**Technical Summary of EPA's Analysis of Hunters Point Air Monitoring Filters for Asbestos**
**December 22, 2009**

EPA conducted a re-analysis of the asbestos filters from perimeter samplers at Hunter's Point Parcel A during redevelopment to ascertain if, at this site under these conditions, similar conclusions would be reached using EPA's measure of asbestos hazard as compared to the measure described in the California Airborne Toxic Control Measure (ATCM), implemented as part of the Asbestos Dust Mitigation Plan. Overall, the ATCM criteria resulted in more work stoppages and dust mitigation measures then would have been triggered if using only the EPA asbestos measure.

## Background

The former Hunter's Point Naval Shipyard Parcel A is located in the Bayview Hunters Point neighborhood of San Francisco and is approximately 75 acres in size. Parcel A is being redeveloped by the City of San Francisco and its developer, and the construction involves excavating and grading large amounts of soil and bedrock. The rock and soil in the Bayview neighborhood is partially comprised of the mineral serpentine, which contains naturally occurring asbestos (NOA). Construction projects larger than one-acre in size in areas with naturally occurring asbestos are required to file an Asbestos Dust Mitigation Plan (ADMP) with the Bay Area Air Quality Management District ("Air District") following the ATCM.

As part of the ADMP, the Air District required the developer to install five stationary air monitors on and around the site. The locations of the Air District monitors (HV-1, 2, 4, 5 and 6) were determined by geophysical modeling based on the terrain and meteorological information to present the best possibility to evaluate dust levels at the fence line. Samples are generally collected for each 24 hour period Monday through Friday. The Air District established a trigger level of 0.016 total structures per cubic centimeter of air (reported as 1.6E-2 s/cc). Under the ADMP, a reading at any monitor above the trigger level requires that the developer stop work for the day and subsequent days until all monitors are below the trigger level. The purpose of the work stoppages is to decrease asbestos releases by re-evaluating procedures and methods to reduce dust levels before work resumes. It is important to note that the trigger level established by the Air District for this project is not a legal standard and that results above the trigger level do not constitute a violation. The monitors and the trigger level are part of the specific ADMP for the development project and are intended to help minimize generation of asbestos from construction activities, not as a method to assess health risks in the community.

Due to feedback from the community about placement of the Air District monitors, the City required the developer to install an additional five monitors at points of community concern. Three of the City monitors (HV-7, 9, and 11) are generally sampled daily, analyzed following the same protocols as the Air District monitors, and similar to the Air District monitors, the City required that work stop on days that results are above the trigger level. HV-8 is located upwind of the project and is thus sampled one day per week at random rather than daily, though its results are also compared to the trigger level and used in the stop work process. HV-12 is located the furthest downwind of the project and is sampled daily. It was originally included in

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the stop-work process but because the results at HV-12 did not correlate with grading and excavating activities, the City now collects the data for informational purposes, but results do not trigger work stoppages. The Air District formally added the City monitors HV-7, 8, 9, and 11 to the Asbestos Dust Mitigation Plan in the latest update, finalized in August of 2009.

**General Analysis and Risk Calculation Methods for Asbestos**

Asbestos hazard assessments are based on epidemiological studies conducted several decades ago on occupational exposures to asbestos. The best method available at that time for measuring asbestos was phase contrast microscopy (PCM) which uses a magnification of 400X. The epidemiological studies correlated risk with asbestos fibers measured with the PCM method, which was able to measure fibers longer than 5 micrometers (μm) and with an aspect ratio greater than 3. Such fibers are called the PCM equivalents.

The current method used to count asbestos fibers is transmission electron microscopy (TEM) which has a magnification of 20,000X. TEM can resolve fibers as small as 0.5 μm in length, as well as definitively determine the asbestos type and provide a more accurate fiber size distribution. However, the specific causative asbestos fiber type and fiber size associated with disease is not known, therefore the PCM equivalents were used as a surrogate of exposure. This leads to a problem with utilizing the newer data in risk assessments since TEM can resolve both the short and long fibers, but the epidemiological data are based on the longer fibers.

One approach to work around this problem is to convert the total fiber counts from the current TEM measurements back to the original epidemiologic measures. This is the approach that the California Air Resources Board (CARB) requires in their asbestos ATCM. CARB utilizes a modified version of the procedures outlined in the Asbestos Hazard Emergency Response Act (AHERA) published in 1987 in response to asbestos material in schools. The CARB procedure counts all the fibers greater than 0.5 μm in length, then converts the total count to PCM equivalents by applying a conversion factor of 320 total fibers/1 PCM equivalents. This is based on observations that with chrysotile asbestos, a common commercial mineral form, the fiber distribution is heavily weighted to fibers shorter than 5 μm in length. However, site specific conversion factors may vary in situations with naturally occurring asbestos.

EPA prefers to use the International Organization for Standardization (ISO) 10312 method published in 1995. This method also uses TEM but provides a count of both the total number of fibers as well as a count of the strict PCM equivalents. The PCM equivalents count can then be used directly in the risk calculations. Another significant difference between the CARB and the EPA procedures is in how individual fibers are categorized and tabulated. The EPA preferred method allows the analyst to identify and tabulate any distinguishable fiber that meets the dimensional requirements regardless of the complexity, while the CARB procedure counts any complex of fibers as a single entry as long as one fiber is visible that meets the size definition. Both the CARB method and the ISO 10312 method preferred by EPA use similar sample collection methods, preparation, instrumentation and resolution. However, the fiber dimensions of concern are different and the procedures for how individual fibers or complexes are tallied can result in differences in the totals based on the complexity of the asbestos structures and size distribution. Therefore, the results from the two methods cannot be directly correlated.

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**Analysis of Data from Parcel A**

EPA oversaw the re-analysis of 34 filters – including at least one from each of the ten monitors. The filters used in the re-analysis include a range of detected fibers, with a bias towards those with the highest counts (e.g., December 29, 2008). Our re-analysis employed both the CARB and EPA procedures and fiber counting rules and definitions.

More than half of the filters originally analyzed by the CARB method over the life of this project were non-detect -- that is, no asbestos fibers were measured in 4,153 out of 7,278 filters. In the original CARB analysis, approximately two percent of the filters had results above the trigger level. Ninety-four percent of the filters that we chose for re-analysis had detectable levels of asbestos under the CARB method and 41 percent of the filters had results from the original CARB analysis above the trigger level. The time frame from which the filters were selected was between December 2008 and August 2009. The results of the re-analysis using the EPA method detected no asbestos fibers in 25 out of the 34 filters, even though these filters were selected to represent some of the worst case situations from the original analyses.

The listing of each filter location and date, along with the original CARB result and the PCM equivalents re-analysis result, is shown in the table below. The results in bold denote filters whose original CARB results were above the trigger level of 1.6E-2 structures/cc.

| Monitor | Date | Original CARB Total s/cc | PCM Equivalents (re-analysis) s/cc |
|---|---|---|---|
| HV-2 | 4/2/2009 | 8.00E-04 | 0 |
| HV-1 | 5/7/2009 | <8.00E-04 | 0 |
| HV-8 | 3/2/2009 | 9.00E-04 | 0 |
| HV-5 | 5/15/2009 | 9.00E-04 | 0 |
| HV-9 | 4/9/2009 | 1.00E-03 | 9.90E-04 |
| HV-4 | 2/27/2009 | <1.10E-03 | 0 |
| HV-11 | 5/5/2009 | 2.00E-03 | 0 |
| HV-7 | 3/10/2009 | 2.80E-03 | 0 |
| HV-1 | 4/21/2009 | 2.90E-03 | 0 |
| HV-4 | 3/20/2009 | 2.90E-03 | 0 |
| HV-2 | 5/1/2009 | 2.90E-03 | 0 |
| HV-9 | 6/5/2009 | 3.90E-03 | 0 |
| HV-1 | 5/1/2009 | 4.80E-03 | 0 |
| HV-11 | 4/13/2009 | 5.90E-03 | 0 |
| HV-12 | 5/15/2009 | 7.70E-03 | 0 |
| HV-12 | 4/20/2009 | 9.70E-03 | 0 |
| HV-11 | 4/29/2009 | 1.28E-02 | 9.80E-04 |
| HV-4 | 6/5/2009 | 1.38E-02 | 0 |
| HV-4 | 7/17/2009 | 1.41E-02 | 0 |
| HV-4 | 5/6/2009 | 1.44E-02 | 0 |
| **HV-4** | **5/29/2009** | **1.71E-02** | **9.20E-04** |
| **HV-12** | **3/10/2009** | **2.00E-02** | **3.80E-03** |
| **HV-4** | **5/18/2009** | **2.04E-02** | **9.70E-04** |

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|---|---|---|---|
| HV-11 | 4/14/2009 | 2.32E-02 | 0 |
| HV-12 | 4/14/2009 | 2.32E-02 | 9.90E-04 |
| HV-4 | 5/5/2009 | 3.11E-02 | 0 |
| HV-12 | 3/12/2009 | 3.23E-02 | 0 |
| HV-09 | 4/21/2009 | 3.34E-02 | 2.90E-03 |
| HV-4 | 5/14/2009 | 4.15E-02 | 0 |
| HV-09 | 5/21/2009 | 4.35E-02 | 0 |
| HV-4 | 5/15/2009 | 4.53E-02 | 9.20E-04 |
| HV-11 | 4/21/2009 | 5.22E-02 | 1.90E-03 |
| HV-12 | 12/29/2008 | 9.53E-02 | 0 |
| HV-11 | 12/29/2008 | 1.92E-01 | 0 |

Seventy-four percent of the filters re-analyzed by the EPA method did not have any detectable PCM equivalents fibers, even though the CARB method results for these filters were frequently above the trigger level. The re-analysis also confirmed that the crystalline form of asbestos found at this site is primarily chrysotile asbestos and the fiber distribution heavily favors shorter fibers or fibers less than 5 μm in length. Using the PCM equivalents counts from our re-analysis, EPA would determine a level of concern for continuous exposure over the approximately five year project life at 2.2E-3 PCM equivalents structures. Most of the PCM equivalents data in the above table were either non-detect or were below this level indicating that the risk is at acceptable levels. Interestingly, all of the samples that had elevated PCM equivalents counts were samples that had CARB results above the Air District trigger level, while none of the filters with CARB results below the trigger level had elevated PCM equivalents counts. This indicates that a high CARB result may or may not correlate with the presence of PCM equivalents fibers, but a low CARB result does correlate with low PCM equivalents results.

In considering potential health effects from asbestos exposures, disease was correlated with cumulative, average lifetime exposure. Since the perimeter sampling is designed to assess the level of airborne asbestos at the fence line and not a continuous individual exposure, it is not appropriate to calculate an average exposure number by combining all the sampling stations; and, with such a large number of non-detects, the average exposure at any single station would be low. We can conclude, however, that if the trigger level were based on the PCM equivalents fiber counts, the result would be far fewer shut-down days than required using the CARB method. This does not mean that one method is better or worse than the other, but the CARB method does result in a more conservative approach for the conditions found at Parcel A.

Therefore, the Dust Mitigation Plan and the Air District monitoring procedures are operating in an effective manner in minimizing dust generation and limiting asbestos exposure. Based on our review of both the CARB data and EPA results, EPA believes that the Air District oversight of the project is appropriate and sees no reason to suspend or stop the construction project.

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