BEFORE THE
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

PROPOSED FUGITIVE DUST POLICY STATEMENT (52 Fed. Reg. 24716, July 1, 1987)	))	EPA Docket No. A-87-01

EXECUTIVE SUMMARY

The following Comments on EPA's proposed fugitive dust policy statement, 52 Fed. Reg. 24716-24723 (July 1, 1987), are submitted on behalf of the American Mining Congress (AMC), which is concerned with the impact which the policy changes under consideration may have on mining operations. Many AMC member companies operate mines and mineral processing plants in areas heavily impacted by rural fugitive dust. Without the rural fugitive dust policy, these companies would face severe restrictions on existing operations and future expansions or modifications, in exchange for an illusory benefit to public health or welfare. Therefore, AMC has a vital interest in retention of a revised and expanded rural fugitive dust policy which recognizes existing practice and scientific and technical reality.

The key points made in AMC's Comments are these:

1. There is clear and present necessity for maintaining some form of rural fugitive dust policy, so that sufficient flexibility exists to avoid severely restricting current and future mining and other economic development based on harmless dust.

2. There is strong scientific, technical and practical support for such a policy, including the following key points:

   * The fundamental distinction in terms of origin, distribution, toxicity and chemical composition between fine and coarse particles.

* The body of medical opinion that no adverse health or welfare effects are attributable to fugitive dust at ambient concentrations, and the corresponding lack of documented health or welfare effects from fugitive dust.

* The impossibility of significant further controls on fugitive dust, particularly at mining operations which are already effectively required to apply BACT.

* The draconian adverse effects on current and future mining operations if appropriate discounting of fugitive dust is not allowed.

3. EPA has ample legal authority and indeed a legal duty to develop a revised and expanded fugitive dust policy that recognizes the scientific and technical facts and demonstrates the "administrative good sense" that Congress has long urged with respect to fugitive dust.

4. None of EPA's "alternatives" are adequate; instead, a revised and expanded fugitive dust policy should be developed and proposed for public comment.

FACTUAL BACKGROUND

EPA's fugitive dust policy has been a necessary concomitant of the particulate matter (PM) National Ambient Air Quality Standards (NAAQS) for as long as those standards have existed. This policy has reflected the fact that the PM standards were routinely exceeded by coarse particle fugitive dust from natural sources, agriculture, unpaved roads, mining, construction and other sources, especially in arid areas of the West. EPA, Congress, and the scientific community have long recognized the fundamental distinction between fine particle PM, generally considered to present health and visibility concerns, and coarse particle PM, which has generally been considered harmless, and has been discounted and exempted by one mechanism or another since the first PM standards were adopted. Congressional proposals to exempt such coarse particle fugitive dust have been met with repeated assurances that legislation was unnecessary because EPA would exercise "administrative good sense" in dealing with the "logical dilemma" posed by the fact that large areas were in nonattainment as a result of such harmless fugitive dust.

The mining industry has a major interest in the PM standard because numerous studies and monitoring data have demonstrated that all but the smallest surface mining operations are not able to meet the PSD increments, and often the 24-hour PM NAAQS, even after the application of Best Available Control Technology ("BACT"), so long as a "Total Suspended Particulate" (TSP) definition of particulate matter applied. See AMC Surface Coal Mine Rulemaking Comments, Docket No. A-84-33 at 6-21 (1/28/85). It has also been shown that fugitive particulate matter from mining, at the levels it exists in the ambient air, does not present substantial health or welfare concerns. Id. at 23-24. EPA and CASAC correctly decided to discard TSP as an outmoded, scientifically misleading definition of particulate matter in favor of a "size-selective" definition that would focus on those fine particles implicated in health and welfare effects. One of the most hotly-debated aspects of the NAAQS rulemaking was the size cutpoint issue. Substantial scientific evidence exists that a

7 um, a 5 um, or even a 2.5 um cutpoint would have provided ample protection against all known or anticipated health or welfare impacts. However, EPA selected a "PM10" cutpoint. TSP as measured around mining operations is of course predominantly coarse particles existing at harmless concentrations but can include some fraction of PM10 particles.

It is unclear to what extent the new PM10 standard will, due to its inherent conservatism and possible over-inclusiveness, count coarse, harmless particles such as those resulting from mining. Early data and EPA's probability methodology suggest that EPA may once again be faced with the logical dilemma of harmless dusts exceeding the standards. AMC therefore welcomes EPA's efforts to study what kind of fugitive dust policy should be continued for PM10.

However, to the consternation of the mining industry, EPA has retained TSP as the definition of particulate matter for purposes of the PSD increments. Prior to promulgation of the PM10 standard, states were allowed to issue non-PSD permits even though the modeling ordinarily required to obtain state emission permits showed exceedance of the TSP increments. 48 Fed. Reg. 38752 (August 25, 1983). Because of the virtual prohibition of economically-sized surface mining which imposition of TSP-measured increments represents, and the fact that Congress clearly intended for EPA to discount fugitive dust in determining compliance, these comments will document the legal and technical basis for continuing and clarifying the discounting and exemption of fugitive dust from ambient air quality impact determinations involving the NAAQS as well as PSD increments.

I. EPA SHOULD ALLOW HARMLESS FUGITIVE DUSTS TO BE DISCOUNTED IN MAKING AMBIENT DETERMINATIONS, PARTICULARLY WITH RESPECT TO THE PSD INCREMENTS.

EPA's long-standing policy of permitting harmless fugitive dusts (i.e., large-size, chemically inert dusts) to be discounted for all ambient air quality determinations, including PSD increment consumption determinations, should be continued, particularly for so long as a TSP definition applies. This policy is consistent with the Court's opinion in Alabama Power Co. v. Costle, 636 F.2d 323 (D.C. Cir. 1979) ("Alabama Power"), and constitutes the "administrative good sense" which Congress expected EPA to exercise in this area. Most important, unless fugitive dust is discounted, mining operations throughout the country, including coal and other mining vital to energy and mineral independence, and critical to the country's exports and balance of payments, will be severely curtailed or even prohibited. EPA should not be concerned that this treatment of fugitive dust will mean that fugitive dust is not controlled. Operations producing fugitive dust remain subject to the comprehensive State Implementation Plan and state fugitive dust control regulations, as described in prior Comments. See Exhibit E to AMC Settlement Agreement Rulemaking Comments, Docket No. A-82-83 (10/10/83).

A. The Scientific Evidence Supports the Discounting of Mining-Related Fugitive Dust.

The fugitive dust produced by mining consists almost entirely of coarse, non-toxic, non-respirable particles, which have no discernible or documented adverse effects on human health, welfare or visibility. This conclusion has been extensively briefed in previous AMC Comments to EPA and documented in the Exhibits accompanying those Comments. AMC Surface Coal Mine Rulemaking Comments, Docket No. A-84-33 at 23-34 (1/28/85). The following statements are illustrative of the body of scientific opinion that rural fugitive dust is essentially harmless, due to its large size and non-toxic composition:

> ". . . it is my opinion that fugitive dust from mines do not constitute a health hazard to the general population."[1]

> "Fugitive dust emissions, whether from mining, agriculture, or from traffic on unpaved public roads consist largely of coarse particles which settle out of the atmosphere close to the source. These particles do not account for any known adverse effects to health or welfare other than localized nuisance problems usually associated with periods of dry, windy weather."[2]

---

1 Statement by Dr. W.K.C. Morgan, University Hospital, London, Ontario (July 18, 1980) submitted with Holland & Hart Comments on External Review Draft No. 1 of the Revised Criteria Document for Particulate Matter and Sulfur Oxides (July 31, 1980), EPA Docket No. ECAO-CD-79-1.

2 Comment on Final and Proposed PSD Regulations by Dr. Chatten Cowherd, Midwest Research Institute (January 30, 1978).

A 1978 report on emissions from surface coal mines prepared for EPA by PEDCo states:

> "Health effects research data clearly indicate that adverse effects are associated with respirable particles rather than the large particles which fall out within a short distance of the source."[3]

The PEDCo report also establishes that mining operations produce very few particles in the respirable size range. See Appendix D of the PEDCo report. A 1979 ERT-DOE study concludes:

> ". . . surface mining operations may have little or no impact on regional air quality. . . . [because] only the very small dust particles, less than 3 um in diameter, affect visibility and health."[4]

The evidence that non-toxic, large-size mining dust is virtually harmless continues to accumulate.[5] We attach Technical Comments prepared by TRC Environmental Consultants reviewing the most recent scientific evidence, which continues to support the discounting of coarse particulate, chemically inert fugitive dusts. (Ex. 1.) This is corroborated by the Comments of Dr. Benjamin C. Ferris of the Harvard School of Public Health, attached hereto as

---

3 "Survey of Fugitive Dust from Coal Mines," EPA-908/7-78-003 at 8 (February 1978).

4 "Comparison of Alternative Approaches for Estimation of Particulate Concentrations Resulting from Coal Strip Mining Activities in Northeastern Wyoming," ERT Document P-3545-106 at 6-2 (October 1979).

5 See Ex. H to Holland & Hart Comments on September 5, 1979 Proposed Regulations, "Compilation of Materials on the Lack of Health and Welfare Effects Resulting from Fugitive Dust."

Ex. 2. Finally, as discussed in the next section, EPA's own past regulatory treatment of fugitive dust provides persuasive evidence of its lack of discernible health and welfare effects.

B. EPA Has a Long-Standing Policy of Discounting Fugitive Dust.

The lack of discernible health and welfare effects from fugitive dust is evidenced by EPA's consistent past policy of discounting and exempting fugitive dust. Thus, EPA promulgated the "fugitive dust exemption" in its June 1978 PSD regulations, which excluded fugitive dust from key elements of the PSD permit requirements. 40 C.F.R. § 51.24(k)(5) and 52.21(k)(5) (1978). EPA explicitly recognized the special nature of fugitive dust in its Opening Brief in the Alabama Power case.

> "The 1977 Senate and House Reports reflect an intention to prevent emissions of non-respirable and chemically harmless particulate matter from being a significant factor in setting limits on development. . . . The 'fugitive dust' exemption excludes emissions of largely non-repirable and chemically harmless particulate matter from the PSD review process."
>
> * * *
>
> ". . .'fugitive dust' is by definition not composed of substances thought to affect public health. . . ." (Emphasis added.) Opening Brief of Respondent EPA at pages 130, 138.

EPA stated in the preamble to the June 1978 PSD regulations that fugitive dust would not be treated as consuming increment "for the purposes of evaluating other sources under PSD," 43 Fed.

Req. 26395; and added in its Opening Brief (page 140) that fugitive dust would also be excluded in the periodic assessments of increment consumption by the States.

EPA thus has a well-established policy of distinguishing for PSD purposes between fugitive dust, deemed to have no significant impact on human health or welfare, and other particulate matter emissions. EPA's policy is soundly based on the scientific evidence that fine mode particles (2.5-3 micrometers and smaller), rather than coarse particles, are of predominant concern in protecting health and welfare. In 1973, EPA officials told Congress that "those particles below 2 microns in size (i.e., fine particles) . . . seem to be inordinately important from a health standpoint." Hearings before the Subcommittee on Public Health and Environment of the Committee on Interstate and Foreign Commerce, H. Rept. No. 93-62, 93rd Cong., 1st Sess. 93-94 (1973). In 1974, EPA indicated that fine particles of 2 micrometers or less in diameter were primarily responsible for most of the potential health and welfare effects that EPA had previously believed to be associated with airborne particulate matter in general.[6]

---

6 U.S. EPA Memorandum, "Fine Particulate Standard," from B. J. Stiegerwald, Director, Office of Air Quality Planning and Standards, to Roger Strelow, Assistant Administrator for Air Waste Management.

In 1975, EPA, through a memorandum transmitted to the staff of the U.S. Senate Subcommittee on Environmental Pollution, repeated that fine particles ("roughly defined as less than 2 microns") "are believed responsible for most of the adverse affects [sic] generally associated with suspended particulate matter and may not be adequately regulated." EPA summarized its findings with regard to the "importance of fine particulates" as follows:

> "[Fine particles] effectively limit visibility by scattering more light per unit mass than do larger particles. . . . Fine particles, because of their aerodynamic size, penetrate deeply into the respiratory system and impose a probable danger to public health by their own innate toxicity, or by acting as a transport mechanism for more toxic substances. . . . TSP measurements in some regions can be influenced by measurements of <u>larger particles such as wind-blown, agricultural or road dust which are not believed to be of major interest in protecting public health and visibility</u>."[7]

In 1980, EPA once again acknowledged that fine particles are of primary concern to public health:

> "Not all types of particulate matter have the same level of impact on human health. <u>Small particles, which are more likely to be deposited in the alveolar region and which require much longer periods of time to be cleared from the respiratory tract, have a greater potential to affect human health than larger particles</u>." (Emphasis added.) 45 <u>Fed</u>. <u>Reg</u>. 14499 (March 5, 1980).

---

7 U.S. EPA Memorandum, "Fine Particulate Control Strategies," from B. J. Steigerwald, Director, Office of Air Quality Planning and Standards, to Roger Strelow, Assistant Administrator for Air and Waste Management (July 2, 1975).

In sum, EPA has a sound scientific basis and a consistent public policy of excluding harmless fugitive dust from TSP increment consumption and ambient air quality determinations generally.

C. Congress Intended That EPA Should Exercise "Administrative Good Sense" Regarding Fugitive Dust.

In enacting the 1977 Amendments to the Clean Air Act, Congress clearly expected EPA to exercise "administrative good sense" in its treatment of fugitive dust:

> "Because of the imprecision inherent in the total suspended particulates standards, background dusts. . . . can cause levels in excess of the particulate standards. Fortunately, the logical dilemma posed by the shortcomings of the present particulates standards can be overcome by administrative good sense until such time as modification of the standards are adopted. The states have begun to recognize this problem of background particulates and should discount its effect where the problem involves particulates not generally of the substances and respirable sizes thought to affect public health. The Environmental Protection Agency has used this approach in its current policy, and the Committee endorses it. In calculating baseline levels for the purposes of the nondeterioration requirements, and in making determinations of attainment and nonattainment of ambient particulate standards, the Committee would expect that this administrative good sense would apply." (Emphasis supplied.) Senate Report No. 95-127, 95th Cong., 1st Sess. 98 (1977).

Significantly, the foregoing discussion of the need for "administrative good sense" occurred in the context of the PSD program generally and specifically how the PSD increments and baselines were to be measured. Id., 97-98. As with other cases of unrealistic deadlines or virtual impossibility in meeting standards (such as nonattainment deadlines), Congress counts on EPA to use "administrative good sense" to make the regulatory system work (e.g., the Reasonable Extra Efforts Program) and thereby retain public support for reasonable and feasible environmental regulation. Such administrative reasonableness and flexibility is particularly appropriate in the case of harmless fugitive dusts where the environmental risks are insubstantial, and control costs are enormous and lack substantiated environmental benefit. EPA has acknowledged this implication of the relevant legislative history:

> ". . . both the Senate and the House wanted to shift EPA's focus away from control of relatively harmless gross particles--in the words of the Senate Committee, 'particulates not generally of the substances and respirable sizes thought to effect public health--to smaller and more damaging particles." Opening Brief of Respondent EPA at page 136.

It is also clear that Congress did not mean to prevent or unduly restrict future surface mining in enacting the PSD provisions. For example, Senator Buckley, a member of the Senate Subcommittee on Environmental Pollution, refuted the results of a study purporting to show the adverse impacts of the proposed PSD requirements on coal mining by stating that the Senate Bill "will have no adverse impacts on coal extraction in West Virginia, Kentucky, or elsewhere." 122 Cong. Rec. S12581 (July 27, 1976).

Likewise, the House Report took pains to refute the contention that the Committee's proposed PSD increments would "limit the size or operation of new large strip mines in the West." See House Report No. 95-294, 95th Cong., 1st Sess. 165 (1977). Again, EPA has acknowledged this Congressional aim by stating, in the preamble to the 1978 regulations, that "Congress did not intend PSD to prohibit surface mines of an economically viable size." 43 Fed. Reg. 26395 (June 19, 1978).

In sum, Congress expected and intended that EPA would use "administrative good sense" in dealing with fugitive dust and in devising a PSD program which would not unduly restrict mining. EPA has recognized this Congressional intent. Therefore, EPA should continue its long-standing approach permitting mining-related fugitive dust to be discounted in PSD increment consumption and other ambient air quality determinations.

D. The Alabama Power Court Allowed and Encouraged EPA to Recognize the Unique Problems Presented by Regulation of Fugitive Dust and to Discount or Exempt Fugitive Dust.

The Court's ruling regarding fugitive emissions in Alabama Power, coupled with its suggestion to EPA to provide tailored coverage and a suitable legislative response to the special problems presented by fugitive dust, afford EPA ample room to follow AMC's recommendations and to exclude fugitive dust from ambient determinations including evaluation of the PSD increments.

First, the Court overturned EPA's automatic inclusion of _all_ emissions, fugitive and non-fugitive, in the "threshold determination" of whether a source constituted a "major stationary source" for PSD purposes. Instead, the Court ruled that, for each category of source, fugitive emissions could _not_ be counted in the threshold determination unless and until EPA conducted a specific rulemaking for that source category. 636 F.2d at 370.

Second, the Court overturned EPA's "fugitive dust exemption" because it was based on the "erroneous" premise that the Act "of its own momentum subjects major sources of fugitive emissions to PSD preconstruction review and permit requirements." 636 F.2d at 370. As the Court in effect recognized, the "fugitive dust exemption" was no longer relevant or necessary, because, unless EPA conducted specific, category-by-category rulemakings for fugitive dust sources, fugitive dust would not be counted in determining whether sources were "major" and so could not be subject to PSD review.[8]

---

8 The Court explicitly declined to resolve the question whether EPA's "fugitive dust exemption" was valid; however, _in dicta_, the Court expressed some doubt about the "manner" in which EPA had promulgated the exemption. 636 F.2d at 370. As the Court itself immediately indicates, its doubts about the "manner" of the original exemption by no means rules out other regulatory policies with the same goal and same result of excluding fugitive dust from increment consumption.

Thus, the Court was not asked to decide, nor did it decide, whether fugitive dust can or must consume increment. Nothing in the Court's opinion bars EPA from devising specifically tailored regulatory policies regarding fugitive dust. On the contrary, the Court clearly recognized the unique policy considerations presented by fugitive dust, and took pains to point out to EPA methods for effectively exempting fugitive dust from the PSD program. In sum, in the wake of Alabama Power, EPA retains a great deal of discretion to fashion innovative regulatory treatment of fugitive dust, as a close reading of the decision demonstrates.

For example, the Court in Alabama Power had before it voluminous documentation that mines simply could not meet the PSD increments, due to the fugitive dust they produce.[9] The Court noted that there was no "serious opposition" to the contention by the mining industry that mines were incapable of meeting the TSP-PSD increments. 636 F.2d at 369.

Furthermore, the Court explicitly recognized the valid policy considerations which underlay EPA's fugitive dust exemption, and urged EPA to take those considerations into account in deciding whether (and how) to regulate fugitive dust. Thus, in ruling that Section 302(j) of the Act requires source category-by-source category rulemaking before fugitive emissions from a

---

9 See Industry Petitioners' Brief on the Fugitive Dust Issue, pages 7-10, and documents cited therein.

given source can be counted in the threshold determination, the Court noted that Section 302(j) calls for a "legislative response" to the "policy considerations" presented by regulation of sources "where the predominant emissions are fugitive, particularly fugitive dust." (Emphasis added.) 636 F.2d at 370. The Court viewed Section 302(j) as "serendipitous," because "it gives EPA flexibility to provide industry-by-industry consideration and the appropriate tailoring of coverage." (Emphasis added.) Id.

The Court went even a step further, and suggested to EPA a mechanism for "accomplishing its objectives of partially exempting fugitive dust emitted by major emitting facilities from the requirements of Section 165 . . ." (Emphasis added.) 636 F.2d at 370. Footnote 134 suggests a procedure for imposing PSD review on certain source categories after redefinition of the term "particulate matter" to exclude "particulates of a size or composition determined not to present substantial public health or welfare concerns." Id. at 370-371. The "net result" of the Court's suggested approach would be the imposition of "Best Available Control Technology" ("BACT") on such sources but no need for the showing required by Section 165(a)(3) that emissions of "excluded particulates" would not violate NAAQS or allowable increments:

> "No NAAQS would exist for 'excluded particulates' <u>and the increments applicable to particulate matter would not apply</u>." (Emphasis added.) 13 E.R.C. at 2018.

The Court reinforced this concept by noting elsewhere:

> "Congress expected EPA to use 'administrative good sense' in establishing the baseline <u>and calculating exceedances</u>." (Emphasis added.) 636 F.2d at 380.

<u>Therefore, the Court plainly envisaged--and indeed suggested--that EPA could exempt certain particulate matter emissions from consumption of the TSP-PSD increments</u>.

This key concept constitutes a specific exception to the Court's very general statement that the preconstruction permit requirements of Section 165 "apply with equal force to fugitive emissions and emissions from industrial point sources." 636 F.2d at 369. In light of the Court's unusual efforts to suggest ways for EPA to permit discounting of fugitive dust, it would be incorrect for EPA to interpret the statement just quoted as a bar to exempting fugitive dust (as EPA appears to do in the regulatory preamble). <u>See</u> 45 <u>Fed</u>. <u>Reg</u>. 52691 (August 7, 1980). On the contrary, the Court plainly recognized the unique circumstances presented by the PSD regulation of mines and other fugitive dust sources, and both expected and encouraged EPA to devise policies recognizing the unique problems of such sources.

This conclusion is reinforced by the Court's reasonable belief that EPA <u>intended</u> to provide special treatment for fugitive dust. The Court had before it (1) EPA's "fugitive dust exemption," (2) statements in EPA's brief that fugitive dust is essentially harmless,[10] and (3) EPA's statements in the 1978 regulatory preamble[11] and EPA's brief[12] that fugitive dust would not be considered to consume the PSD increments. The Court understandably viewed these statements and actions as expressing a consistent EPA policy.

Given EPA's representations to the Court with respect to its objectives and intentions regarding fugitive dust, it would be extremely misleading for EPA to reverse field and suddenly treat fugitive dust as consuming the PSD increment for all purposes. Such a radical departure from past policy would contradict the underlying intent of the Court, because the Court clearly understood and approved EPA's underlying policy objective. Therefore, EPA should seek to develop a regulatory treatment of fugitive dust which is consistent with EPA's past policy and complies with the spirit of the Court's [illegible]

---

10 Opening Brief of Re[illegible] 130, 136 and 38.

11 43 Fed. Reg. 26[illegible]

12 Opening Brief of Respondent EPA at 140.

E. Counting Fugitive Dust Against the PSD Increments Would Severely Disrupt Mineral and Energy Development in the United States.

It is well-known that mining operations, particularly west of the Mississippi, inevitably produce large quantities of fugitive dust from the hauling, loading, earth removal and storage which occurs during mining. This dust is generally of large-size particles, chemically harmless, and falls to earth over relatively short distances. Nevertheless, because of lack of precision in the definition of "particulate matter," this harmless fugitive dust can cause PSD increment "violations." As a result, western mining will be seriously disrupted if EPA imposes the PSD increments on mining operations without tailored treatment for fugitive dust.

A number of modeling studies have conclusively shown that all but the smallest mines will be unable to meet the PSD increments, even after the best available dust suppression measures are applied, unless fugitive dust is discounted.[13] For example, a 1976 study prepared for the Federal Energy Administration by Environmental Research & Technology, Inc. ("ERT") on surface coal mines demonstrated that, if fugitive dust were counted, the Class II PSD increments would "severely restrict" surface mining, requiring a "buffer zone" around mines of 2 to 10 kilometers,

---

13 See Holland & Hart Comments (November 3, 1979) at pages 12-13, and documents cited therein.

while the Class I PSD increments would be exceeded for distances of 4 to 25 kilometers from the mine.[14] EPA cited this study in support of its "fugitive dust exemption" in its Opening Brief in the Alabama Power case (pages 130-131).

Several more recent modeling studies have corroborated the finding that the PSD increments will be exceeded for substantial distances around surface mines if fugitive dust is counted.[15] A 1979 study prepared by ERT for the U.S. Department of Energy used the most current modeling techniques--including a particle deposition function--to evaluate the air quality impacts of surface mines in Wyoming's Powder River Basin, using several different scenarios for including mining-related dust in air quality review. The scenario wich included all mining-related fugitive dust resulted in predictions of very high ambient particulate matter concentrations, far in excess of the PSD Class II increments and in some cases exceeding even the annual particulate

---

14 "Impact of Significant Deterioration Proposals Upon Western Surface Coal Mining Operations," ERT-FEA Conservation Paper No. 52 (May 5, 1976) at pages 1-4 and 5-1. Also see "Preliminary Draft Northwest Colorado AQMA Analysis," prepared by PEDCo for EPA (November 1976). This report concludes that oil shale development in northwest Colorado could meet the PSD increments and the particulate matter NAAQS only if fugitive dust emissions from haul roads, mining, disposal of processed shale and disturbed land in the plant area were not counted.

15 See, e.g., "Assessment of Particulate Matter Impact Associated With Strip Mining Activities: Fugitive Dust and the Proposed Surface Coal Mining Regulations" (Draft), prepared by ERT for U.S. Department of Energy, ERT Document No. P-3545 (November 1978).

matter NAAQS.[16] By contrast, the scenarios which excluded fugitive dust or included only dust in the respirable size range (2.5 to 3 micrometers or smaller) would not unduly restrict mining.[17]

A 1980 study prepared for EPA studied the effect of including mining-related fugitive dust in new source review of contiguous, energy-related processing facilities, such as oil shale plants, coal gasification of liquification plants, coal-fired generators and uranium mills. The study concluded that <u>all</u> of the facilities modeled would exceed the PSD Class II increments <u>if</u> mining-related fugitive dust was included.[18]

More recently, the Department of Energy commissioned PEDCo Environmental, Inc. to perform a study of the impact of subjecting surface coal mines to the PSD increments. "Assessment of Impacts on the Surface Coal Mine Industry Resulting From Possible Changes to PSD and Ambient Air Quality Standards" (PEDCo 1984). This study utilizes the ISC model and what are now standard emission factors for surface coal mining operations (Supplement 14 to AP-42, "Compilation of Air Pollutant Emission

---

16 "Comparison of Alternative Approaches for Estimation of Particulate Concentrations Resulting from Coal Strip Mining Activities in Northeastern Wyoming," ERT Document P-3545-106 (October 1979), at pages 5-4 to 5-8 and 6-1 to 6-2.

17 <u>Id</u>.

18 "The Impact of Including Fugitive Emissions from Mining Operations at Contiguous Processing Facilities," prepared by Energy and Environmental Analysis, Inc. for EPA (March 1980).

Factors," Third Edition, May 1983). Those emission factors are in general three to twenty times higher than the emission factors previously used for the permitting of surface coal mining operations. The study concluded that the Class I increment would limit surface coal mines to maximum production of between 0.1 and one million tons per year, while the Class II increments would limit such mines to maximum production of 0.5 to 3.3 million tons per year.

In fact, however, the PEDCo study overpredicts the size of operations which could actually be permitted. It assumes, for instance, that "C" and "D" stability classes may be used in modeling the impacts of surface coal mining operations. In reality, permitting authorities typically require the modeling of "worst case" conditions, which, in almost every case, occur during "E" and "F" stabilities with low wind speeds. The result is that PEDCo has underestimated the maximum ground level TSP concentration and overestimated the size of a mine that could be permitted.

A second assumption made by PEDCo is that ambient air quality values for purposes of the PSD increments are determined outside of the entire mine lease area, when in fact such determinations are required to be made at the point of nearest public access. Again, the "worst case" scenario required for permitting in the real world must reflect the fact that surface coal mines at some point do indeed mine at the lease boundary and often have their haul roads located along those boundaries. Finally, PEDCo assumed that none of the increment had been used, when in fact part or all of the increment has been used in major surface coal mining production areas, such as Wyoming's Powder River Basin, where the baseline was set on August 7, 1977.

In sum, the question of fugitive dust presents EPA with a stark choice: either EPA requires that fugitive dust be counted against the PSD increments, and thereby bars or severely restricts mining in this country; or EPA permits mining to occur, by allowing the discounting of fugitive dust.

F. EPA Should Give the States Flexibility to Discount Fugitive Dust for PSD Purposes.

In addition to discounting fugitive dust from increment and other ambient determinations in its own administration of PSD and other permit programs, EPA should make clear that the States have flexibility to adopt their own policies and regulations regarding discounting fugitive dust. This serves the important objective of State control over implementation of the Clean Air Act, which has been recognized by Congress in enacting the 1977 Clean Air Act Amendments, by the Court in deciding the Alabama Power case, and by EPA itself.

The legislative history of the 1977 Amendments contain numerous indications of Congressional intent that the States, not EPA, should be responsible for developing and administering the PSD program. For example, according to the Senate Report, one of the "fundamental concerns" prompting the 1977 revision of the Clean Air Act was:

> "[t]he need to augment the responsibility, authority, and effectiveness of State and local air pollution control programs." S. Rept. No. 95-127, 95th Cong., 1st Sess. 1384 (May 10, 1977).

The Senate Report adds:

> "The authority of States and localities to implement air pollution control programs within the framework of the national policy must be encouraged. . . . States and localities are given broad discretion to make decisions. . . . The Federal role must be one of support rather than control." Id. at 1384.

With specific reference to the PSD portions of the 1977 Amendments, the Senate Report states:

> "This policy will be implemented by the States. Judgments will be made on a case-by-case basis, taking into account local factors." (Emphasis added.) Id. at 1385.

Finally, the Senate Report characterizes the PSD provisions of the Act as placing "primary responsibilities and authority with the States, backed by the Federal government." Id. at 1403.

The legislative history in the House likewise identifies the need for State control and flexibility in implementing PSD. The House Report states:

> "The committee proposal [regarding PSD] provides for a program in which State and local governments (not Federal agencies) will determine appropriate policy after considering the multiple objectives of minimizing air pollution increases in clean air regions and permitting stable, long-term

> commercial, industrial and energy developments. . . . <u>The committee purposely chose not to dictate a Federal response</u> to balancing sometimes conflicting goals. It purposely chose not to dictate what State and local decisions on air quality deterioration must be. <u>Maximum flexibility and State discretion are the basis of the committee's approach</u>." (Emphasis added.) H. Rept. No. 95-294, 95th Cong., 1st Sess. 2613 (May 12, 1977).

The decision of the Court in <u>Alabama Power</u> strongly supports the principle of State control and State flexibility, specifically referring to the question of increment consumption:

> ". . . EPA has authority under the statute to prevent or to correct a violation of the increments, <u>but the Agency is without authority to dictate to the States their policy for management of the consumption of allowable increments</u>." (Emphasis added.) 13 E.R.C. at 2010.

Finally, EPA itself has noted, in the preamble to the proposed September 5, 1979 regulations, that "some flexibility in approving State plans should also apply to the PSD program. . . ." 44 <u>Fed</u>. <u>Reg</u>. 51945. In order to bring EPA's policies into conformance with the Court's opinion and Congressional intent, EPA should make clear that the States do indeed have flexibility to develop individualized treatment of fugitive dust and increment consumption issues suited to the particular conditions and objectives of the State concerned.

II. EPA SHOULD CONTINUE TO IMPLEMENT THE EXISTING FUGITIVE DUST POLICY UNTIL SUBSTANTIAL SCIENTIFIC EVIDENCE JUSTIFIES CHANGING IT.

EPA described opposition to continuation of the existing fugitive dust policy as based upon concerns that "fine particles, fertilizers, pesticides, and herbicides in fugitive dust from agricultural processes and other processes that disturb the land may have as great an impact on rural communities as other sources do on urban communities." 52 Fed. Reg. 24717. EPA reports that several commenters allege that rural fugitive dust can include fungal spores which cause diseases such as "Valley Fever," and that fugitive dust should be controlled whenever it is technically and economically possible. Id.

AMC does not oppose reasonable controls of fugitive dust that are technically and economically practical. Those are already required, are in practice, and in place. See Exhibit E to AMC Surface Coal Mine Rulemaking Comments, Docket No. A-82-83 (10/10/83). In the long history of the controversy over fugitive dust, critics of EPA and the fugitive dust policy have yet to identify a single inadequacy in fugitive dust controls of any mining operation.

The lack of a reasonable basis for concern about the purported potential health effects of rural particulate matter is addressed in the attached Technical Comments by TRC (Ex. 1). These concerns are little more than speculation, without the support of a single piece of peer-reviewed research nor any evidence of impact or effect. It is difficult to address or disprove comments which are so lacking in supporting evidence.

AMC has reviewed the entire record in this docket. It lacks any evidence at all to support these concerns regarding rural PM. AMC is therefore unable to identify, much less respond in detail, to whatever basis EPA or the commenters may have had for reciting these concerns.

Before EPA makes any change in the fugitive dust policy based on such concerns, its foundation (if any) should be identified and the public should be provided with the opportunity to evaluate and comment upon them. This lack of any scientific evidence of record to support a decision to depart from long-standing EPA and Congressional policy is a fundamental reason for maintaining the existing fugitive dust policy. No practical, real, or even anecdotal need has been adduced to support a change in the fugitive dust policy. Given the lack of environmental effect or benefit from prohibiting operations producing fugitive dust, and the adequacy of existing controls on such operations, it is impossible to justify a major policy change entailing enormous additional costs and illusory or negative net benefits.

III. EPA SHOULD CLARIFY THE EXISTING FUGITIVE DUST POLICY TO REFLECT EXISTING PRACTICE AND CONDITIONS.

The existing, "official" fugitive dust policy written in 1977 does not reflect current practice or conditions and should be revised to do so. For instance, the policy states that new sources may locate in rural fugitive dust areas without offsets so long as "the impact of their emissions plus the emissions from other stationary sources in the vicinity of the proposed location, along with normal background, is not projected to cause violations of the NAAQS." The policy also officially only applies if there is an "absence of significant industrial particulate emissions" and a "lack of significant, nonfugitive dust, area source emissions" in the entire RFDA.

In practice, as described above, states have discounted harmless fugitive dust in ambient determinations. In other words, where background monitors have shown, as they often do in the West, that windblown dust is exceeding the 24-hour PM NAAQS and that year-to-year variation in such dust is exceeding the increments, those readings have been ignored or discounted in permitting new sources. Under the official formulation, this "normal background" plus the source's impact are not allowed to exceed the NAAQS. In fact, they have exceeded the NAAQS routinely in the West; otherwise, new sources could not have been permitted in vast areas throughout the West.

In practice, fugitive dust has also been discounted in areas with significant industrial particulate emissions (if mining is considered in that category), as well as areas with significant nonfugitive area sources. Examples are the mine-mouth power plants that have been permitted in the West in the last 10 years and the mines that have been permitted in Wyoming since 1970 (see letter from Wyoming to EPA Docket A-84-33, dated January 25, 1985). In almost every case those mines could not have been permitted if the official EPA fugitive dust policy had been rigorously applied. Likewise, SIPs would have had to be adopted to control windblown and other fugitive dust from agriculture, unpaved roads and numerous other sources if the official written policy had been applied or enforced. It has not been. EPA's fugitive dust policy should therefore be changed to reflect reality and existing policy and conditions. It should, in other words, be made realistic and enforceable.

In particular, the terms of the existing policy which excludes entire RFDAs if they have significant industrial sources are overbroad and need refinement. The PM emissions from the disturbed areas of a mine are often virtually identical to those from adjacent roads, farms and other area sources. They are coarse, chemically inert, and do not cause health or welfare effects at the concentrations at which they occur in the ambient air. There is thus no reason to disqualify further permitting in an entire RFDA based on the presence of such an operation. Even where a significant stationary combustion source is located in an RFDA, its area of impact and the combined effect (if any) of its emissions with fugitive dust are what is relevant for analysis. The combined effect and area of impact may well be determined to be insignificant and therefore should not eliminate the possibility of permitting new sources in the RFDA. Again, in real life, the combined effects have been deemed insignificant and such sources permitted in the case of dozens of facilities throughout the West since 1970.

V. EPA SHOULD ADOPT A REFORMULATED FUGITIVE DUST POLICY.

AMC applauds EPA's efforts to face and deal with the dilemma presented by fugitive dust causing possible exceedances of the PM10 standards. It must broaden that policy to deal with the disastrous impacts which enforcement of the TSP increments will have and enforcement of even PM10 increments may have. If coarse, chemically inert PM10 having no substantial health or welfare effects is causing exceedances of applicable PM10 limits, then the fugitive dust policy will continue to be a necessary concomitant of a PM standard so broad that it regulates all airborne particles from the very toxic to the wholly innocuous. In order to make the PM standard workable, reasonable and enforceable, a revised and broadened fugitive dust policy is essential.

EPA has analyzed five RFDAs and considered four alternatives. AMC submits that Grant County, New Mexico and the Southeast Desert Air Basin are representative of the areas where the fugitive dust policy has been most relevant and necessary in the past. As EPA's analysis concludes, these areas have a high probability of not meeting the 24-hour or annual standard. The cost of control strategies to meet the standards would be astronomical but without substantial environmental benefit.

While Alternatives III and IV do not require SIPs to meet the PM10 standard by specified dates, they would require new sources (and presumably modifications) to demonstrate that "the impact of their emissions, plus the emissions of other stationary sources in the vicinity, plus normal background would not cause violations of the PM10 NAAQS." As already discussed, this formulation does not appear to allow discounting fugitive dust, which has been essential to permit new sources and modifications in the arid West. This aspect of Alternatives III and IV must be revised to allow the discounting of harmless fugitive dusts and the permitting of such sources. In concept, AMC would support either Alternative III or IV with such a change.

VII. A REASONABLF AND FEASIBLE FUGITIVE DUST POLICY IS LEGALLY PERMISSIBLE.

The legal basis for the fugitive dust policy has been set forth at length in Section I above. Congress and the courts will continue to expect EPA to exercise "administrative good sense" in dealing with the dilemma presented by harmless fugitive dust exceeding the PM standards. Therefore, continuation of a properly-structured fugitive dust policy is not only legally defensible but legally mandated.

September 28, 1987

Submitted by
Holland & Hart
on behalf of
The American Mining Congress

Rural Fugitive Dust and Health:
Comments on EPA's Proposed
PM_{10} Fugitive Dust Policy
Docket Number A-87-01

Presented to:

U.S. Environmental Protection Agency

Prepared on behalf of:

American Mining Congress
1920 N. Street, N.W.
Washington, DC 20036

Prepared by:

Gale F. Hoffnagle, CCM
James M. Kawecki
TRC Environmental Consultants, Inc.
800 Connecticut Boulevard
East Hartford, CT 06108
(203) 289-8631

Project No. 4360-M11

EXHIBIT 1

EXECUTIVE SUMMARY

The EPA proposed policy statement on Particulate Matter Fugitive Dust Policy (52FR24716-24723) presents concerns of "commenters" that rural fugitive dust may pose a health hazard requiring controls. One such "commenter" was the California Air Resources Board (Ref. 1). The CARB comments fall into three specific areas:

1. That rural PM_{10} "nearly approaches (the) health risk posed by urban PM_{10}."
2. That as much as 50% of total rural dust is "fine particles".
3. "Rural fugitive dust appears to transport substances that are just as hazardous...(as) urban fugitive dust."

The concerns expressed by CARB and then echoed by Region IX EPA but not by any other commenters are not supported by the available facts.

1) In assuming that rural and urban PM_{10} are equivalent in terms of health risk, CARB ignores the profound chemical and physical differences. Health effects are generally attributed to particles less than 2.5 microns (probably less than 1 micron) which are chemically active. Health effects are not found with fugitive dust particles between 2.5-10 microns.

2) If PM_{10} concentrations approach the standard, this will normally occur in correlation with high TSP concentrations. During such episodes of wind blown dust, the less than 10 micron portion is still harmless fugitive particles which do not play a substantial role in health risk.

3) The presence of "toxic" substances in rural fugitive dust may be theoretically possible but dose and exposure are negligible. Control of spores, silica and natural asbestos is impractical and any alleged health effects are undocumented. Rural fugitive dust metals concentrations are miniscule and are or will be controlled through specific NAAQS, NESHAPS, NSPS as appropriate to protect public health from significant risk. Current pesticide practices dictate low application concentrations and rapidly decomposing compounds. Significant exposures beyond the treated field are unlikely and controlled through other government programs.

In summary, there is no evidence to conclude that rural fugitive dust contributes to health effects. On the contrary, health effects are related to particles of less than 1 micron size of anthropogenic origin which are chemically active. Whatever harmful constituents there may be in rural fugitive dust are of insignificant dose and are controllable as appropriate under other regulatory mechanisms as noted above. Therefore, EPA's prior judgment that rural fugitive dust is benign was correct and is not controverted by any evidence yet available.

PREFACE

In addressing the issue of a PM-10 standard in relation to fugitive dust, Dr. Bernard Goldstein, EPA's previous administrator for Research and Development, raised the question, "How does one control mother nature..? (Ref. 2) A more fundamental question is whether one needs to control mother nature. But this is essentially what some areas of the US may be required to do if fugitive dust is considered to have the same degree of toxicity (and offer the same degree of exposure) as the particulate matter found in industrialized urban areas.

Particulate matter is used as a surrogate indicator of airborne aerosols (solid and liquid particles) which are presumed to include constituents that have health effects. Particulate matter less than 10 microns (PM_{10}) in size is the current basis of the National Ambient Air Quality Standards. In actuality, 10 microns is the 50% cut point and larger particles (probably up to a maximum of 14-15 microns) affect the mass concentration measurements. Fine particles are usually defined as less than 2.5 microns and coarse particles are the 2.5-15 micron range (These definitions are an artifact of the sampling technique not directly related to health effects). Total suspended particulate matter (TSP) is measured with a high volume sampler and was the basis of the old NAAQS. Misuse of particulate matter definitions is frequent and care must be taken. Fine particles does not mean PM_{10}, for instance. PM_{10} therefore has both fine and coarse fractions. Rural measurements of PM_{10} therefore include fugitive dust which is predominantly coarse particles. This distinction is important since violations of the PM_{10} NAAQS in rural settings would be expected to contain a high percentage of coarse fugitive dust particles which, because of their larger size (as opposed to fine particles), will dominate the mass measurement.

Because of the health concerns some commenters have raised regarding fugitive dust, this report attempts to address what is known about the health risks associated with exposure to fugitive dusts. A review of the published scientific literature on this subject offered little direct information on health effects. However, much information was found regarding the -ole of fine versus coarse particulate matter. Coarse particulate matter is the primary constituent of fugitive dust. Careful review of the health studies concerning particulate matter and discussions with some of the nation's pre-eminent air pollution health researchers confirmed that studies on the health effects from exposure to fugitive dusts have not been performed because of (1) the relatively low concentrations in the ambient environment, (2) their relatively large particle size (>2.5 μm), and (3) their composition (primarily the earth's crustal material). Still, in order to address the fugitive dust issue, a summary report of several key studies on fine and coarse particles is presented. The work of Covert and Frank, (Ref. 3) the 1982 Criteria Document (Ref. 4) for particulate matter and sulfur oxides, and the most recent epidemiological material on particulate matter comprise the body of this assessment.

INTRODUCTION

An assessment of the health effects of fugitive dusts, including the PM_{10} range requires information on various factors. These include factors important to determining exposure, dose, and toxicity. This assessment addresses these factors by considering <u>first</u> the importance of particle size and chemical composition in determining respiratory uptake and retention in the biological system; <u>second</u>, the physical and chemical properties of fugitive dust; and <u>third</u>, the toxicological effects from exposure to fugitive dusts.

FACTORS AFFECTING RESPIRATORY UPTAKE AND BIOLOGICAL DOSE

Ultimately, the nature of the biologic response to airborne particles, elicited by either brief or prolonged exposure, is a function of the dose. Dosage, particularly as it affects local sites within the respiratory system, is determined by a complex interplay between the particle and host. As noted in the comprehensive review by Dr. Robert Frank, a current member of CASAC, and Dr. David Covert, some of the commonly recognized determinants of dosage apart from the ambient concentration are:

- Physical properties of the particle, including size, shape, and density.
- Mode of breathing: The nose is a more efficient scrubber of particles than the mouth, thereby shifting the site of deposition.
- Pattern of ventilation and flow profiles within airways: slow breathing increases the time for particles to deposit by diffusion and sedimentation; rapid breathing associated with turbulent flow increases the likelihood for inertial impaction. (A maneuver commonly used to increase the total uptake of therapeutic or bronchoconstrictive aerosols is a rapid, deep inspiration followed by breath holding.)
- Size and shape of the airways.

How evenly the dosage is distributed within different regions of the lung reflects the distribution of mechanical properties and ventilation. In healthy individuals the rate of deposition of monodispersed particles in the periphery of the lung during breath holding, a measurement used to assess the size of airspaces, appears to be uniform from one occasion to the next, but varies among individuals. The clearance rate of insoluble particles from the lung also tends to be more consistent within than among individuals. Both findings underscore the role of factors inherent in the lung that determine the level of exposure to particulate matter.

A discussion of the behavior and deposition of fugitive dust particles in the respiratory system also requires consideration of their chemical properties. While particle size and density, which determine aerodynamic diameter, primarily govern the deposition efficiency of aerosol particles within the respiratory system, chemical parameters are also important. Chemical composition determines not only the toxicity but also the hygroscopic (water soluble) nature of the particles, thus their potential for reaction with gaseous compounds before and after inhalation.

In general, the atmospheric size distribution of particulate matter is the sum of two or three separate modes of particles that have different sources, sinks, and physical and chemical properties. An example of an atmospheric volume-size distribution is presented in Figure 1. The bimodal form shown is typical of that found in the atmosphere. However, the total volume concentration of the area under the bimodal curve may vary by a factor of 10 or more with time at a specific location or between locations at a particular time. The relative magnitude of the two modes may vary by a factor of about 2, depending on the history of the air mass, but the volume-mean sizes of the fine and coarse modes remain between 0.2 to 0.6 µm and 5.0 to 10 µm, respectively. The minimum in the volume-size distribution which separates the two modes occurs consistently between 1.0 and 2.0 µm.

According to the discussion by Covert and Frank (Ref. 3), the chemistry of the particles in these two modes is markedly different and can be related to their sources. The major fraction of particle mass in the fine mode is due to combustive processes associated with human activities, such as fossil fuel power plants, vehicles, industrial processes, domestic heating and hydrocarbon emissions. The emissions consist of gases-sulfur dioxide (SO_2), sulfur trioxide (SO_3), nitrogen oxides (NO_x); hydrocarbons and nuclei mode sized particles: heavy metals such as lead (Pb), vanadium (V), and manganese (Mn); and graphitic carbon (soot). In the atmosphere these compounds react in combination with water vapor, ammonia (NH_3), and sunlight, all of which

Figure 1

Atmospheric Aerosol, Volume Size Distribution

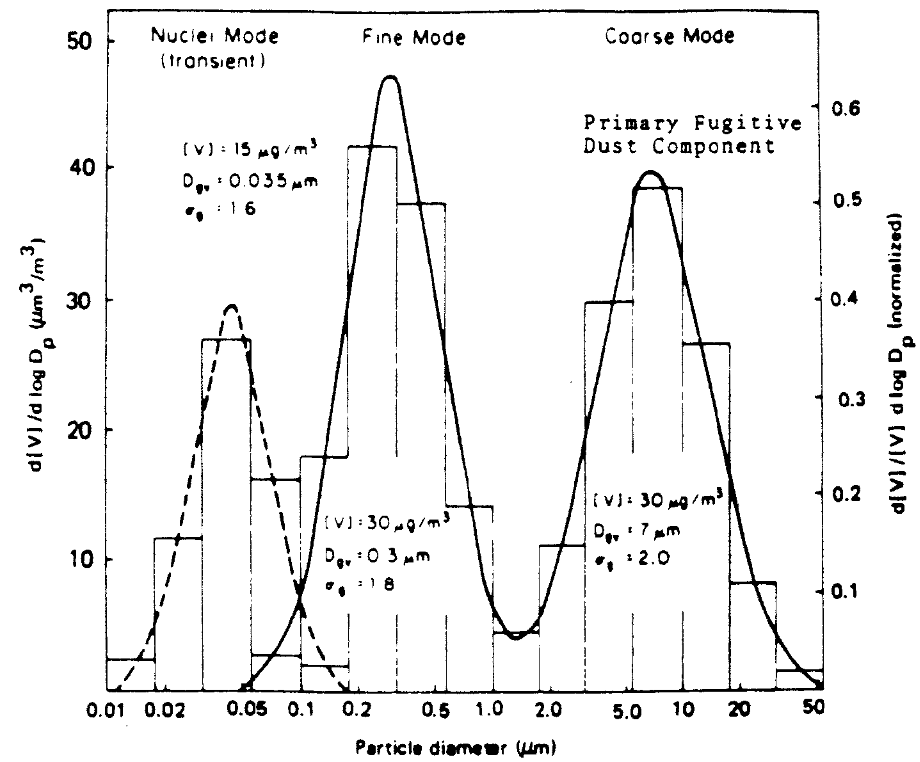

FIGURE 1 Atmospheric aerosol, volume size distribution. Abscissa: particle diameter D_p (μm) on a logarithmic scale. Ordinate: (left) incremental particle volume (expressed as concentration) per increment of particle size $d[V]/d \log D_p$ ($\mu m^3/cm^3$); (right) normalized volume scale $d[V]/[V]\ d \log D_p$.

Adapted from Covert and Frank (1980)

occur naturally, as well as with ozone (O_3), which occurs naturally but also is a product of photochemical reactions initiated by pollutants. Sulfate and nitrate compounds, and a wide range of hydrocarbons (organic acids, aldehydes, and salts) are formed.

While it is difficult to generalize about the physical and chemical properties of such a complex mixture as atmospheric aerosols, certain aspects of the fine mode particles have become clear in the last few years. Our present understanding of the structure of these particles is that they consist of a solid water-insoluble core composed of graphitic carbon, hydrocarbons, and heavy metals, which is surrounded by a solid (or liquid) layer of water-soluble organic and inorganic salts and/or acids. Their density is generally between 1 and 1.5 g/cm^3. The water-soluble layer may comprise 50 to 90% of the mass of the particle.

The mass of material in the coarse particle mode is more evenly divided between anthropogenic and natural sources than in the fine mode. The primary sources of the coarse mode are soil and sand from the earth's surface, which are raised by the wind either alone (natural) or in conjunction with agricultural, mining, or transportation activities (anthropogenic). The chemical composition of these particles is generally similar to that of the earth's crust. It includes silicates (SiO_2), aluminum (Al), magnesium (Mg), and iron (Fe). Near the coastline, sea salt, which is predominantly sodium chloride (NaCl) in a size range of 3 to 5 μm, can contribute to the mass of the coarse mode. At times, pollens (>10 μm) add to the mass of this size mode.

The physical structure of the particles in the coarse mode is more irregular than that of the fine mode particles. They vary in shape from cubes (NaCl) to plates. Their densities range between 2 and 3 g/cm^3. Thus, their aerodynamic diameter is ~1.5 times their geometric volume mean diameter. They are also less homogeneous chemically. A summary of the sources, chemical composition, and physical and chemical properties of the fine and coarse modes is presented in Table 1. Although little information was found for the biological component of coarse mode rural particulate matter, the US EPA reported on the results of a study of fourteen cities by Bradway and Record (Ref. 5) that biological material (primarily pollen, leaves, and other plant material) accounted for less than two percent of the weight of the total coarse fraction (Table 2). As seen in Figure 2, the coarse mode will deposit primarily in the nasopharyngeal region with a high efficiency of 50 to 100%. The fine mode will deposit primarily in the pulmonary region with a much lower efficiency of 20 to 40%.

ORIGIN AND COMPOSITION OF FUGITIVE DUST

According to the US EPA (1982) (Ref. 4), a substantial portion of TSP, usually more than half, is accounted for by coarse or supercoarse particles, and a great portion of this mass is mineral dust, also called "crustal material" in many of the papers reporting chemical analytical data. There is growing opinion that this major component of TSP is contributed almost entirely by agitation of soil in some way, and this component is commonly called fugitive dust. One of the major sources for fugitive dust generation is vehicle traffic; the motion of vehicles can reentrain silt (fine soil particles) that has been deposited by settling from the air, washing from nearby areas in rain, or falling from vehicle tires.

TABLE 1

Chemical Compostion and Sources of Atmospheric Aerosol Size Modes

Mode	Source	Chemical compounds or classes of compounds	General physical and chemical properties
Accumulation	Combustion of fuels; gas to particle conversion; photochemical oxidation	SO42-, NO3-, NH3+, H+, hydrocarbons, graphite carbons, heavy metals (Pb, As, Vn)	Water soluble (hygroscopic); low density, 1-1.5; near spherical shape
Coarse	Wind-blown dust; grinding processes	Silicates; carbonates, ferric oxides, Al, Mg+, Ca2+, pollen, fly ash	Less water soluble (non-hygroscopic); high density, 2-2.5; more irregular shape

Covert and Frank (1980)

TABLE 2

Fourteen-City Study - Microscopic Identification of Coarse Materials Collected in Urban Atmospheres

	Wt. % of Component			
Location	Minerals	Combustion products	Biological material	Miscellaneous (rubber tire debris)
Oklahoma City	88	8	1	4
Denver	81	7	1	11
Miami	79	8	1	12
St. Louis	75	21	<1	4
Washington, DC	70	23	5	2
Baltimore	69	25	3	3
Birmingham	66	22	2	10
Philadelphia	64	33	1	2
Providence	64	22	1	13
Seattle	60	27	3	10
San Francisco	52	29	3	16
Cincinnati	51	44	1	4
Cleveland	51	40	1	8
Chattanooga	36	35	16*	13

*Anomalously large amounts of plant material(pollen, leaf fragments, etc.)

Source: US EPA (1982) from Bradway and Record (1976)

Figure 2

Deposition-Size Distribution

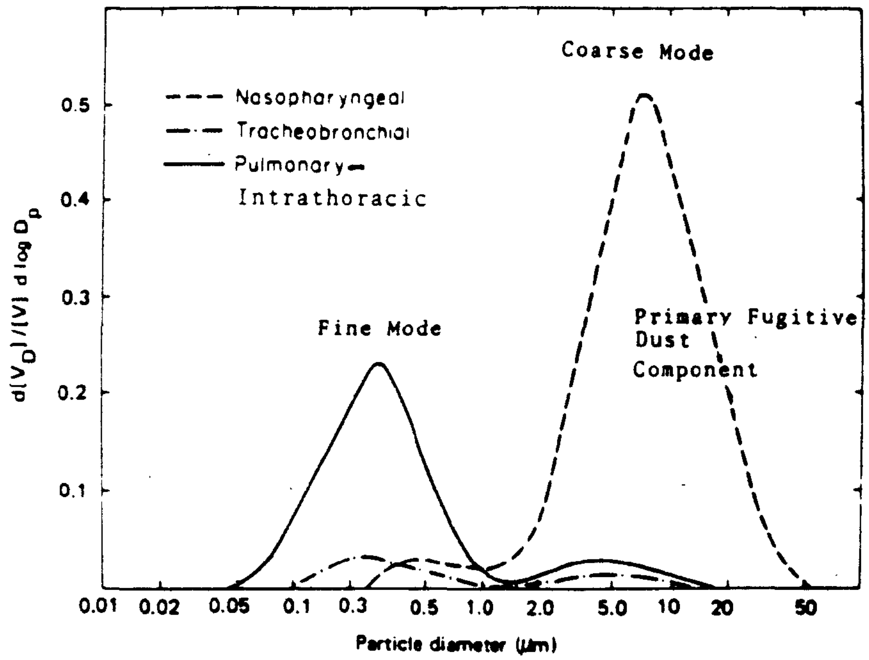

FIGURE 2 Deposition-size distribution. Abscissa: particle diameter D_p (μm). Ordinate: increment of aerosol volume deposited per increment of particle size, $dV_D/F\ d\log D_p$ ($\mu g/m^3$), where V_D = particle volume deposited.

Adapted from Covert and Frank (1980)

In an assessment of particle source influence on TSP in western States, fugitive dust from anthropogenic disturbance of soils accounted for 53 to 95 percent of TSP emissions (with exceptions near point sources) and 31 to 50 percent of TSP concentrations (with 2 exceptional at critical receptor locations in 20 inland western cities (Ref. 6). Additionally, 15 to 30 percent of TSP concentrations were background, i.e., not attributable to man-made emissions.

Figure 3 shows the traditional division of fugitive dust sources for 1976 in terms of emissions. It is clear that soils are the main constituent with unpaved roads and agricultural operations being predominant combined to constitute 94.3% of all emissions.

Figure 4 is from the Harvard Six Cities Study (Ref. 7). It shows monthly average concentrations of fine and coarse fractions, inhalable particles (<15 microns, IP) and total sulfate mass. The cities were selected on the following basis:

- Steubenville and St. Louis: exceed both SO_2 and TSP standards
- Watertown and Harriman: high but less than standard concentrations of SO_2 and TSP
- Portage: low SO_2 and low TSP
- Topeka: low SO_2 and TSP concentration exceeding the standards.

The figure shows a very different pattern in Topeka than the other more eastern cities. In Topeka the IP mass is dominated by and tracks the coarse particle fraction while fine particles do not track the total mass. This is indicative of fugitive dust situations and while not strictly rural, shows the pattern we would expect in rural fugitive dust areas. In the other cities the total IP mass pattern is dominated by fine particle concentrations (see Harriman and Steubenville) or fine and coarse track together (see Portage).

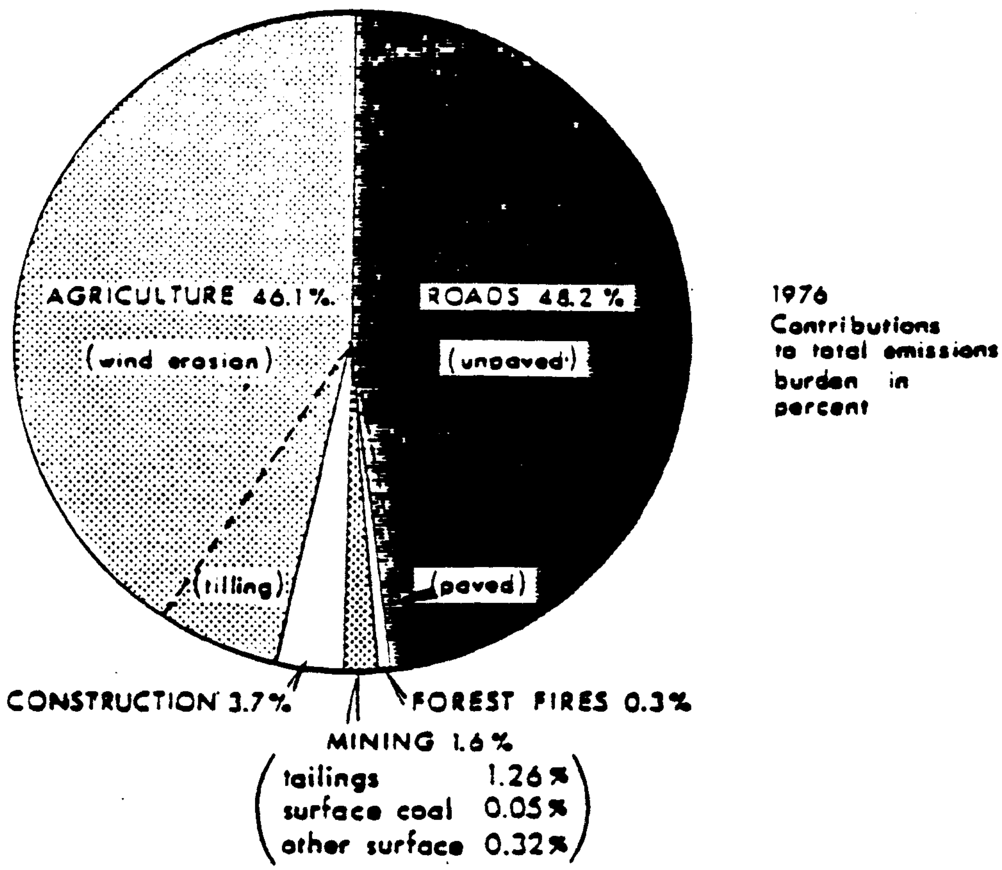

Figure 3. Categories of Particulate Emissions from Open Sources in the U.S

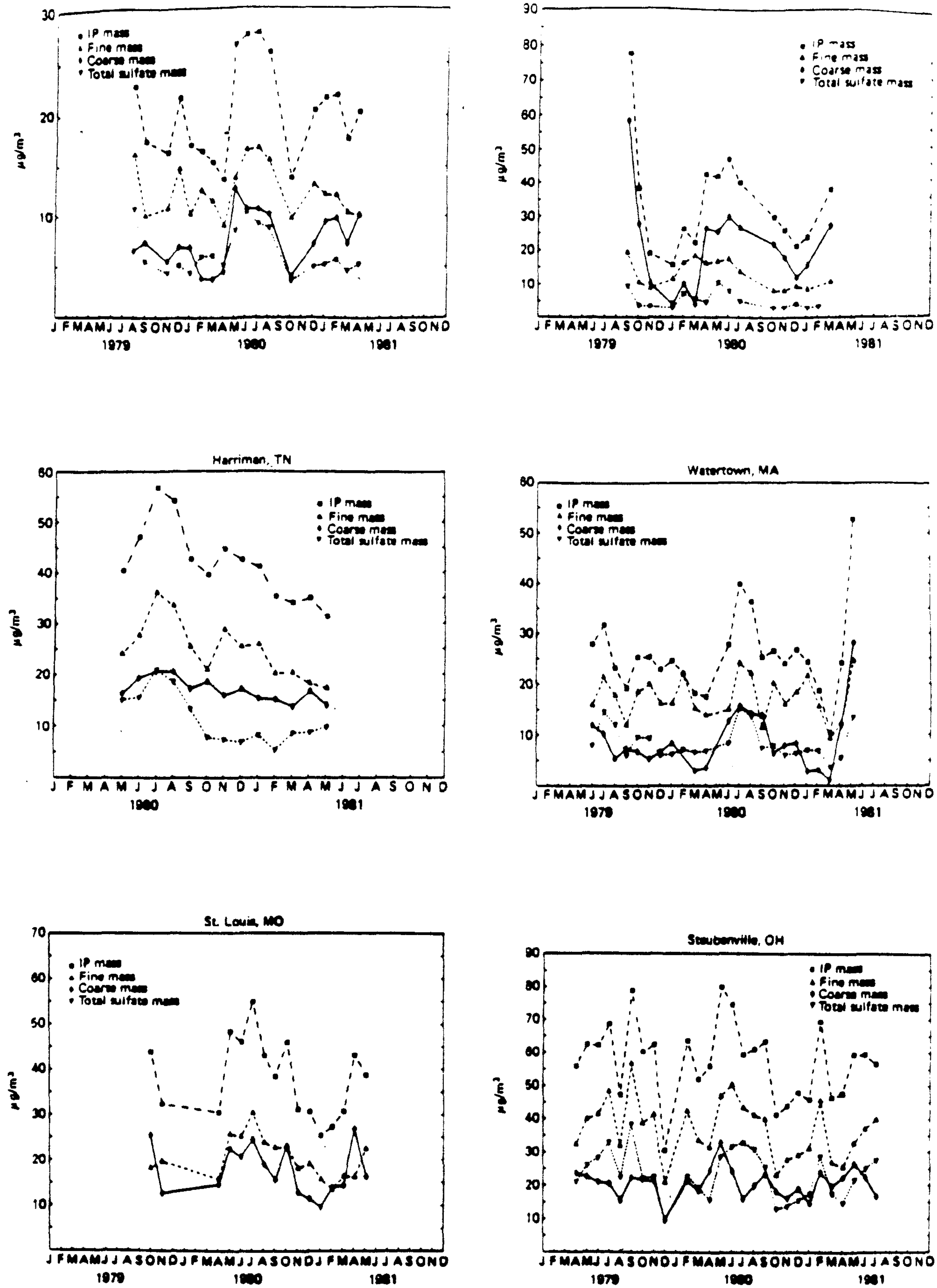

Figure 2. Monthly mean concentrations (in µg/m³) of IP, Fine Fraction, and S as $(NH_4)_2SO_4$ in Portage, Wisconsin; Topeka, Kansas; Harriman, Tennessee; Watertown, Massachusetts; St. Louis, Missouri; and Steubenville, Ohio.

Figure 4 (Ref. 7)

The California Air Resources Board (Ref 1) has suggested that "fine particles often constitute over 50 percent of total rural dust" and that "agricultural tillage is the largest direct source of PM_{10} emissions in California." CARB concludes that "rural (primarily agricultural) sources of PM_{10} may provide for a much greater proportion of the population's actual exposure to fine particles than previously believed." There is confusion in these statements concerning the definitions of fine particles and PM_{10} implying that they are equivalent. A review of CARB's cited reference (Ref 8) reveals that it is an extensive review of fugitive dust from only agricultural operations. The emission factors developed for agricultural soil preparation in the study indicate that 10% of fugitive dust emissions are fine particles (<2.5 microns) and that 25% are inhalable particles (<15 microns). This is in direct contradiction to the CARB statement that 50% of total rural dust is "fine particles."

HEALTH EVALUATIONS

Detailed assessments on the health risks to populations resulting from exposures to airborne particles have been presented by numerous researchers. Invariably, it is the fine mode, urban aerosols that are associated with possible health effects. A multidisciplinary study on airborne particles initiated by Harvard University and funded by Department of Energy addressed this concern (Ozkaynak et al., 1985a) (Ref. 9). These investigators concluded that the most toxic substances in ambient air are highly concentrated in the fine particle mass (<2.5 μm). It is especially the fine particle fraction of ambient aerosols that includes carcinogenic or toxic metals, organic, and acidic components resulting from automobile and other combustion emissions (Ref. 10 and Ref. 11). Other epidemiological analyses from Harvard also indicate that variations in ambient fine particle and sulfate mass are more important to public health than variations in the levels of coarse particles (Ref. 12; Ref. 13; Ref. 10). The cumulative results from numerous studies "suggest that it is the fine particle mass fraction or its toxic constituents...rather than inhalable particles (<15 μm) or TSP, that should be focused on in studies of human health effects" (Ref. 14).

Pengelly et al. (Ref. 15) conducted a massive study on 3,500 elementary school children in Hamilton, Ontario, Canada on the effects of environmental factors on respiratory health. Because of a substantial gradient in particle concentration and size over the study area, this investigation was designed, in part, to separate out the effects of fine versus coarse particles. Outside of the Six-Cities study, this is the only study reported in the scientific literature to measure the effects of particle size. The investigators found that the only statistically significant association was that between decrements in pulmonary function and exposure to fine particles. There was, therefore, no statistically significant association between coarse particles and pulmonary function.

In reviewing epidemiological research on particulate matter, Pengelly et al. also noted that

> "there is a good theoretical basis for the hypothesis that particle size and chemical composition are important determinants of (particulate matter) toxicity...The results of this study support the idea that the fine fraction of the aerosols is the most important, when considering the impact on the respiratory health of children."

Information on nontraditional components of fugitive dusts, pesticides and virulent spores, was scarce in the reported scientific literature. According to a comprehensive review by Mulla, Mian, and Kawecki (Ref. 16), pesticides are found in detectable concentrations throughout the inhabitated and noninhabitated world. They result from applications in the home, garden, greenhouse, and agriculture and exist in most of the foods we consume. The vapor pressure of many pesticides is such that in hot arid areas, such as those of the Southwest, they are more likely to volatilize. Invariably, some pesticide will adsorb on the surface of the agricultural dusts, but because these dust particles tend to be in the coarse mode, they are not transported long distances under typical weather conditions. When they are, they are most likely diluted to barely detectible concentrations. Also, because most pesticides are applied in repeated short-term periods, the dose from the transport of dust-laden pesticides appears to be negligible.

The most likely exposures to pesticides are those indoors. A recent report by EPA (Ref. 17) looked at pesticide exposure indoors versus outdoors in a pilot study. The pesticide exposures from household and garden pesticide use were generally higher indoors than outdoors. Further, little information is available on baseline concentrations of pesticides away from agricultural areas.

The information on biological contaminants is even poorer. At present information on the amounts and types of biological materials is not available, and the virulence of viable organisms varies tremendously. Again baseline data for virulence of viable organisms is not known (Ref. 17). If long-range transport of biological contaminants does occur (unsubstantiated claims of a 1977 San Francisco episode), it is rare and totally uncontrollable.

CONCLUSIONS

Fugitive dust is a type of particulate matter that consists primarily of coarse materials primarily from soils. Because this dust is formed mechanically by comminution or disintegration processes, the size of the dust particles vary considerably, from 2.5 μm aerodynamic diameter to 100 μm, with maximum concentrations occurring in the 5 to 50 μm range. Biological materials such as pollen and spores make up a small percentage of the coarse particles. Particles less than 2.5 μm are termed "fine" particles. Typically, fine particles are formed by the combustion of fuels and from the conversion of toxic gases in the atmosphere. Fine particles also tend to have high water solubilities and low densities, unlike the more highly dense, less water soluble coarse particles. Ultimately, these properties determine the innocuousness or the toxicity of the inhaled particulate matter.

Medical research has shown that the smaller, fine particles are the potentially toxic fraction of particulate matter. Because of their size, usually between 0.1 and 1 μm, they are able to penetrate deeper into the respiratory system, reaching the intrathoracic or pulmonary region. The greater water solubility (hygroscopicity) of the particles less than 1 μm causes them to grow in size after entering the deep lung, thereby increasing their deposition efficiency. This same solubility also enhances their ability to react in the biological system. These basic fundamentals of "particle toxicology" have directed the focus of medical research over the past decade. As such, studies on the health effects from exposure to fugitive dust in ambient air generally are not conducted, since knowledgeable scientists do not consider ambient air exposure to the coarse, natural crustal particles to be harmful.

Just as minute amounts of various pollutants are found in every part of the world, including pristine areas, so are traces of chemical substances detected in soils of the United States, the source of fugitive dust. From market basket surveys, it is evident that trace amounts of pesticides are found in nearly all food categories, but at levels considered not harmful to human health. If trace amounts of pesticides were detected in a "transported" fugitive dust sample, the concentrations probably would be such as to approximate background, grocery-store levels. Additionally, the widespread use of home and garden pesticides makes it nearly impossible to trace the origin of a specific pesticide. Without a sufficient dose (defined as the concentration of a substance times the duration of exposure), even so called "toxic" substances are innocuous.

Finally, biological materials were shown to make up a very small percentage of coarse particles, and they comprise an even smaller fraction of total fugitive dusts. Certain virulent spores endemic to the southwestern United States can be carried by the wind, just as pollen and other allergens are carried. But these naturally occurring plant materials are part of the natural environment and likely will not be affected one way or another by EPA's decision on the rural fugitive dust policy. As Dr. Goldstein said, "How does one control mother nature?"

Fugitive dust is inert chemically (being mostly soils) and has no demonstrable health effect. Contaminants which might be attached to fugitive dust (which is less unlikely because of the soils chemical inertness) are small in concentration and concomitant dose and are either uncontrollable or controlled better through other mechanicsms than PM_{10} standards attainment.

REFERENCES

1. California Air Resources Board, Comments on Rural Fugitive Dust Policy, July 2, 1985, EPA Docker A-87-01.

2. B. Goldstein, Improving the Scientific Basis for Risk Management Decisions for Particulate Matter in Arosols, Lee et al., (Eds) Lewis Publisher, Inc. Chelsea, MI (1986).

3. Covert, D.S. and N.R. Frank Atmospheric Particles: Behavior and Functional Effects in Physoilogy and Pharmacology of the Airways. J.A. Nadel (Ed.) Marcel Dekker, Inc. New York (1980).

4. US EPA Air Quality Criteria for Particulate Matter and Sulfur Oxides. ECAO: EPA-600/8-82-0296 Research Triangle Park, NC (1982).

5. Bradway, R.M. and F.A. Record - National Assessment of the Urban Particulate Pro Chem. Vol II - Particle Characterization EPA-450/3-76-025. Research Triangle Park, NC (1976).

6. Axetell, K. Assessment of non-traditional source impacts in the western U.S. in Specialty conference and the Technical basis for a Size Specitic Particulate Standard Proceedings. APCA Pittsburg PA (1980).

7. Spengler, J.D., Thurston, G.D.: "Mass and Elemental Composition of Fine and Coarse Particles in Six U.S. Cities," JAPCA, Volume 33, No 12 p 1162. December 1983.

8. California Air Resources Board (1981): "The Role of Agricultural Practices in Fugitive Dust Emission" June 1981, available from NTIS - PB81-219073.

9. Ozkaynak, H. J. Spengler, A. Garsd, and E. Thurston. Assessment of Poopulation Health Risks Researching from Exposures to Airbone Particles in Aerosols. Lewis Publishers, Inc. Chelsea, MI (1986).

10. Ozkaynak, H., G. D. Thurston and A. Schatz. "Relationships between Human Morbidity and Ambient Pollution: Preliminary Findings." Paper no. 84-1.6, presented at the 77th Annual Meeting of the Air Pollution Control Association, San Francisco, CA (1984).

11. Thurston, G. D., H. Ozkaynak and A. Schatz. "A Chemical Characterization and Source Apportionment of the IP Network Fine Particle Data," presented at the 77th Annual Meeting of the Air Pollution Control Association, San Francisco, CA (1984).

12. Garsd, A., and H. Ozkaynak. "Mortality Risks due to Air Pollution: Time Series Analysis of 13 Years of Data from New York City," cited in, Aerosols, Lewis Publisher, Inc. Chelsea, MI (1986).

13. Ozkaynak, H. and J.D. Spengler, "Analysis of Health Effects Resulting from Population Exposures to Acid Precipitation Precursors." Environ. Health Persp. 64:45-55 (1985).

14. Ozkaynak, H., J. D. Spengler, and G D. Thurston. "Consideration of Risk Analysis Methods in the Revision of the Primary Standards for Ambient Particles," presnted at the 78th Annual Meeting of the Air Pollution Control Association, Detroit, MI (1985).

15. L. Pengelly, C. Goldsmith, A. Kerigan, W. Furlong, and s. Toplack. The Hamilton Study: Effect of Particle Size on Respiratory Health in Children, Aerosols, Lewis Publishers, Inc. Chelsea, MI (1986).

16. Mulla, M., Li Mian, J. M. Kawecki. Distribution Transport, and fate of the Insecticide, Melathien and Parathien in the Environment: Residue Reviews Vol 81. Springer-Verlag, New York (1981).

17. US EPA EPA Indoor Air Quality Environmental Plan. Appendix A. EPA/600/8-87-014. June 1987.