Technical Comments Concerning the Particulate Matter Policy Assessment (June 2010 Draft) Clean Air Science Advisory Committee Meeting, July 26, 2010

Coarse Particulate Matter Coalition

The Coarse Particulate Matter Coalition ("Coalition") appreciates the opportunity to submit these technical comments in support of the presentation being made on July 26, 2010 at the CASAC meeting in Chapel Hill, North Carolina. The Coalition will submit additional written comments concerning the EPA Policy Assessment (June 2010 Draft) to the U.S. Environmental Protection Agency ("EPA") prior to the August 16th specified submittal date.

The Coalition is not now and has not previously opposed the promulgation of standards to regulate the ambient air levels of thoracic coarse particulate matter ("coarse PM"). **We continue to believe that the existing 24-hour average standard of 150 micrograms per cubic meter ($\mu g/m^3$) based on PM_{10} as an indicator of coarse-mode PM is the most appropriate limit based on the presently available health effects data and corresponding air quality data.**

The Coalition does not find technical data in the Integrated Science Assessment or the Policy Assessment Document (June 2010 Draft) to support changing the form of the coarse PM 24-hour average standard to a 98th percentile basis or to a value lower than 150 microgram per cubic meter. We have summarized the technical data and information that support our conclusion. These comments address the following seven interrelated issues.

1. Spatial nonuniformity of coarse-mode particulate matter in intraurban areas introduces substantial uncertainty into the results of epidemiological studies.

2. Supporting evidence is lacking to independently confirm the results of epidemiological studies.

3. The Policy Assessment Document (June 2010 Draft) incorrectly implies that globally-transported dust from Asian and African deserts is primarily in the coarse-mode.

4. The lack of coarse PM compositional data introduces substantial uncertainty into the epidemiological study results.

5. The proposed change in the format and level of the 24-hour coarse-mode NAAQS to a three-year average 98th percentile format is premature at the very least.

6. Arbitrary standard setting based on insufficient data will aggravate already severe unemployment, which is itself a major health problem.

7. Effective control strategies to achieve a very low 24-hour coarse-mode PM NAAQS are not clear.

Some of these comments echo summary technical comments submitted by the Coalition to EPA and CASAC concerning coarse-mode PM standards. Specifically, the Coalition has consistently and emphatically recommended that EPA (1) accelerate deployment of direct-measuring coarse PM monitors in many locations in the U.S., (2) evaluate compositional differences in coarse PM throughout the U.S., and (3) evaluate the surface characteristics of urban and rural coarse PM to determine if there is any basis for the assumption that toxic material carriers on urban coarse particles. The comments and recommendations in this presentation are consistent with the Coalition's long-standing recommendations.

1. Spatial nonuniformity of coarse-mode particulate matter in intraurban areas introduces substantial uncertainty into the results of epidemiological studies.

As indicated in the following excerpts from the Policy Assessment Document (June 2010 Draft), EPA has correctly identified the spatial nonuniformity of thoracic coarse-mode particulate matter as a major source of uncertainty.

> *The ISA (sections 2.3.3, 2.3.4) concludes that an important uncertainty in the $PM_{10-2.5}$ epidemiologic literature is that associated with the air quality estimates used in these studies. Specifically, the ISA concludes that there is greater error in estimating ambient exposures to $PM_{10-2.5}$ than to $PM_{2.5}$ and that such uncertainty is a particularly relevant consideration when interpreting $PM_{10-2.5}$ epidemiologic studies. Contributing to this uncertainty is the relatively limited spatial coverage provided by existing $PM_{10-2.5}$ monitors (US EPA, 2009a, sections 2.2.3, 2.3.3, 2.3.4, 3.5.1.1 and see above).*
>
> Page 3-15, Policy Assessment Document, June 2010 Draft

> *Epidemiologic studies currently use a variety of approaches to measure/estimate $PM_{10-2.5}$ concentrations. It is important that we better understand the relationship between results from studies that estimate $PM_{10-2.5}$ concentrations using either (1) difference method of colocated monitors, (2) difference method of county-wide averages of PM_{10} and $PM_{2.5}$, or (3) direct measurement of $PM_{10-2.5}$ using a dichotomous sampler.*
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> Page 3-46, Policy Assessment Document, June 2010 Draft

Significant spatial variations in thoracic coarse particulate matter are to be expected given the high terminal settling velocities and deposition rates of these particles. These particles have relatively short atmospheric residence times and quickly deposit in localized areas around roadways, construction sites, industrial sources, agricultural operations, and natural areas vulnerable to wind erosion. The short residence times and limited atmospheric dispersion of thoracic coarse particles have been discussed extensively by a number of researchers, including but not limited to Blanchard et al (1999), Chen et al (2007), Chow et al (1999), Chow et al (2000), Chow and Watson (2001), Freiman et al (2006), Koutrakis et al (2005), Thornburg et al (2009), Wilson and Suh (1997), and Wilson et al (2005).

Furthermore, the significant spatial variability of thoracic coarse particulate matter has also been observed repeatedly by Coarse Particulate Matter Coalition members using ambient air monitors

on and near plant property. Monitor movement over distances as short as 100 meters can result in substantial changes in the observed coarse particulate matter concentrations.

While EPA recognizes the issue of coarse-mode particulate matter spatial nonuniformity even in localized areas, the Coarse Particulate Matter Coalition was surprised that the Integrated Science Assessment ("ISA") published in December 2009 included very limited information concerning spatial variability analyses for coarse-mode particulate matter. It is apparent that ISA Chapter 3, Section 3.5.1 and the relevant portions of Annex A of the ISA primarily address only $PM_{2.5}$ and PM_{10}—there is little information specifically relevant to $PM_{2.5-10}$. The coefficients of divergence provided in the ISA in Section 3.5.1 and Annex A for PM_{10} do not represent the coefficient of divergent values for $PM_{2.5-10}$. Despite the fact that six months have passed since the ISA was finalized, EPA staff personnel have not progressed in their analysis of coarse PM spatial nonuniformity. In fact, data are available to support an evaluation of coarse particulate matter spatial nonuniformity in EPA's AQS database.

The Coarse Particulate Matter Coalition has downloaded 24-hour PM_{10} and $PM_{2.5}$ data from monitoring sites providing data to the AQS. The Coalition has restricted this evaluation to the following three urban areas highlighted in the ISA and Policy Assessment.

Pittsburgh, 2009 data
Phoenix, 2007 data
Los Angeles, 2007 data

The Coalition has further restricted the evaluation to only those monitoring sites that have colocated PM_{10} and $PM_{2.5}$ monitors providing 24-hour average data. Using this approach, the Coalition calculated the $PM_{2.5-10}$ concentration based on the difference between the two colocated monitors operating simultaneously. While the Coalition does not enthusiastically support coarse PM measurement by "difference," this is presently the only publicly available coarse particulate matter data. The Coalition compared the coarse particulate matter data for each monitoring site from values measured simultaneously at similar monitoring sites in the same urban area.

The Coalition chose Pittsburgh because it was one of the 15 urban areas discussed in the ISA and because it represents an eastern city with moderate-to-high $PM_{2.5}$ concentrations. Pittsburgh is also of interest because many of the industrial sources and air quality monitors are located in river valleys that affect pollutant dispersion and transport. For 2009, the Coalition was able to locate data for four monitoring sites in the Greater Pittsburgh area that had colocated PM_{10} and $PM_{2.5}$ monitors.

Phoenix was also one of the 15 specific urban area addressed by EPA in the ISA and Policy Assessment. Coarse particulate matter dominates Phoenix's particulate matter air quality. There are three monitoring sites in the city with colocated PM_{10} and $PM_{2.5}$ monitors, and these sites are relatively closely spaced.

Los Angeles represents a relatively unique urban area due to its geographical scale, complex topography, semi-arid climate, and moderate-to-high $PM_{2.5}$ levels. In 2006, a total of six monitoring locations had colocated PM_{10} and $PM_{2.5}$ monitors. In subsequent years, several of the sites with colocated 24-hour FRMs were converted to continuous monitoring stations. The Coalition chose to use the 2007 data set, which had the maximum number of 24-hour FRM samplers representative of most of the monitoring sites in the U.S.

The Coalition has calculated the coefficients of divergence ("COD") for the monitors in these three cities using Equation 1 shown in the ISA (page 3-60) and in Wilson (2005). With this coefficient, a value of zero indicates no divergence, and a value of one indicates extreme divergence.

$$COD = \sqrt{\left(\frac{1}{p} \sum_{i=1}^{i=n} \left(\frac{X_{ij} - X_{ik}}{X_{ij} + X_{ik}} \right)^2 \right)} \qquad \text{Equation 1}$$

The results of these calculations are provided in Tables 1, 2, and 3. The CODs ranged from 0.30 to 0.47 for Pittsburgh (Table 1), 0.19 to 0.42 for Los Angeles (Table 2), and 0.22 to 0.36 for Phoenix (Table 3). All of these ranges are substantially above the $PM_{2.5}$ and PM_{10} COD values reported by EPA in the ISA and the Policy Assessment Document. For example, the COD for $PM_{2.5}$ data among various $PM_{2.5}$ monitors in Pittsburgh averaged 0.15 and ranged from 0.09 to 0.22.

These calculations demonstrate that the spatial nonuniformity of the coarse particulate matter data is substantially greater than those for $PM_{2.5}$ and PM_{10}. These calculations support the conclusion that considerable uncertainty exists in the results of epidemiology studies relying on county-wide average concentrations.

Table 1. Coefficient of Divergence Values, Pittsburgh, PA Coarse Particulate Matter (Four monitoring sites in Allegheny County)

Monitoring Site	64	67	1301	3007
64	0	0.41	0.41	0.35
67		0	0.48	0.30
1301			0	0.47
3007				0

Table 2. Coefficient of Divergence Values, Los Angeles, CA Coarse Particulate Matter (Six monitoring sites in Los Angeles County)						
Monitoring Site	2	1002	1103	4002	2002	9033
2	0	0.19	0.23	0.28	0.36	0.26
1002		0	0.32	0.23	0.29	0.34
1103			0	0.20	0.42	0.27
4002				0	0.40	0.29
2002					0	0.41
9033						0

Table 3. Coefficient of Divergence Values, Phoenix, AZ, Coarse Particulate Matter (Three monitoring sites in Maricopa County)			
Monitoring Site	1003	4003	7020
1003	0	0.36	0.35
4003		0	0.22
7020			0

It is important to note that the four monitoring sites for Pittsburgh almost certainly do not fully characterize the extent of nonuniformity in metropolitan Pittsburgh and the surrounding suburbs in Allegheny County. Some of the highest coarse PM levels might be in industrial river valley locations that do not presently have colocated PM_{10} and $PM_{2.5}$ monitors or direct reading coarse PM monitors. There is simply an insufficient number of monitors to adequately apply difference calculations to estimate coarse-mode particulate matter spatial nonuniformity. Los Angeles County and Maricopa County (Phoenix) have similar monitoring site limitations.

The day-by-day monitoring data available in the AQS can be used to go beyond the COD to further suggest the extent of coarse particulate matter spatial nonuniformity. In Figures 1 through 3, trend lines from sixth-day point to sixth-day point have been added to demonstrate the shifts in the highest concentration values. These trend lines are meant for illustrative purposes and do not imply any data applicable to the five-day periods between each monitoring period. In the case of Pittsburgh, the highest coarse PM concentrations are not always at the same monitor. Unlike the conditions associated with $PM_{2.5}$, these variations suggest that regional air masses are not a dominant factor affecting coarse PM emissions. The variations are due to factors that, at most, affect only a small subset of the monitoring sites. This leads to a question that cannot presently be addressed due to the severe lack of coarse particulate matter data—are there opposing trends in coarse PM air quality in intraurban areas where on specific days the concentrations in some parts of a county improve while concentrations increase in other parts of the county? If so, a spatial average concentration value used in an epidemiological study is of limited usefulness.

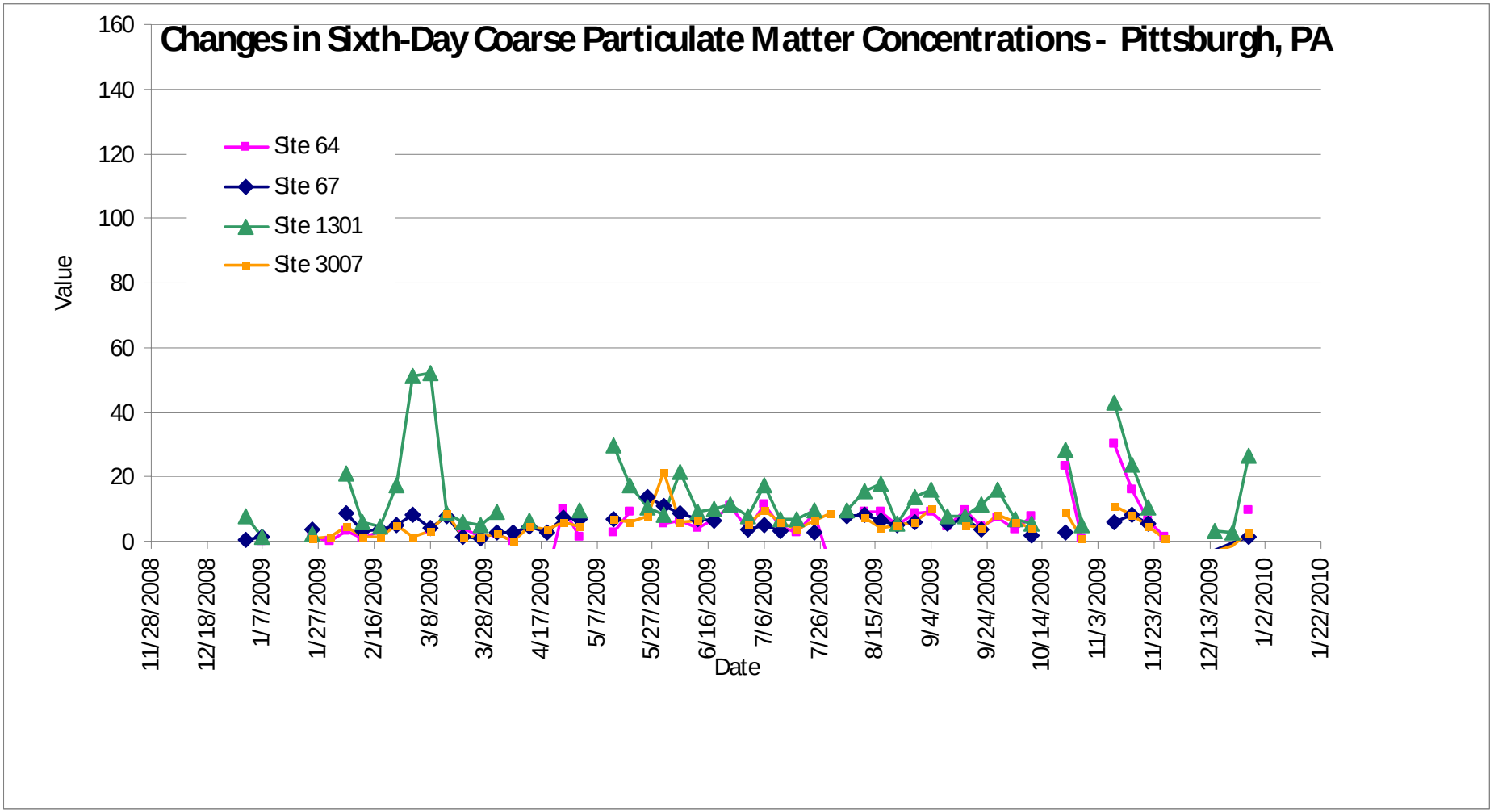

Figure 1. Pittsburgh Coarse Particulate Matter Concentrations Calculated by Difference from Colocated PM_{10} and $PM_{2.5}$ Monitors

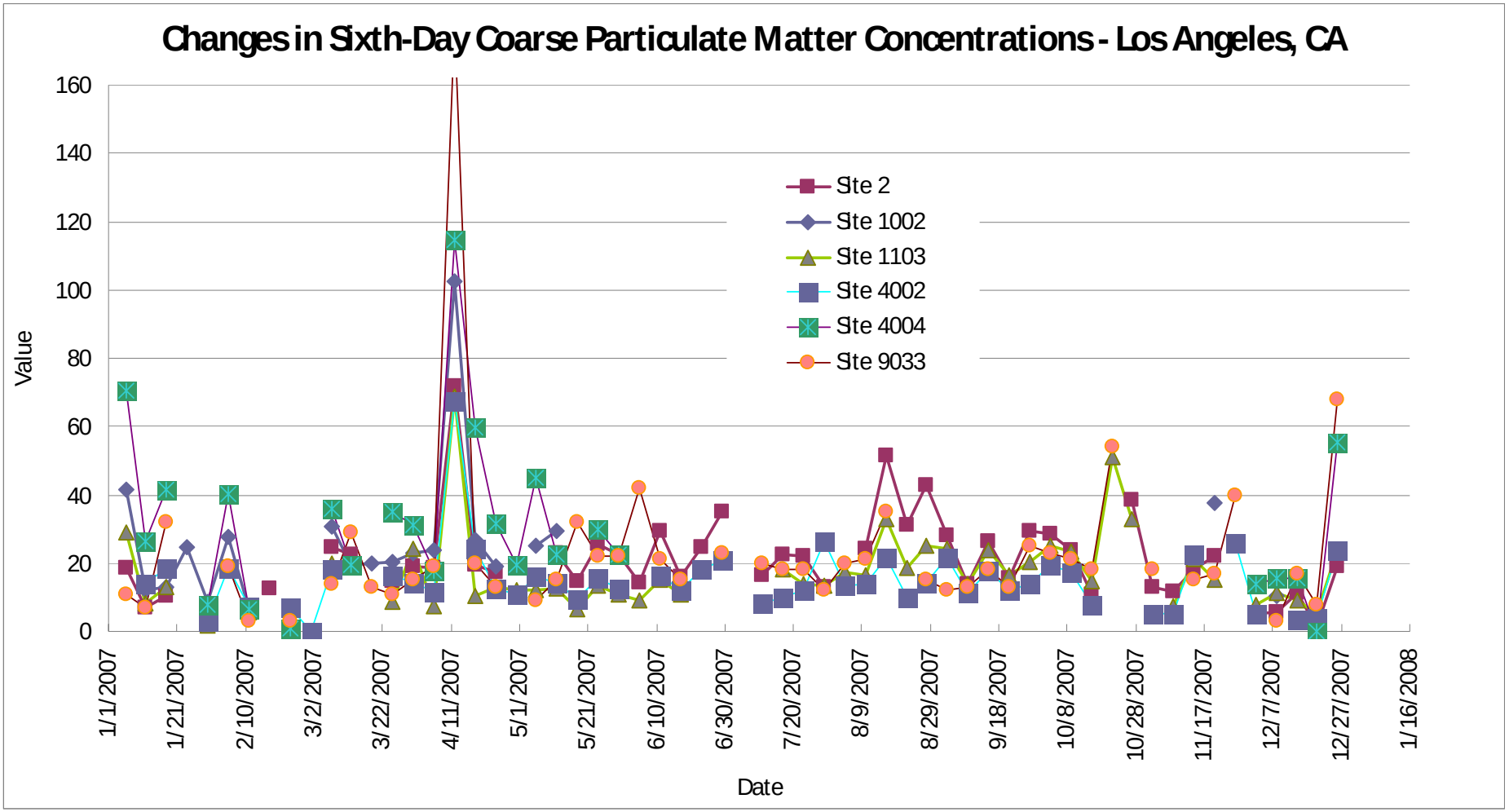

Figure 2 Los Angeles Coarse Particulate Matter Concentrations Calculated by Difference from Colocated PM_{10} and $PM_{2.5}$ Monitors

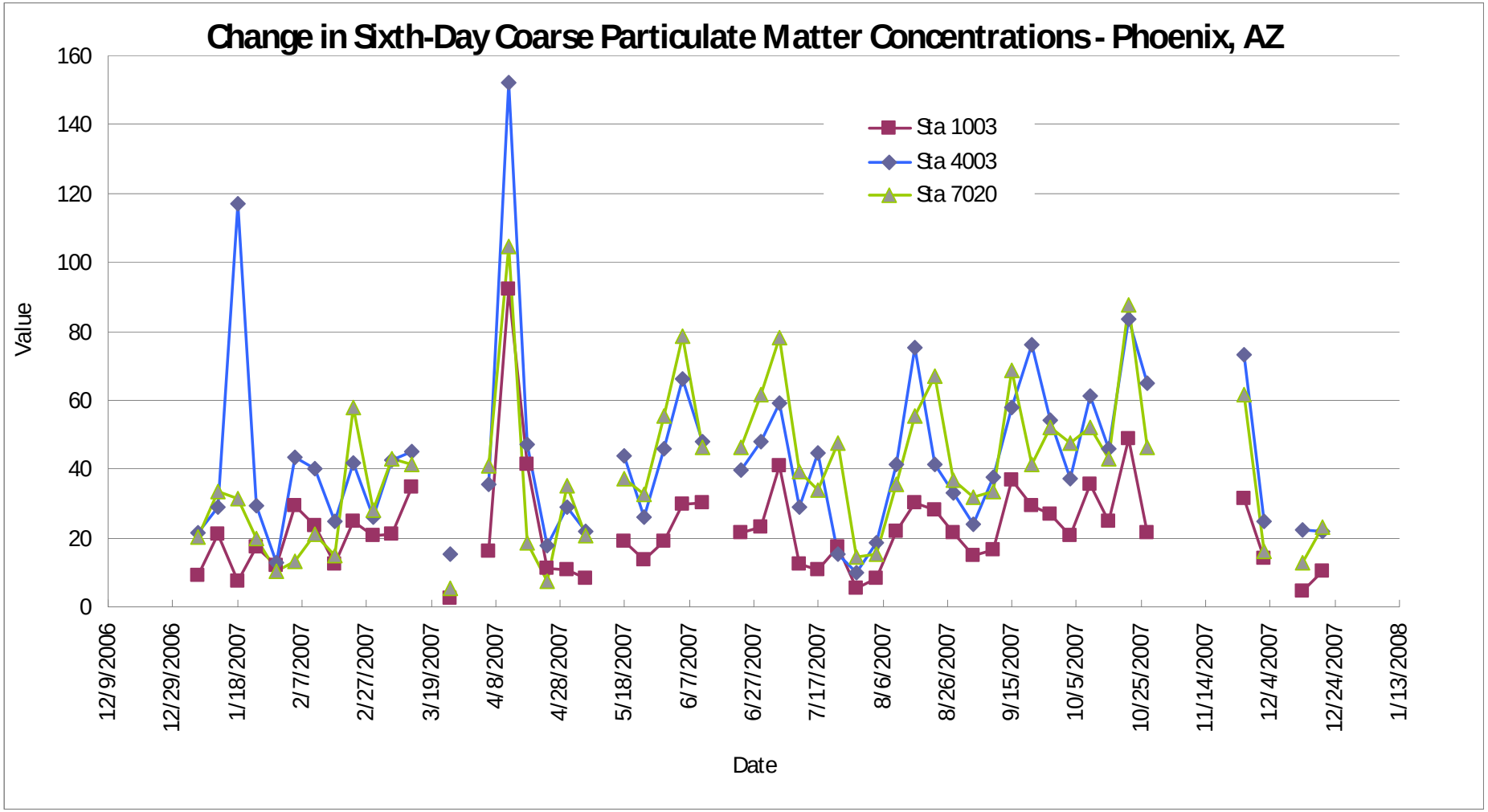

Figure 3 Phoenix Coarse Particulate Matter Concentrations Calculated by Difference from Colocated PM_{10} and $PM_{2.5}$ Monitors

One of the characteristics of coarse PM concentration profiles evident from Figures 1, 2, and 3 is the day-to-day spiking characteristics. The coarse PM is not well characterized by a single average concentration value even for a single monitoring site directly and accurately measuring coarse PM. The spiking characteristics appear more pronounced for coarse-mode as compared to fine-mode particulate matter. This introduces additional uncertainty into the epidemiological results because of the significant differences that might exist in individual exposures.

The spiking characteristics apparent in the urban-oriented data shown in Figures 1, 2, and 3 are also readily apparent near farms and natural areas subject to wind erosion and dust entrainment. Gusts of wind create short-term spikes of coarse-mode particulate matter. The 24-hour concentrations created by ambient winds acting on arid or agriculturally disturbed soils can generate high coarse-mode concentrations. While the coarse-mode NAAQS ultimately promulgated by EPA will apply nationally, the epidemiological studies in the ISA and Policy Assessment have a heavy urban emphasis. There is extreme uncertainty in the coarse PM exposure conditions downwind of farms during tilling and harvesting. Extreme uncertainty also exists concerning coarse-mode concentrations downwind of controlled burns, wild fires, and natural wind erosion in arid portions of the West and Midwest. Ambient coarse-mode concentration data in rural and arid portions of the West are even less-well-characterized than in the major urban areas. Any changes in the coarse PM NAAQS are premature until coarse-mode concentration data are available for a large part of the U.S—urban and rural.

In concluding our comments concerning coarse PM spatial nonuniformity, the Coalition disagrees with the statement reproduced below from page 3-15 of the Policy Assessment.

> *The net effect of these uncertainties on epidemiologic studies of $PM_{10-2.5}$ is to bias the results of such studies toward the null hypothesis.*
> Policy Assessment, page 3-15

The lack of data characterizing coarse PM spatial nonuniformity does not in any way change the number of hospital admissions or any other health indicators observed in the epidemiological studies cited in the ISA. The lack of data simply means that the researcher did not have adequate knowledge regarding the range of concentrations that might have contributed to the adverse health effects. Indeed, the health effects reported in the epidemiological studies might well have been caused by high concentrations in one or more very localized areas. The air quality analyses in these studies based on county-wide averages or other single monitor values were not sufficient to identify the presence or absence of these localized conditions.

Without adequate data on the spatial nonuniformity of the concentrations, the health outcome cannot be adequately matched to the dose. It is possible that the results of some of the epidemiological studies are significantly impaired by this lack of information.

It is also important to note that the extent of spatial nonuniformity in coarse PM concentrations between urban areas or between urban and rural areas cannot be assessed at this time due to the severe lack of coarse PM data. Accordingly, it would be premature, and almost certainly

incorrect, to assume that the average-to-peak concentrations in study areas are consistent from city-to-city and state-to-state. The only practical means to adequately assess coarse PM health effects is to do the work necessary to measure coarse PM directly in a reasonable number of locations in the study area. There is no substitute for adequate data.

2. Supporting evidence is lacking to independently confirm the results of epidemiological studies.

Section 3 of the Policy Assessment Document indicates that EPA would consider reducing the 24-hour standard applicable to coarse particulate matter to a value between 65 and 85 micrograms per cubic meter evaluated based on the three-year average 98th percentile concentration. This is a major change in the stringency of the coarse standard that is not supported by the coarse PM air quality data and health effects studies described in the ISA. Considerable independent data are needed to confirm the suggestive relationships claimed by EPA in Section 3. The Coalition does not find sufficient confirming evidence in the ISA or the Policy Assessment.

In this section, the Coalition focuses on two possible types of confirming evidence: (a) a clear dose-response relationship based on data from urban and rural areas across the U.S. experiencing a wide range of coarse PM concentrations and (b) toxicological studies that clearly point to a plausible mechanism for coarse PM-induced health effects.

a. Dose-Response Relationships

The NAAQS are dose-based standards that apply across the entire U.S. Based on the regulatory history described in Section 1 of the Policy Assessment Document, EPA has concluded that rural crustal emissions cannot be addressed differently than urban coarse PM. As indicated in the ISA, the coarse concentrations are higher in the arid and rural portions of western U.S. than in the eastern U.S. These differences are apparent in the coarse PM data shown in Figures 1, 2 and 3 that have the lowest concentrations in Pittsburgh, moderate concentrations in Los Angeles, and relatively high concentrations in Phoenix. Other coarse data that can be recovered from PM_{10} and $PM_{2.5}$ data in the AQS illustrate similar regional differences.

If the health effects of coarse PM are truly a function of the total coarse PM without regard to composition, then there logically should be greater coarse PM-related health effects in the arid areas in the West than in the East. That is not indicated by the various health effects studies summarized in Chapter 3 of the Policy Assessment Document or in the ISA.

In considering the necessary coarse PM standard, EPA must now look beyond the urban areas that are the focus of the Policy Assessment Document, Chapter 3 and consider the coarse PM levels in rural background and rural agricultural areas.

To confirm the epidemiological study results summarized in the Policy Assessment Document there should be a reasonable dose-relationship. If no dose-relationship is apparent, then EPA must look for specific components of coarse particulate matter or look for co-pollutants such as

$PM_{2.5}$ to explain any observe health effects. Until a dose-relationship becomes clear, changing the coarse PM NAAQS is premature.

There has been some discussion that the epidemiological studies inherently underestimate adverse health outcomes because they are inherently limited to time-series analyses focusing on one or more lag days from the step changes in particulate matter concentration. The analyses of health issues over a broad geographical area with a wide range of coarse PM concentrations should provide a means to identify any of these undetected health concerns. However, the data included in the ISA do not appear consistent with the conclusion that higher levels of coarse PM are necessarily associated with higher levels of health effects.

b. Toxicological Studies

The Policy Assessment Document (June 2010) correctly states the need for considerably additional toxicological data to identify and clarify mechanisms of injury caused by coarse particulate matter. Considering the severe lack of such information, it is premature to conclude that any observed relationship between coarse particulate matter exposure and adverse health effects is anything but a secondary relationship.

3. The Policy Assessment incorrectly implies that globally transported dust from Asian and African deserts is primarily in the coarse mode.

Section 3 of the Policy Assessment Document presents a lengthy discussion of the possible health implications of dust storms originating in Asian and African deserts. On page 3-14 of Section 3, EPA stated the following:

> *As discussed above, most $PM_{10-2.5}$ epidemiologic studies have been conducted in urban locations in the U.S., Canada, and Europe while a small number of studies have examined the health impacts of dust storm events (US EPA, 2009a, sections 6.2.10.1, 6.5.2.3). Although these dust storm studies do not link specific particle constituents to health effects, it is useful to consider them within the context of the toxicity of particles of non-urban crustal origin. Several studies have reported positive and statistically significant associations between dust storm events and morbidity or mortality, including the following:*
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> - *Middleton et al. (2008) reported that dust storms in Cyprus were associated with a statistically significant increase in risk of hospitalization for all causes and a non-significant increase in hospitalizations for cardiovascular disease.*
> - *Chan et al. (2008) studied the effects of Asian dust storms on cardiovascular hospital admissions in Taipei, Taiwan and reported a statistically significant increase associated with 39 Asian dust events. Evaluating the same data, Bell et al. (2008) also reported positive and*

statistically significant associations between hospitalization for ischemic heart disease and $PM_{10-2.5}$.

- *Perez et al. (2008) tested the hypothesis that outbreaks of Saharan dust exacerbate the effects of $PM_{10-2.5}$ on daily mortality in Spain. During Saharan dust days, the $PM_{10-2.5}$ effect estimate was larger than on non-dust days and it became statistically significant, whereas it was not statistically significant on non-dust days.*

In contrast to the studies noted above, some dust storm studies have reported associations that were not statistically significant. Specifically, Bennett et al. (2006) reported on a dust storm in the Gobi desert that transported PM across the Pacific Ocean, reaching western North America in the spring of 1998. The authors reported no excess risk of cardiac or respiratory hospital admissions associated with the dust storm in the population of British Columbia's Lower Fraser Valley (Bennett et al., 2006). In addition, Yang et al. (2009) reported that hospitalizations for congestive heart failure were elevated during or immediately following 54 Asian dust storm events, though effect estimates were not statistically significant. The implications of these studies for the current review, for consideration of potential standard indicators, are discussed below. EPA Policy Assessment Document (June 2010 Draft), Page 3-14.

EPA continued with their discussion of dust storm issues with the following statement provided on pages 3-15 and 3-16:

Another uncertainty results from the relative lack of information on the chemical and biological composition of $PM_{10-2.5}$, and the effects associated with the various components (ISA, section 2.3.4). As discussed above, a few recent studies have evaluated associations between health effects and particles of non-urban, crustal origin by evaluating the health impacts of sand storm events. Though these studies provide some information on the health effects of particles that likely differ in composition from the particles of urban origin that are typically studied, without more information on the chemical speciation of $PM_{10-2.5}$, the apparent variability in associations with health effects across locations is difficult to characterize (US EPA, 2009a, 3 section 6.5.2.3). EPA Policy Assessment (June 2010), Pages 3-15 to 3-16

Implicit in Section 3 of the Policy Assessment Document is EPA's apparent assumption that the dust arriving in the U.S. due to Asian and African desert dust storms is primarily in the coarse-mode. The assumption is inconsistent with particle size data obtained in numerous studies. Data provided in papers such as Gomes and Gillette (1993), Syzkman et al (2003), VanCurren et al (2002), Prospero (1996 and 1999), Bennett (2005), McKendry (2001), and Schultz and Serbert (1987) indicate that the mass median diameter of dust transported globally is in a size range close to or below 2.5 micrometers. It is apparent that dust storm particles are present in both the coarse-mode and fine-mode. It is not appropriate to assign observed health effects to coarse-mode particulate matter simply because the measured PM_{10} levels have increased.

All of the Asian and African dust storm discussions in the Policy Assessment Document should be substantially revised. This information should be discussed in both sections 2 and 3 of the document or deleted entirely. No conclusions regarding coarse-mode health effects should be based on the data cited in the Policy Assessment Document regarding globally transported dust.

4. The lack of coarse PM compositional data introduces substantial uncertainty into the epidemiological study results.

The Coalition continues to recommend that EPA compile and evaluate the variations in composition of coarse PM in both urban and rural areas of the U.S. The Coalition also believes that a thorough understanding of the variations in the composition of coarse and fine-mode particulate matter should be included in epidemiological studies to the maximum extent possible. Perhaps future toxicological studies will provide data and information that inform interpretation of epidemiological results in both rural and urban areas.

The Coalition continues to be encouraged that both EPA and CASAC recognize the importance of data concerning coarse and fine-mode particulate matter composition. The following statement in the Policy Assessments summarizes EPA's concerns:

> *Another uncertainty results from the relative lack of information on the chemical and biological composition of $PM_{10-2.5}$, and the effects associated with the various components (ISA, section 2.3.4). As discussed above, a few recent studies have evaluated associations between health effects and particles of non-urban, crustal origin by evaluating the health impacts of* ***sand storm events****.(emphasis added) Though these studies provide some information on the health effects of particles that likely differ in composition from the particles of urban origin that are typically studied, without more information on the chemical speciation of $PM_{10-2.5}$, the apparent variability in associations with health effects across locations is difficult to characterize (US EPA, 2009a, 3 section 6.5.2.3).*
> Policy Assessment, pages 3-16 to 3-17

While the Coalition agrees with the general concept expressed in the excerpt above, it is worth noting again that the reference to "sand storm events" is inappropriate considering that dust storms can have 50% or more of the particulate mass in the fine mode. Furthermore, very little compositional data are available as a function of the particle size distribution of globally transported dusts.

There is very little information available concerning the speculated presence of toxic materials on aging coarse-mode particles in urban environments. Considering that EPA evidently funded a number of coarse PM oriented studies as a result of solicitation EPA-G2006-STAR-Q1, "Sources, Composition, and Health Effects of Coarse Particulate Matter" (closing November 30, 2006.), it is unclear why no new data and information are included in the ISA and the Policy

Assessment. Accordingly, the Coalition can only repeat the comments submitted on October 5, 2009, which, in turn, simply reiterated earlier Coalition comments.

- "Future NAAQS standards should take into account the relative importance of the "carrier" mechanism in each size range if research eventually demonstrates that particles in portions of the fine and coarse particulate matter distributions serve as carriers of toxic contaminants present on the particle surfaces.

- The presently available data suggest that the "carrier" mechanism might be important with respect to fine particulate matter and unimportant with respect to coarse particulate matter."
  Coalition Presentation to CASAC, October 5, 2009

5. The proposed change in the format and level of the 24-hour coarse-mode NAAQS to a three-year average 98th percentile format is premature at the very least.

The Coalition believes that any change in the format and level of the 24-hour NAAQS for coarse-mode particulate matter using PM_{10} as an indicator is premature. We concur with the Administrator's previous conclusion summarized below in an excerpt from the Policy Assessment Document.

> *As discussed above, in the last review the Administrator retained the one-expected exceedance form of the primary 24-hour PM_{10} standard. This decision was linked to the overall conclusion that "the level of protection from coarse particles provided by the current 24-hour PM_{10} standard remains requisite to protect public health with an adequate margin of safety" (71 27 FR 61202). Because revising either the level or the form of the standard would have altered the protection provided, it was concluded that such changes "would not be appropriate based on the scientific evidence available at this time" (71 FR 21202). Therefore, the decision in the last review to retain the one-expected-exceedance form was part of the broader decision that the existing 24-hour standard provided requisite public health protection.*
> Policy Assessment Document, page 3-30.

The Coalition finds very little additional data concerning coarse-mode PM in the ISA and the Policy Assessment. The data gaps continue to be substantial.

The analyses summarized in Figure 3-7 of the Policy Assessment Document are based on PM_{10}. It is clear from the correlation coefficients presented for essentially all eastern U.S and midwestern urban areas that PM_{10} is composed primarily of $PM_{2.5}$. The dominance of $PM_{2.5}$ in these analyses potentially skews the results.

The form and level of the 24-hour standard is addressed in Section 3 of the Policy Assessment Document without the benefit of information concerning 24-hour background levels of coarse PM in arid western and midwestern regions and in agricultural areas during tilling and

harvesting. Indeed, the ISA information concerning policy-relevant-background ("PRB") levels is quite limited and includes only a brief discussion of annual average coarse PM. There are no data concerning 24-hour PRB levels even in the urban areas.

It is clear from a review of the coarse PM data obtainable by difference at colocated PM_{10} and $PM_{2.5}$ monitoring sites that western areas of the U.S. are subject to considerably more concentration spiking than areas of the East. For example, Figures 1, 2, and 3 discussed earlier in these comments are plotted on an equal axis to highlight the differences in the severity of spiking. Additional 24-hour coarse PM concentration data are provided in Figures 4 and 5 for El Paso, Texas and Salt Lake City, Utah. These charts have clear similarities with Figure 3, which shows coarse PM data for Phoenix. The charts have quite different spiking characteristics than the $PM_{2.5}$ dominated Pittsburgh data in Figure 1.

The analysis summarized in Figure 3-7 of the Policy Assessment Document is inherently biased against any urban and rural areas vulnerable to wind-reentrainment of crustal material from unvegetated or agriculturally disturbed land. These areas will be relegated to nonattainment status through no fault of the mobile and stationary sources in the area.

The Coalition recommends that EPA delay any reconsideration of the form and level of the 24-hour NAAQS relevant to coarse-mode particulate matter until additional coarse PM monitoring data become available. The Coalition understands that many agencies are in the process of upgrading their monitoring networks to include these instruments. Accordingly, data should be available soon for EPA to reevaluate the NAAQS.

It is important to note that the Coalition does not agree with EPA's discussion on page 3-39

> *In considering this issue in the specific locations where we have evidence for associations between $PM_{10-2.5}$ and mortality or morbidity, we note that, as described above, positive and statistically significant $PM_{10-2.5}$ effect estimates have been reported in the following U.S. locations:*
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> - *Coachella Valley (Ostro et al., 2003)*
> - *Detroit (Ito et al., 2003)*
> - *Phoenix (Mar et al., 2003; Wilson et al., 2007)*
> - *Chicago, Salt Lake City, Detroit, Pittsburgh, Birmingham, St. Louis (US EPA, 2009a, Figure 6-29)*
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> *In considering the PM10 air quality, we note that 98th percentile PM10 concentrations were above 87 $\mu g/m^3$ in all of these cities, even those with PM10 concentration-equivalent design values below 150 $\mu g/m^3$ (Detroit, Chicago, Pittsburgh) (see section 3.2.1 above for PM10 concentration equivalent design values).*
> Policy Assessment Document, page 3-39.

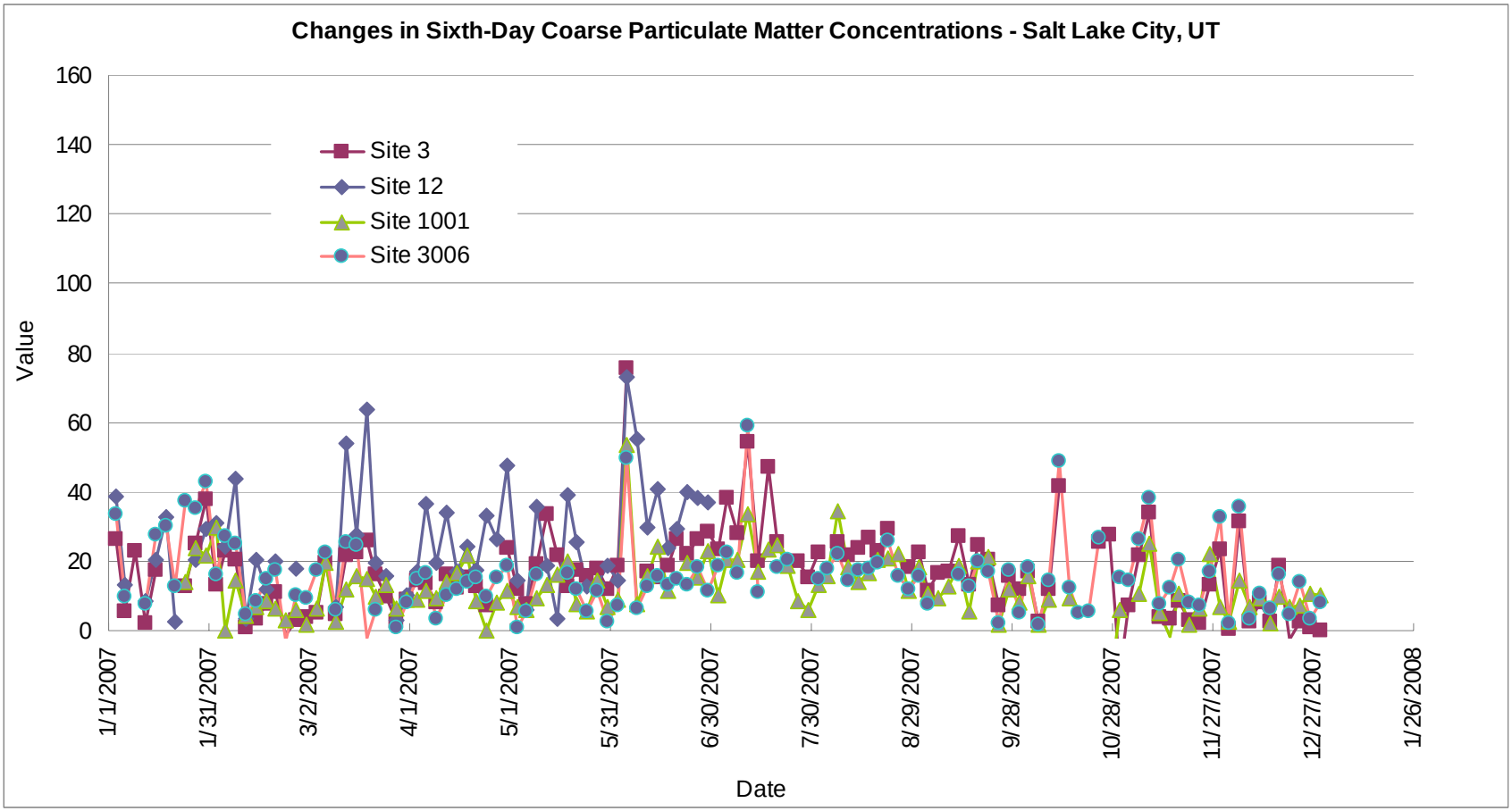

Figure 4 Salt Lake City Coarse Particulate Matter Concentrations Calculated by Difference from Colocated PM_{10} and $PM_{2.5}$ Monitors

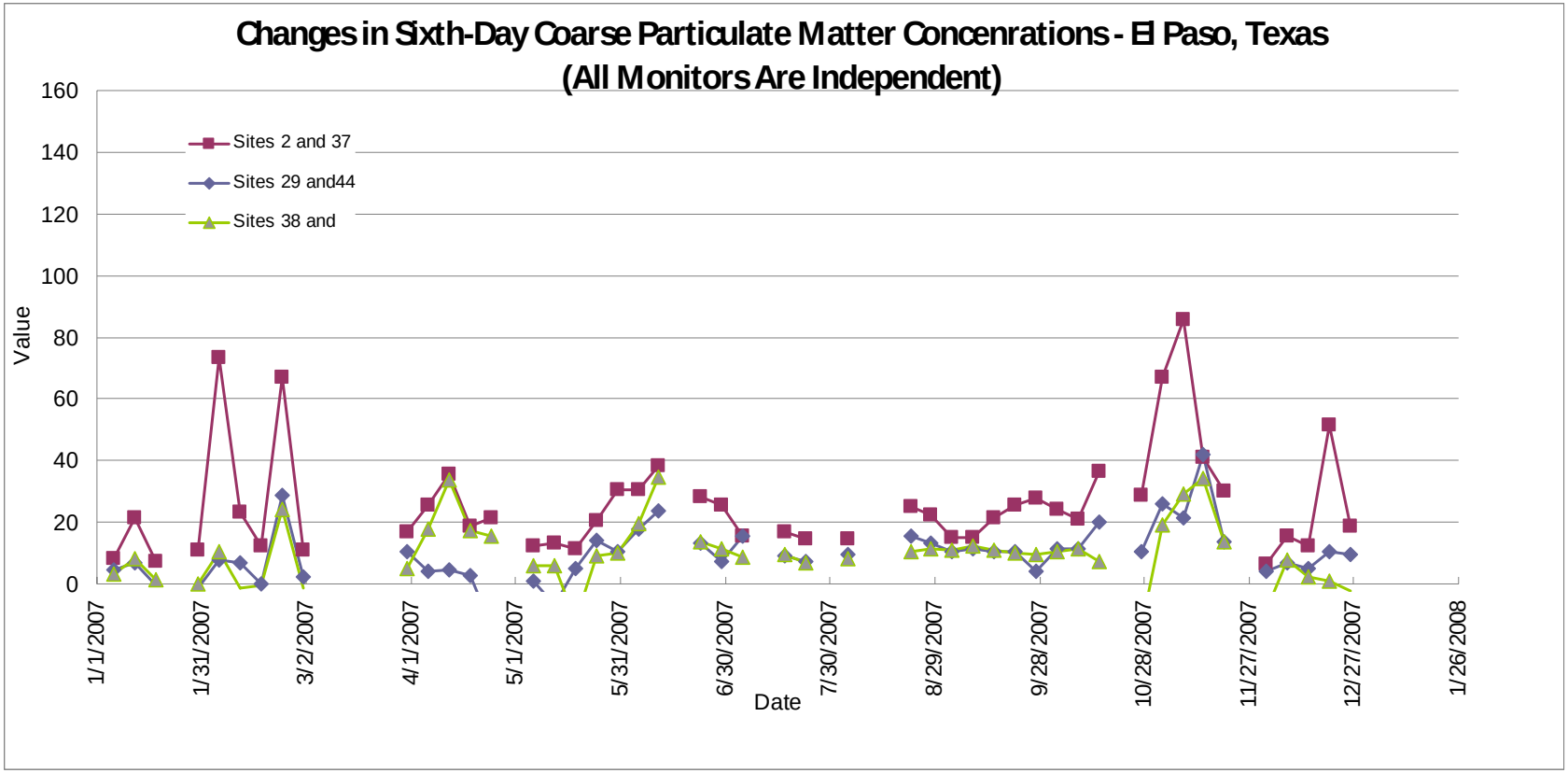

Figure 5 El Paso Coarse Particulate Matter Concentrations Calculated by Difference from Colocated PM_{10} and $_{PM2.5}$ Monitors

EPA has previously described numerous uncertainties regarding the epidemiological data. The Coalition believes that EPA continues to underestimate the uncertainties of these results. Accordingly, it is inappropriate to use selected epidemiological data to justify the level of the standard. Instead, EPA should work to reduce the uncertainties and ensure that coarse PM, and not simply a component of coarse PM, is the appropriate pollutant to regulate.

6. Arbitrary standard setting based on insufficient data will aggravate already severe unemployment, which is itself a major health problem.

The Coalition is aware of the provisions in the Clean Air Act Amendments that preclude EPA from considering economic factors in setting health-based ambient air quality standards. The Coalition believes that EPA could and should expand its understanding of health effects while staying within the guidelines of Congress. Specifically, EPA should include an evaluation of the implications of proposed NAAQS changes on unemployment rates. The relationship between unemployment (especially recession-related unemployment) is addressed in papers by Charles and DeCicca (2008), Kuhn et al (2009), George Washington School of Public Health (2009), McLean et al (2005), Mathers and Schofield (1998), Perry et al (2009), Stuckler et al (2009), Torres (1991), and the World Health Organization (2003).

While the unemployment/health issue is especially complex, it must be considered in the standard-setting process due to the impact of the NAAQS on the ability of industrial sources to obtain permits to modify or expand operations. The ability of industrial to hire new employees is partially dependent on the availability of construction and operating permits. Setting standards potentially at or close to background levels also threatens the viability of existing sources.

If EPA lowers the 24-hour coarse PM standard to a level of 65 to 85 $\mu g/m^3$ as suggested in the Policy Assessment Document, it takes the risk of increasing already severe unemployment or slowing employment growth, especially in arid and agriculturally-oriented regions of the Midwest and West.

7. Effective control strategies to achieve very low 24-hour coarse PM NAAQS are not clear.

All previous NAAQS were directed at pollutants for which anthropogenic sources were clearly dominant. State Implementation Plan control strategies were directed at sources amenable to control. This is not necessarily the case with coarse PM. As indicated in Section 3 of the ISA and specifically in Table 3-7, the major sources of coarse PM, especially in the West and Midwest, include, but are not limited to the following:

(1) Wind-blown fugitive dust from unvegetated surfaces,
(2) Controlled burns,
(3) Wild fires,
(4) Unpaved roads,
(5) Paved roads,

(6) Agricultural harvesting and tilling,
(7) Sea salt spray in ocean coastal areas
(8) Globally transported dust from Asian and African deserts, and
(9) Pollen and other biological materials

Industrial process and fugitive emissions are responsible for a relatively small part of the total inventory of coarse PM primary emissions in some parts of the country. Secondary formation of coarse PM is at or near negligible levels. Accordingly, the control strategies that EPA expects states to implement to achieve the coarse PM NAAQS throughout the U.S. are not clear.

The Policy Assessment Document should explicitly address (1) the feasibility of coarse PM control within SIPs and (2) the possible impact of proposed NAAQS changes on a broad range of health issues. As part of the Policy Assessment Document, EPA should provide a thorough analysis of the extent to which at a new NAAQS standard can be achieved, especially in difficult-to-control regions of the U.S. such as the West and Midwest.

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