or when crops are in the seedling stage,
- watering of construction sites,
- chemical stabilization of completed cuts and fills,
- chemical, physical, or vegetative stabilization of tailings piles,
- covering, enclosure, or spraying with a dust suppressant chemical for aggregate storage piles, and
- daily watering of cattle feedlots.

Implementation of these control measures would attain the primary standard of 75 $\mu g/m^3$ in all parts of the six AQCR's except areas of intensive agricultural activity. These are Dona Ana Counties in the El Paso-Las Cruces-Alamogordo region, Maricopa County in the Phoenix-Tucson region, and Kern and Tulare counties in the San Joaquin AQCR. The only additional controls which might be employed in these areas are the spraying of chemical soil stabilizers on newly planted fields or removing part of the land from active tilling.

In several other counties, the primary standard is achieved by the strategy, but not the secondary standard of 60 $\mu g/m^3$. Possibly, the time extension available for development of a plan to attain the secondary standards can be utilized in the El Paso, Phoenix-Tucson, and San Joaquin AQCR's. Regardless, most of the southern half of the San Joaquin region will have difficulty in reaching the secondary standards because of the high density of farming activity and arid climate throughout this area.

Much work is currently underway to better define the conditions causing fugitive dust emissions and methods for their control. However, of all the fugitive dust sources, the least attention from an air pollution control standpoint is being given to agriculture. The present study indicates that agriculture is the most difficult source to control with existing technology. Specific investigations which would advance understanding of agricultural emission mechanisms and define control techniques are:

- determination of the portion of wind erosion losses that are measured as suspended particulate;
- impact that an ambient air quality standard for the respirable particle sizes would have on problems in agricultural areas;
- extensive field testing of chemical stabilization of newly planted fields; and
- study of educational methods and economic incentives for extending soil conservation programs to include particulate air pollution control as a major objective.

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16. ABSTRACT

A study of alternative control strategies for controlling fugitive dust emissions in six (6) air quality control regions. The study was initiated to determine if, by using available technology, fugitive dust emissions be controlled in AQCR's where fugitive dust emissions prevent t of the national ambient air quality standards for particulate. Fugitive dust emissions from the following sources were studied: (1) unpaved roads, (2) agriculture, (3) construction, (4) tailing piles, (5) aggregate storage, (6) feedlots. The strategies were tested by IPP and/or proportional modeling for each AQCR within the study area.

17. KEY WORDS AND DOCUMENT ANALYSIS

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