U.S. EPA Review of Dust/Naturally Occurring Asbestos Control Measures and Air Monitoring At the Former Hunters Point Naval Shipyard

June 9, 2010

Executive Summary

At the request of several groups from the Bayview Hunters Point community, the U.S. Environmental Protection Agency (EPA) Region 9 reviewed the dust control measures and possible exposures to dust and naturally occurring asbestos near the development at Parcel A of the former Hunters Point Naval Shipyard. EPA also evaluated the dust control measures and air monitoring for naturally occurring asbestos, radiation and metals at the Navy cleanup sites at the former Shipyard.

Parcel A was originally used by the Navy primarily for housing, and as such, there were only small amounts of contamination on the property. The Navy completed environmental cleanup work at Parcel A to residential standards and transferred it to the City of San Francisco in 2004. Development work at Parcel A began in 2006. The Navy plans to finish its work on Parcels B and G this year and transfer those parcels to the City in 2011. The remaining parcels will follow in the next few years.

Many regions of California, including areas in San Francisco such as Hunters Point, sit on soil containing naturally occurring asbestos. Because naturally occurring asbestos in construction dust is a widespread concern in California, the State of California requires that all large construction projects in such areas work under an Asbestos Dust Mitigation Plan (ADMP) enforced by the local Air District. The goal is to control the dust in order to minimize possible exposure to asbestos. EPA reviewed the ADMP for the Parcel A development and found that strict best management practices for dust and asbestos monitoring and mitigation are in place to protect the community and keep exposure to asbestos in dust within acceptable levels. The current practice of daily inspections by the Bay Area Air Quality Management District ("Air District") and the City of San Francisco Department of Public Health provide appropriate oversight and enforcement.

The Air District requires air monitoring for asbestos as part of the ADMP for the Parcel A development project to provide feedback on the effectiveness of the dust mitigation efforts. While the Air District did not intend the asbestos air monitoring program to be used to evaluate exposure or health risk in the neighborhood, EPA calculated potential risk using the daily air monitoring data as a screening evaluation of what is in the air directly at the monitoring stations. The results were within EPA's defined acceptable risk range of between a one-in-one-million and one-in-ten-thousand chance of developing an asbestos related cancer.

The daily analysis of asbestos at the site is done by the method required by the California Air Resources Board (CARB), which counts all asbestos fibers. EPA re-analyzed 34 asbestos monitoring filters using a different method that provides a specific count of the longer asbestos fibers that correlate with asbestos health effect studies. EPA found lower levels of the "long" asbestos fibers. The results confirm previous conclusions by the Air District, the San Francisco

Department of Public Health, and the California State Department of Public Health that the daily monitoring results are within acceptable risk levels.

While EPA's analysis focused primarily on naturally occurring asbestos, some community groups also asked EPA to evaluate whether metals and radiation might be in the dust at Parcel A and the Navy portion of the Shipyard. The monitoring data indicate that naturally occurring metals in dust at Parcel A and the Navy portion of the Shipyard do not pose an unacceptable risk. The radiation measured at all Navy excavations is below levels set for residential exposure. The Navy completed its cleanup at Parcel A to EPA's unrestricted residential standards, so the development work is not releasing Navy-related chemicals, metals or radiation to the community.

EPA will continue to coordinate with the Air District to ensure that both the developer and the Navy meet all the requirements of their Dust Mitigation Plans and that any releases of dust, asbestos and other possible contaminants remain at acceptable levels.

Introduction

Parcel A at the former Hunters Point Naval Shipyard is located in the Bayview Hunters Point neighborhood of San Francisco and covers approximately 75 acres (see Figure 1). Parcel A is being developed 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 and metals such as manganese and arsenic. 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 Air District under a state law called the Airborne Toxics Control Measure.

Review of the Asbestos Dust Mitigation Plan for Parcel A

EPA reviewed the ADMP for Parcel A prior to its reauthorization by the Air District in 2009. EPA found that the plan contained strict dust control measures, including requirements for wetting work areas, controlling soil stockpiles, covering truck loads, controlling dirt track out (e.g., washing wheels), and cleaning streets. The goal of the plan is to allow no visible dust to leave the site and no dirt track out onto neighborhood streets. This is in line with lessons learned from other sites with naturally occurring asbestos -- the best way to minimize exposure is to minimize dust generation. The plan is enforced through daily inspections by the Air District and separately by the City Department of Public Health under a city ordinance (Article 31).

Review of Dust and Asbestos Monitoring Plans and Practices at Parcel A

As part of the ADMP, the Air District required the developer to install five stationary air monitors on and around the site (Figure 2). The locations of the Air District monitors (HV-1, 2, 4, 5 and 6) were determined by geophysical modeling based on terrain and meteorological information to present the best locations to evaluate asbestos levels at the fence line.

Samples are generally collected for each 24 hour period on work days. The monitors work by pumping air in through a filter, which catches the asbestos fibers. The filters are collected in the morning and sent to an independent certified laboratory which counts the fibers using an electron microscope.

The Air District established a trigger level of 16,000 total asbestos structures per cubic meter (s/m^3) of air. 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 forcing the developer and Air District to re-evaluate procedures and methods to reduce dust and asbestos 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 concerns from the community about the problems with the monitors in the early summer of 2006, the City required the developer to install an additional five monitors. The filters are analyzed using the same protocol as the Air District monitors. Three of the City monitors (HV-7, 9, and 11) are generally sampled every work day. Similar to the Air District, 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 sampled one day per week at random, though its results are also compared to the trigger level and used in the stop work process. HV-12 is located the furthest distance from the project and is sampled on work days. It was originally included in the stop work process, but because HV-12 is located on a dirt shoulder adjacent to a roadway and its results do not correlate with grading and excavating activities, the City now simply collects the data for informational purposes. The Air District formally added City monitors HV-7, 8, 9, and 11 to the ADMP in the latest update, finalized in August 2009.

The City Department of Public Health also requires continuous measurements for dust, with a minimum requirement that there be one dust monitor upwind of the project and two downwind. Currently, the City requires dust monitoring at five stations (HV-1, 2, 5, 7, and 11).

EPA found that the asbestos and dust monitors are the appropriate types of equipment for the project and provide the necessary information to monitor and control the worksite.

General Analytical and Risk Calculation Methods for Asbestos in Air

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 (length divided by width) 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 asbestos fiber type and size associated with disease is not known, therefore the PCM equivalents are used as a surrogate for 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 only 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 regulations. 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 equivalent. 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 ISO 10312 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 a complex of fibers as a single entry. This means that the CARB method reports a clump of fibers as one, while the EPA method attempts to count all the fibers in the clump. Both the CARB method and the ISO 10312 method 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.

Analysis of Air Asbestos Data at Parcel A

In the health studies that form the basis for evaluating potential health effects from asbestos exposures, cancer 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 represent a continuous individual exposure, it is not appropriate to calculate an overall risk number. However, as a screening measure, EPA calculated a potential risk number at each of the monitoring stations using the 7,000 plus data points collected and analyzed by the CARB method from mid-2006 through 2009. The result at each monitoring station is below a one-in-one-hundred-thousand potential risk. This calculation was based on exposure beginning in infancy to provide the most conservative estimate. Again, this does not represent the risk in the community, but rather is a measure of what is in the air directly at the fence line monitoring stations.

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.

EPA oversaw the re-analysis of 34 filters – including at least one from each monitoring station that had results above the detection limit. EPA selected filters over the complete range of detected fiber concentrations and with a majority representing filters with high counts from the CARB method. EPA's re-analysis employed both the CARB and EPA procedures and fiber counting rules and definitions. The filters available for selection were from days between December 2008 and August 2009.

The monitor locations and dates are shown in the table below, along with the original CARB result and the PCM equivalents re-analysis results. The results in bold denote filters whose original CARB results were above the trigger level of 16,000 structures/m^3.

Monitor	Date	Original CARB Total (s/m^3)	PCM Equivalents (EPA re-analysis) (s/m^3)
HV-4	2/27/2009	non-detect	non-detect
HV-2	4/2/2009	800	non-detect
HV-1	5/7/2009	800	non-detect
HV-8	3/2/2009	900	non-detect
HV-5	5/15/2009	900	non-detect
HV-9	4/9/2009	1,000	non-detect
HV-11	5/5/2009	2,000	non-detect
HV-7	3/10/2009	2,800	non-detect
HV-1	4/21/2009	2,900	non-detect
HV-4	3/20/2009	2,900	non-detect
HV-2	5/1/2009	2,900	non-detect
HV-9	6/5/2009	3,900	non-detect
HV-1	5/1/2009	4,800	non-detect
HV-11	4/13/2009	5,900	non-detect

HV-12	5/15/2009	7,700	non-detect
HV-12	4/20/2009	9,700	non-detect
HV-11	4/29/2009	12,800	980
HV-4	6/5/2009	13,800	non-detect
HV-4	7/17/2009	14,100	non-detect
HV-4	5/6/2009	14,400	non-detect
HV-4	**5/29/2009**	**17,100**	**920**
HV-12	**3/10/2009**	**20,000**	**3,800**
HV-4	**5/18/2009**	**20,400**	**970**
HV-11	**4/14/2009**	**23,200**	non-detect
HV-12	**4/14/2009**	**23,200**	**990**
HV-4	**5/5/2009**	**31,100**	non-detect
HV-12	**3/12/2009**	**32,300**	non-detect
HV-09	**4/21/2009**	**33,400**	**2,900**
HV-4	**5/14/2009**	**41,500**	non-detect
HV-09	**5/21/2009**	**43,500**	non-detect
HV-4	**5/15/2009**	**45,300**	**920**
HV-11	**4/21/2009**	**52,000**	**1,900**
HV-12	**12/29/2008**	**95,300**	non-detect
HV-11	**12/29/2008**	**192,000**	non-detect

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 data indicate 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.

A true risk calculation cannot be done with only 34 data points and with so many non-detects. However, as a point of reference, the highest value measured by EPA, 3,800 structures/m^3, corresponds to a potential risk of one-in-ten-thousand if that were the concentration that a person was continuously exposed to. All of the PCM equivalents data in the above table were either non-detect or below this level indicating that the risk is at acceptable levels. In addition, we can conclude 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.

Malfunctioning Monitors Around Parcel A in 2006

There was a period of approximately three months at the beginning of earthmoving activity in 2006 when the perimeter asbestos air monitors were not functioning properly. The Air District assessed a penalty for this violation and the problem was fixed in early August of 2006. The only data available from this time period are several worker safety monitors worn by equipment operators on Parcel A and Navy monitors located downwind near Navy excavations on Parcels B-G. The asbestos levels measured in worker safety monitors at Parcel A and at Navy monitors during this time period are below limits set for worker exposure. The measurements for the worker safety monitors use different methods than the perimeter monitors and thus may not be directly compared or averaged with the perimeter monitors for risk analysis. EPA believes that

the three plus years of data taken daily at the perimeter monitors since 2006 provide the best representation of conditions at the site and thus used this data in our assessment.

Radionuclides and Metals Dust at Parcel A and the Navy Portion of the Shipyard

EPA, California EPA and the Air District enforce a similar Dust Mitigation Plan for the Navy's Shipyard remediation work as the Air District requires at Parcel A. In addition to asbestos and dust, the Navy also monitors for radiation, manganese and lead immediately adjacent to all of its work sites at the Shipyard.

The average monitoring result for radiation is 10^{-13} microcuries/milliliter of air for both alpha and beta activity. These reported levels include both potential Navy sources and naturally occurring sources native to the soil. This corresponds to a dose less than EPA's limit of 5 millirems per year for residential exposure. Thus, EPA sees no elevated risk to the community from radioactivity related to Navy cleanup activities. At Parcel A, EPA scanned the entire surface of the parcel prior to transfer and found no radiation above natural background levels. Thus, the construction activity at Parcel A should also pose no threat to the community from radionuclides.

For metals, manganese poses the highest potential risk of the naturally occurring metals and lead poses the highest potential risk of possible Navy contaminants. Other metals, such as arsenic, chromium, nickel, etc., are present in the soil at concentrations with lower potential risks than manganese and lead. The following table shows that the concentrations for these two metals measured in airborne dust adjacent to Navy excavations are less than the EPA Schools Air Toxics screening levels.

Metal	Average Navy Measurement (micrograms/m^3)	Schools Air Toxics Screening Level (micrograms/m^3)
Lead	0.0076	0.15
Manganese	0.028	0.05

Because the San Francisco Department of Public Health and the Air District only require monitoring for dust and asbestos at Parcel A, EPA compared the dust levels measured at Parcel A with dust levels measured by the Navy. The dust measurements are of particulates with a diameter smaller than 10 micrometers, called PM-10. Since the soil type is the same at both sites, the concentrations of naturally occurring metals in dust would be expected to also be the same. The average dust concentration measured by the Navy is 35 micrograms/m^3. The annual averages at the five dust monitors at Parcel A are in this same range, typically between 30 and 60 micrograms/m^3. Therefore, we expect that the concentrations of metals in dust at Parcel A are below the screening criteria. Finally, EPA's national standard for PM-10 is 150 micrograms/m^3 in ambient air, meaning the general air in a region. The dust concentrations directly at the construction site at Parcel A are below this level.

Minimizing Exposure to Dust and Asbestos

Because naturally occurring asbestos is found throughout Bayview Hunters Point, it is important to minimize all potential exposure pathways. EPA will continue to work with the Air District and the City Department of Public Health on improving the dust mitigation efforts. However, there are also a number of non-construction activities that can release asbestos. Based on research in other locations with naturally occurring asbestos, EPA has developed recommendations for how individuals can minimize their exposure. The recommendations include:

- Cover areas of rock and soil with clean soil, rock, vegetation, or other material
- Pave over unpaved walkways, driveways, or roadways containing naturally occurring asbestos (NOA)
- Landscape areas with vegetation and add a layer of organic mulch or NOA-free soil
- Water garden areas before digging
- After gardening or other activities in the dirt, remove boots and gloves outside and take dirty clothes directly to the laundry
- Keep windows and doors closed on windy days
- Limit track-in by using door mats, and wipe down pets before they enter buildings to reduce the amount of soil tracked indoors
- Allow children to play in outdoor areas only if the area has a ground covering, such as wood chips, mulch, sand, pea gravel, grass, asphalt, shredded rubber, or rubber mats
- Relocate outdoor activities to areas that do not contain NOA. Walk, run, hike, and bike only on paved trails
- Avoid dusty areas, especially in windy conditions

Conclusion

The Air District effectively oversees and regulates the developer's construction activities at Parcel A under the Asbestos Dust Mitigation Plan. Dust generation is minimized by the dust mitigation measures and the monitoring and inspection procedures, thus keeping asbestos and metals exposures within acceptable risk levels. At the same time, EPA, California EPA and the Air District oversee the Navy's dust and asbestos mitigation efforts. Navy monitoring results for metals, radiation and asbestos are all below health based screening levels.

Additional Resources

EPA factsheet on naturally occurring asbestos:
http://www.epa.gov/superfund/health/contaminants/asbestos/noa_factsheet.pdf

EPA website on the former Hunters Point Naval Shipyard Superfund site:
http://yosemite.epa.gov/r9/sfund/r9sfdocw.nsf/db29676ab46e808188257426007437 34/23b69b19b13d34c488257007005e9421!OpenDocument

San Francisco Department of Public Health webpage with fact sheets and a spreadsheet with the daily asbestos monitoring data: http://www.sfdph.org/dph/EH/HuntersPoint/default.asp

Navy webpage with dust data and documents related to Navy remediation at the Shipyard: http://www.bracpmo.navy.mil/basepage.aspx?baseid=45&state=California&name=hps

Figure 1: Location Map of Hunters Point

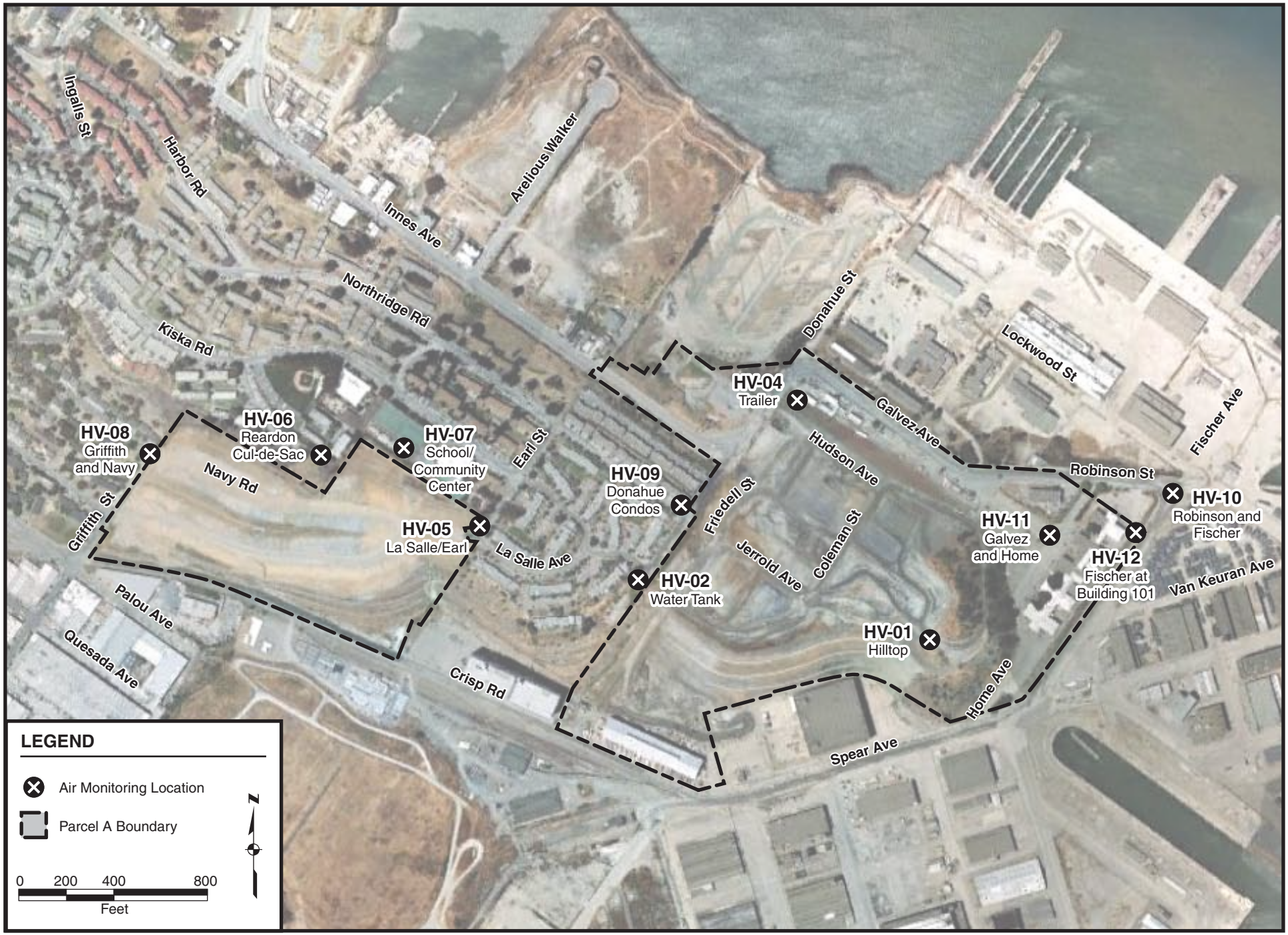

Figure 2: Asbestos Air Monitor Locations Around Parcel A