Scientific Input on Issues Related to EPA's Response Activities to the Attacks on the World Trade Center (Task Order #59, EPA Contract 68-C-02-060)

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1. **The Confirmation Cleaning Study concluded that "asbestos air sampling was a conservative method for determining if additional cleaning was required." Given this conclusion and its supporting data in the Confirmation Cleaning Study and all other data sources, is the selection of asbestos as a surrogate for determining the risk from other contaminants supported? Please provide a detailed response, explaining the reasoning for your yes or no answer.**

No.

Assumptions inherent for selecting a substance as a surrogate for determining risk from other contaminants for a particular source of contaminants following cleaning of an area include at least: 1) the substance is present in the all of the distributed source material at a near uniform concentration ratio to other contaminants of concern; 2) the dispersion of the material does not cause a partitioning of surrogate and the contaminants of concern; 3) the medium the surrogate is measured in reflects the amount of the contaminants in all of the media and locations where exposure could occur; and 4) the cleaning process is at least as effective and does not discriminate for the other contaminants compared to the surrogate.

The Confirmation Cleaning Study can be used to evaluate assumption 4 and possible 3. It cannot be used to evaluate either assumptions 1 or 2 since it was limited to cleaning within a single building, so the results from that study are not representative of the material from the WTC disaster as a whole, but a relatively small subsection of the material. Samples within a single building are also not useful for understanding whether there was partition of the source material while it was being dispersed.

The Confirmation Cleaning Study examined series of contaminants of concern in the air and dust following a series of different cleaning protocols to determine whether each contaminant would be reduced to levels below its Health-Based Benchmark. As indicated in our charge, the Confirmation Cleaning Document states that the PCMe asbestos air sampling was the most sensitive of the testing methods. This statement is based on the number of times the air concentration for asbestos exceeded the Health-Based Benchmark, causing additional cleaning compared to the other contaminants. The report then states, within its Highlighted Box 7 in the Conclusion Section: "The study found that conducting asbestos sampling after cleaning could be used as a surrogate method for determining if future cleaning was needed" and presumable if the area would be below the Health-Based Benchmark suggested for all other contaminants. However,

lead in surface wipes exceeded the Health-Based Benchmark in the first post cleaning samples in Units 4D and 5A when the asbestos air samples did not. Thus, if asbestos air levels were used as a surrogate in these two apartments, lead in dust would not had been adequately abated. The wipe and micro vacuum samples for asbestos did show decreases between the pre- and some, but not all, first post-cleaning samples. The cleanings do not remove all of the contaminants from the dust within the apartments, but by three cleanings, the air levels and the dust levels were below the Health-Based Benchmarks.

Possible reasons for the asbestos air levels being acceptable but the lead dust levels still exceeding the Health-Based Benchmark is the exact mechanism for resuspension of the dust and the percent that is resuspended during the air sampling may discriminate across the particle distribution or spatially within the residence. There may be sections of the residences from which the dust is not resuspended, which may have been sampled for the wipe sample. Further, differences in the particle size and shape distributions for the different contaminants exist. Asbestos is by definition >5μm with a minimum 5:1 aspect ratio, a different size and shape than the particles expected to contain lead and other contaminants. These two size and shape particle groups may be made airborne to different degrees under the conditions of modified-aggressive air sampling.

The Confirmation Cleaning Study compared the aggressive and modified aggressive air sampling procedures by measuring air concentrations in the same apartment prior to cleaning by first doing the modified aggressive and then the aggressive air sampling. I strongly encourage that a single method be used throughout the cleanup. Using different methods leaves open the possibility that community members will claim that the two methods produce different results and results of the modified aggressive method did not adequately evaluate whether the residence was clean, since the protocol currently suggests using the aggressive techniques when the occupants agree. If EPA and the panel are convinced that the two methods are equivalent, as summarized in the Confirmation Cleaning Study, then I suggest that all homes be sampled under the modified aggressive method and this be designated in the SOP as the appropriate method, since the full aggressive method cannot be use for some occupied apartments without major movement of belongings. If the two methods are not considered equivalent then no sampling should be done under the modified aggressive method.

As indicated above, one of the assumptions inherent in the choice of asbestos air sampling being used as a surrogate for other contaminants of potential concern, is the ratio of asbestos to those contaminants should be the same in dust from the WTC in all locations that the dust was distributed to throughout lower Manhattan. There is concern that this may not be the case since asbestos was not used throughout the two buildings but rather was used as an insulator mainly in the North Tower up to the 40th floor (see, for example, Mount Sinai Pediatric Environmental Health Specialty Unit WTC Asbestos Fact Sheet). Thus, the debris created and the dust from the WTC would not be expected to be uniform for asbestos. In three samples of outdoor settled dust collected in close proximity to the WTC, within a week of the disaster, the levels of asbestos were 0.8, 0.8 and 3.0%, a range of a factor of four (Lioy et al. Characterization of the Dust/Smoke Aerosol that Settled East of the World Trade Center (WTC) in Lower Manhattan after the

Collapse of the WTC, EHP 110(7) 703-714, 2002). Due to the proximity of these samples to the WTC site they should be representative of the source material without discrimination by transport. Further, the sample with the higher asbestos was collected within a block of one of the other samples and would be expected to originate from the same portion of the debris. Table 1 provides the concentration and ratios to asbestos of several key contaminants in the two samples collected in close proximity. The ratios differ between factors of 2 to >6 for these samples.

Concentration and Ratios to Asbestos in Outdoor Dust Samples Near the WTC Site (Cherry St and Marker St are within one block of each other) (Lioy et al 2002)

	Cortlandt St		Cherry Street		Market Street	
	Concentration	Ratio to Asbestos	Concentration	Ratio to Asbestos	Concentration	Ratio to Asbestos
Asbestos	0.8%	-	0.8%	-	3.0%	-
Lead	142 µg/g	177	489µg/g	611	289 µg/g	96
Flourene *	6.8 µg/g	8.5	2.6 µg/g	3.3	32.2 µg/g	10.7
Total PAH	383 µg/g	479	218 µg/g	272	376 µg/g	125
Dioxin	104 ng/kg	130	63ng/kg	79	103ng/kg	34
Glass Fibers	40%	50	49%	61	37%	12

*Flourene had the largest differences of the PAHs across the three sites.
Cellulose makes up the difference in percent for these two samples
Ratio taken without regard to differences in units

The composition of the settled dust collected at various sites throughout lower Manhattan, suspected of having been impacted by the WTC disaster, did not contain a uniform amount of asbestos. Differences in concentrations in these samples would reflect both differences in concentrations in the sources material and discrimination in particles during transport. The USGS evaluation of the asbestos distribution showed 'an asymmetric distribution pattern. More chrysotile was detected in the east-west direction than south… While there is a general trend, it is not exclusive, meaning that chrysotile was detected in all directions. It also should be noted that samples obtained next to each other (on the map this means a city block apart) can show different results: one has asbestos, another has no chrysotile above the detection limit.)' (Clark et al, US Geological Survey, Open File Report OFR-01-0429 Environmental Studies of the World Trade Center area after the September 11, 2001 attack, http://pubs.usgs.gov/of/2001/ofr-01-0429/). These results, which refer to the percentage of the material that was asbestos, indicate that differences in the ratio of other contaminants to asbestos will exist. Thus, at least one, if not both, of the first two assumptions on the validity of using asbestos as a surrogate for other compounds that are listed in the first paragraph of this response were violated.

The use of asbestos as a surrogate for Synthetic Vitreous Fibers is questioned in the Final Report of the Public Health Investigation to Assess Potential Exposures to Airborne and Settle Surface Dust in Residential Areas of Lower Manhattan, September 2002, NYC DHMH and ATSDR-USDHHS on Page 27 where it states 'Although the presences of asbestos in the dust seems to correspond to SVF, the absence of asbestos does not predict or correspond to a presence or absence of SVF in settled surface dust, in either indoor or

outdoor areas of lower Manhattan.' In Table 6 of that report, asbestos was found in 12 (18% of the locations sampled) while SVF was found in 26 (46% of the locations sampled) residences. Thus, monitoring of asbestos will not provide documentation that there is not potential health risk from SVF. In The USEPA Region II World Trade Center Residential Dust Cleanup Program Draft Final Report, March 2004, 'the rate of exceedance of the health-based benchmarks for airborne asbestos (PCMe) was very low; approximately 0.4% of the asbestos samples exceeded the health-based benchmark. On a residence-basis, the cleanup program was successful in achieving the health-based benchmark for asbestos (PCMe) after the first cleaning approximately 99% of the time. … (for) lead wipe samples, approximately 14% of the pre-cleanup samples exceeded the HUD screening level of 25 $\mu g/ft^2$, while approximately 3% of the post-cleanup samples exceeded the screening level …. The cleanup program was successful in reducing the average dust lead loading in 31 of the 36 residences to below the 25 $\mu g/ft^2$ screening level, a success rate of approximately 86%. … The cleanup program reduced the average dust lead leading in 21 out of the 23 residences, a success rate of approximately 91%.' Since the success rate for asbestos was higher than for lead and asbestos was below the Health-Based Benchmark after the first cleaning in all cases for this report, but lead was not, using asbestos as a surrogate would result in residences not being cleaned to the Health-Based benchmark for lead in dust for a variety of residences in lower Manhattan.

2. **Do other contaminants that were measured in the Confirmation Cleaning Study provide equally good or better surrogates for determining the risk from other contaminants? If yes, please describe in detail which contaminants you would consider and why. If no, provide justification for your response.**

Yes.
As discussed in response to charge 1, whether lead in settle dust presented a health risk was not adequately represented by asbestos air concentrations. It is not clear from the data whether this is because the particles containing lead and asbestos are not resuspended in an identical manner, more of the dust needs to be cleaned to reach the lead Health-Based Benchmark in dust than was needed to reach the air asbestos Health-Based Benchmark, or if there were areas in the residence that were not cleaned adequately but were not resuspended yet were sampled by the wipe sample. I therefore suggest that in addition to the asbestos air sample, a wipe sample for lead also be analyzed to validate whether the residence has been cleaned sufficiently to reduce the risk to all contaminants of concerned in both media: air and dust.

A second consideration is there were dust samples from the WTC that do not contain asbestos but do contain other contaminants of concern. It is not clear whether lead in dust would be an adequate surrogate when asbestos is not present as lead in dust comes from many sources and may not be indicative of WTC material. It may be necessary to have an additional surrogate for air samples since asbestos has not been at measurable quantities in all locations where dust from WTC appears to have been deposited (see response to Charge 3 for one possible selection).

Rather than a different surrogate, I suggest that two additional species be measured. The first is the lead in the dust through a wipe sample.

3. Do the reviewers know of any other contaminants associated with the World Trade Center that were not included in the COPC document or the Confirmation Cleaning Study that may serve as a surrogate for determining the risk from other contaminants? If so, please provide the details regarding these contaminants and the reasons why they should be considered. Provide citations for any references mentioned, and/or submit hard copies of the referenced documents.

As a significant portion of the dust and air samples collected from lower Manhattan (outdoor 57%, Common areas 81%, Residential 82% - Table 6 and Figure 7 – Final Report of the Public Health Investigation to Assess Potential Exposures to Airborne and Settled Surface Dust in Residential Areas of Lower Manhattan, NYCDHMH and ATSDR-USDHHS, September 2002 and from http://www.epa.gov/wtc/bulkdust/) had non-detectable levels of asbestos but were in the area impacted by WTC dust. Thus, asbestos does not serve as and adequate surrogate for the presence of WTC dust in all locations of lower Manhattan It is therefore, advisable to have an additional surrogate to indicate the presence of WTC dust that might require cleaning to reduce the levels of contaminants of concern. It is not clear whether lead in dust, the proposed addition made in response to Charge 2, would be an adequate surrogate as it could be present in dust from many other sources and may not be indicative of WTC material. One of the substances present in sample of WTC dust in high concentrations is glass fibers (Lioy et al. 2002) (not fiber glass or SVC). Glass fibers were produced as a result of the shattering and subsequent grinding of all material during the collapse of the building. The expected prevalence of glass fibers in the dust resulted from the entire outside of the buildings being covered by glass windows (600,000 sq feet of glass, Table 1 Final Report of the Public Health Investigation to Assess Potential Exposures to Airborne and Settled Surface Dust in Residential Areas of Lower Manhattan, NYCDHMH and ATSDR-USDHHS, September 2002). Glass fibers are not expected to be prevalent elsewhere, as large amounts of glass are not ground fine enough to produce fibers under most conditions. Glass fibers therefore have the potential to be an indicator of the presence of WTC materials. Its health concern is not clearly known, though glass fibers may have been implicated in irritation of the respiratory tract under heavy load conditions for adults and the “WTC Cough”. Whether there are additional concerns at lower concentrations in sensitive individuals (elderly and children) are unknown.