SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

EXECUTIVE OFFICE M E M O R A N D U M

DATE: April 16, 2008

TO: Interested Parties

FROM: Barry R. Wallerstein, D.Env., Executive Officer

SUBJECT: Elevated Airborne Hexavalent Chromium Concentrations in Western Riverside

Late in 2007, the AQMD completed data analysis for the MATES-III study, a regional evaluation of air toxics pollution in Southern California. Results indicated a noticeable upward trend of hexavalent chromium at the Western Riverside Air Monitoring Station relative to a previous air toxics study in 1998 (see Figure 1). This finding was contrary to anticipated levels, as several AQMD regulations should have resulted in a decrease of hexavalent chromium emissions.

AQMD staff has been investigating the reasons for this increase over a five month period. Numerous activities related to air sampling, permit reviews, area-wide surveys and surveillance, air quality modeling, material and soil sample collection, and detailed chemical analysis were conducted. The steps are outlined below:

- Wind data analysis indicated that the days with higher concentrations of hexavalent chromium at the Western Riverside sampling location occurred when wind was coming from the Northeast. Two cement production facilities are located in the upwind direction. (See Figure 2)
- A review of permit files did not find any significant hexavalent chromium sources in the area around the monitoring station. A review of previous reports and the technical literature did not indicate that the hexavalent chromium emissions from cement production were significant enough to cause the observed levels.
- Over 70 deposition plates, which passively collect particulate fallout, were deployed in a 40-square mile area around the area in a wide survey to roughly map out hexavalent chromium levels. Results consistently showed higher levels near the Riverside Cement facility, and generally decreasing levels with distance away from the facility.
- Hexavalent chromium particulate samplers were deployed at four new monitoring locations in the area. Results again showed significantly higher levels near Riverside Cement. An average of 2.65 nanograms per cubic meter (ng/m^3) was measured adjacent to the facility compared to 0.30 at the Western Riverside monitoring location. (See Figure 3)
- Another area-wide effort to identify permitted and unpermitted sources of hexavalent chromium to the air was conducted in a 50-square mile area in the area. No new significant sources were found.
- Over 50 soil and cement material samples were collected from Riverside Cement property and analyzed for hexavalent chromium content. Results showed higher levels in the gray cement and the gray clinker storage areas.
- The gray clinker samples were sieved to separate out the finer dust, which is more likely to become airborne and be blown offsite. The hexavalent chromium content was found to be 2-10 times higher in these finer dust particles. (see Figure 4)

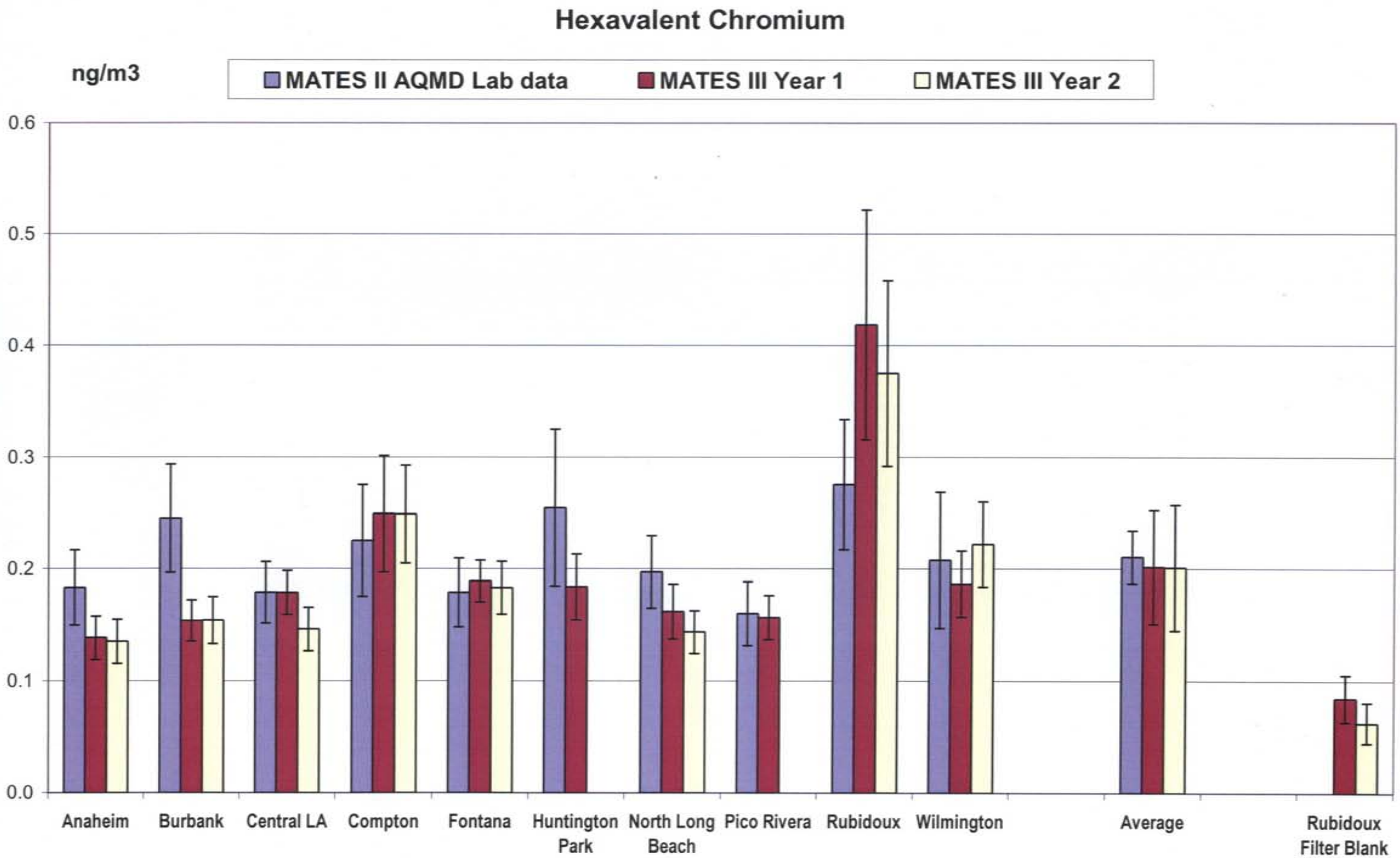
- A comprehensive emissions test was conducted on some of the white cement production equipment and measured emissions of hexavalent chromium were too low to result in the levels measured at the monitoring locations. The fuels used to feed the kiln were also found to have negligible hexavalent chromium content.
- Air quality modeling was performed using the hexavalent chromium content of the finer dust, reasonable emissions factors, and measured wind data. Results showed that the atmospheric concentrations measured by the samplers were in the range predicted by the dispersion model.
- The deposition plates and the gray clinker samples were also examined under a microscope. Gray clinker–type particles were clearly evident in samples collected at the sampling site adjacent to the facility. (see Figure 5)
- The deposition plates and gray clinker fine dust were also analyzed by X-Ray Diffraction to determine bulk chemical composition and crystal structure. Results indicate that the gray clinker fine dust has a unique chemical fingerprint, and that it is present in significant quantities on the deposition plates collected adjacent to Riverside Cement.
- There have been multiple reports by community members and AQMD inspectors of dust clouds emanating from Riverside Cement operations.

Given this extensive evidence completed in the last week, it is the best professional opinion of AQMD staff that Riverside Cement is the source of the elevated hexavalent chromium emissions near the facility and at the Western Riverside Air Monitoring Station.

The estimated cancer risk associated with the 2.65 ng/m^3 measured adjacent to the facility is about 400-500 in one million. Note that these risk estimates are based on 70-year continuous exposures, and the current sampling data only covers about six weeks. Also, these levels of risk are comparable to living next to a busy freeway, a rail yard, or a large chrome plating plant. The overall risk to residents in Southern California averages 1200 in one million as determined by the MATES-III study. Furthermore, occupational acute and chronic exposure limits for hexavalent chromium range from 200 – 5000 ng/m^3.

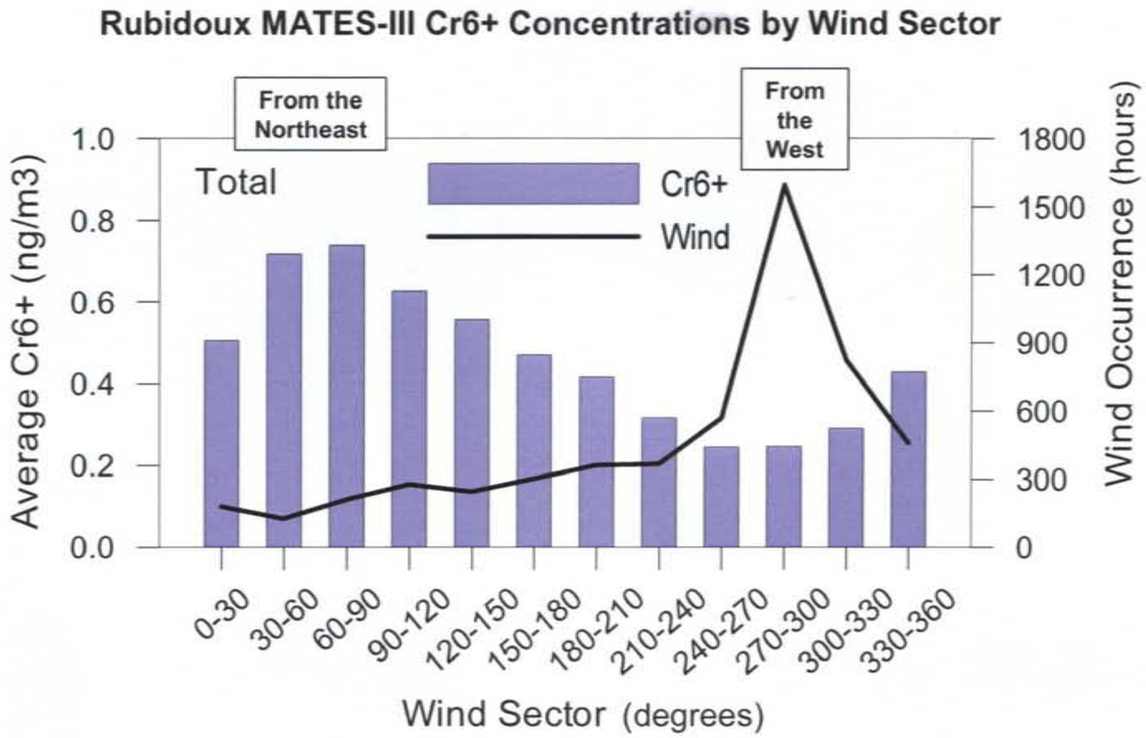
Based on AQMD staff investigations and inspections, AQMD is issuing Notices of Violation to Riverside Cement for violation of AQMD rules and regulations and will require Riverside Cement to conduct a new Health Risk Assessment. Although the measured levels are well below occupational limits, AQMD believes that the higher levels detected in the field samples present an unacceptable risk from a single facility, and will take appropriate actions to reduce the hexavalent chromium emissions from Riverside Cement and thus lower the risk levels in the community around the facility.

Figure 1



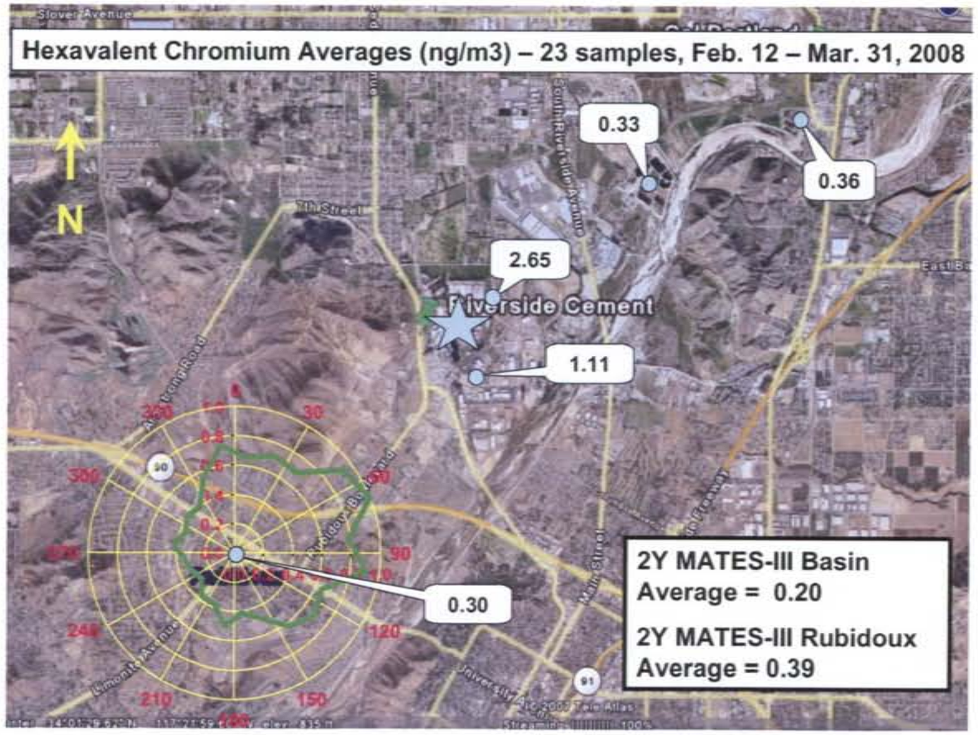
- Rubidoux is the location of the Western Riverside Air Monitoring Station
- MATES II was conducted in 1998; MATES III was conducted from April 2005 through April 2007
- Lines at the top of each bar show the statistical margin of error
- A "filter blank" shows the level of chromium on a filter taken to the monitoring station but not used for collecting air samples

Figure 2



The blue bars on this chart represent the average hexavalent chromium concentration when significant winds (greater than 4.5 miles per hour) were blowing from a particular wind sector. Zero degrees represents winds from the north, 90 degrees represents winds from the east, etc. The highest hexavalent chromium levels were observed when winds were blowing from 30 to 90 degrees (northeast). The black line represents the frequency of winds in each wind sector. For example, the most prevalent wind direction was from the 270-300 degree sector (west). About 1600 hours out of the two years of sampling showed winds blowing from this sector. So, while the highest hexavalent chromium levels were observed when winds were blowing from the northeast, the wind came from this direction much less frequently than winds blowing from the west.

Figure 3



The numbers in the bubbles represent average hexavalent chromium concentrations from a total of 23 samples collected between February 12, 2008 and March 31, 2008. Concentrations are in nanograms per cubic meter (ng/m3). The blue dots represent monitoring locations, including the Western Riverside Air Monitoring Station to the lower left. The circles around this station are a "pollution rose" indicating that the highest levels of hexavalent chromium (green line) occur when the winds blow from the northeast. Figure 2 presents the same data in a different way.

Figure 4

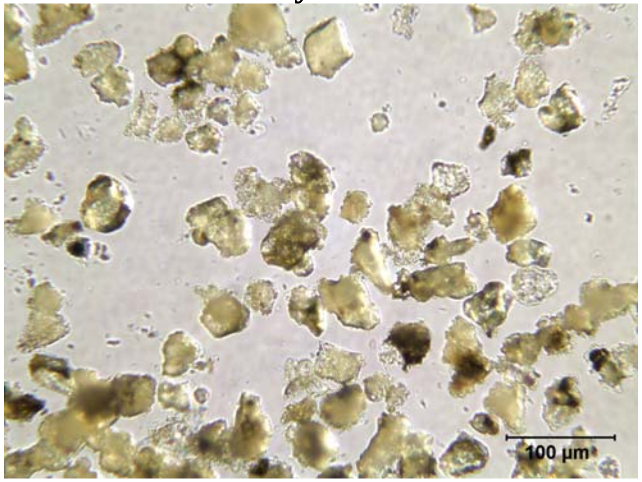
Gray Clinker Material
Bulk vs.Sieved

	Bulk samples	Sieved Samples
		(<44 µm)
	Cr+6	Cr+6
Location	(ppb)	(ppb)
Bay A surface	500	
Bay A sub-surface	750	3980
Bay B surface	800	3346
Bay B sub-surface	870	
Bay H surface	1320	6830
Bay H sub-surface	2030	
Bay I surface	1140	2067
Bay I sub-surface	1120	
Bay J surface	1670	15026
Bay J sub-surface	1740	

The table provided results from the laboratory analysis of the gray clinker samples taken from the storage piles. It compares the whole, unsieved samples (bulk) to the finer dust separated from those bulk samples (sieved).

Figure 5

Pure Fine Gray Cement Clinker



Deposition plate adjacent to the facility