



**Ambient Air Monitoring for
Hexavalent Chromium and Metals in Barrio Logan:
May 2001 through May 2002**

Operations Planning and Assessment Section
Quality Management Branch
Monitoring and Laboratory Division

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In addition to this report, the companion paper Neighborhood Scale Monitoring in Barrio Logan, authored by Linda C. Murchison, Carolyn B. Suer, and Jeffrey P. Cook of the California Air Resources Board, was prepared and presented at the Air and Waste Management Association's 96th Annual Conference and Exhibition, June 22-26, 2003, in San Diego, CA.

I. Report Identification and Approval

Title: Ambient Air Monitoring for Hexavalent Chromium and Metals in Barrio Logan: May 2001 through May 2002

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II. Introduction

In May 2001, the Air Resources Board (ARB) began monitoring around two chrome plating facilities in the San Diego community known as Barrio Logan (Figure 1). The location of the chrome-plating facilities close to multiple residences and a community youth center, coupled with local concern over hexavalent chromium emissions from these facilities, provided a strong basis for designing a receptor-oriented sampling scheme focusing on airborne hexavalent chromium concentrations. The monitoring conducted for this study was also consistent with ARB's policy of incorporating environmental justice concerns into all ARB programs.

A second, equally important reason for monitoring in Barrio Logan was to provide monitoring data pursuant to the Children's Environmental Health Protection Act (SB25, Escutia, 1999). SB25 requires that air monitoring be conducted at multiple locations within each of six communities to evaluate the levels of air pollution, including toxic air contaminants, affecting children. Monitoring at the Memorial Academy Charter School, the primary SB25 site in the San Diego area, was conducted from October 1999 through February 2001, and generated data on the ambient concentrations of over fifty pollutants. The full report may be accessed on the internet at www.arb.ca.gov/ch/aq_result/barriologan/tech_support_doc_07-02_final.pdf.

In response to the concerns of the community members, and to meet the requirements of SB25, staff of the Monitoring and Laboratory Division (MLD) collected ambient air samples for hexavalent chromium and other metals in Barrio Logan between May 2001 and May 2002. Samples were collected near two chrome plating facilities on Newton Avenue, a residential-commercial thoroughfare located between San Diego Bay and Interstate Highway 5 (Figure 2).

The monitoring at Barrio Logan also addressed the need for data to verify that the existing chrome plating Air Toxic Control Measure (ATCM) is effectively providing public health protection, especially in community settings where residences and sensitive receptors are in close proximity to possible emission sources.¹ Barrio Logan was well-suited for assessing the effectiveness of the hexavalent chromium ATCM since it is a residential-commercial area with single-family homes and apartments located in close proximity to light industrial facilities, including decorative and hard chrome plating shops. Many of the families living near the chrome plating shops include children and the elderly. In addition to the plating shops, there are approximately twelve single-family residences, a cabinet shop, a neighborhood youth center, and a community swimming pool on Newton Avenue between South Evans Street and Sampson Street.

As a result of this monitoring, the current ATCM is being reevaluated with respect to emission controls required for decorative chrome plating facilities.

¹ 17CCR §93102, Hexavalent Chromium Airborne Toxic Control Measure for Chrome Plating and Chromic Acid Anodizing Operations. Adopted: February 18, 1988. Amended: May 21, 1998.



Figure 1: San Diego Bay Region



Master Plating
(Decorative Chrome)



Carlson & Beauloye
(Hard Chrome)

Figure 2: Newton Avenue Chrome Plating Shops

This report includes a description of the sampling approach used during each phase, a summary of the analytical methods used, quality control information, data quality objectives, and a summary of results. All sampling protocols as well as field and laboratory operating procedures are included in a separate appendix.

III. Sampling Design

A. Site Selection

The selection of sampling sites was based on the requirement to measure hexavalent chromium emissions from the nearby chrome plating facilities. Of primary importance was placement of the samplers as close as possible to residences and sites with greater resident activity or at a community center. In most cases, residents were receptive to placing samplers in their front yards.

In a subsequent phase of the project, samplers were placed where the highest ambient concentrations were likely to be measured. Several key factors were considered in determining the placement of the samplers. First, any possible sources of hexavalent chromium other than the plating facilities were identified and evaluated in terms of the likelihood that emissions from those sources would impact the samplers.

Second, the influence of wind speed and direction on sampling locations near the plating facilities was considered. Wind roses were created using meteorological data from San Diego Airport/Lindbergh Field and measurements made from a meteorological station placed on Newton Avenue during the earlier phase of the project. The wind roses, coupled with input from the San Diego County Air Pollution Control District (SDAPCD), assisted in placement of the samplers at residences and other locations in the neighborhood to better explain impacts from the plating operations on residents.

During the latter phases of sampling, staff of the ARB and the SDCAPCD used air dispersion models to place additional samplers and ensure complete coverage in all areas of expected high concentrations. Meteorological data and facility emission rates from source tests collected early in the project were used as model input.

All sampling locations were chosen with reference to Appendix E of Title 40 Part 58 of the Code of Federal Regulations (CFR), and other monitoring guidance documents. The criteria account for the influence of nearby buildings, trees, roadways and other topographical features that may impact the samplers. Some compromises to specifications on allowable distances between obstacles and the samplers were necessary given their location near houses. (Refer to photographs in Appendix E (page 589).

Sampling was done in six phases with the last four phases conducted consecutively. Each sampling phase involved differences in site locations, sampling duration, or additional sampling for selected metals, depending on the specific objective. The initial phases of sampling were intended to understand exposure of residents to hexavalent

chromium, and to determine general ambient concentrations in the area. When elevated ambient concentrations at nearby residences immediately around the platers were observed, the study focus changed to identify the specific cause of the high concentrations.

B. Sampling Times

1. Period

The study period for hexavalent chromium in Barrio Logan was 133 days between May 22, 2001, and May 24, 2002. The sampling period was made up of six phases: I, II, III, III-A, III-B, III-C, and III-D (see Table 1). The last four phases, during which the source and pattern of hexavalent chromium emissions from the chrome shops were determined, occurred from February 5, 2002, through May 24, 2002.

2. Duration

The sampling duration varied depending on the site objective and the parameter measured (hexavalent chromium or other metals). Each sampling phase provided information for the next phase, allowing for more focused sampling near the potential source during the time of maximum expected emissions.

Ambient sampling was 24-hours and 12-hours in duration. Indoor sampling at each plating facility was initially conducted for 8-hours and included hours of business and/or plating operation. This was later expanded at one plater to include 12-hour and 24-hour duration indoor samples to coincide with the ambient sampling.

Twelve-hour indoor sampling was added at one plater to obtain information on re-entrainment of hexavalent chromium dust during the early morning hours of setup and cleaning prior to the start of plating operations.

3. Frequency

At the outset, ambient sampling was conducted each weekday, from May 22, 2001 through June 8, 2001. During two weeks of sampling in December 2001, the frequency increased to include weekdays and Saturdays. From February 5 through the end of the project on May 24, 2002, sampling occurred daily.

The frequency of indoor sampling was linked to the operation of the plating facilities and, in the case of one of the two plating facilities, coincided with days on which source emissions tests were performed (see Phase III (February/March 2002) page 16 for more information).

Table 1 summarizes the sampling period, duration, and frequency during each phase of the study.

Table 1: Hexavalent Chromium Sampling Times

<i>Phase</i>	<i>Dates</i>	<i>Period</i>	<i>Duration</i>	<i>Frequency</i>
I*	May 22 – June 8, 2001	13 days	24 hours	Each weekday except for May 28
II	December 3 – December 17, 2001	13 days	24 hours	Daily, Monday - Saturday
III	February 5 – March 8, 2002	32 days	24-, 12-, and 8-hour samples	Daily
III-A	March 11 – March 24, 2002	14 days	23- and 12-hour samples	Daily
III-B	March 25 – March 28, 2002	4 days	23- and 12-hour samples	Daily
III-C	March 29 – April 19, 2002	22 days	23- and 12-hour samples	Daily
III-D	April 20 – May 24, 2002	35 days	23- and 12-hour samples	Daily

*Data from Phase I were later invalidated and were not used in evaluations.

IV. Sampling Method

ARB and SDCAPCD staffs conducted the air sampling in Barrio Logan. The sampling techniques, including field quality control procedures, were developed by the ARB.

A. Air Samplers

The ambient air samplers used for the project were portable BGI, Inc. PQ-100 PM10 Reference Samplers (BGI). A XonTech 920 air sampler operated by the SDCAPCD was used indoors at the exhaust port at Master Plating. Both samplers collected total suspended particulate.

The BGI air sampler is a single-filter, battery-powered, mass-flow controlled unit capable of 24-hours of continuous operation. Each unit is microprocessor-controlled and can store hourly and 24-hour average flow rate information.

The XonTech 920 air sampler is a multi-channel unit capable of collecting hexavalent chromium and metals samples simultaneously. The 920 unit, used in ARB's regular toxics air monitoring network, is less portable than the BGI sampler and requires 110v AC current. The 920 sampler is also mass-flow controlled and may be programmed to start and stop without the presence of a field operator.

Throughout the project, all sampling was conducted at a nominal flow rate of 10 standard liters per minute (slpm) during each sampling run. The flow rate was pre-set and maintained by each sampler with a mass flow controller. Sampling duration varied among sites from eight hours to twenty-four hours, but all sampling was conducted at a constant flow rate. All samplers were configured to collect total suspended particulate only and were not equipped with any size selective inlet, impactor, or cyclone. Operational details for the BGI sampler and XonTech 920 can be found in Appendix B.2 (page 171).

B. Hexavalent Chromium Sample Filters

Whatman 37 millimeter cellulose fiber filters (20-25 micron pore size prior to preparation) were used for sampling hexavalent chromium. The filters have low ash residue and metal content. Prior to use, the filters were soaked in a sodium bicarbonate solution then dried in a fume hood. The sodium bicarbonate is used as to prevent chemical reduction of the hexavalent chromium in the sample. Filters were inspected for contamination or damage, then mounted in plastic filter cassettes and stored in petri dishes for transport to the field. Filters were prepared in batches and released to the field on an as-needed basis. All filters were prepared, handled, and transported under identical conditions.

C. Total Metals Sample Filters

Whatman 37 millimeter Teflon membrane filters (0.5 micron pore size) were used for sampling seven metals (total chromium, lead, copper, manganese, zinc, nickel, and iron). Unlike the filters for hexavalent chromium, no pre-treatment is required. All total metals filters were inspected for contamination or damage, mounted in plastic filter cassettes and stored in petri dishes for transport to the field. Sample and field blank filters were prepared, handled and transported under identical conditions. All filters were prepared and analyzed at ARB's northern laboratory in Sacramento.

D. Meteorological Station

A Met One meteorological (met) station was operated at the "Vacant Lot " site on Newton Avenue during all phases of the project. The Met One station is a battery-powered unit capable of collecting and storing hourly average data on wind speed, wind direction, ambient temperature, and relative humidity. The Met One data logging system calculates and records meteorological parameters. The standard deviation of the horizontal wind direction, known as sigma-theta, was collected by the Met One data logger and recorded in hourly averages. Sigma theta values, wind speed and direction, along with emissions information may be used in point source dispersion modeling.

The met station was positioned according to standard siting criteria used by the ARB. Priority was given to locating the met station coincident with a sampler. This resulted in placing the met station closer to a nearby one story house and 15-foot tall tree than the specified distance of one and one-half times the obstruction height. Another known compromise was the six-foot height of the station instead of the recommended ten-foot minimum.

Hourly averaged measurements of ambient temperature, wind speed, wind direction, and relative humidity were collected. Meteorological data were used during several phases (-III, -III-A, -III-B, and -III-C) of monitoring, along with associated hexavalent chromium emission related data for modeling runs to site monitors at the south end of Newton Avenue and along Main Street.

Daily wind speed and predominant wind direction data are provided in Appendix C. The predominant wind direction was calculated using the hours between 0700 and 1800 each day to coincide with hours of chrome plating at Master Plating.

V. Sampling Locations and Events

Several phases of monitoring were conducted to evaluate emissions of hexavalent chromium and metals near the plating facilities. The sampling dates, duration, locations and sampling design of each phase are described below as Phase I through Phase III-D. The selection of ambient sampling sites was based primarily on the location of receptors and their proximity to the chrome plating facilities. With the exception of Phase I, State and Federal siting criteria were used (40CFR, Part 58, Appendix E, and ARB's Quality Assurance Manual, Volume II, Section 2.0.4 (February 2000)) as guidance.

The monitoring sites consisted of the following locations, as shown in Figure 3:

- *2121 Newton Avenue*
A residence located on the south side of Newton Avenue between the chrome plating shops. It consists of a single-family residence facing Newton Avenue, and a second, smaller residence directly behind the first. Both residences are occupied.
- *Alley*
A rooftop located on the south side of Newton Avenue. The alley monitoring site is in the predominant downwind location of one of the two plating facilities (Master Plating) and is located directly south of the residences at 2121 Newton Avenue. The alley runs parallel to Newton Avenue.
- *Master Plating*
Master Plating is one of the two neighborhood chrome plating facilities around which most of the monitoring was conducted. It is a decorative chrome plating facility applying a relatively thin layer of chrome over nickel plated parts such as bathroom fixtures, automotive parts, and other small machined parts. Plating occurs during the shop's regular business hours of approximately 7:00 a.m. to 4:00 p.m. but was generally confined to Thursdays and Fridays in the afternoon. Mater plating is located at 2109 Newton Avenue.

Monitoring inside Master Plating occurred at the exhaust fan outlet, referenced in data tables as "MPIEXT," and at the opposite end of the building, referenced as "2109 Newton."
- *Carlson & Beauloye (C&B)*
C&B is a hard chrome plater specializing in applying wear and corrosion resistant chrome surfaces to industrial and military parts. It is the second

plating facility on the 2100 block of Newton Avenue and is located at 2141 Newton Avenue. Chrome plating at C&B occurs for longer periods, often over 24 hours or more, since the thickness of chrome plating on industrial parts is typically tens times or more that applied to decorative chrome parts. C&B also has an extensive machine shop with grinding, fabricating, and metal spraying capabilities. Monitoring at C&B was conducted within the facility in conjunction with a series of stationary source tests to determine compliance with applicable State and District regulations as specified on the facility's permit to operate.

- *2144 Newton Avenue*
A single-family residence located on north side of Newton Avenue across the street from C&B.
- *2152 Newton Avenue*
A single-family residence located on north side of Newton Avenue and to the east of 2144 Newton Avenue, also across the street from C&B.
- *Mercado Apartments*
A multi-unit apartment complex located on the 2000 block of Newton Avenue to the north of the plating facilities. Monitoring at the Mercado Apartments occurred in the parking area along South Evans Street.
- *Vacant Lot*
A fenced site located on the east side of Newton Avenue, directly across the street from Master Plating. Local residents occasionally use the area for outdoor cooking and ceremonial gatherings. Samplers and a meteorological station were placed in the vacant lot.
- *2168 Newton Avenue*
A residence located on north side of Newton Avenue, in the predominant downwind direction from Master Plating and C&B. Monitoring at 2168 Newton Avenue was based on air dispersion modeling results from ARB and SDCAPCD staff.
- *2196 Newton Avenue*
The site of a community swimming pool operated and maintained by the Barrio Station, a youth activity center. Referenced in data tables simply as "Pool," this monitoring site is located near 2168 and is predominantly downwind of the plating facilities.
- *2191 Main Street*
The address of a half-block-long warehouse on south side of Main Street; an impact area for possible emissions from C&B, as predicted by dispersion models.

- *2141 Main Street*

The address of an empty building adjacent to the warehouse at 2191 Main Street. Owned by San Diego Gas & Electric, the location of the monitoring site on this building was also based on modeling results.

A. Phase I (May / June 2001)

Hexavalent chromium sampling in Barrio Logan occurred daily from May 22 through June 8, 2001. Seven samplers were used during Phase I, five single units and one collocated pair. Samplers were located in the front yards of 2121, 2144, and 2152 Newton Avenue. The remaining samplers were placed in the Alley, the parking area of the Mercado Apartments, and a collocated pair of samplers in the Vacant Lot. The sampling duration was 24 hours. A meteorological station was placed in the Vacant Lot to collect data on wind speed and direction.

One purpose of this sampling was to collect data needed for evaluating the emissions from the two chrome platers on the neighborhood. Samplers were placed in a semi-circular pattern around the facilities on residential property. The objective was to gather information on exposure of nearby local residents. Daily activity information, in the form of ampere-hours, was recorded from each plating operation.

An in-depth review of sampler placement after Phase I determined that the sites did not meet siting criteria and hexavalent chromium results may have been adversely affected at 2121, 2144, and 2152 Newton Avenue, and the Vacant Lot. Airflow to the samplers at the Vacant Lot may also have been obstructed due to fine-mesh screens placed around the lot fence by the property owners. Consequently, data from this phase of monitoring was deemed invalid for use in further assessments.

In the winter of 2001, samplers were re-deployed to the same locations as Phase I monitoring.

B. Phase II (December 2001)

The repeat sampling effort, identified as Phase II, occurred from December 3 through December 17, 2001. Greater consideration was given to placement of sampler inlets with respect to the ground and possible airflow obstructions. Tripods were used to elevate the sampling inlets of samplers at 2121, 2144, and 2152 Newton Avenue and at the Vacant Lot to a minimum of two meters above the ground.

The sampling approach remained the same as for Phase I. The sampling duration at all sites was 24 hours and, as with Phase I, the hours of plating at each facility were recorded as ampere-hours. The purpose for recording ampere-hours was to confirm that any hexavalent chromium readings from air sampling coincided with actual plating from one or both of the facilities. Sampling on Saturday was added.

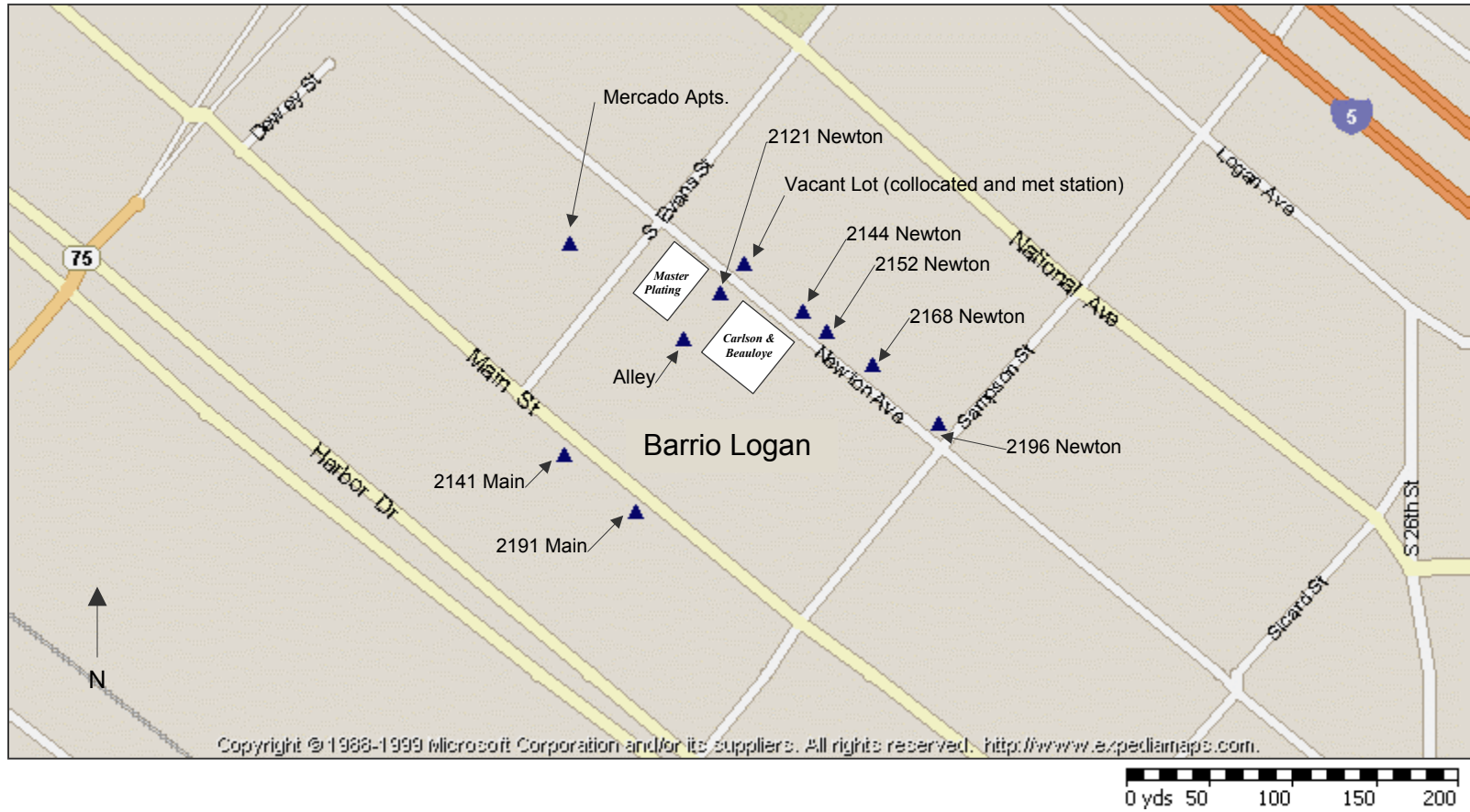
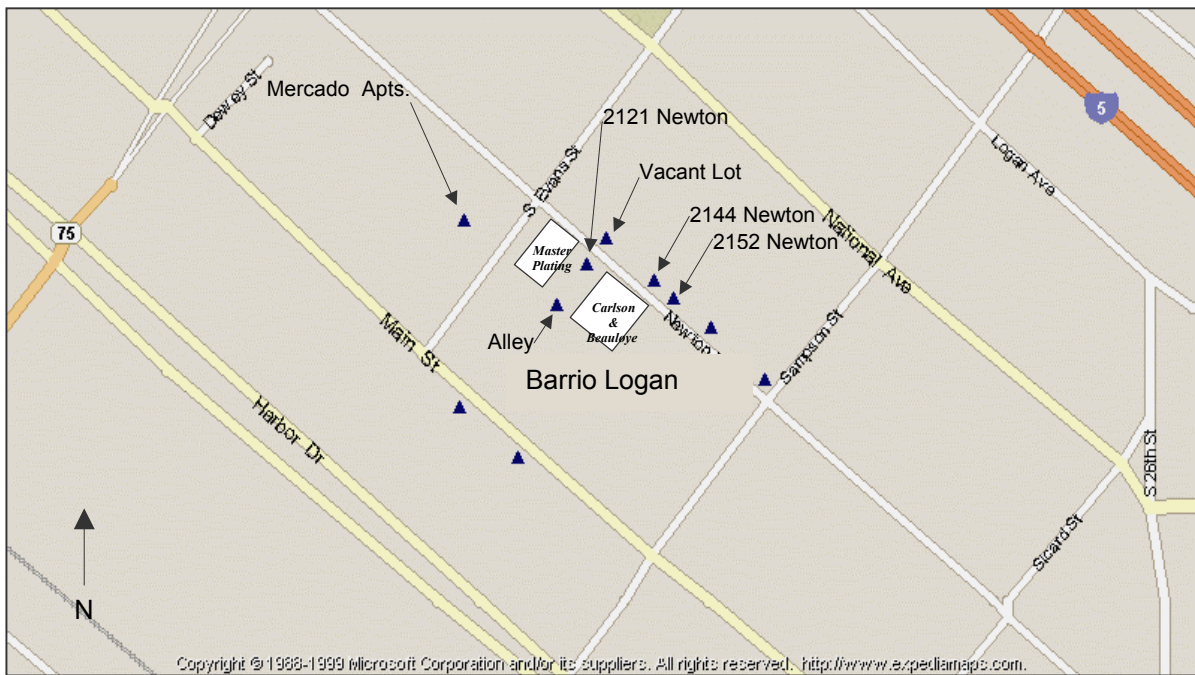


Figure 3: Barrio Logan Outdoor Sampling Locations

The results of the December monitoring showed some unusually high hexavalent chromium levels (nine samples had results greater than 3.0 ng/m^3) along Newton Avenue and in the immediate vicinity. The single highest 24-hour ambient hexavalent chromium value recorded in ARB's statewide toxics network was 22 ng/m^3 measured on February 20, 1995, in Burbank in the South Coast Air Basin. The next highest values statewide were 9.9 ng/m^3 and 3.0 ng/m^3 . The statewide annual average is 0.12 ng/m^3 . Levels of hexavalent chromium in Phase II ranged from less than the LoD (0.2 ng/m^3) to 22 ng/m^3 . Among the 25 measurements in Phase II that were above the LoD, the average value was 3.1 ng/m^3 and the median was 1.3 ng/m^3 . Seven of the 25 values above the LoD were observed at the monitoring site in the Alley. Results of the December sampling are shown in Table 2.

Figure 4: Phase II Monitoring Sites



Unlabelled sites were not used in this phase.

0 yds 50 100 150 200

Table 2: Phase II - December 3-17, 2001- Hexavalent Chromium Results

Date	Day	Wind Direction	MP Amp Hours	2121 Newton (24hr)	Vacant Lot (24hr)	Vacant Lot (C) (24hr)	2144 Newton (24hr)	2152 Newton (24hr)	Alley (24hr)	Mercado Apts (24hr)
12/03/01	Monday	WNW	NA	<0.2	<0.2	NA	<0.2	<0.2	<0.2	<0.2
12/04/01	Tuesday	WNW	0	0.2	<0.2	<0.2	<0.2	<0.2	0.5	<0.2
12/05/01	Wednesday	WNW	421	1.9	<0.2	<0.2	<0.2	0.3	0.6	NA
12/06/01	Thursday	WNW	NA	3.8	<0.2	<0.2	0.2	0.2	0.3	<0.2
12/07/01	Friday	W	NA	9.3	3.6	3.2	7.9	4.8	1.3	0.3
12/08/01	Saturday	WNW	closed	<0.2	<0.2	NA	<0.2	<0.2	<0.2	<0.2
12/09/01	Sunday	(various)	closed							
12/10/01	Monday	WNW	0	<0.2	<0.2	<0.2	0.8	1.5	<0.2	<0.2
12/11/01	Tuesday	S	0	<0.2	<0.2	<0.2	NA	<0.2	4.0	0.3
12/12/01	Wednesday	WNW	0	0.2	<0.2	<0.2	<0.2	<0.2	6.9	1.0
12/13/01	Thursday	S	416	2.4	<0.2	<0.2	<0.2	<0.2	22	0.5
12/14/01	Friday	WNW	NA	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
12/15/01	Saturday	WNW	closed	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
12/17/01	Sunday	WNW	closed	0.3	<0.2	<0.2	0.4	0.5	<0.2	<0.2

All result concentrations are in nanograms per cubic meters (ng/m³).
 Hour in parentheses is sampling duration.
 (C) = collocated sampler

Limit of Detection for 24 hour sample = 0.2 ng/m³.
 NA = invalid sample
 Shaded areas indicate no sample collected.

C. Phase III (February / March 2002)

Further sampling was conducted to identify the source or sources of the emissions and the specific activities leading to the high concentrations found in December. Follow-on sampling began on February 5 and ran daily through March 8, 2002. As with the December sampling, ARB staff recorded ampere-hours from C&B and Master Plating at the beginning and at the end of each sampling day. The SDCAPCD conducted sampling inside the building near the facility's exhaust fan at Master Plating. This began on February 7 and continued each weekday, except for February 18, until March 8, 2002.

A comprehensive approach was taken to investigate the chrome plating facilities on Newton Avenue. The goal was to identify the source of the emissions, including the pathway by which the hexavalent chromium became airborne, and to address the public health concern associated with the ambient hexavalent chromium levels.

The following is a summary of additional investigation and sampling conducted within the neighborhood to fully evaluate the nature and extent of the high hexavalent chromium concentrations first observed in December:

- 1) Staff of SDCAPCD and ARB collected activity data from each facility, including ampere-hours, operational status of plating tanks, type and number of parts being plated, and other operating processes, such as the use of air agitation to mix the plating solution ("sparging").
- 2) The SDCAPCD, in coordination with ARB, performed unannounced, detailed compliance inspections and reviewed operational records at Master Plating and C&B. Despite the high hexavalent chromium levels in the community, both facilities were found to be operating in compliance with the existing rules and were operating in accordance with their permits at the time.
- 3) On March 5 and 6, SSD and SDCAPCD staff collected a total of 35 soil, dust, and wipe samples (including blanks) at various locations near the platers including yards of nearby residences, the vacant lot and other neighborhood sites. Dust samples were also collected within Master Plating and C&B. Each sampling site represented likely areas for the accumulation of hexavalent chromium-laden dust and other areas where the presence of hexavalent chromium was suspected. In addition to hexavalent chromium, samples were analyzed for total chromium, lead, and nickel using U.S. EPA methods. EnviroMatrix Analytical of San Diego, a private, accredited environmental laboratory, performed all analyses for SDCAPCD.

Results from dust and soil samples were used as a preliminary screening tool primarily to help guide the investigation. Details regarding the analytical results from soil and dust samples may be obtained from the Program Review Section within SSD.

- 4) ARB conducted source tests of C&B along the exhaust ducting of the facility's two chrome tanks on February 11, 12, 19, 20, 27, and 28, 2002. The purpose of the source tests was to determine if the mist elimination system for the chrome plating tanks was functioning as designed and whether the facility was in compliance with the District rules and regulations. The test results showed that the source met the existing rules and regulations of the SDCAPCD.
- 5) Indoor air sampling was conducted at Master Plating and at C&B. At Master Plating, indoor sampling was conducted at the facility's exhaust fan. This represented air being emitted into the community and included emissions from all phases of the plater's operation, including housekeeping. Placing the sampler at the facility's exhaust fan was done in lieu of traditional source testing since Master Plating is a decorative chrome plater and does not have a chromic acid mist collection and elimination system. It was required to suppress hexavalent chromium emissions on the surface of the plating tanks. Indoor hexavalent chromium concentrations at Master Plating ranged from 2.4 to 904 ng/m³ (8 to 24-hour averages). See Figure 10 for a graph of these results.

Indoor sampling at C&B was conducted only in conjunction with source tests of the facility to verify that the chromic acid mist collection system was functioning correctly and that source test results reflected the controlled emissions from properly operating collection, transport, and control systems. Eight hour indoor samples at C&B were collected on February 11, 12, 19, 20, 27, and 28, 2002. Indoor hexavalent chromium concentrations ranged from 12 to 43 ng/m³.

- 6) An air dispersion model was run to estimate locations of high concentrations using emission data from Master Plating and C&B and meteorological data collected from the Vacant Lot. This assisted in siting additional monitors.
- 7) ARB and SDCAPCD staff conducted extensive area-walks and unannounced inspections of nearby businesses in Barrio Logan looking for possible sources of hexavalent chromium that might have led to the elevated levels observed in December. None were found.
- 8) Beginning with Phase III, a workgroup consisting of staff and management from the Planning and Technical Support Division (PTSD), SSD, MLD, and the SDCAPCD began evaluating hexavalent chromium data with respect to wind direction and plating activity data.

Although Phase III ambient sampling occurred at the same locations as Phase II sampling, significant differences were made to the sampling design to diagnose the causes of the hexavalent chromium emissions. Ambient sampling was expanded to include Saturdays and Sundays. Multiple samplers were placed at three of the six ambient sites to obtain greater temporal resolution in sampling and/or to collect ambient concentration data on airborne metals. The metals information was collected at the source and in the community in order to establish emission fingerprints.

An increase in temporal resolution was needed to better align the facilities operating hours with the sampling hours. It was achieved by operating two samplers at 2121 Newton and 2152 Newton. One of the two samplers at each site was operated for a 24-hour duration, the other, for a 12-hour duration. Both samplers were set with internal timers to begin at approximately 8:00 a.m. each day. Since the flow rate through each sampler was kept the same, the LoD was increased by a factor of two for the 12-hour samples from 0.2 ng/m³ to 0.4 ng/m³. Nevertheless, because the ambient concentrations present in the neighborhood frequently were at or above 0.4 ng/m³, the addition of 12-hour samples provided useful information.

The residence at 2121 Newton was chosen for 12-hour sampling because it is bounded by the two chrome plating facilities. 2152 Newton was chosen because it is located directly across Newton Avenue from C&B, the larger (higher amp-hour production rate) chrome plating facility.

Two ambient samplers and one indoor air sampler, at Master Plating, collected seven different airborne metals: total chromium, copper, iron, lead, manganese, nickel, and zinc. One of the two ambient multiple metals samplers was placed at 2121 Newton Avenue. The second metals sampler was placed at the Alley monitoring location, the location of the 22 ng/m³ hexavalent chromium result in December 2001. Both ambient multiple metals samplers were operated for 24 hours per sample.

The metals readings would help identify the source of the emissions using a variety of ratios and comparisons. One compared the hexavalent chromium to total chromium ratio and another compared indoor concentrations of one of the six other metals analyzed with outdoor concentrations. The seven metals chosen for analysis were associated with chrome plating and activities, such as grinding, welding, and nickel plating.

Indoor sampling at Master Plating continued for the duration of the project. At Master Plating, the sampling duration indoors was primarily aimed at profiling emissions during hours of facility operation. Exhaust fan samples were collected for eight continuous hours during normal business hours (approximately 8:00 a.m. through 4:00 p.m. on weekdays), and included hexavalent chromium measurements as well as metals measurements. An additional 13 indoor hexavalent chromium samples were collected just inside the roll-top door located on the southwest side of Master Plating adjacent to the alley. The back door samples (identified as 2109 Newton on data tables) were collected over 24-hours and were intended to establish whether the higher values seen at the Alley sampling location were caused by activities within Master Plating. Indoor sampling at C&B was conducted for 8 hours on those days that source testing occurred at the facility.

Results from Phase III air monitoring confirmed the continued presence of high ambient levels of hexavalent chromium first observed in December 2001. Twenty-four hour levels at 2121 Newton were as high as 3.6 ng/m³. Twelve-hour samples collected at 2121 Newton ranged from less than the LoD (0.4 ng/m³) to 4.7 ng/m³. The highest

ambient concentration recorded at a site other than 2121 Newton during Phase III was 0.9 ng/m³ at 2152 Newton (12-hour sample collected on February 22).

Sampling results for hexavalent chromium are shown in Table 3. For comparison purposes, the closest routine toxics sampling site to Newton Avenue is located in Chula Vista, approximately 10 miles to the south. In 2001, the highest 24-hour hexavalent chromium measurement was 0.3 ng/m³ at Chula Vista, one-twelfth of what was detected at 2121 Newton during Phase III.

Figure 5: Phase III Monitoring Sites

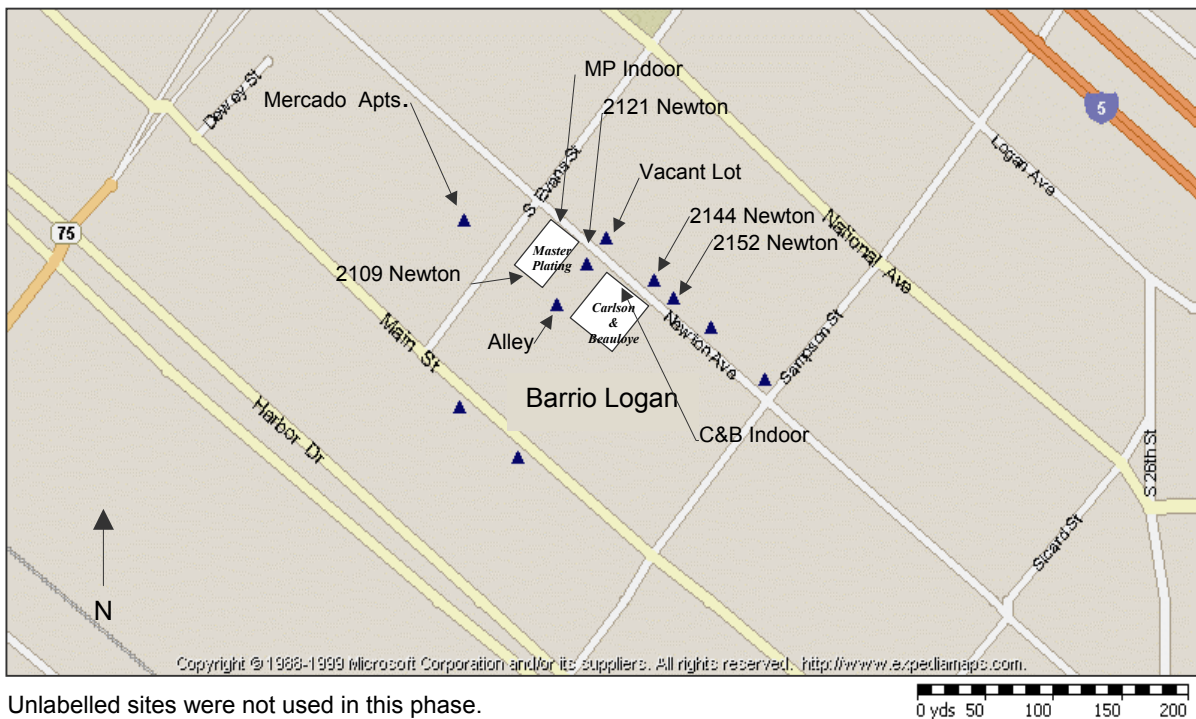


Table 3: Phase III - February 5 - March 8, 2002 - Hexavalent Chromium Results

Date	Day	Wind Direction	MP Amp Hours	C&B Amp Hours		2121 Newton (24hr)	2121 Newton (12hr)	Vacant Lot (24hr)	Vacant Lot Co-Loc (24hr)	2144 Newton (24hr)	2152 Newton (24hr)	2152 Newton (12 hr)	Alley (24hr)	Mercado Apts (24hr)	MPIEXT Indoor (8hr)	C&B 2141 Newton (24hr)	2109 Newton (24hr)
				Tank 1	Tank 2												
2/5/02	Tuesday	SSW	0	13593	11698	<0.2	<0.4	0.3	0.3	<0.2	<0.2	<0.4	0.3	NA			
2/6/02	Wednesday	SSE/W	193	14153	0	0.3	<0.4	<0.2	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2			
2/7/02	Thursday	W	280	0	0	0.4	NA	<0.2	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2	149.0		
2/8/02	Friday	W/WSW	370	1975	0	0.8	0.9	<0.2	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2	265.0		
2/9/02	Saturday	W/SW	closed	4383	2650	<0.2	<0.4	<0.2	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2			
2/10/02	Sunday	(various)	closed	4383	2650	1.4	<0.4	0.2	<0.2	0.3	0.4	<0.4	0.8	<0.2			
2/11/02	Monday	W	0	8659	5917	0.6	0.8	0.3	0.3	<0.2	0.4	0.5	0.2	0.2	17.0	30.0	
2/12/02	Tuesday	SSE	0	8798	5237	0.2	<0.4	<0.2	<0.2	<0.2	<0.2	<0.4	0.2	<0.2	3.9	27.0	
2/13/02	Wednesday	SSE	141	2690	1	<0.2	<0.4	<0.2	<0.2	<0.2	<0.2	<0.4	<0.2	NA	220.0		
2/14/02	Thursday	S	363	5279	0	<0.2	0.4	0.3	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2	451.0		
2/15/02	Friday	W	203	3779	0	0.5	1.7	<0.2	<0.2	<0.2	<0.2	0.5	<0.2	<0.2	368.0		
2/16/02	Saturday	W	closed	1992	0	<0.2	0.4	<0.2	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2			
2/17/02	Sunday	SE/SW	closed	59	0	<0.2	<0.4	<0.2	<0.2	<0.2	<0.2	<0.4	0.2	<0.2			
2/18/02	Monday	W	0	59	0	0.2	<0.4	<0.2	<0.2	<0.2	<0.2	<0.4	0.2	<0.2			
2/19/02	Tuesday	W	0	1	2630	0.2	<0.4	<0.2	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2	5.9	12.0	
2/20/02	Wednesday	W	0	6258	3744	0.3	0.4	<0.2	<0.2	<0.2	<0.2	<0.4	<0.2	0.2	6.0	18.0	
2/21/02	Thursday	W	423	323	2257	3.6	4.7	0.4	0.4	0.6	0.3	0.7	0.4	0.4	521.0		544.00
2/22/02	Friday	WNW	377	2219	1911	1.7	4.3	0.2	<0.2	0.3	0.3	0.9	<0.2	0.2	442.0		302.00
2/23/02	Saturday	W/SW	closed	1885	1267	0.3	<0.4	<0.2	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2			
2/24/02	Sunday	W	closed	0	3	<0.2	<0.4	<0.2	<0.2	0.2	<0.2	<0.4	<0.2	<0.2			

All result concentrations are in nanograms per cubic meters (ng/m³). Limit of Detection for 24 hour sample = 0.2 ng/m³.
 Hour in parentheses is sampling duration. Limit of Detection for 12 hour sample = 0.4 ng/m³. (C) = collocated sampler
 MP = Master Plater (decorative chrome plating) Limit of Detection for 8 hour sample = 0.6 ng/m³. NA = invalid sample
 C&B = Carlson & Beuloye (hard chrome plating) Shaded areas indicate no sample collected

Table 3 (cont.): Phase III - February 5 - March 8, 2002 - Hexavalent Chromium Results

Date	Day	Wind Direction	MP Amp Hours	C&B Amp Hours		2121 Newton (24hr)	2121 Newton (12hr)	Vacant Lot (24hr)	Vacant Lot Co-Loc (24hr)	2144 Newton (24hr)	2152 Newton (24hr)	2152 Newton (12 hr)	Alley (24hr)	Mercado Apts (24hr)	MPIEXT Indoor (8hr)	C&B 2141 Newton (24hr)	2109 Newton (24hr)
				Tank 1	Tank 2												
2/25/02	Monday	W	0	6253	0	0.4	0.4	<0.2	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2	6.0		
2/26/02	Tuesday	W	0	13053	764	0.6	0.6	<0.2	<0.2	<0.2	NA	<0.4	<0.2	<0.2	2.4		4.40
2/27/02	Wednesday	SSE	149	9616	632	0.2	0.7	<0.2	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2	851.0	42.0	NA
2/28/02	Thursday	SSE	225	9942	2853	1.3	0.8	0.7	0.4	<0.2	0.2	<0.4	<0.2	<0.2	904.0	43.0	107.00
3/1/02	Friday	W	209	875.5	1721	1.9	3.4	<0.2	<0.2	0.5	<0.2	<0.4	<0.2	<0.2	614.0		216.00
3/2/02	Saturday	NNE	closed	38.5	1101	0.4	0.4	<0.2	<0.2	<0.2	<0.2	<0.4	NA	<0.2			
3/3/02	Sunday	W	closed	0	0	1.3	<0.4	<0.2	<0.2	<0.2	<0.2	<0.4	0.3	<0.2			
3/4/02	Monday	W	0	2334	1039	0.3	0.6	<0.2	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2	96.0		16.00
3/5/02	Tuesday	SSW	0	8780	2386	0.5	<0.4	<0.2	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2	48.0		26.00
3/6/02	Wednesday	W	94	3752	2982	1.0	3.1	<0.2	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2	652.0		215.00
3/7/02	Thursday	SSE	115	0	1562	0.2	<0.4	0.3	0.5	<0.2	<0.2	<0.4	<0.2	<0.2	367.0		
3/8/02	Friday	S	0	828	543	<0.2	<0.4	<0.2	0.2	<0.2	NA	<0.4	<0.2	<0.2	87.0		

All result concentrations are in nanograms per cubic meters (ng/m³). Limit of Detection for 24 hour sample = 0.2 ng/m³.

Hour in parentheses is sampling duration.

MP = Master Plater (decorative chrome plating)

C&B = Carlson & Beuloye (hard chrome plating)

Limit of Detection for 12 hour sample = 0.4 ng/m³.

Limit of Detection for 8 hour sample = 0.6 ng/m³.

Shaded areas indicate no sample collected.

NA = invalid sample

(C) = collocated sampler

Table 4: Phase III - February 5 - March 8, 2002 - Metals Results

Date	Day	Wind Direction	MP Amp Hours	C&B Amp Hours		Total Chromium 2121 Newton (24hr)	Total Chromium Alley (24hr)	Total Chromium MPIEXT Indoor (24hr)	Copper 2121 Newton (24hr)	Copper MPIEXT Indoor (8hr)	Iron 2121 Newton (24hr)	Iron MPIEXT Indoor (8hr)	Lead 2121 Newton (24hr)	Lead MPIEXT Indoor (8hr)
				Tank 1	Tank 2									
2/5/02	Tuesday	SSW	0	13593	11698	9.1	7.8		65		1621		31	
2/6/02	Wednesday	SSE/W	193	14153	0	5.8	3.6		84		783		24	
2/7/02	Thursday	W	280	0	0	3.7	4	158	52	6327	633	5699	12	25
2/8/02	Friday	W/WSW	370	1975	0	2.8	2	281	41	5066	661	7958	12	67
2/9/02	Saturday	W/SW	closed	4383	2650	3.2	3.4		26		1886		18	
2/10/02	Sunday	(various)	closed	4383	2650	NA	5.8		NA		NA		NA	
2/11/02	Monday	W	0	8659	5917	5.4	3.7	101	48	2202	1129	11886	19	127
2/12/02	Tuesday	SSE	0	8798	5237	5.1	3.6	40	47	895	1026	10092	18	47
2/13/02	Wednesday	SSE	141	2690	1	NA	4	NA	NA	NA	NA	NA	NA	NA
2/14/02	Thursday	S	363	5279	0	4.1	3.3	497	40	8764	796	12823	12	74
2/15/02	Friday	W	203	3779	0	5.3	3.6	403	47	6062	647	8122	11	129
2/16/02	Saturday	W	closed	1992	0	3.6	NA		14		418		7.3	
2/17/02	Sunday	SE/SW	closed	59	0	2.6	2.2		11		256		4	
2/18/02	Monday	W	0	59	0	3	2.7		24		529		6.8	
2/19/02	Tuesday	W	0	1	2630	3.6	NA	NA	31	NA	732	NA	11	NA
2/20/02	Wednesday	W	0	6258	3744	4.4	4.6	43	76	1633	995	7799	14	156
2/21/02	Thursday	W	423	323	2257	7.9	5.6	488	136	7162	1882	17228	21	66
2/22/02	Friday	WNW	377	2219	1911	7	5.2	501	62	5543	1716	14028	41	47
2/23/02	Saturday	W/SW	closed	1885	1267	4.3	3.3		17		333		19	
2/24/02	Sunday	W	closed	0	3	4.8	4.2		39		706		20	

All result concentrations are in nanograms per cubic meters (ng/m³).

Hour in parentheses is sampling duration.

MP = Master Plater (decorative chrome plating)

C&B = Carlson & Beuloye (hard chrome plating)

NA = invalid sample

(C) = collocated sampler

Shaded areas indicate no sample collected.

Table 4 (cont.): Phase III - February 5 - March 8, 2002 - Metals Results

Date	Day	Wind Direction	MP Amp Hours	C&B Amp Hours		Total Chromium 2121 Newton (24hr)	Total Chromium Alley (24hr)	Total Chromium (MPIEXT Indoor (24hr)	Copper 2121 Newton (24hr)	Copper MPIEXT Indoor (8hr)	Iron 2121 Newton (24hr)	Iron MPIEXT Indoor (8hr)	Lead 2121 Newton (24hr)	Lead MPIEXT Indoor (8hr)
				Tank 1	Tank 2									
2/25/02	Monday	W	0	6253	0	6.2	5.4	79	137	8417	1257	8371	40	1349
2/26/02	Tuesday	W	0	13053	764	8.2	10	34	80	17206	997	14723	38	3451
2/27/02	Wednesday	SSE	149	9616	632	4	3.4	797	25	5539	350	25155	14	214
2/28/02	Thursday	SSE	225	9942	2853	5.2	2.2	942	38	8742	289	12271	7.3	73
3/1/02	Friday	W	209	875.5	1721	5.2	3.7	930	34	6626	804	10340	9.8	47
3/2/02	Saturday	NNE	closed	38.5	1101	3.1	2.8		26		671		14	
3/3/02	Sunday	W	closed	0	0	7.7	4		90		1228		24	
3/4/02	Monday	W	0	2334	1039	5.6	3.9	436	52	7011	1348	30432	28	255
3/5/02	Tuesday	SSW	0	8780	2386	3.6	2.9	146	45	2365	760	10128	16	477
3/6/02	Wednesday	W	94	3752	2982	5	4	NA	46	NA	414	NA	9.9	NA
3/7/02	Thursday	SSE	115	0	1562	3.2	2.6	416	90	13947	157	15357	3.4	253
3/8/02	Friday	S	0	828	543	3.7	3.6	404	23	12045	669	12597	13	270

All result concentrations are in nanograms per cubic meters (ng/m³).

Hour in parentheses is sampling duration.

MP = Master Plater (decorative chrome plating)

C&B = Carlson & Beauloye (hard chrome plating)

NA = invalid sample

(C) = collocated sampler

Shaded areas indicate no sample collected.

Table 4 (cont.): Phase III - February 5 - March 8, 2002 - Metals Results

Date	Day	Wind Direction	MP Amp Hours	C&B Amp Hours		Manganese 2121 Newton (24hr)	Manganese MPIEXT Indoor (8hr)	Nickel 2121 Newton (24hr)	Nickel MPIEXT Indoor (8hr)	Zinc 2121 Newton (24hr)	Zinc MPIEXT Indoor (8hr)
				Tank 1	Tank 2						
2/5/02	Tuesday	SSW	0	13593	11698	77		20		190	
2/6/02	Wednesday	SSE/W	193	14153	0	17		20		96	
2/7/02	Thursday	W	280	0	0	12	23	12	508	65	1448
2/8/02	Friday	W/WSW	370	1975	0	15	53	11	1006	83	1909
2/9/02	Saturday	W/SW	closed	4383	2650	60		17		76	
2/10/02	Sunday	(various)	closed	4383	2650	NA		NA		NA	
2/11/02	Monday	W	0	8659	5917	24	95	15	717	119	2849
2/12/02	Tuesday	SSE	0	8798	5237	30	53	19	253	116	5114
2/13/02	Wednesday	SSE	141	2690	1	NA	NA	NA	NA	NA	NA
2/14/02	Thursday	S	363	5279	0	16	35	13	672	77	1085
2/15/02	Friday	W	203	3779	0	13	28	13	846	67	1504
2/16/02	Saturday	W	closed	1992	0	7.9		8.2		50	
2/17/02	Sunday	SE/SW	closed	59	0	4.9		3.7		25	
2/18/02	Monday	W	0	59	0	10		7.3		78	
2/19/02	Tuesday	W	0	1	2630	16	NA	11	NA	86	NA
2/20/02	Wednesday	W	0	6258	3744	21	55	15	375	104	3918
2/21/02	Thursday	W	423	323	2257	54	70	32	760	215	1623
2/22/02	Friday	WNW	377	2219	1911	38	66	19	517	141	1237
2/23/02	Saturday	W/SW	closed	1885	1267	10		7.3		89	
2/24/02	Sunday	W	closed	0	3	18		10		79	

All result concentrations are in nanograms per cubic meters (ng/m³).
 Hour in parentheses is sampling duration.
 MP = Master Plater (decorative chrome plating)
 C&B = Carlson & Beauloye (hard chrome plating)

NA = invalid sample
 (C) = collocated sampler
 Shaded areas indicate no sample collected.

Table 4 (cont.): Phase III - February 5 - March 8, 2002 - Metals Results

Date	Day	Wind Direction	MP Amp Hours	C&B Amp Hours		Manganese 2121 Newton (24hr)	Manganese MPIEXT Indoor (8hr)	Nickel 2121 Newton (24hr)	Nickel MPIEXT Indoor (8hr)	Zinc 2121 Newton (24hr)	Zinc MPIEXT Indoor (8hr)
				Tank 1	Tank 2						
2/25/02	Monday	W	0	6253	0	39	63	21	461	165	3100
2/26/02	Tuesday	W	0	13053	764	44	182	23	464	142	9513
2/27/02	Wednesday	SSE	149	9616	632	9.6	186	13	1422	56	1354
2/28/02	Thursday	SSE	225	9942	2853	11	103	9.9	2323	55	3446
3/1/02	Friday	W	209	875.5	1721	30	58	11	1023	57	3289
3/2/02	Saturday	NNE	closed	38.5	1101	23		7.6		114	
3/3/02	Sunday	W	closed	0	0	33		23		143	
3/4/02	Monday	W	0	2334	1039	37	178	16	1648	140	7310
3/5/02	Tuesday	SSW	0	8780	2386	20	72	11	297	68	2687
3/6/02	Wednesday	W	94	3752	2982	9.8	NA	7.8	NA	52	NA
3/7/02	Thursday	SSE	115	0	1562	4	65	5.1	879	32	2158
3/8/02	Friday	S	0	828	543	15	68	7.6	876	55	3073

All result concentrations are in nanograms per cubic meters (ng/m³).
 Hour in parentheses is sampling duration.
 MP = Master Plater (decorative chrome plating)
 C&B = Carlson & Beuloye (hard chrome plating)

NA = invalid sample
 (C) = collocated sampler
 Shaded areas indicate no sample collected.

D. Phase III-A (March 2002)

In early March, several important modifications were made to the Phase III sampling design to coordinate the duration of each sample and to focus on those monitoring sites where most of the high values were recorded in February. Phase III-A sampling is the period from March 11 through March 24, 2002. On March 9 and 10 all samplers were shut down for quality control (QC) checks and maintenance; therefore no sampling occurred.

One modification was to reset the 24-hour sample to 23 hours to give the site operator time to service each sit and keep the sample period synchronized. A 23-hour run allowed field technicians to collect all samples, download information from each sampler's microprocessor, and still maintain the same start time for all samplers. Twenty-three hours is consistent with MLD's QC criteria for manual 24-hour samples and with the data quality objective (DQO) for coincident samples as outlined in the December 7, 2001, Barrio Logan sampling protocol. The start time for all samplers (12- and 24-hour) was approximately 8:00 a.m. each morning.

The extent of sampling was reduced to sites that consistently had the highest readings in December and February. This provided more efficient use of resources and focused our efforts where additional information was needed. The remaining sites were 2121 Newton, the Alley, and indoors at Master Plating. Sampling during this phase consisted of 12- and 24-hour hexavalent chromium measurements at 2121 and the Alley each day, and inside Master Plating each weekday. Twenty-four hour metals measurements were collected at 2121 and the Alley each day.

Beginning on March 24, ARB and SDCAPCD samplers were used to collect 12-hour hexavalent chromium samples inside Master Plating over the weekends, specifically from Sunday evening through Monday morning. The Sunday night-Monday morning time periods experienced high readings when active plating was not occurring. Sampling was reoriented to isolate this time period more distinctly and understand the emission source. All sampler start times were pre-set on Fridays prior to 4:00 p.m., as there was no access to Master Plating after 4:00 p.m. The Friday-Monday weekend sampling schedule inside Master Plating during Phase III-A was conducted as shown in Figure 6.

From March 11 through March 24, 9 of 14 24-hour ambient hexavalent chromium measurements at 2121 Newton were equal to or greater than the LoD. Five 23-hour readings were greater than 1 ng/m³. Hexavalent chromium results from Phase III-A are shown in Table 5.

Figure 6: Weekend Sampling Scheme Inside Master Plating (starting March 23, 2002)

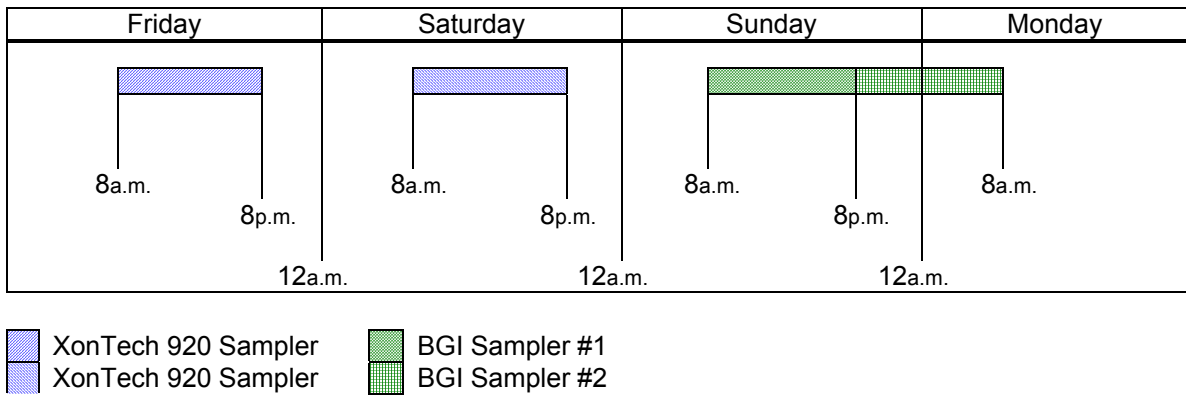
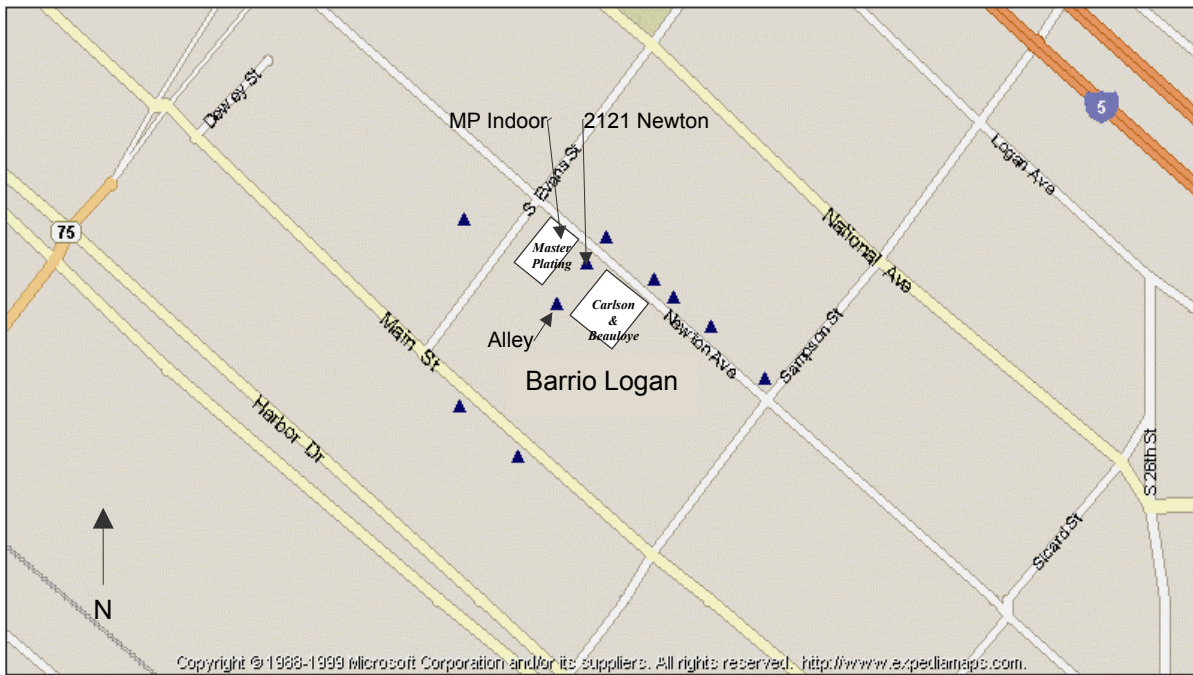


Figure 7: Phases III-A and III-B Monitors



Unlabelled sites were not used in these phases.

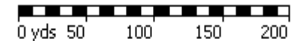


Table 5: Phase III-A - March 11-24, 2002 - Hexavalent Chromium Results

Date	Day	Wind Direction	MP Amp Hours	C&B Amp Hours		2121 Newton (24hr)	2121 Newton (12hr)	Alley (24hr)	Alley (12hr)	MPIEXT Indoor (12hr)	MPIEXT Indoor (24hr)	MPIEXT Indoor (12hr night)
				Tank 1	Tank 2							
3/9/02	Saturday	W	closed	0	40.5							
3/10/02	Sunday	W	closed	0	40.5							
3/11/02	Monday	W	0	3665	0	0.3	<0.4	<0.2	<0.4	5.1	4.6	
3/12/02	Tuesday	S	0	4310	2354	<0.2	<0.4	<0.2	<0.4	3.5	3.1	
3/13/02	Wednesday	SSE/WNW	0	6309	1928	0.2	<0.4	<0.2	<0.4	7.8	5.3	
3/14/02	Thursday	W	179	1482	0	1.3	1.5	<0.2	NA	308.0	142.0	
3/15/02	Friday	W	316	423	666	1.9	2.9	<0.2	<0.4	845.0	383.0	
3/16/02	Saturday	W	closed	201	0	<0.2	0.4	<0.2	<0.4			
3/17/02	Sunday	W	closed	201	0	<0.2	<0.4	<0.2	<0.4			
3/18/02	Monday	WNW	0	4676	2086	0.2	<0.4	<0.2	<0.4	36.0	17.0	
3/19/02	Tuesday	W	0	5802	31	0.3	0.5	<0.2	<0.4	6.5	12.0	
3/20/02	Wednesday	W	0	5884	2297	1.0	1.5	0.2	<0.4	60.0	22.0	
3/21/02	Thursday	W	119	7566	0	1.0	1.9	<0.2	0.4	153.0	83.0	
3/22/02	Friday	W	344	3627	0	3.1	4.8	0.3	<0.4	600.0		
3/23/02	Saturday	S/W	closed	0	0	<0.2	<0.4	<0.2	<0.4	46.0		
3/24/02	Sunday	W	closed	0	0	<0.2	<0.4	<0.2	<0.4	25.0		49.0

All result concentrations are in nanograms per cubic meters (ng/m³).
 Hour in parentheses is sampling duration.
 MP = Master Plater (decorative chrome plating)
 C&B = Carlson & Beauloye (hard chrome plating)
 NA = invalid sample

Limit of Detection for 24 hour sample = 0.2 ng/m³.
 Limit of Detection for 12 hour sample = 0.4 ng/m³.
 Limit of Detection for 8 hour sample = 0.6 ng/m³.
 Shaded areas indicate no sample collected.
 (C) = collocated sampler

Table 6: Phase III-A - March 11-24, 2002 - Metals Results

Date	Day	Wind Direction	MP Amp Hours	C&B Amp Hours		Total Chromium 2121 Newton (24hr)	Total Chromium Alley (24hr)	Copper 2121 Newton (24hr)	Copper Alley (24hr)	Iron 2121 Newton (24hr)	Iron Alley (24hr)	Lead 2121 Newton (24hr)	Lead Alley (24hr)
				Tank 1	Tank 2								
3/9/02	Saturday	W	closed	0	40.5								
3/10/02	Sunday	W	closed	0	40.5								
3/11/02	Monday	W	0	3665	0	NA	3.2	NA	41	NA	518	NA	13
3/12/02	Tuesday	S	0	4310	2354	3.1	2.8	16	18	238	331	16	19
3/13/02	Wednesday	SSE/WNW	0	6309	1928	5.2	3.6	66	33	941	782	13	9.5
3/14/02	Thursday	W	179	1482	0	5.4	3.8	75	42	774	768	15	13
3/15/02	Friday	W	316	423	666	5.6	3.4	43	17	483	345	11	6.7
3/16/02	Saturday	W	closed	201	0	2.3	2.1	7.4	5	141	96	2.3	1.4
3/17/02	Sunday	W	closed	201	0	2.3	1.9	6	4.8	104	95	2.7	2.8
3/18/02	Monday	WNW	0	4676	2086	NA	4.9	NA	28	NA	440	NA	10
3/19/02	Tuesday	W	0	5802	31	NA	4.9	NA	78	NA	715	NA	25
3/20/02	Wednesday	W	0	5884	2297	NA	5.7	NA	60	NA	877	NA	20
3/21/02	Thursday	W	119	7566	0	4.8	4.2	66	42	608	640	14	13
3/22/02	Friday	W	344	3627	0	NA	NA	NA	NA	NA	NA	NA	NA
3/23/02	Saturday	S/W	closed	0	0	2	1.6	7.7	3.9	96	69	3.8	1
3/24/02	Sunday	W	closed	0	0	2.1	2	7.5	7.1	153	150	10	7.9

All result concentrations are in nanograms per cubic meters (ng/m³).

Hour in parentheses is sampling duration.

MP = Master Plater (decorative chrome plating)

C&B = Carlson & Beuloye (hard chrome plating)

NA = invalid sample

(C) = collocated sampler

Shaded areas indicate no sample collected.

Table 6 (cont.): Phase III-A - March 11-24, 2002 - Metals Results

Date	Day	Wind Direction	MP Amp Hours	C&B Amp Hours		Manganese 2121 Newton (24hr)	Manganese Alley (24hr)	Nickel 2121 Newton (24hr)	Nickel Alley (24hr)	Zinc 2121 Newton (24hr)	Zinc Alley (24hr)
				Tank 1	Tank 2						
3/9/02	Saturday	W	closed	0	40.5						
3/10/02	Sunday	W	closed	0	40.5						
3/11/02	Monday	W	0	3665	0	NA	17	NA	9.7	NA	62
3/12/02	Tuesday	S	0	4310	2354	14	19	5.3	7.3	37	54
3/13/02	Wednesday	SSE/WNW	0	6309	1928	25	24	15	11	92	67
3/14/02	Thursday	W	179	1482	0	18	18	15	13	102	81
3/15/02	Friday	W	316	423	666	12	10	17	9	72	45
3/16/02	Saturday	W	closed	201	0	3	2.1	2.6	2.4	21	14
3/17/02	Sunday	W	closed	201	0	3	2.2	1.7	2	15	14
3/18/02	Monday	WNW	0	4676	2086	NA	11	NA	7.1	NA	66
3/19/02	Tuesday	W	0	5802	31	NA	25	NA	15	NA	103
3/20/02	Wednesday	W	0	5884	2297	NA	26	NA	18	NA	138
3/21/02	Thursday	W	119	7566	0	21	22	15	15	95	100
3/22/02	Friday	W	344	3627	0	NA	NA	NA	NA	NA	NA
3/23/02	Saturday	S/W	closed	0	0	2.3	1.5	4.3	1.6	17	15
3/24/02	Sunday	W	closed	0	0	4.2	3.1	2	2.2	23	22

All result concentrations are in nanograms per cubic meters (ng/m³).

Hour in parentheses is sampling duration.

MP = Master Plater (decorative chrome plating)

C&B = Carlson & Beuloye (hard chrome plating)

NA = invalid sample

(C) = collocated sampler

Shaded areas indicate no sample collected.

E. Phase III-B (Late March 2002)

Another modification, referred to as Phase III-B, ran from March 25 through March 28, 2002. It differed from Phase III-A sampling in two ways. First, 12-hour metals samples were taken within Master Plating, rather than 8-hour samples, to better index activities within the facility to 12-hour metals results at ambient sites. Second, all chrome plating activity at Master Plating stopped as of March 25 due to a court order to discontinue plating while additional air data was collected and evaluated. Therefore, all ambient readings after March 25 represented either sources of hexavalent chromium other than Master Plating, or activities by Master Plating other than plating that produced elevated ambient levels.

Table 7 contains hexavalent chromium monitoring results for Phase III-B and shows that on three of the four days of this phase of monitoring, high ambient levels were noted at 2121 Newton with 12- and 24-hour samples. The high levels seen at the ambient sites were consistent with high indoor levels at Master Plating and with westerly winds which would have caused emissions from Master Plating to impact the samplers at 2121 Newton. Although all chrome plating at Master Plating was stopped by March 25, field observations confirmed that sweeping, clean-up activities, and construction were taking place. Amidst routinely low inside and outside readings (post closure), we recorded periodic significant spikes in hexavalent chromium concentration that coincided with the activities inside the plater that re-entrained floor residue. The hexavalent chromium-laden dust within the facility was carried westerly by winds and impacted samplers at 2121 Newton.

Table 7: Phase III-B - March 25-28, 2002 - Hexavalent Chromium Results

Date	Day	Wind Direction	MP Amp Hours	C&B Amp Hours		2121 Newton (24hr)	2121 Newton (12hr)	Alley (24hr)	Alley (12hr)	MPIEXT Indoor (12hr)	MPIEXT Indoor (24hr)
				Tank 1	Tank 2						
3/25/02	Monday	W	0	0	0	0.6	0.7	<0.2	<0.4	41.0	28.0
3/26/02	Tuesday	W	0	0	0	<0.2	<0.4	<0.2	<0.4	19.0	12.0
3/27/02	Wednesday	W	0	15715	1843	0.7	1.1	<0.2	<0.4	34.0	12.0
3/28/02	Thursday	S	0	20432	5377	1.0	0.4	<0.2	<0.4	21.0	20.0

All result concentrations are in nanograms per cubic meters (ng/m³).

NA = invalid sample

(C) = collocated sampler

Hour in parentheses is sampling duration.

MP = Master Plater (decorative chrome plating)

C&B = Carlson & Beauloye (hard chrome plating)

Limit of Detection for 24 hour sample = 0.2 ng/m³.

Limit of Detection for 12 hour sample = 0.4 ng/m³.

Limit of Detection for 8 hour sample = 0.6 ng/m³.

Table 8: Phase III-B - March 25-28, 2002 - Metals Results

Date	Total Chromium 2121 Newton (12hr)	Total Chromium Alley (12hr)	Total Chromium MPIEXT Indoor (12hr)	Copper 2121 Newton (12hr)	Copper Alley (12hr)	Copper MPIEXT Indoor (12hr)	Iron 2121 Newton (12hr)	Iron Alley (12hr)	Iron MPIEXT Indoor (12hr)	Lead 2121 Newton (12hr)	Lead Alley (12hr)
3/25/02	9.3	7.1	433	84	21	7318	478	167	12688	15	4.3
3/26/02	7.5	7.7	111	50	58	1716	461	529	8359	9	9.6
3/27/02	14	7.8	321	569	121	28118	1735	641	104706	36	12.0
3/28/02	7.7	7.7	50	46	35	1318	456	432	3094	13	6.2

Table 8 (cont.): Phase III-B - March 25-28, 2002 - Metals Results

Date	Lead MPIEXT Indoor (12hr)	Manganese 2121 Newton (12hr)	Manganese Alley (12hr)	Manganese MPIEXT Indoor (12hr)	Nickel 2121 Newton (12hr)	Nickel Alley (12hr)	Nickel MPIEXT Indoor (12hr)	Zinc 2121 Newton (12hr)	Zinc Alley (12hr)	Zinc MPIEXT Indoor (12hr)
3/25/02	577	14	5.4	85	18	5.1	1599	137	49	5906
3/26/02	117	11	12	53	13	26	533	82	93	2299
3/27/02	1530	23	16	445	146	30	8505	747	209	34821
3/28/02	69	15	12	23	15	8.3	436	195	178	1122

All result concentrations are in nanograms per cubic meters (ng/m³).

Hour in parentheses is sampling duration.

MP = Master Plater (decorative chrome plating)

C&B = Carlson & Beauloye (hard chrome plating)

NA = invalid sample

(C) = collocated sampler

Shaded areas indicate no sample collected.

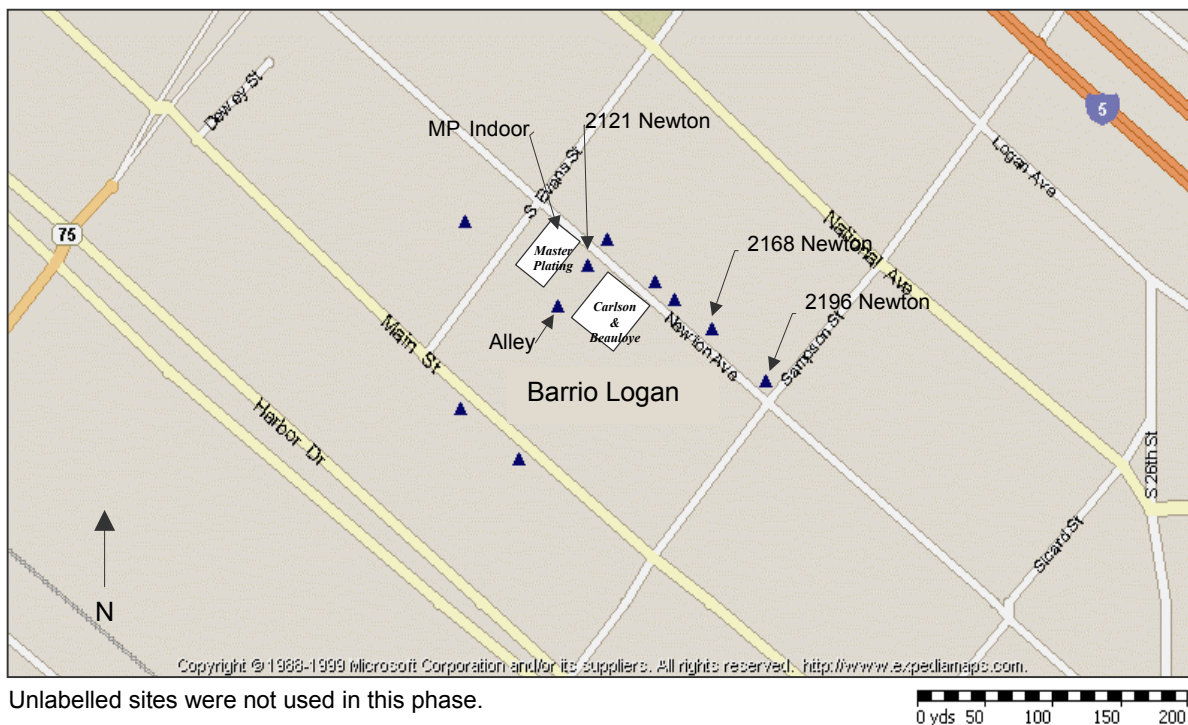
F. Phase III-C (March / April 2002)

Sampling for this phase is identified as the period from March 29 through April 19, 2002 and included the same monitoring locations as Phase III-B. In addition, however, ARB and PTSD staff ran dispersion models using input from C&B source testing results, ampere-hour readings, and meteorological measurements to select areas the C&B plume would strike the ground. The purpose was to aid in the placement of two additional samplers. Samplers were placed downwind of C&B to confirm their contribution to the neighborhood exposure to hexavalent chromium as shown in Figure 8.

The models supported placing samplers at 2168 Newton Avenue, a private residence, and at 2196 Newton Avenue, a community swimming pool operated by the Barrio Station, a local youth center. Sampling at 2168 Newton began on March 29. Sampling at 2196 Newton, referred to as the Pool, began on April 12. At each of these new sites, 12-hour hexavalent chromium samples were collected each day. Samples from 2168 Newton and the Pool were collected from 9:00 a.m. to 9:00 p.m. The timing of these 12-hour duration samples was based on the diurnal wind patterns in this part of San

Diego this time of year. During the daytime hours, breezes typically are onshore while in the evening hours the prevailing wind is from inland areas toward the ocean (offshore). See Figures 1 and 2.

Figure 8: Phase III-C Monitors



The samplers at 2168 Newton and the Pool were intended to capture potential emissions from C&B to ensure that conclusions being formulated thoroughly addressed the causes of high concentrations in the neighborhood. On several days early in Phase III-C, relatively high ambient levels were detected at 2168 Newton. For example, on April 1 a reading of 0.7 ng/m^3 was recorded at 2168 Newton. Relatively little plating activity occurred at C&B on April 1. However, the resultant wind direction for at least one-third of the day was from the northwest to the southeast with an average speed of approximately 2.7 knots. Activity from within Master Plating (e.g., cleaning, painting, etc.) may have resulted in high ambient levels recorded at 2168 Newton, southeast of the facility. Most other ambient readings taken during Phase III-C at 2168 Newton were at or below the LoD.

High readings at 2121 Newton during Phase III-C ranged from below the LoD to 21 ng/m^3 for a 24-hour sample collected on April 6. While some weekend plating occurred at C&B (8900 amp hours at Tank 1 and 5200 amp hours at Tank 2) on Saturday, April 6, the facility was closed and no other activities occurred. A value of 21 ng/m^3 , however, can be explained through activity and sampling data from Master Plating. Documentation from field personnel confirms that during the weekend of April 6, clean up and construction took place within Master Plating. Indoor air samples collected on April 6 revealed a hexavalent chromium level of 2315 ng/m^3 , the highest level recorded

during the entire study. Fugitive dust generated within Master Plating by clean up and construction activities, which was later shown to contain high levels of hexavalent chromium (1200 mg/kg or higher), exited the building either through the exhaust fan or through the front door and resulted in elevated readings at 2121 Newton. Light, southwesterly winds early in the day, followed by northwesterly winds during the late afternoon and early evening support the conclusion that hexavalent chromium-laden dust, generated by activities at Master Plater not directly related to plating, resulted in high ambient levels near a source.

Throughout the study, the high readings at 2121 Newton occurred on days that the residence was downwind of Master Plating. On these days C&B would have been downwind of 2121 Newton.

Hexavalent chromium analyses of samples collected prior to and during Phase III-C implicated Master Plating as the source of the high ambient hexavalent chromium measurements. Data up through and including Phase III-C suggest that Master Plating's routine cleaning activities, leading to fugitive dust outside the building, as well as its daily plating process, were the cause of the high ambient hexavalent chromium readings.

All results from Phase III-C are shown in Table 9 (hexavalent chromium) and Table 10 (metals).

Table 9: Phase III-C - March 29-April 19, 2002 - Hexavalent Chromium Results

Date	Day	Wind Direction	MP Amp Hours	C&B Amp Hours		2121 Newton (24hr)	2121 Newton (12hr)	Alley (24hr)	Alley (12hr)	MPIEXT Indoor (12hr)	MPIEXT Indoor (12hr night)	MPIEXT Indoor (24hr)	2168 Newton (12hr)	2196 Newton Pool (12hr)
				Tank 1	Tank 2									
3/29/02	Friday	W	0	3347	1144	<0.2	<0.4	<0.2	0.5	11.0			0.6	
3/30/02	Saturday	W	closed	0	3486	2.1	2.9	<0.2	<0.4	127.0			<0.4	
3/31/02	Sunday	W	closed	0	3486	0.7	1.5	<0.2	<0.4				<0.4	
4/1/02	Monday	W	0	3684	3364	<0.2	<0.4	0.4	<0.4	10.0		4.9	0.7	
4/2/02	Tuesday	SW	0	7552	5271	0.2	<0.4	<0.2	<0.4	10.0		6.5	<0.4	
4/3/02	Wednesday	W	0	11553	5303	0.2	<0.4	<0.2	<0.4	4.5		3.4	<0.4	
4/4/02	Thursday	W	0	8647	1928	<0.2	<0.4	<0.2	<0.4	8.1		4.9	<0.4	
4/5/02	Friday	W	0	245	810	<0.2	<0.4	<0.2	<0.4	5.3			<0.4	
4/6/02	Saturday	WSW	closed	8932	5161	21.0	16.0	<0.2	<0.4	2315.0			0.4	
4/7/02	Sunday	SSE	closed	8932	5161	0.2	<0.4	<0.2	<0.4	10.0	401.0		<0.4	
4/8/02	Monday	SW	0	262	5053	0.4	0.5	0.3	0.5	200.0		76.0	<0.4	
4/9/02	Tuesday	WNW	0	1883	12542	NA	0.9	<0.2	<0.4	25.0		9.4	<0.4	
4/10/02	Wednesday	WSW	0	5210	7471	<0.2	<0.4	<0.2	<0.4	25.0		10.0	<0.4	
4/11/02	Thursday	SSE	0	0	1908	<0.2	<0.4	<0.2	<0.4	9.1		4.6	<0.4	
4/12/02	Friday	SSE	0	0	1856	<0.2	0.5	<0.2	<0.4	6.4			<0.4	<0.4
4/13/02	Saturday	W	closed	11925	10845	<0.2	<0.4	<0.2	<0.4	<0.4			<0.4	<0.4
4/14/02	Sunday	SSE	closed	11925	10845	<0.2	<0.4	<0.2	<0.4	<0.4	<0.4		<0.4	<0.4
4/15/02	Monday	SSE	0	6140	5904	0.3	0.7	<0.2	<0.4	6.2		2.9	<0.4	<0.4
4/16/02	Tuesday	S	0	13033	7129	0.4	0.9	<0.2	<0.4	91.0		49.0	<0.4	<0.4
4/17/02	Wednesday	SW	0	2043	10314	0.2	<0.4	<0.2	<0.4	NA		NA	0.4	<0.4
4/18/02	Thursday	W	0	789	13320	<0.2	<0.4	<0.2	<0.4	5.4		3.1	<0.4	<0.4
4/19/02	Friday	SSE	0	3436	529	0.3	<0.4	0.2	<0.4	20.0			<0.4	<0.4

All result concentrations are in nanograms per cubic meters (ng/m³).

NA = invalid sample

Hour in parentheses is sampling duration.

(C) = collocated sampler

MP = Master Plater (decorative chrome plating)

C&B = Carlson & Beauloye (hard chrome plating)

Limit of Detection for 24 hour sample = 0.2 ng/m³.

Limit of Detection for 12 hour sample = 0.4 ng/m³.

Limit of Detection for 8 hour sample = 0.6 ng/m³.

Shaded areas indicate no sample collected.

Table 10: Phase III-C - March 29-April 19, 2002 - Metals Results

Date	Day	Wind Direction	MP Amp Hours	C&B Amp Hours		Total Chromium 2121 Newton (12hr)	Total Chromium Alley (24hr)	Total Chromium Alley (12hr)	Total Chromium MPIEXT (12hr)	Total Chromium MPIEXT (12hr night)	Copper 2121 Newton (12hr)	Copper Alley (24hr)	Copper Alley (12hr)
				Tank 1	Tank 2								
3/29/02	Friday	W	0	3347	1144	9.5	4.2				62	19	
3/30/02	Saturday	W	closed	0	3486	14		7.7			91		39
3/31/02	Sunday	W	closed	0	3486	12		6.9	652	49	104		33
4/1/02	Monday	W	0	3684	3364	6.7		6.7	64		47		24
4/2/02	Tuesday	SW	0	7552	5271	6.7		6.7	87		84		47
4/3/02	Wednesday	W	0	11553	5303	6.7		4.4	53		96		51
4/4/02	Thursday	W	0	8647	1928	NA		6.7	67		NA		72
4/5/02	Friday	W	0	245	810	6.4		5.4			81		60
4/6/02	Saturday	WSW	closed	8932	5161	35		5.9			30		13
4/7/02	Sunday	SSE	closed	8932	5161	4.6		4.7			10		11
4/8/02	Monday	SW	0	262	5053	8.4		7.3	1426		46		23
4/9/02	Tuesday	WNW	0	1883	12542	8.3		NA	178		45		NA
4/10/02	Wednesday	WSW	0	5210	7471	6.3		7	220		54		56
4/11/02	Thursday	SSE	0	0	1908	6.6		6	80		18		24
4/12/02	Friday	SSE	0	0	1856	10		5.6			40		29
4/13/02	Saturday	W	closed	11925	10845	5.7		5			30		14
4/14/02	Sunday	SSE	closed	11925	10845	4.5		4.2			17		8.2
4/15/02	Monday	SSE	0	6140	5904	6.5		5.7	NA		22		19
4/16/02	Tuesday	S	0	13033	7129	7.9		4.7	371		35		21
4/17/02	Wednesday	SW	0	2043	10314	6.3		5.4	137		77		45
4/18/02	Thursday	W	0	789	13320	1.7		NA	49		9.7		NA
4/19/02	Friday	SSE	0	3436	529	7.5		4.8			31		26

All result concentrations are in nanograms per cubic meters (ng/m³).
 Hour in parentheses is sampling duration.
 MP = Master Plater (decorative chrome plating)
 C&B = Carlson & Beauloye (hard chrome plating)

NA = invalid sample
 (C) = collocated sampler
 Shaded areas indicate no sample collected.

Table 10 (cont.): Phase III-C - March 29-April 19, 2002 - Metals Results

Date	Copper MPIEXT (12hr)	Copper MPIEXT (12hr night)	Iron 2121 Newton (12hr)	Iron Alley (24hr)	Iron Alley (12hr)	Iron MPIEXT Indoor (12hr)	Iron MPIEXT Indoor (12hr night)	Lead 2121 Newton (12hr)	Lead Alley (24hr)	Lead Alley (12hr)	Lead MPIEXT Indoor (12hr)	Lead MPIEXT Indoor (12hr night)
3/29/02			701	281				16	5.6			
3/30/02			447		304			10		6.9		
3/31/02	8312	407	470		325	21105	1006	16		7	625	49
4/1/02	1002		699		560	13169		8.9		6.7	53	
4/2/02	3806		688		609	13750		8.9		6.7	178	
4/3/02	6583		683		613	4880		11		6.7	254	
4/4/02	3506		NA		677	4725		NA		12	96	
4/5/02			538		522			10		11		
4/6/02			318		217			7.4		3.5		
4/7/02			181		197			2.3		1.9		
4/8/02	6489		362		324	9814		9.4		5.7	614	
4/9/02	1597		861		NA	17168		16		NA	104	
4/10/02	5012		516		674	9692		9.8		10	413	
4/11/02	5381		199		362	10265		4.6		7.6	120	
4/12/02			388		323			9.8		5.6		
4/13/02			519		475			11		6.6		
4/14/02			281		210			6.3		3.4		
4/15/02	NA		172		185	NA		1.9		1.6	NA	
4/16/02	6647		425		336	7017		11		2.1	228	
4/17/02	9443		831		869	6762		9.3		8.5	163	
4/18/02	3647		116		NA	6048		1.7		NA	63	
4/19/02			597		527			10		6.8		

All result concentrations are in nanograms per cubic meters (ng/m³).
 Hour in parentheses is sampling duration.
 MP = Master Plater (decorative chrome plating)
 C&B = Carlson & Beauloye (hard chrome plating)

NA = invalid sample
 (C) = collocated sampler
 Shaded areas indicate no sample collected.

Table 10 (cont.): Phase III-C - March 29-April 19, 2002 - Metals Results

Date	Nickel 2121 Newton (12hr)	Nickel Alley (24hr)	Nickel Alley (12hr)	Nickel MPIEXT Indoor (12hr)	Nickel MPIEXT Indoor (12hr night)	Zinc 2121 Newton (12hr)	Zinc Alley (24hr)	Zinc Alley (12hr)	Zinc MPIEXT Indoor (12hr)	Zinc MPIEXT Indoor (12hr night)
3/29/02	27	7.1				144	56			
3/30/02	33		9.5			105		45		
3/31/02	34		13	2734	121	168		47	11481	483
4/1/02	13		11	479		98		69	2306	
4/2/02	20		13	1501		73		69	1700	
4/3/02	22		11	1461		82		71	3126	
4/4/02	NA		19	670		NA		98	1764	
4/5/02	17		14			68		72		
4/6/02	11		5			44		27		
4/7/02	2.7		2.9			21		22		
4/8/02	13		8.3	1584		95		70	6023	
4/9/02	26		NA	1123		109		NA	2028	
4/10/02	14		16	1052		85		108	5077	
4/11/02	5.2		9.4	1386		41		68	2166	
4/12/02	11		9.9			55		49		
4/13/02	8.1		9.7			54		42		
4/14/02	5.3		4.8			35		26		
4/15/02	15		6.8	NA		29		31	NA	
4/16/02	11		6.5	1220		63		47	3522	
4/17/02	19		14	1064		123		106	5026	
4/18/02	2.7		NA	528		17		NA	2723	
4/19/02	11		9			58		63		

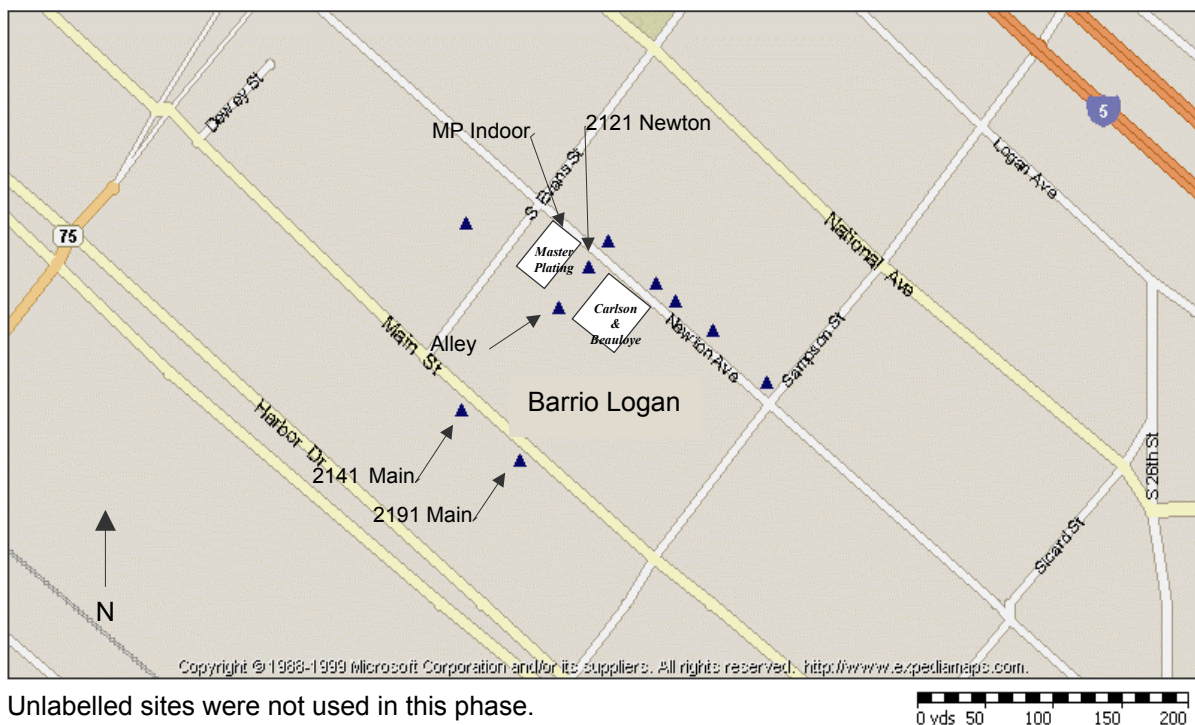
All result concentrations are in nanograms per cubic meters (ng/m³).
 Hour in parentheses is sampling duration.
 MP = Master Plater (decorative chrome plating)
 C&B = Carlson & Beauloye (hard chrome plating)

NA = invalid sample
 (C) = collocated sampler
 Shaded areas indicate no sample collected.

G. Phase III-D (April / May 2002)

By late April a significant amount of data had been gathered and preliminary conclusions drawn as to the source of the high hexavalent chromium emissions. A final supplement to the study, Phase III-D, focused on acquiring additional information from Master Plating. Particular emphasis was on emissions from C&B, and whether the emissions vented through two exhaust stacks on the roof could be detected at the Pool, 2168 Newton Avenue, or on two new sites on Main Street.² Beginning on April 20, sampling was reduced to 24-hour samples at 2121 Newton Avenue and the Alley site. On May 3, all 12-hour indoor hexavalent chromium sampling at Master Plating was discontinued; but 24-hour indoor sampling continued.

Figure 9: Phase III-D Monitors



Unlabelled sites were not used in this phase.

Twelve-hour sampling for hexavalent chromium continued at 2168 Newton and the Pool (downwind of C&B) and on May 3, 12-hour sampling began at the two new sites on Main Street. Main Street runs parallel to and south of Newton Avenue (see Figure 9). The new sites were intended to detect emissions from C&B, whose operation overnight made it important to be downwind of C&B during offshore conditions. The two samplers on Main Street were operated overnight (from 9:00 p.m. to 9:00 a.m.) and were operated sequentially with samplers at 2168 Newton and the Pool, which operated from 9:00 a.m. to 9:00 p.m. One sampler was placed at 2191 Main, on the roof of a large warehouse. Two collocated samplers were placed on the roof of an adjoining building

² Results from stationary source tests of C&B conducted by the ARB in February showed that all emissions were within controlled limits specified on the facility's Permit to Operate and would not result in the high ambient concentrations detected during the study.

located at 2141 Main. As with samplers at 2168 Newton and the Pool, the samplers at 2191 and 2141 Main Street were intended to capture potential emissions from C&B.

Ambient hexavalent chromium concentrations during Phase III-D ranged from below detection to 1.2 ng/m³ at 2168 Newton on April 24. Winds on that day were almost exclusively northwesterly. While neither Master Plating nor C&B were plating on that day, records indicate that activity within Master Plating may have disturbed hexavalent chromium-laden dust.

On April 29, 2002 additional dust samples were collected by SDCAPCD at eight locations within Master Plating. The purpose was to determine if high ambient readings observed outside of Master Plating at 2121 Newton Avenue were attributable to dust from cleaning activities within the facility. EnviroMatrix Analytical analyzed the samples under contract to SDCAPCD. Duplicate samples from six of the eight locations were also screened at MLD for comparison with results from EnviroMatrix Analytical.

The dust sampling locations within Master Plating were:

- (1) shelf under the SDCAPCD sampler head,
- (2) forward containment area near the west side of the building,
- (3) on the top steps of the staircase along the west side of the building,
- (4) within the dust/debris can located near the grinding room,
- (5) inside the facility at the front door near the east wall of the building,
- (6) inside the facility at the rear door,
- (7) at the bottom of the staircase along the west wall of the building behind the buffing wheel, and
- (8) rear area of the building near the treatment unit. Duplicate samples collected from locations (1), (2), and (3) above.

Results ranged from <1 mg/kg (LOD) to 1200 mg/kg. Details regarding the analytical results from soil and dust samples may be obtained from the Program Review Section within SSD or from SDCAPCD.

Throughout the study, ARB staff performed the daily operation, maintenance, and field quality control (QC) for the BGI samplers and the meteorological station. All QC for the XonTech 920 sampler used to collect samples within Master Plating was conducted by SDCAPCD staff.

Commencing May 4th, the SDCAPCD staff assumed all field operations in Barrio Logan from the ARB. ARB continued to provide all sampling equipment, consumables and, by filter analysis. The transfer of field responsibilities was based on the general reduction in sample collection and planned cessation of all sampling on May 24. Sampling for Phase III-D began on April 20 and concluded on May 24, 2002 at which time all air monitoring ended in Barrio Logan. Results for Phase III-D are shown in Table 11.

VI. Analytical Methodology

All filter samples received from the field were logged into MLD's Laboratory Information Management System for tracking and reporting purposes. Filters were inspected for contamination, tears, holes, etc. Filters were not analyzed if they did not meet validation criteria specified in MLD 039, Part 11, or Volume II, Appendix R, Section R.1.2.9, of MLD's Quality Assurance Manual.

The following sections summarize and reference the laboratory methodologies used to analyze air sample filters for hexavalent chromium and metals.

A. Hexavalent Chromium

Exposed filters were extracted with deionized water and analyzed by ion chromatography method MLD 039 (SOP in Appendix B.3, page 235). The analytical concentration was converted to air concentration using the extract volume and the total volume of air sampled.

The LoD of the sample depended on the sample duration. The LoD is inversely proportional to the mass on the filter, as determined by flow rate and sample duration. Typically, hexavalent chromium samples are collected using a flow rate of 10 standard liters per minute (slpm) for 24 hours (see Attachment 2 for calculations).

For this study, 12-hour and 8-hour samples were collected and have a LoD of approximately 0.4 ng/m³ and 0.6 ng/m³ of sampled air, respectively.

B. Metals

The analytical method for metals analysis was ARB's "Standard Operating Procedure for the Trace Elemental Analysis of Low-Volume Samples Using Inductively Coupled Plasma-Mass Spectrometry (ICP-MS)" (MLD 061). The SOP for MLD 061 is included in Appendix B.4, page 244. Each filter was extracted with nitric acid followed by heat and sonication. Extracts were diluted and analyzed by ICP-MS. The metals of interest were total chromium, copper, iron, lead, manganese, nickel and zinc. LoDs vary among the metals, but all were in the low parts per billion (ppb) range per MLD 061.

Table 11: Phase III-D - April 20-May 24, 2002 - Hexavalent Chromium Results

Date	Day	Wind Direction	MP Amp Hours	C&B Amp Hours		2121 Newton (24hr)	Alley (24hr)	MPIEXT Indoor (24hr)	MPIEXT Indoor (12hr)	MPIEXT Indoor (12hr night)	2168 Newton (12hr)	2196 Newton Pool (12hr)	2141 Main (12hr)	2141 Main Coll (12hr)	2191 Main (12hr)
				Tank 1	Tank 2										
4/20/02	Saturday	SSW	0	9918	471	<0.2	<0.2		<0.4		<0.4	<0.4			
4/21/02	Sunday	W	0	9918	471	<0.2	<0.2		1.9	266	<0.4	<0.4			
4/22/02	Monday	W	0	16934	5361	0.3	<0.2	1.7	7.8		<0.4	<0.4			
4/23/02	Tuesday	W	0	23105	10698	0.2	<0.2	1.7	4.6		<0.4	<0.4			
4/24/02	Wednesday	WNW	0	28613	7272	<0.2	0.2	2	4.5		1.2	NA			
4/25/02	Thursday	W	0	17175	8108	<0.2	<0.2	2	4.2		<0.4	<0.4			
4/26/02	Friday	S	0	3436	2372	0.4	0.3		7.5		0.7	<0.4			
4/27/02	Saturday	W	0	9918	6.5	<0.2	<0.2		NA		<0.4	<0.4			
4/28/02	Sunday	W	0	648.5	6.5	<0.2	<0.2	2.7			<0.4	<0.4			
4/29/02	Monday	W	0	5177	4829	0.3	0.2	7.2	17		0.5	0.4			
4/30/02	Tuesday	W	0	13766	3813	0.3	0.3	NA	NA		0.7	0.5			
5/1/02	Wednesday	SW	0	9270	4202	0.8	0.5	330	724		0.5	<0.4			
5/2/02	Thursday	S	0	6096	7920	0.2	<0.2	8.6	13		<0.4	<0.4			
5/3/02	Friday	W	0	0	50	<0.2	<0.2				<0.4	<0.4	<0.4	<0.4	<0.4
5/4/02	Saturday	W	0	302	144	<0.2	<0.2				<0.4	<0.4	<0.4	<0.4	<0.4
5/5/02	Sunday	SW	0	0	144	0.2	<0.2	1.7			<0.4	<0.4	<0.4	<0.4	<0.4
5/6/02	Monday	S	0	0	0	0.2	<0.2	3.8			<0.4	<0.4	<0.4	<0.4	<0.4
5/7/02	Tuesday	SE	0	0	0	<0.2	<0.2	4.3			<0.4	<0.4	<0.4	<0.4	<0.4
5/8/02	Wednesday	S	0	6540	0	<0.2	<0.2	5.7			<0.4	<0.4	<0.4	<0.4	<0.4
5/9/02	Thursday	W	0	0	0	<0.2	0.2	3.9			<0.4	<0.4	<0.4	0.4	<0.4
5/10/02	Friday	S	0	0	0	<0.2	<0.2	6.7			<0.4	<0.4	<0.4	<0.4	<0.4
5/11/02	Saturday	S/W	0	1331	225	<0.2	<0.2	<0.2			<0.4	0.4	<0.4	<0.4	<0.4
5/12/02	Sunday	W	0	1331	225	<0.2	<0.2	0.6			<0.4	<0.4	<0.4	<0.4	<0.4
5/13/02	Monday	W	0	197	0	<0.2	<0.2	7.3			<0.4	<0.4	<0.4	<0.4	<0.4
5/14/02	Tuesday	S	0	0	0	<0.2	<0.2	1.0			<0.4	<0.4	<0.4	<0.4	<0.4

All result concentrations are in nanograms per cubic meters (ng/m³).

NA = invalid sample

Hour in parentheses is sampling duration.

(C) = collocated sampler

MP = Master Plater (decorative chrome plating)

C&B = Carlson & Beauloye (hard chrome plating)

Limit of Detection for 24 hour sample = 0.2 ng/m³.

Limit of Detection for 12 hour sample = 0.4 ng/m³.

Limit of Detection for 8 hour sample = 0.6 ng/m³.

Shaded areas indicate no sample collected.

Table 11 (cont): Phase III-D - April 20-May 24, 2002 - Hexavalent Chromium Results

Date	Day	Wind Direction	MP Amp Hours	C&B Amp Hours		2121 Newton (24hr)	Alley (24hr)	MPIEXT Indoor (24hr)	MPIEXT Indoor (12hr)	MPIEXT Indoor (12hr night)	2168 Newton (12hr)	2196 Newton Pool (12hr)	2141 Main (12hr)	2141 Main Coll (12hr)	2191 Main (12hr)	
				Tank 1	Tank 2											
5/15/02	Wednesday	SSE	0			0.6	1.3	3.9			0.4	<0.4	<0.4	<0.4	<0.4	NA
5/16/02	Thursday	SSE	0			0.2	<0.2	2.0			<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
5/17/02	Friday	WSW	0			0.3	NA	11			<0.4	0.7	<0.4	<0.4	<0.4	<0.4
5/18/02	Saturday	S	0			<0.2	<0.2	2.3			<0.4	1.4	<0.4	<0.4	<0.4	<0.4
5/19/02	Sunday	SW	0			<0.2	<0.2	0.7			<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
5/20/02	Monday	W	0			0.5	0.4	8			<0.4	0.9	<0.4	<0.4	<0.4	<0.4
5/21/02	Tuesday	W	0			<0.2	<0.2	11			<0.4	0.4	<0.4	<0.4	<0.4	<0.4
5/22/02	Wednesday	W	0			<0.2	<0.2	0.8			<0.4	0.7	<0.4	<0.4	<0.4	<0.4
5/23/02	Thursday	SSE	0			<0.2	<0.2	1.6			0.8	<0.4	<0.4	<0.4	<0.4	<0.4
5/24/02	Friday		0			0.2	<0.2	2.5			<0.4	<0.4	<0.4	<0.4	<0.4	<0.4

All result concentrations are in nanograms per cubic meters (ng/m³).

NA = invalid sample

Hour in parentheses is sampling duration.

(C) = collocated sampler

MP = Master Plater (decorative chrome plating)

C&B = Carlson & Beauloye (hard chrome plating)

Limit of Detection for 24 hour sample = 0.2 ng/m³.

Limit of Detection for 12 hour sample = 0.4 ng/m³.

Limit of Detection for 8 hour sample = 0.6 ng/m³.

Shaded areas indicate no sample collected.

VII. Quality Control

Field and laboratory QC procedures are critical to ensuring that data collected are consistent, relevant, and defensible. The ARB's standard field and laboratory QC procedures were used for each phase of the project and are detailed in the SOPs contained in Appendix B.

A. Field Sampling

Field QC procedures are those activities performed on a routine basis in the field to ensure that samples are representative, accurate, and precise. During all phases of the Barrio Logan project, the following field QC procedures were performed unless otherwise noted in Section IX of this report.

1. Sampler Calibrations and Flow Checks

Calibrations and flow checks were conducted on air samplers using flow meters either certified or calibrated against a primary standard. Certification of a field flow standard involves a multi-point comparison in the laboratory against a primary flow standard traceable to the National Institute of Standards Technology (NIST), followed by least square regression analysis. Calibrations are similar to certifications except that a single comparison is made, rather than a multi-point, and the acceptable coefficient of determination is less strict. Details on flow standard certification and calibration procedures are available from the ARB's Quality Assurance Section. All meteorological equipment was calibrated prior to field deployment using NIST-traceable standards.

The ambient samplers were calibrated in the field using an NIST-traceable standard at least once during each phase of the study to verify the flow rate was 10 slpm. Calibration and certification information is contained in Appendix C.1, page 278.

2. Collocated Samples

Measurement precision is an important quality assessment attribute and was determined using side-by-side identical samplers (collocated) operated each day during Phases II and III at the Vacant Lot, and Phase III-D at 2141 Main Street. Each sampler was operated identically to the other following criteria set forth in 40CFR, Part 58 (i.e., within 4 meters of each other, but at least 1 meter apart to prevent airflow interference). Valid collocated results are shown in each Table of data from Phases II, III, and III-D and are summarized in Section XI of this report.

3. Trip Blanks

A trip blank is an unexposed filter that is used to indicate whether contamination occurred during transport and handling of the filters from the laboratory to the field and back. One trip blank per day was submitted for analysis along with the daily batch of field samples. All trip blanks were prepared and handled as regular sample filters and were found to be free of contamination (less than the limit of detection).

B. Hexavalent Chromium Analysis

Analysis of hexavalent chromium by ion chromatography (MLD 039) includes laboratory QC procedures such as the use of filter blanks, water blanks, spiked filters, and replicate analyses.

1. Calibration Curve

Four known standards were used to establish the linear regression calibration curve before samples were analyzed. The results of the analysis of the calibration curve must have a correlation coefficient of 0.950 or greater or else the standards are re-analyzed. If a sample was analyzed under an 'out-of-control' condition, the ion chromatographer was recalibrated and samples were re-analyzed. The calibration curve is run prior to field samples as well as after each 10 samples in the analysis run.

2. Filter Blanks

Filter blanks are unexposed filters that are extracted and analyzed along with each batch of field samples to monitor any contamination that may have been introduced. All filter blanks for this project were free of contamination (results below the LoD).

3. Water Blanks

Water blanks are samples of the nanopure water used to extract the sample set. They were analyzed with each set of extracted filters to test for contamination. All water blanks analyzed for this project were free of contamination (results below the LoD).

4. Laboratory Spikes

Laboratory spikes are samples prepared and analyzed to assess the analytical process, independent of any matrix effects (such as interferences that may be found in field samples). Measuring the recovery of a known sample in a controlled matrix or from a matrix-free sample is used to assess laboratory performance and the accuracy of the analytical process. For hexavalent chromium analyses, unexposed filters are prepared using standard techniques, then spiked with a known quantity of hexavalent chromium. Spiked samples are extracted and analyzed in the same manner as all field samples. Spikes were run with each sample batch extracted.

The measured concentration of laboratory spikes for the project were within the control limits of $\pm 20\%$ of the known concentration.

5. Replicate Analysis

Analytical precision is the agreement between replicate measurements of the same sample extract. Replicates were done at a rate of one per ten field samples. Relative percent difference (RPD) between results was calculated and all were within 20% of one another, which meets the <30% method criteria.

C. Metals Analysis

Metals were analyzed by ICP-MS. Laboratory QC procedures included analyzing calibration (reagent) blanks, rinse blanks, extraction (filter) blanks, and the use of calibration verification standards, internal standards, and post-digestion spikes. As with hexavalent chromium analysis, replicate analyses were run on ten percent of each sample batch.

1. Calibration (Reagent) Blanks

The calibration blank (reagent blank) is used to check for contamination during analysis. The solution is analyzed before and after analyzing each sample batch. The sample batch must be re-analyzed if either the pre-analysis or post-analysis blank results are greater than the LoD.

2. Rinse Blanks

Rinse blanks are used to flush the system between all samples and standards to prevent cross contamination.

3. Extraction Blank

The extraction blank (filter blank) is an extract created using an unexposed Teflon filter and the same reagents, solutions, and preparation procedures as the sample batch. This blank is used to monitor any contamination that may have been introduced during extraction procedures. An extraction blank is created and analyzed with each sample batch. Results must be less than the LoD for each element reported.

4. Calibration Verification (Standard Check)

A check of a mid-range standard is made every ten samples and after completion of the last sample in each batch. If the standard check is greater than $\pm 10\%$ of the expected value, re-calibration and sample reanalysis must be performed.

5. Internal Standards

Internal standards are compounds that analytically behave similarly to the target analytes. Internal standards are compounds not found in the sample but are added in equal amounts to the reagent blank, to the calibration standards, and to the samples. They are used to quantitate results and are used to correct for injection variability in mass spectrometer methods. The intensities of all internal standards must be monitored for every analysis. The internal standard intensities must register between 60 - 140% of the intensity of that internal standard in the initial calibration standard. Dilutions and/or corrective actions, as described in the SOP (Appendix B), must be made if outside the limits.

6. Post-Digestion Spikes

Post-digestion spikes are added to an aliquot of a prepared extract or its dilution. The spike amount recovered upon analysis must be within 80 - 120% of the known value, based on the original concentration of each element of interest in the sample. Every batch of 40 or fewer samples includes a low and high spike for analysis.

Details on analytical procedures for hexavalent chromium (MLD 039) and total metals analyses (MLD 061) may be found in Appendix B.

VIII. Laboratory Results

MLD’s Inorganic Laboratory Section (ILS) staff performed analyses for all hexavalent chromium and metals using ion chromatography and ICP-MS, respectively. All concentration data were reported in units of nanograms per cubic meter (ng/m³). ILS staff performed corrective actions as needed prior to submitting data to OPAS staff per the method procedure. Data were peer reviewed by ILS staff and also reviewed by OPAS staff.

Sampling locations and durations are noted in the column headers of each table of results. Shaded areas of the tables represent instances where no sample was collected on that day. "NA" indicates invalid data that have not been reported.

IX. Data Quality Objectives

Data quality objectives (DQOs), as in any ambient air sampling work, were identified prior to the study to ensure the data from this study are of sufficient quantity and quality to meet the quality objectives and users needs.

DQOs for the Barrio Logan project originally focused on meeting the data needs for reassessment of the hexavalent chromium Air Toxic Control Measure (ATCM) for chrome plating facilities. However, the DQOs evolved from the initial Phase I work and later focused on providing SSD and other ARB client Divisions the data necessary to evaluate the neighborhood residents’ exposure to the high ambient levels of hexavalent chromium observed in December 2001 (Phase II).

The DQOs required best practices and rigid quality goals. Strict adherence to those goals enabled the data to be used for other purposes as well, including modeling and inventory evaluation.

Table 12: Data Quality Objectives

Parameter Measured	Goal	Achieved
Accuracy (% difference in flow)	10%	8.3% or less
Precision (average RPD)	20%	7.5%
Completeness – Hexavalent Chromium	75%	98% (see Table 15)
Completeness - Metals	75%	94% (see Table 15)

The following is a description of key field and laboratory measurement objectives used throughout the Barrio Logan project to generate the quantity and quality of data needed by the clients.

A. Sampler Precision and Accuracy

Accuracy is defined as the extent of agreement between an observed value and an accepted reference standard. For this project, the accuracy of field samplers is described as the percent difference between the flow transfer standard (reference) and each sampler's indicated flow.

Results of field flow checks using a certified or calibrated transfer standard are shown in Appendix C. All samplers differed by 8.3 percent or less which met the goal of $\pm 10\%$.

Precision is the degree of mutual agreement among individual measurements made under prescribed conditions. Precision for manual sampling methods is obtained by operating collocated samplers at selected sites. For each pair of collocated samplers, one is designated as the primary sampler and is used to report air quality for the site. The other is designated as the collocated sampler. The differences in the measured concentration between the two collocated samplers are used to calculate and assess the precision of the monitoring data.

For the Barrio Logan project, collocated samplers were placed at the Vacant Lot during Phases I, II, III and III-D. Considering only valid hexavalent chromium sample pairs, there were 11 collocated pairs collected during Phase II, 32 during Phase III, and 22 for Phase III-D. For all phases in which collocated samples were collected, the RPD between the primary and collocated results varied. Fifty-eight of 66 valid sample pairs (88 percent) had a RPD of zero. Among those samples with RPDs greater than zero, the average was 52. The average RPD for all collocated pairs collected was 6.3. This met the project requirements for precision.

Table 13: Collocated Sampler Results – Hexavalent Chromium at 2141 Main

Date	Primary Result	Collocated Result	RPD	Date	Primary Result	Collocated Result	RPD
5/3/02	<0.4	<0.4	0	5/14/02	<0.4	<0.4	0
5/4/02	<0.4	<0.4	0	5/15/02	<0.4	<0.4	0
5/5/02	<0.4	<0.4	0	5/16/02	<0.4	<0.4	0
5/6/02	<0.4	<0.4	0	5/17/02	<0.4	<0.4	0
5/7/02	<0.4	<0.4	0	5/18/02	<0.4	<0.4	0
5/8/02	<0.4	<0.4	0	5/19/02	<0.4	<0.4	0
5/9/02	<0.4	0.4	67	5/20/02	<0.4	<0.4	0
5/10/02	<0.4	<0.4	0	5/21/02	<0.4	<0.4	0
5/11/02	<0.4	<0.4	0	5/22/02	<0.4	<0.4	0
5/12/02	<0.4	<0.4	0	5/23/02	<0.4	<0.4	0
5/13/02	<0.4	<0.4	0	5/24/02	<0.4	<0.4	0

Table 14: Collocated Sampler Results – Hexavalent Chromium at Vacant Lot

Date	Primary Result	Collocated Result	RPD	Date	Primary Result	Collocated Result	RPD
12/03/01	<0.2	NA	NA	2/15/02	<0.2	<0.2	0
12/04/01	<0.2	<0.2	0	2/16/02	<0.2	<0.2	0
12/05/01	<0.2	<0.2	0	2/16/02	<0.2	<0.2	0
12/06/01	<0.2	<0.2	0	2/17/02	<0.2	<0.2	0
12/07/01	3.6	3.2	12%	2/18/02	<0.2	<0.2	0
12/08/01	<0.2	NA	NA	2/19/02	<0.2	<0.2	0
12/10/01	<0.2	<0.2	0	2/20/02	<0.2	<0.2	0
12/11/01	<0.2	<0.2	0	2/21/02	0.4	0.4	0
12/12/01	<0.2	<0.2	0	2/22/02	0.2	<0.2	67%
12/13/01	<0.2	<0.2	0	2/23/02	<0.2	<0.2	0
12/14/01	<0.2	<0.2	0	2/24/02	<0.2	<0.2	0
12/15/01	<0.2	<0.2	0	2/25/02	<0.2	<0.2	0
12/17/01	<0.2	<0.2	0	2/26/02	<0.2	<0.2	0
2/5/02	0.3	0.3	0	2/27/02	<0.2	<0.2	0
2/6/02	<0.2	<0.2	0	2/28/02	0.7	0.4	55%
2/7/02	<0.2	<0.2	0	3/1/02	<0.2	<0.2	0
2/8/02	<0.2	<0.2	0	3/2/02	<0.2	<0.2	0
2/9/02	<0.2	<0.2	0	3/3/02	<0.2	<0.2	0
2/10/02	0.2	<0.2	67%	3/4/02	<0.2	<0.2	0
2/11/02	0.3	0.3	0	3/5/02	<0.2	<0.2	0
2/12/02	<0.2	<0.2	0	3/6/02	<0.2	<0.2	0
2/13/02	<0.2	<0.2	0	3/7/02	0.3	0.5	50%
2/14/02	0.3	<0.2	100%	3/8/02	<0.2	0.2	67%

B. Representativeness

Representativeness for this project refers to how well the sampling design captures the hexavalent chromium concentrations in the monitoring area, and therefore represents the exposure of residents in the community. All sampling sites were near the chrome plating facilities or at residences in order to meet the definition of representativeness.

Samplers located at 2121, 2144, 2152, and 2168 Newton Avenue and the Vacant Lot were positioned on tripods with the sampler inlet approximately 2 meters above ground level. Limited space and security considerations required placing those samplers at the Mercado Apartments, the Pool, the Alley, and those samplers on Main Street atop buildings or other structures. All samplers were within the 2-7 meter range above the ground as required for particulate matter samplers. Air mixing within that range is considered thorough enough to ensure that sampled air is representative of the exposure experienced by receptors.

C. Completeness

Data are complete if a stated percentage of the intended measurements were obtained. The target number of valid samples (including collocated samples) is prescribed in the

monitoring protocol for each event. They ensure the measurements span a comparable period of time and thus can be compared directly, or that an adequate number of samples were collected at a site to generate meaningful statistics. A minimum of 75 percent of the intended number of valid samples was required to satisfy the data completeness objective. If less than 75% valid samples were obtained during any monitoring event for this project, make-up runs were to be conducted until a sufficient number of samples were obtained to meet a satisfactory level of data completeness. For purposes of this project, valid samples were defined as samples that met criteria for sampler calibration, filter preparation, sample collection and review, DQOs, and laboratory analysis.

All individual events had completeness greater than the required 75% as shown in Table 15. The overall completeness for hexavalent chromium was 98% and 94% for metals.

Table 15: Sampling Completeness

Monitoring Event	Expected Number of Hexavalent Chromium Samples	Number of Valid Hexavalent Chromium Samples	Percent Completeness (Hexavalent Chromium)	Expected Number of Metals Samples ¹	Number of Valid Metals Samples	Percent Completeness (Metals)
Phase II	91	87	96	0	0	NA ²
Phase III	324	317	98	106	102	96
Phase III-A	78	77	99	28	22	79
Phase III-B	24	24	100	12	12	100
Phase III-C	153	150	98	58	55	95
Phase III-D	248	242	98	0	0	NA
TOTAL	918	897	98	204	191	94

¹Airborne metals samples consisted of a single filter analyzed for seven different metals. ²Not applicable.

D. Comparability

Data are comparable if they are collected using the same sampling protocols and analytical methods. Comparability among sample sets for this project required that the same sampling methods and procedures, analytical techniques, and reporting units be used during each phase of sampling.

All samples were assessed qualitatively to determine if data collected during each event were comparable with one another. All events were deemed comparable in that they employed the same sampling procedures, analytical techniques, and reporting units. Slight modifications in the LoD were made based on sampling duration and subsequent volume of air collected.

E. Coincident Sampling

A sample is defined as coincident if it is collected on the same day with start and end times within two hours of the coincident sample. Coincident sampling is intended to ensure comparability with other samples collected during the project.

Samplers were run coincident during Phases I and II. As the number of samplers deployed increased with Phase III, start-times for the 24-hour samplers were increasingly delayed on each successive sampling day due to the time required to change filters and download sampler data for each sampler. The lag time resulted in the start-time of some 24-hour samplers delayed with respect to other 24-hour samplers. To correct the delay and ensure all samplers had the same start-time, 24-hour samplers were run for 23 hours. The extra hour of non-operation enabled field staff to perform filter change-outs and download data and maintain a consistent start time at all 24-hour sampling sites.

X. Field Observations

Activities other than plating at each of the chrome plating facilities were suspected of having a major impact on the ambient hexavalent chromium and metals concentrations in the neighborhood. To enhance data usability and assess these activities with respect to ambient readings of hexavalent chromium and metals, field personnel from ARB and SDCAPCD recorded cleaning, painting, and construction activities, particularly after the March 24 chrome plating shutdown at Master Plating. Other activities in the neighborhood that may have resulted in high ambient readings through a known or unknown cause were also recorded.

Activity information is contained in Appendix C.4, page 507.

XI. Modifications to Sampling Protocols

Summarized below are operational departures from the sampling protocols written for Phase II, III, and III-A through III-D. Modifications to the Phase I sampling protocol are not described since those data were invalidated. In addition to the changes described below, several additional sites and sampling intervals were added during the course of the project. These additions are described in Section IV of this report.

Sampling protocols used for the project are contained in Appendix A.1 through A.3, pages 1-87.

A. Phase II

Phase II was intended to repeat Phase I in terms of sampling sites, duration, etc. During Phase I sampling several modifications were made after the project began and those changes were implemented in Phase II.

One primary and one collocated sampler were placed at the Vacant Lot rather than at the Barrio Station Youth Center as initially proposed.

Field calibrations of samplers were not performed as originally specified. Flow checks were performed instead using a calibrated field flow meter.

B. Phase III

Sampling was extended to March 8 from the original end date of February 26, 2002. Sampling was later extended from March 8 through the end of March, April, and through May 24, resulting in Phases III-A, -B, -C, and -D.

C. Phase III-A

A modified sampling schedule on Fridays, Saturdays and Sundays was employed to assist in identifying the source of elevated hexavalent chromium levels on days and at times when chrome plating was not occurring. The schedule is detailed in Section IV.

D. Phase III-B

No significant modifications were made from the planned sampling during Phase III-B.

E. Phase III-C

On March 31, filters designed for metals sampling were inadvertently used with ARB samplers located within Master Plating to collect hexavalent chromium samples. Therefore, there are no indoor hexavalent chromium data for March 31. Metals results have been reported for that day although sampling for metals within Master Plating was not originally scheduled for March 31.

F. Phase III-D

No met data was recorded from April 27 through May 6 due to equipment malfunction. Daily wind direction information for those days was provided by SDCAPCD from 24-hour vector readings obtained from nearby network monitoring sites.

XII. Summary of Results and Findings

The approach taken called for sample results to be assessed as they were received. This resulted in a dynamic network evolution. The goal of determining neighborhood ambient concentrations of hexavalent chromium grew to include determining the specific cause of high readings. By changing the duration and location of samplers we were able to identify the predominant source of the hexavalent chromium emissions. Monitoring on a neighborhood scale provided a wealth of information that the statewide monitoring network could not.

The most significant results and findings from monitoring in Barrio Logan that helped pinpoint the hexavalent chromium source are indicated below.

- Master Plating was usually closed on Saturdays and Sundays and chrome plating was rarely performed on Mondays and Tuesdays. Indoor concentrations at Master Plating increased throughout the week relative to plating operations. Likewise,

Master Plating indoor hexavalent chromium to total chromium ratio (%Cr6) was elevated on Mondays. There were also elevated hexavalent chromium levels on Mondays at 2121 Newton Avenue with similar %Cr6 patterns as at Master Plating. This apparent inconsistency, referred to as the Sunday-night-Monday-morning phenomenon, was attributed to cleaning and other activities performed inside Master Plating on Monday mornings that entrained hexavalent chromium inside that impacted the neighbors.

- With the exception of the point above, high ampere hours at Master Plating, indicative of active plating, coincided with high indoor concentrations at Master Plating. See Figure 11.
- Meteorological data confirmed that 70 percent of the time the winds were from the west. High ampere hours at Master Plating corresponded to high hexavalent chromium concentrations at 2121 Newton when winds were from the west. When there were high indoor concentrations at Master Plating and predominantly west winds, there were high ambient concentrations at the 2121 and 2152 Newton Avenue sites. Concentrations at 2121 Newton Avenue were less than 1 ng/m³ when winds were from the south, even with high amp-hours and/or high indoor concentrations at Master Plating. See Figures 12 and 13.
- Results of source testing showed that C&B had appropriate controls in place and was not contributing to the high levels of hexavalent chromium exposure in the neighborhood, as did Master Plating.
- There was no clear statistical relationship between ampere hour readings at C&B and hexavalent chromium concentrations at 2121 Newton. See Figures 14, 15 and 16.
- High %Cr6 ratios indoors at Master Plating corresponded to days with high amp-hours (chrome plating activity). On west wind days the %Cr6 at 2121 Newton Avenue was similarly elevated. Alternately, the %Cr6 was low at 2121 Newton Avenue when winds were from the south, even though amp-hours and Master Plating indoor %Cr6 was high. See Figures 17 and 18.
- There was a positive correlation between the metals concentrations at Master Plating and 2121 Newton Avenue for both iron and nickel on west wind days beyond statewide background levels. (Figures 19 and 20) This comparison associates Master Plating with impacts at 2121 Newton Avenue using measures other than hexavalent chromium. Nickel is used in the decorative plating process at Master Plating but not with the hard plating process at Carlson and Beauloye.
- On 95 percent of the sampling days (between February 5th and May 24th), the hexavalent chromium concentration at 2121 Newton Avenue was higher than at any of the five other ambient sites in the neighborhood. The variation in concentrations at the ambient sites (high at 2121 Newton Avenue and significantly lower at the

other sites) suggested a local source of hexavalent chromium in proximity to 2121 Newton Avenue.

- Chrome plating stopped on March 25th at Master Plating and indoor and outdoor concentrations dropped. Occasionally there were elevated hexavalent chromium concentrations at 2121 Newton Avenue after closure of the plating operation, but they were specifically on days when cleaning and construction activities were being conducted at Master Plating.
- Hexavalent chromium concentrations were reduced indoors at Master Plating from an average of 83.6 ng/m³ (33 sample results) during active plating to 5.9 ng/m³ (34 sample results) after the chrome plating shutdown. This represents a 93 percent reduction. Ambient hexavalent chromium concentrations were reduced from an average of 0.78 ng/m³ at 2121 Newton Avenue during active plating at Master Plating to 0.2 ng/m³ (LOD = 0.2 ng/m³) after the chrome plating activity at Master Plating stopped. This represents a 74% reduction or 85% of the maximum possible reduction (maximum possible reduction is 87% due to analytical instrument sensitivity). See Figures 21 and 22.

XIII. Future Studies

Valuable information regarding planning for neighborhood scale monitoring studies was obtained from this project. This project started as a neighborhood exposure study and evolved into a diagnostic study due to the real-time data analysis and the results found. The information resulted in an ever-changing sampling scheme that was made possible by the flexibility of staff and equipment. These changes enhanced the data collection and provided information that led to significant changes in the neighborhood and its exposure to hexavalent chromium.

Suggestions for planning future studies based on lessons learned at Barrio Logan include aspects of network planning, community involvement, data analysis and data release as follows:

- Involve the local air district early.
- Identify the purpose or hypothesis early and with as much agreement as possible from agencies and stakeholders.
- Identify secondary objectives.
- Design the sampling network with defined sample duration and frequency using approximately 3-5 monitoring sites at exposure locations, 2-4 monitoring sites at source-oriented locations, and 1-2 background sites. Review inventories and models to support the network design.
- Develop appropriate, detailed protocols to address monitoring, data analysis and data transmittal, but plan to be flexible and issue protocol updates as needed.
- Use rigid chain-of-custody procedures and assume litigation potential.
- Review literature for similar work and refer to statewide network data for background information.

- Develop internal and external data analysis groups.
- Determine compliance of source/facility(s) with all relevant permits.
- Track all relevant source activity information to explain data.
- Establish a community/interagency working group early.
- Interact with residents as well as community representatives.
- Involve residents in gathering information (provide cameras, notebooks, etc.).
- Provide timely and easily understood summaries of results.
- Update web-based reference materials including community pages, protocols, fact sheets, data summaries, and SOPs.

Attachment 1
Data Evaluation Graphs
Figures 10 - 22

Figure 10: Hexavalent Chromium Concentrations at Master Plating

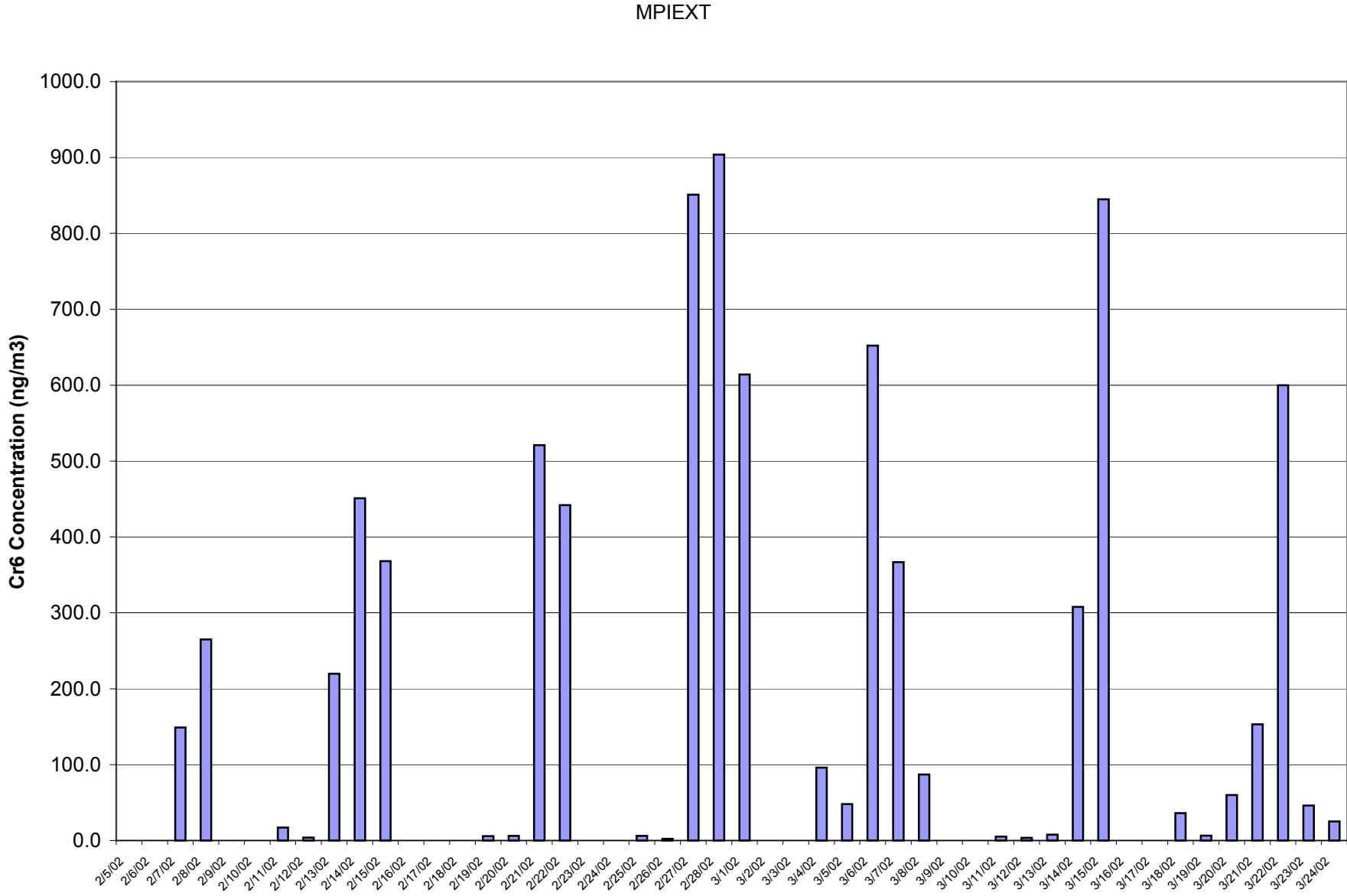


Figure 11: Indoor Hexavalent Chromium Concentration vs. Amp Hours

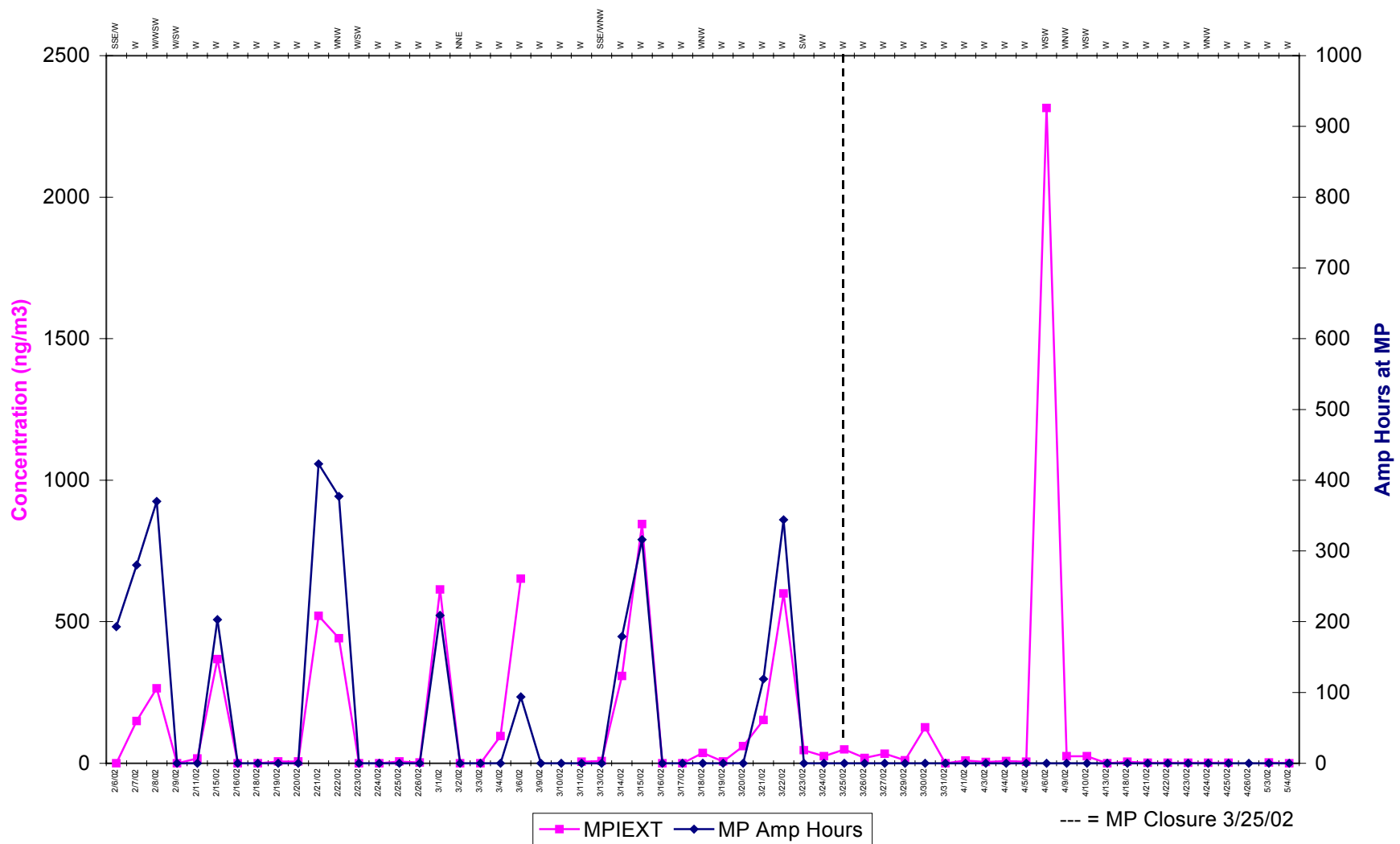


Figure 12: 2121 vs Indoor Hexavalent Chromium Concentrations

Hexavalent Chromium Concentrations on West Wind Days

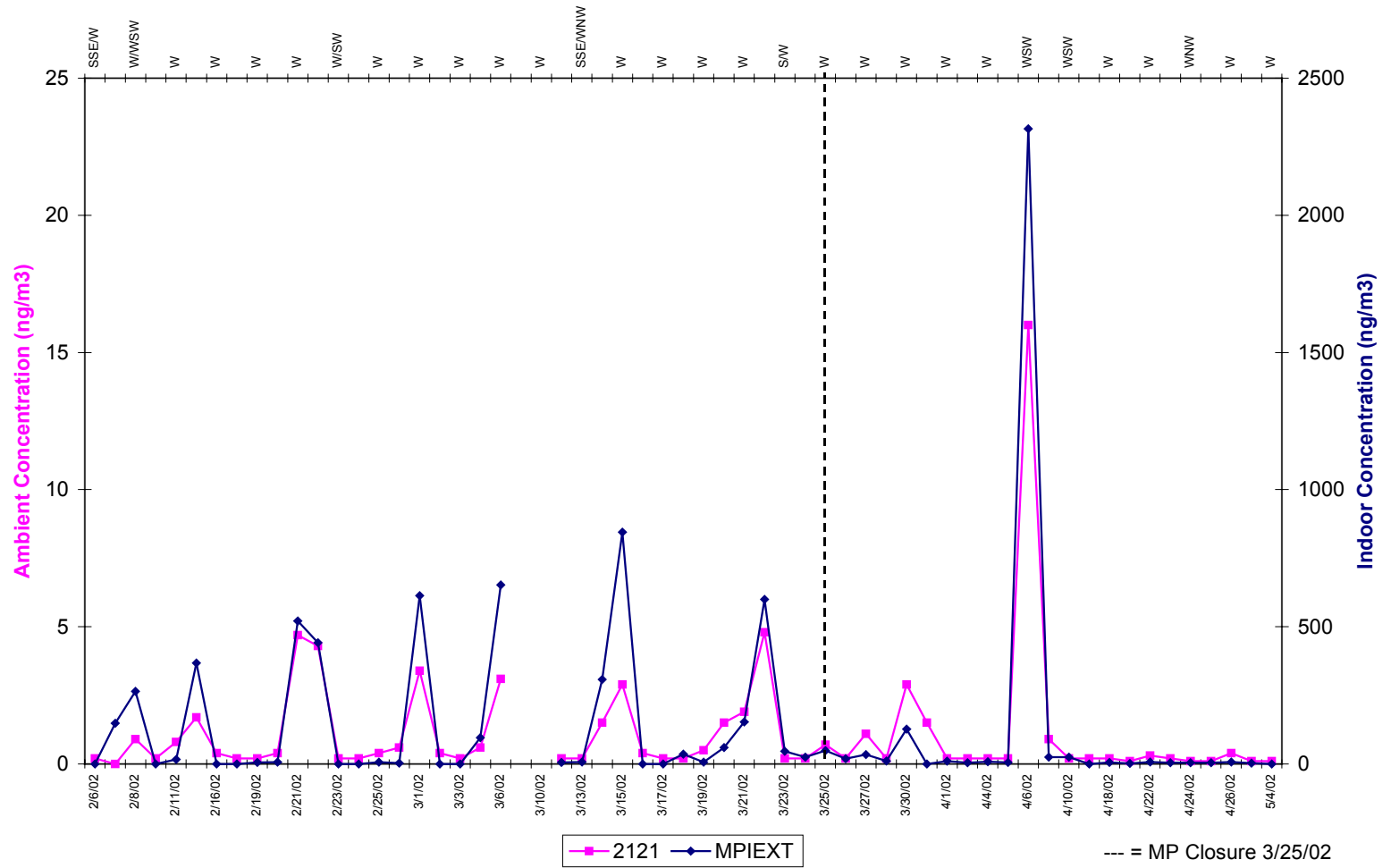


Figure 13: Indoor and Ambient Hexavalent Chromium Concentrations vs Amp Hours

12 Hour Cr6 Concentration vs Amp Hours

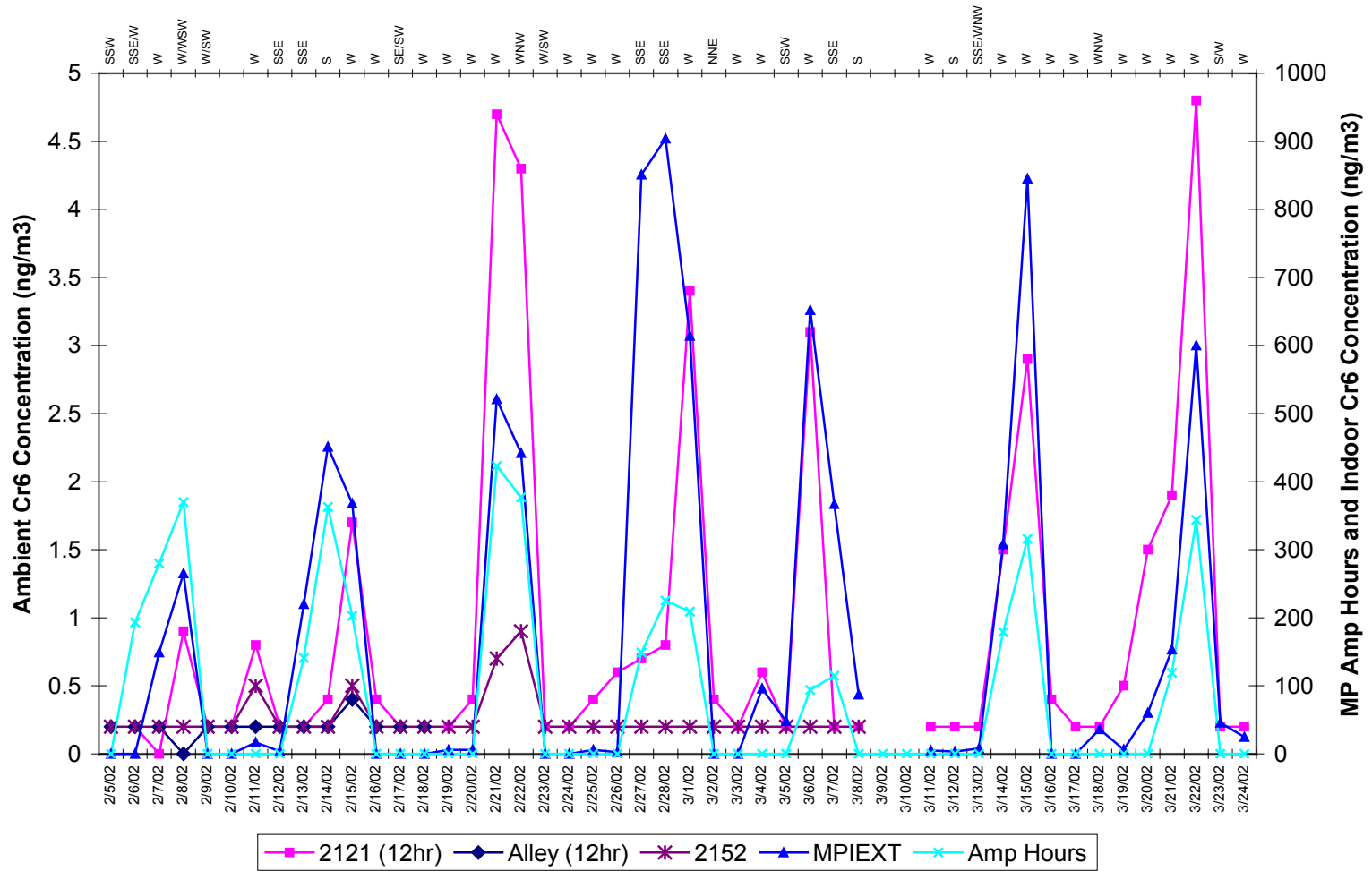


Figure 14: Amp Hours at Carlson & Beauloye

Totals for Tank 1 and Tank 2 Combined

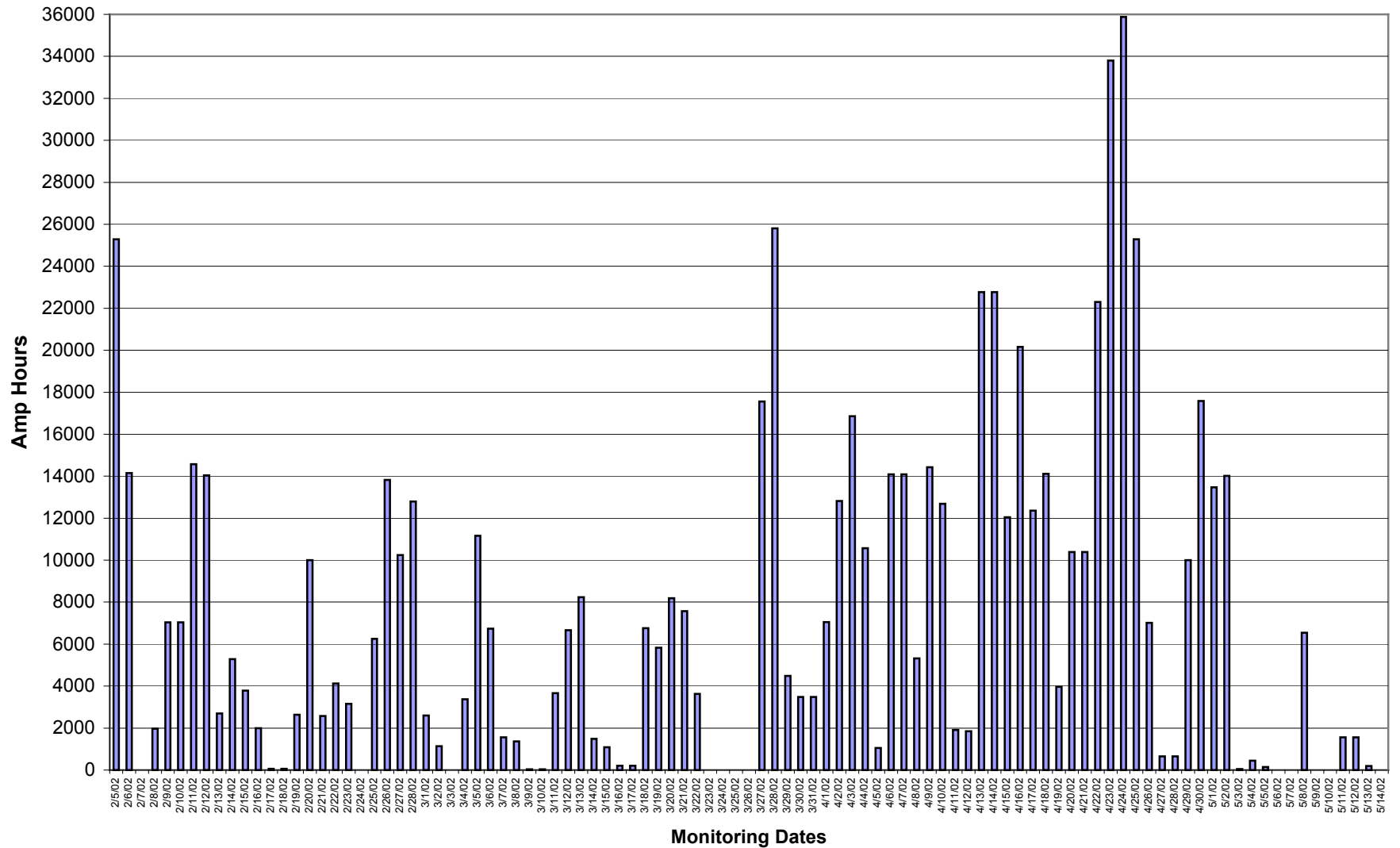


Figure 15: C&B Amp Hours vs. Hexavalent Chromium Concentrations at 2121 Newton (1)

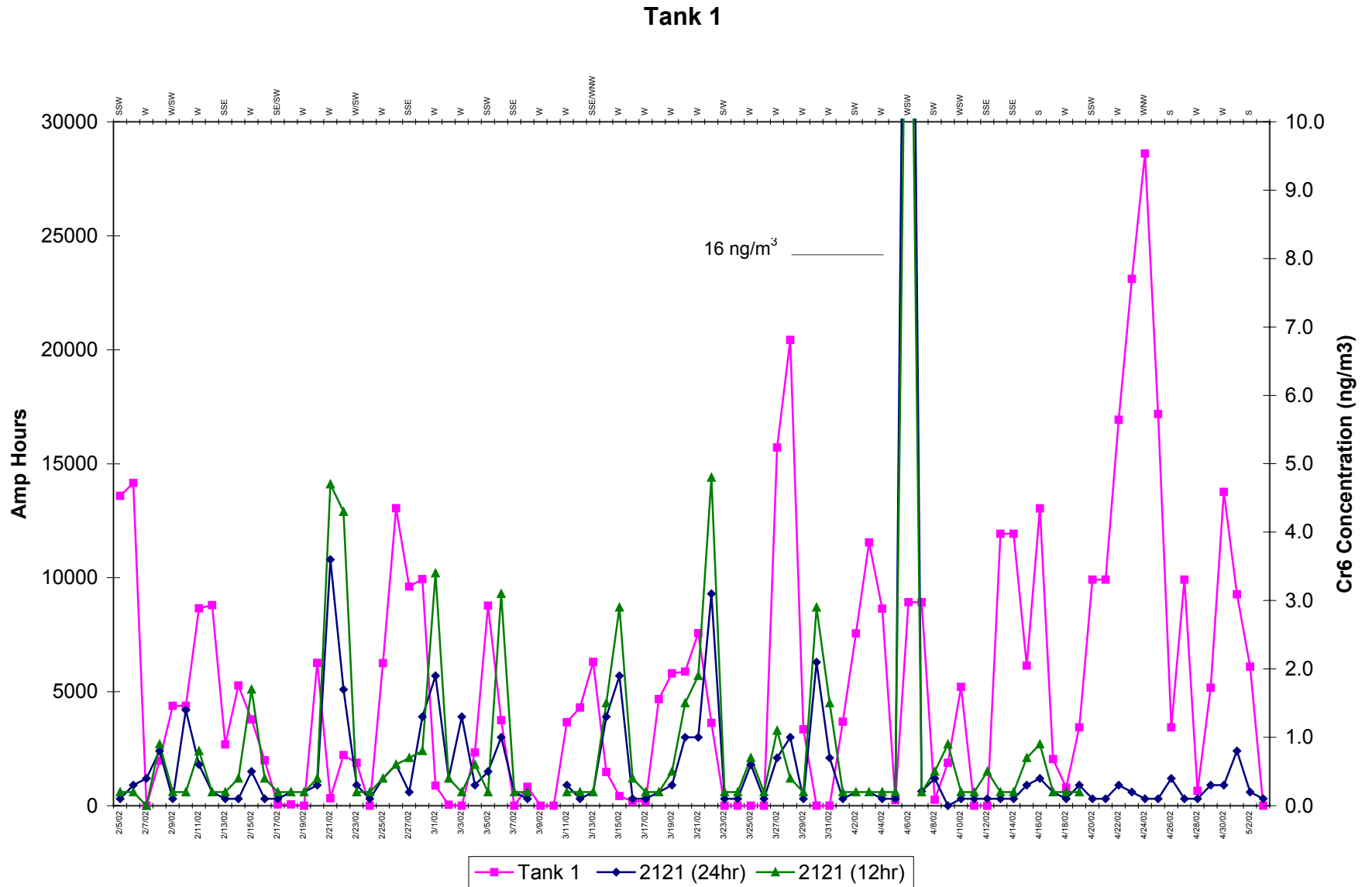


Figure 16: C&B Amp Hours vs. Hexavalent Chromium Concentrations at 2121 Newton (2)

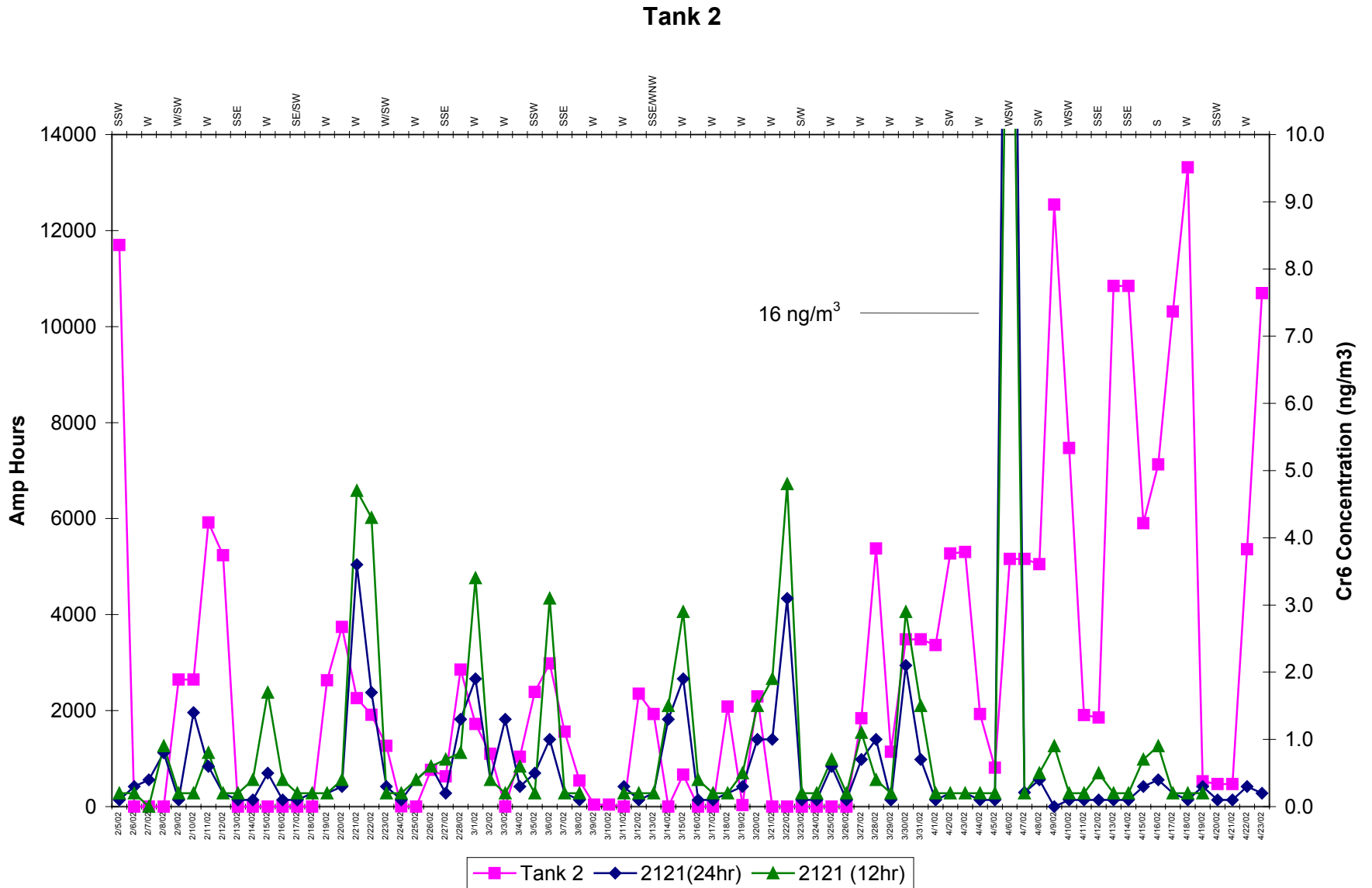


Figure 17: Ratio vs. Amp Hours at Master Plating

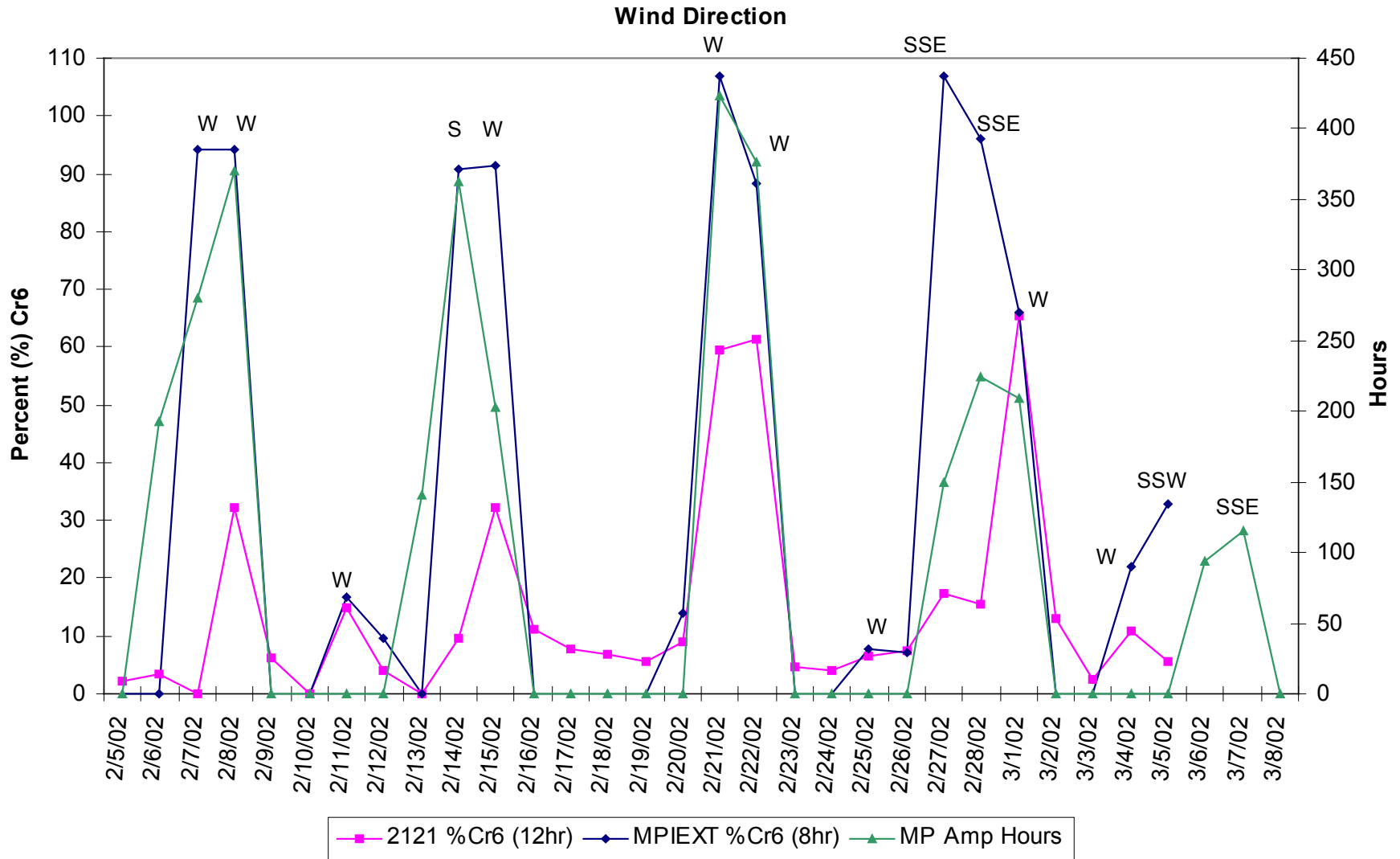


Figure 18: Hexavalent Chromium Ratio Comparisons on West Wind Days

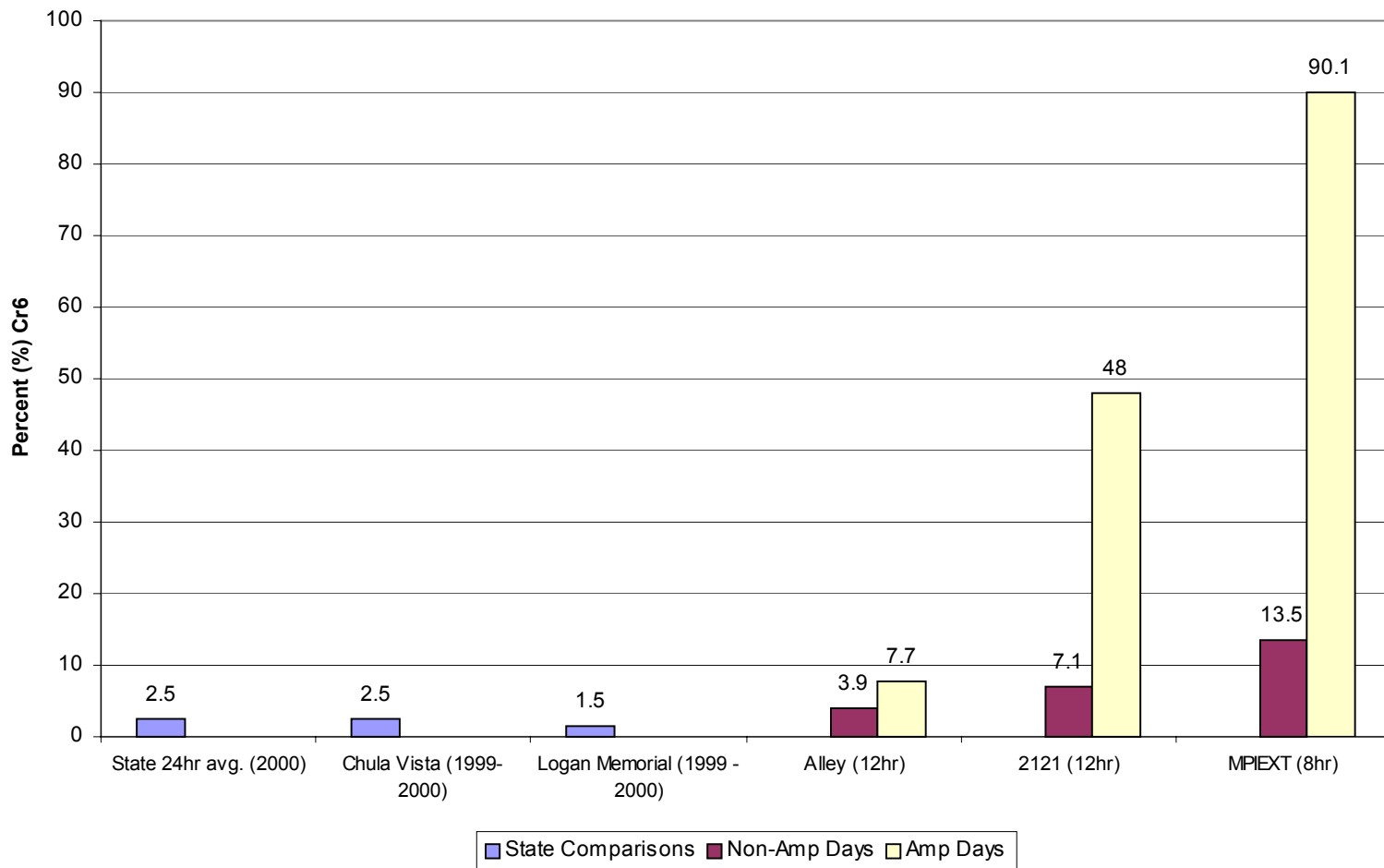


Figure 19: Iron Concentrations on West Wind Days

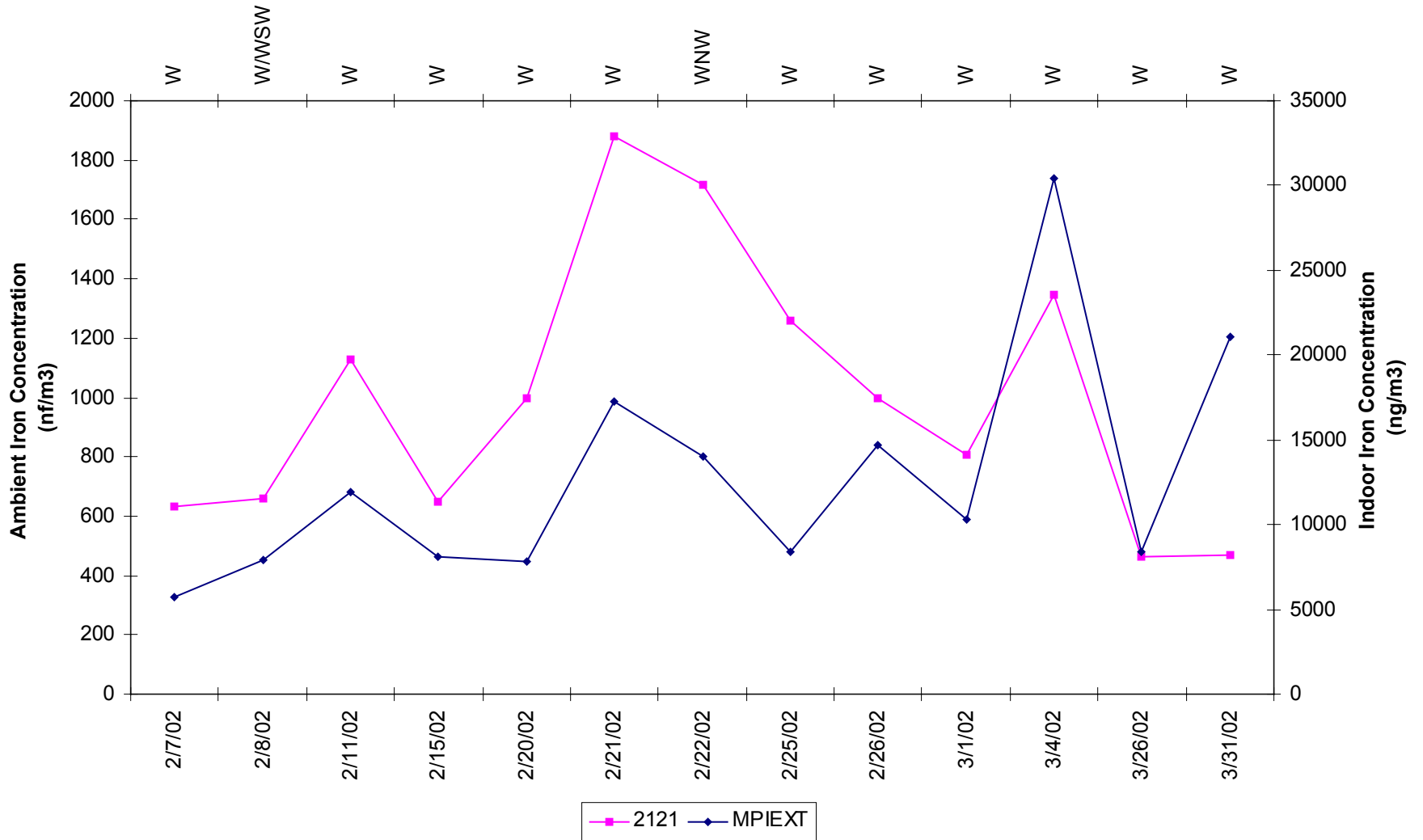
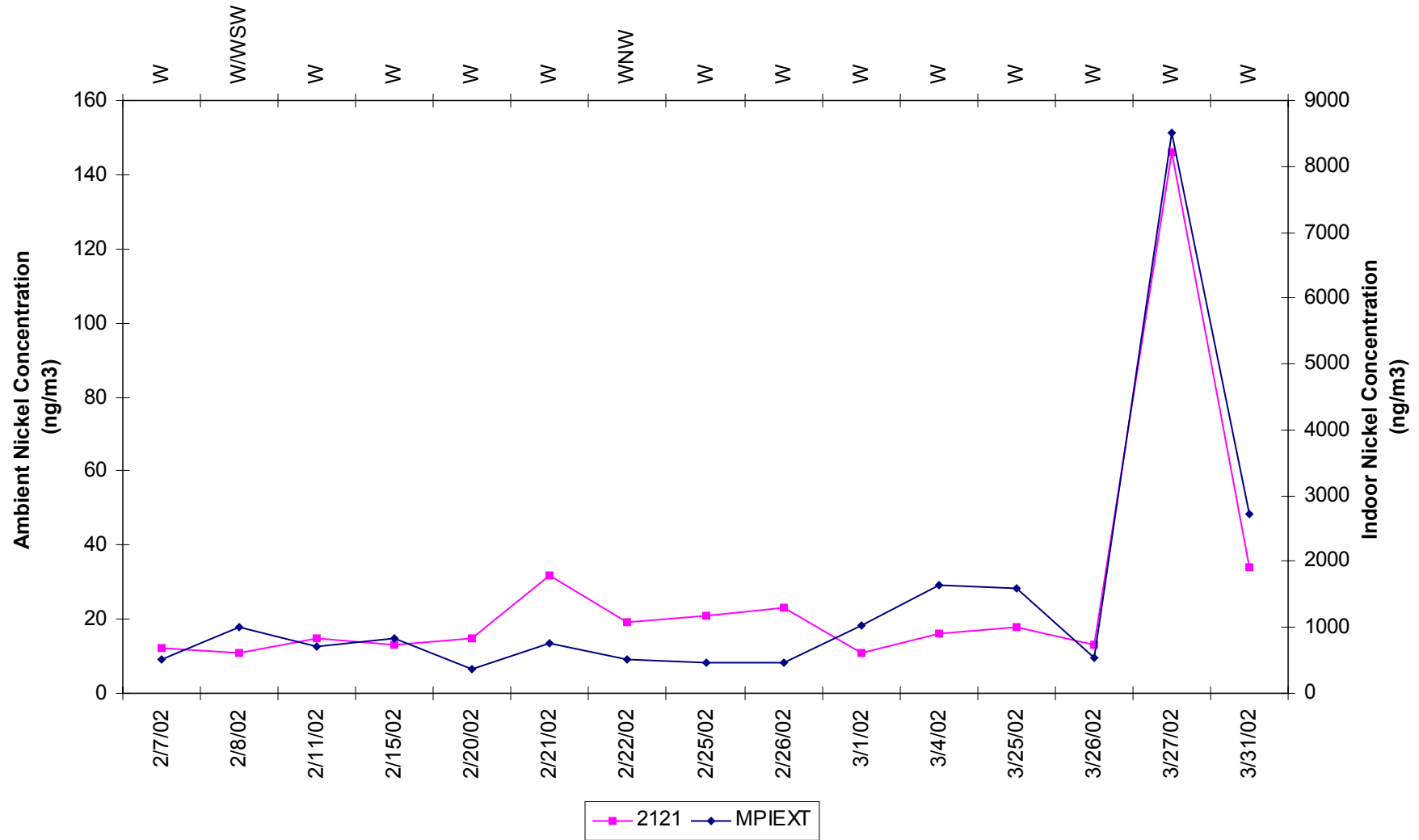


Figure 20: Nickel Concentrations on West Wind Days



Average Hexavalent Chromium Concentrations Before and After Master Plating Closure on West Wind Days

Figure 21: Hexavalent Chromium Reduction at Master Plating

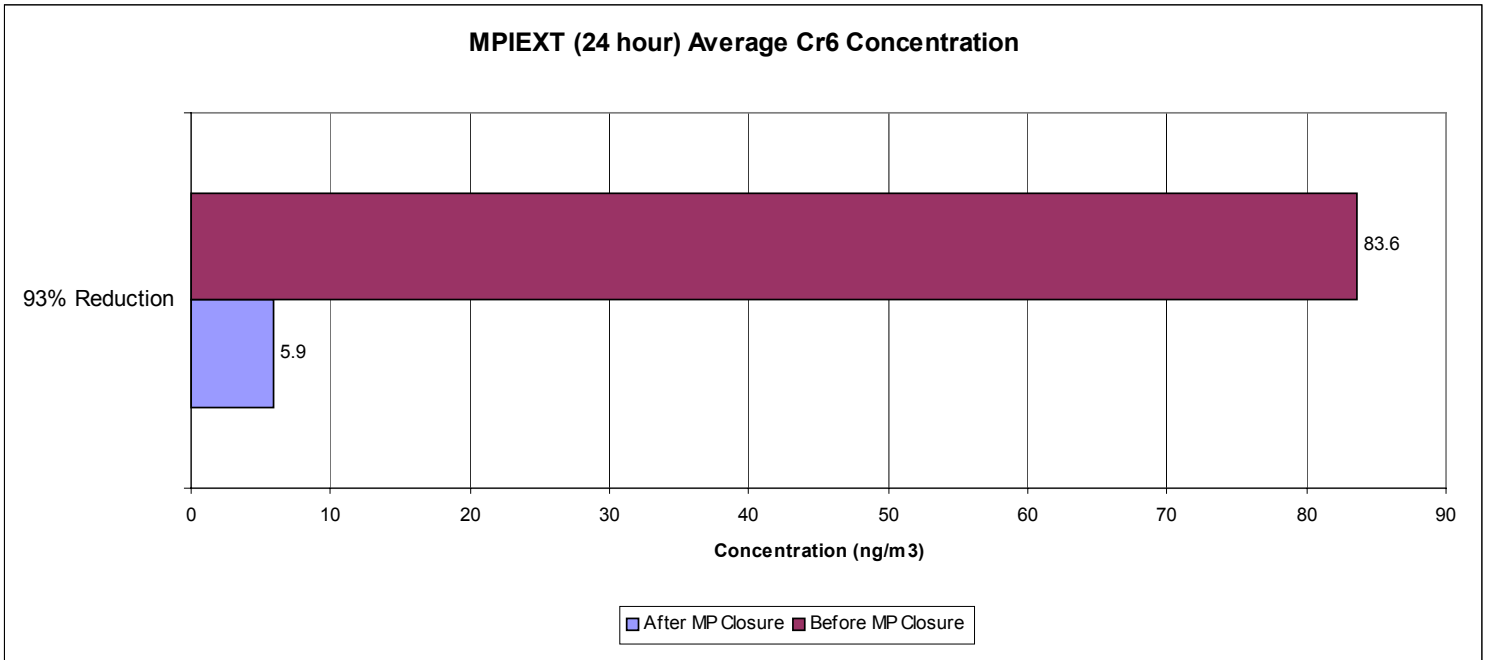
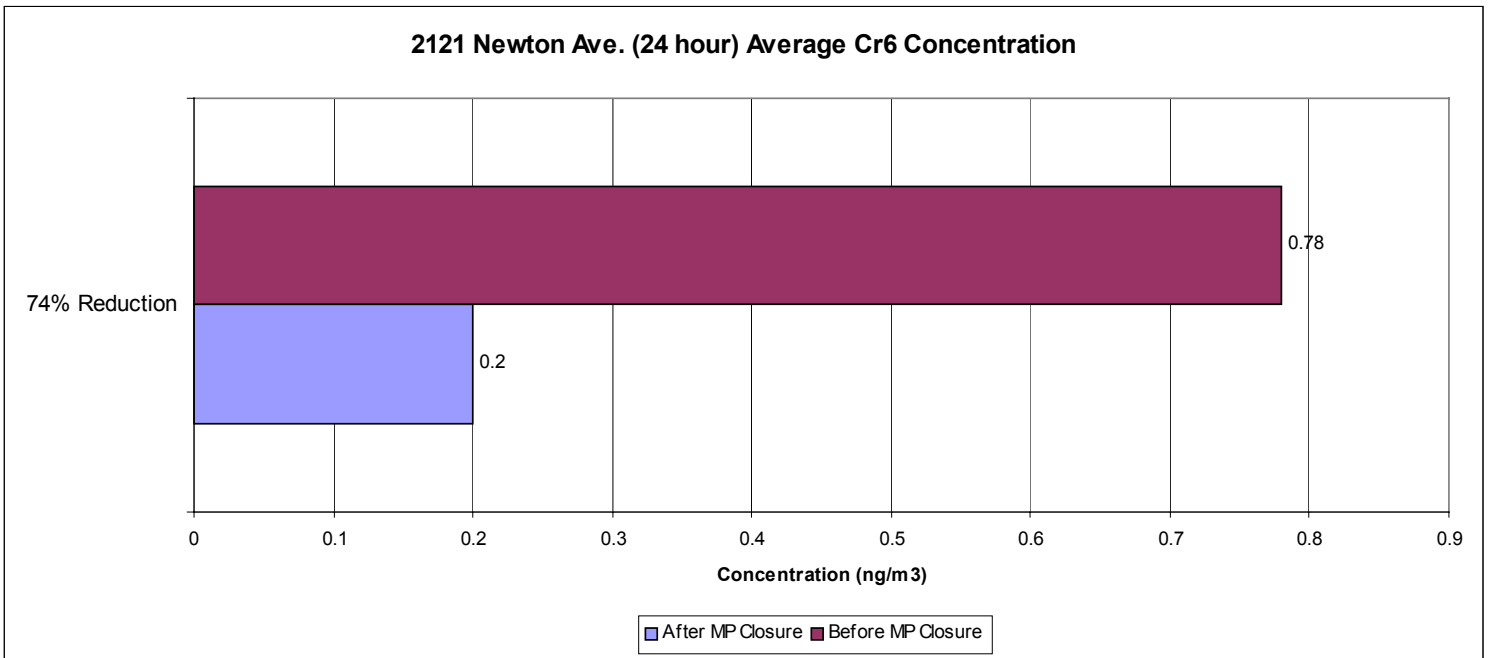


Figure 22: Hexavalent Chromium Reduction at 2121 Newton Avenue



Maximum reduction possible at 2121 Newton is 87% based on 1/2 LoD (LoD = 0.2 ng/m³). Therefore, actual reduction at 2121 Newton was 85% of maximum possible reduction.

**Attachment 2
Calculations**

1) Hexavalent Chromium Ratio

The hexavalent chromium ratios were calculated as follows:

$$\%Cr6 = (\text{Hexavalent} / \text{Total}) \times 100$$

Where: %Cr6 = percent hexavalent chromium ratio,
Hexavalent = hexavalent chromium concentration in ng/m³, and
Total = total chromium concentration in ng/m³

2) Concentration Conversion

The analytical concentration was converted to air concentration using the extract volume and the total volume of air sampled as follows:

$$\text{Conc. (ng/m}^3\text{)} = \frac{[\text{Extract Volume (mL)}] [\text{Extract Conc. (ng/mL)}]}{[\text{Total Air Volume Sampled (m}^3\text{)}]}$$

3) Hexavalent Chromium Level of Detection (LoD)

The relationship between the LoD in ng/mL and the LoD in air concentration units of ng/m³ is expressed as follows:

$$\text{LoD (ng/m}^3\text{)} = \frac{[\text{Extract Volume (mL)}] [\text{LoD (ng/mL)}]}{[\text{Flow Rate (L/min)}] [\text{Duration (hr)}] [60 \text{ min/hr}] [0.001 \text{ m}^3\text{/L}]}$$

Where:

Extract Volume = The volume of deionized water used for filter extraction. Per MLD 039, the extract volume is a constant 15mL.

LoD = The published limit of detection, 0.2 ng/mL of extract.

Flow Rate = Sampler flow rate.

Duration = Total hours of sampling.

4) Data Quality Objectives

- a) **Accuracy** - Accuracy is defined as the extent of agreement between an observed value and an accepted reference standard. For this project, the accuracy of field samplers is described as the percent difference between the

flow transfer standard (reference) and each sampler's indicated flow as shown below:

$$\% \text{Difference} = [(\text{Indicated} - \text{Reference}) / (\text{Reference})] \times 100$$

- b) **Precision** - Precision is the degree of mutual agreement among individual measurements made under prescribed conditions. Precision for manual sampling methods is obtained by operating collocated samplers at selected sites. For each pair of collocated samplers, one is designated as the primary sampler and is used to report air quality for the site. The other is designated as the collocated sampler. The differences in the measured concentration between the two collocated samplers are used to calculate and assess the precision of the monitoring data.

Precision is estimated as the relative percent difference (RPD) between a sample and collocated sample pair. RPD for collocated samplers is calculated as the absolute difference between two sample results divided by the mean of the two sample results:

$$\text{RPD} = (|x - y|) / ((x + y)/2)$$

Where x = measured concentration from primary sampler, and
 y = measured concentration from collocated sampler

As x and y approach the detection limit (e.g., 0.2 ng/m³ for 24-hour hexavalent chromium) the RPD becomes less significant.