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February 21, 2007
000029-02

Sean Sheldrake
Project Coordinator
U.S. EPA, Region 10
1200 Sixth Avenue, M/S ECL-111
Seattle, Washington 98101

Re: Gasco Long-Term Monitoring Approach – Year 0 Event 2 Data Summary Report

Dear Mr. Sheldrake:

Please find attached the Gasco Long-Term Monitoring Approach – Year 0 Event 2 Data Summary Report. Per the Monitoring and Reporting Plan (MARP; Anchor 2006), the sampling results are to be submitted to EPA in the form of a Data Summary Report (i.e., description of activities conducted and submittal of the data) no later than 30 days following receipt of the validated data.

Anchor Environmental, L.L.C. (Anchor) conducted the second round (herein referred to as Event 2) of long-term monitoring of the engineered pilot cap placed at the "Gasco" site (Site) in August and September of 2006. Anchor has received the laboratory data, conducted data validation to ensure the data quality objectives were achieved, and completed the attached Data Summary Report. This letter serves to supplement the required Data Summary Report in order to provide EPA with a preliminary assessment of the findings in relation to the removal action objectives (RAOs) and pilot cap monitoring objectives identified in the MARP (Anchor 2006), and in relation to the first round of monitoring in Year 0 (herein referred to as Event 1) data. Although such a data evaluation is not required, this letter presents a data evaluation because we believe the Event 2 results provide further evidence that the pilot cap monitoring objectives need to be modified to collect useful data for evaluating the potential effectiveness of capping as a long-term remedy at the Site.

Summary of Field Sampling Activities and Deviations

Anchor conducted the Event 2 monitoring from August 18 to September 1, 2006. Core sampling was conducted using the revised methods summarized in Appendix A of the Year 0 Event 1 Data Summary Report. The collection of surface depositional sediment, porewater (via the use

of a piezometer), and near-bottom surface water was conducted in accordance with the methods identified in the MARP (Anchor 2006).

Deviations encountered during the Event 2 monitoring included:

- Station PCM-07 was not reoccupied because the diver occupied a depression approximately 7 feet off-station that looked similar to the disturbance caused by armor layer removal at other stations. Due to the offset, the station was labeled PCM-18.
- As discussed in Appendix A of the Year 0 Event 1 Data Summary Report, four additional surface sediment samples were collected outside of the pilot cap area to document the sediment quality of recently deposited sediments surrounding the pilot cap area (stations PCM-14, PCM-15, PCM-16, and PCM-17). Each of these stations was within the area where fringe cover sand was placed. At station PCM-16, there was no clear layer of fringe cover sand underlying the collected silt; therefore, it is not possible to determine if the identified concentrations are due to recently deposited sediments versus underlying sediments that were not affected by the removal action.
- Due to insufficient cap thickness (i.e., 4 inches), pilot cap porewater was not collected at station PCM-10. Given the bathymetry survey did not show a zone of erosion in the vicinity of this sampling station, the lack of cap thickness is not attributed to cap erosion. In addition, the co-located core collected during the Year 0 Event1b sampling showed 11 inches of cap material, which indicates that cap thickness can vary significantly over short distances on the sloping cap area.
- As discussed in the cover letter submitted with the Year 0 Event 1 Data Summary Report, naphthalene was measured as a volatile organic compound (VOC; EPA Method 8260) during Event 2. NW Natural proposed this deviation to minimize potential volatilization of naphthalene during sample collection and processing.

In addition, although not a requirement of the MARP (Anchor 2006), small-volume passive peeper methods were used during the Year 0 Event 1 sampling to sample porewater from the pilot cap area. Given the measured porewater concentrations using the piezometer and passive peeper methods showed no discernible difference during the Year 0 Event 1 sampling, passive peeper methods were not used during Event 2 sampling.

RAO Results Evaluation – Year 0 Event 2

Evaluation of Physical Barrier Integrity and Stability

An evaluation of the pilot cap performance as a physical barrier to underlying residual contamination, as well as the pilot cap's integrity and stability following the approximately 9-month period following placement, was conducted through:

- A diver reconnaissance survey
- Bathymetry survey
- The collection of nine cores through the pilot cap

As discussed in the Year 0 Event 2 Data Summary Report, the diver reconnaissance survey consistently showed a layer of recently deposited sediment overlying the pilot cap and surrounding fringe cover. At regular intervals within the pilot cap area and fringe cover area, the diver noted the presence of pilot cap armor and fringe cover material, respectively, below the depositional layer. This indicates that the pilot cap was stable and the armor layer withstood potential erosion under the range of summer and winter river velocities encountered to date. This also indicates that the fringe cover material was placed with relatively little mixing with the underlying sediments and remained relatively stable without an overlying armor layer. In addition, the presence of the depositional layer within the removal action area indicates deposition (at least short term) occurs within the pilot cap area.

The core samples documented the thickness of the pilot cap layer throughout the pilot cap area approximately co-located with the Event 1 stations (except station PCM-18, which was offset approximately 7 feet off station from PCM-07). Each of the stations showed pilot cap thicknesses greater than the 12-inch design specification except stations PCM-09 (9 inches; 12 inches during Event 1), PCM-10 (4 inches; 10 inches during Event 1), and PCM-18 (10 inches; offset station PCM-07 pilot cap thickness of 8 inches during Event 1). Given that the Event 2 diver survey and bathymetry surveys confirm the pilot cap layer is stable and not eroding, the variations noted between the measured Event 1 and Event 2 cap thickness can be attributed to the spatial differences in cap thickness. Placement of the cap on the steep slope likely increased the spatial variability due to sloughing of the cap material during placement.

Potential Product Seepage Monitoring

As described in the MARP (Anchor 2006), a total of 11 cores were collected within the removal action area—nine within the pilot cap area and two within the hydraulic low spot created by the dredging just channel ward of the pilot cap area. No seepage of non-aqueous phase liquid (e.g., mobile phase tar oil or tar) was observable in any of the cores collected. In addition, no shoreline product seepage was identified during any of the visual monitoring events.

Long-Term Remedy Information

The pilot cap monitoring identified that the pilot cap and fringe cover design gradations are more than adequate for the range of physical conditions encountered since construction was completed in late October 2006. The relatively small mixing layer identified between the pilot cap layer and the underlying sediments coupled with the documented stability of the pilot cap layer and overlying armor layer indicates that a cap can be effectively placed with minimal mixing with underlying sediments and be maintained to physically isolate underlying sediments (at least during the river conditions so far encountered).

Pilot Cap Objective Results Evaluation – Year 0 Event 2

The pilot cap monitoring objectives were achieved through the collection of sediment cores, porewater samples from within the pilot cap, and near-bottom surface water samples. As identified in the Year 0 Event 2 Data Summary Report, detections of polycyclic aromatic hydrocarbons (PAHs) and benzene, toluene, ethylbenzene and xylene (BTEX) were identified in each of these media. Metals, total petroleum hydrocarbons (TPH), and pesticides were also detected in the pilot cap sediments. Each of these media contained concentrations at select sampling stations above available screening levels (see Year 0 Event 2 Data Summary Report Tables 2, 4, and 5).

Attachment A provides a comparison between the Event 2 and Event 1 chemical concentrations for each sampled media. Each of the tables represents the difference in concentration for each measured analyte in Event 2 compared to Event 1 (i.e., positive values indicate a higher concentration was identified during Event 2 sampling). (Consistent non-detections of BTEX compounds for the pilot cap sediment and discrete near-bottom surface water limited the utility of this type of comparison for BTEX compounds and they are not presented.) Note that comparisons were not made at the following stations for the following reasons:

- Station PCM-03 pilot cap sediments: during Event 1 the pilot cap layer showed two distinct layers, the overlying fringe cover material and underlying pilot cap sand. These two layers were sampled individually. During Event 2, these two layers were composited into a single sample. Note, the porewater concentrations identified during both events were compared since the piezometer was placed at the midpoint of the two cap layers for both events.
- Station PCM-07 (Event 1) and Station PCM-18 (Event 2) for all sampling media: these stations were offset approximately 7 feet so they are not considered co-located.

In general, the pilot cap sediment and porewater concentrations were similar for all stations between the two sampling events. Station PCM-04 consistently showed higher concentrations of PAHs in the pilot cap sediment and PAHs and BTEX in the porewater, whereas station PCM-09 consistently showed lower concentrations of these analytes in each media (Attachment A Figures A-1, A-3, and A-4). Given the limited data set, potential spatial variability associated with sampling offset locations (i.e., the stations are not truly co-located), and the opposite concentration trends noted above, it is difficult to determine whether the observed changes at stations PCM-04 and PCM-09 indicate some change in migration of chemicals from underlying sediments or are simply artifacts of the sampling variations.

The discrete near-bottom surface water concentrations for nearly all PAH analytes (majority of BTEX concentrations were non-detect) at all Event 2 pilot cap sampling stations were slightly elevated above the Event 1 concentrations (Attachment A Figure A-5). Although higher, the relatively elevated near-bottom surface water concentrations cannot be accurately correlated to the potential changes in the flux of chemicals through the pilot cap at this time due to the following:

- Near-bottom surface water PAH concentrations were not consistently the highest or lowest at stations PCM-04 or PCM-09, respectively.
- Insufficient data set.
- Differences in hydrological conditions between the Event 1 and Event 2 sampling periods.
- General variability associated with sampling discrete near-bottom surface water.

In general, the upstream (i.e., PCM-13, PCM-19, and PCM-20) and downstream (i.e., PCM-01) ambient stations showed slightly less near-bottom surface water PAH concentrations relative to the identified near-bottom surface water PAH concentrations in the pilot cap area. The limited data set prohibits an accurate evaluation as to whether this general trend can be associated with migration of chemicals out of the cap and into the water column. This trend was not exhibited during the Event 1 sampling.

Due to an error in laboratory analysis of the Event 1 semipermeable membrane device (SPMD) extracts, the Event 1 SPMDs required re-analysis and the calculated water concentrations were not provided in the Event 1 Data Summary Report. The Event 1 reanalysis was conducted concurrently with the Event 2 SPMD analysis and is presented in the Event 2 Data Summary Report. The laboratory concentrations (reported as nanogram per sample lipid bag) were input into the calculator spreadsheet (see Attachment A of the MARP [Anchor 2006]) using the calculated exposure adjustment factors (EAFs; see Attachment B) for the various performance reference compounds (PRCs; pyrene-d_{10} and phenanthrene-d_{10}) spiked into the SPMD lipid bags.

The calculated time-integrated near-bottom water concentrations for both the Event 1 and Event 2 sampling events are shown relative to the measured discrete near-bottom surface water concentrations and pilot cap porewater concentrations in Attachment A Figures A-6 through A-9. The time-integrated water concentrations were highly variable at each station depending on whether the calculations were conducted using the pyrene-d_{10} and phenanthrene-d_{10} EAFs. In addition, the concentrations showed considerable spatial variability depending upon which EAF was used. Given the calculated water concentrations are equally valid using either EAF, this variation makes it very difficult to accurately interpret the calculated concentrations. For the sake of completeness, the Event 2 Data Summary Report summarizes the calculated concentrations using both EAFs for the Event 1 and Event 2 sampling events.

For all Event 1 and Event 2 sampling stations, the calculated time-integrated water concentrations were lower when calculated using the pyrene-d10 versus phenanthrene-d10 EAFs (Attachment A Figures A-6 through A-9). Similar to the measured discrete near-bottom surface water concentrations, the Event 2 calculated time-integrated concentrations were elevated above the Event 1 calculated concentrations for nearly all PAH analytes at all sampling stations using either the pyrene or phenanthrene EAFs (Attachment A Figure A-10 and Figure A-11) and, in general, the upstream (i.e., PCM-13, PCM-19, and PCM-20) and downstream (i.e.,

PCM-01) ambient stations showed slightly less PAH concentrations relative to those identified in the pilot cap area. Both EAF calculations consistently showed slightly elevated concentrations of fluoranthene and pyrene relative to the other PAH analytes during Event 1 and Event 2. However, these elevated concentrations were not consistent across the various sampling stations using each EAF. In addition, the elevated concentrations were not observed in the co-located measured discrete near-bottom surface water and/or pilot cap porewater.

In summary, the pilot cap sediment and porewater data continue to suggest that groundwater is transporting PAH and BTEX analytes into the pilot cap and potentially contributing the bulk sediment concentrations observed there. The data collected do not facilitate determination of whether the identified chemicals are from upland groundwater sources and/or chemicals that are present in the underlying sediments and forced via groundwater advection out of those sediments and into the cap. The measurement techniques and/or the amount of data available do not allow a determination of whether a link exists between the observed pilot cap sediment and porewater chemical concentrations and observed discrete and time-integrated near-bottom surface water concentrations. The additional data collected during the Event 3 sampling may help in this determination, but it appears equally likely that these measurement techniques may never provide conclusive evidence of any linkage between porewater concentrations and surface water concentrations, even if one does exist.

Sediment Transport and Deposition – Depositional Surface Sediment

The identified depth of deposited sediment above the pilot cap area was similar to the Event 1 accumulation depths indicating that most of this material has not left the area. As shown in Attachment A Figure A-2, the Event 2 depositional surface sediment PAH concentrations at all stations within the pilot cap were elevated above the Event 1 PAH concentrations. The observed PAH concentrations do not correlate with the "co-located" underlying pilot cap sediment and porewater PAH concentrations.

The identified depth of deposited sediment and chemical concentrations surrounding the pilot cap in the fringe cover placement area (i.e., stations PCM-14, PCM-15, PCM-16, and PCM-17) were generally similar to those identified within the pilot cap area, indicating that the pilot cap sediment and porewater is not contributing to the observed surface sediment concentrations within the pilot cap area.

Capping Effectiveness as Site-Wide Remedy

The results continue to indicate that groundwater advection of chemicals into the pilot cap is likely contributing to cap chemical concentrations observed at the Site. Where high groundwater velocities exist and are not reduced by some type of upland groundwater control, capping will likely not be an effective remedy at the Site.

The physical properties of the pilot cap have remained stable during the range of flow conditions encountered, indicating that the design gradations are sufficient for capping

application over a broader area of the Site. Given that the fringe cap was also stable, this may indicate either that the cap armor is over-designed or that substantial velocities did not occur in this region of the river despite the relatively high winter flow conditions. Further cap stability monitoring will continue to observe the performance of the design gradations over a variety of river conditions.

Recommended Path Forward

The monitoring related to the RAOs indicated the cap placement and cap integrity achieved the design specifications and that no seepage of product was observed, thus meeting the RAOs. Cap stability monitoring (i.e., diver reconnaissance and bathymetry surveys), monitoring of the hydraulic low spot created by the removal action, and visual surveys of the removal action area will need to continue to be conducted to confirm continued compliance with RAOs until a Gasco site-wide remedy is determined. Due to the similarity of the Event 1 and Event 2 results, we continue to suggest that the pilot cap monitoring objectives and activities should be revisited to ensure that they focus on the collection of data that best support and inform the efficient performance of any anticipated long-term remedial actions. We propose meeting with EPA following submittal of the Draft Year 0 Annual Evaluation Report (anticipated in May 2007) to discuss a revised frequency for monitoring compliance with the RAOs and a proposed revised monitoring approach to further evaluate the potential effectiveness of capping as a long-term remedy at the Gasco site.

If you have any questions or comments on this preliminary data evaluation, please contact Ryan Barth or Carl Stivers at (206) 287-9130.

Sincerely,

Ryan Barth and Carl Stivers
Anchor Environmental, L.L.C.

cc: Rick Wadsworth
Robert Wyatt
Patty Dost

ATTACHMENT A

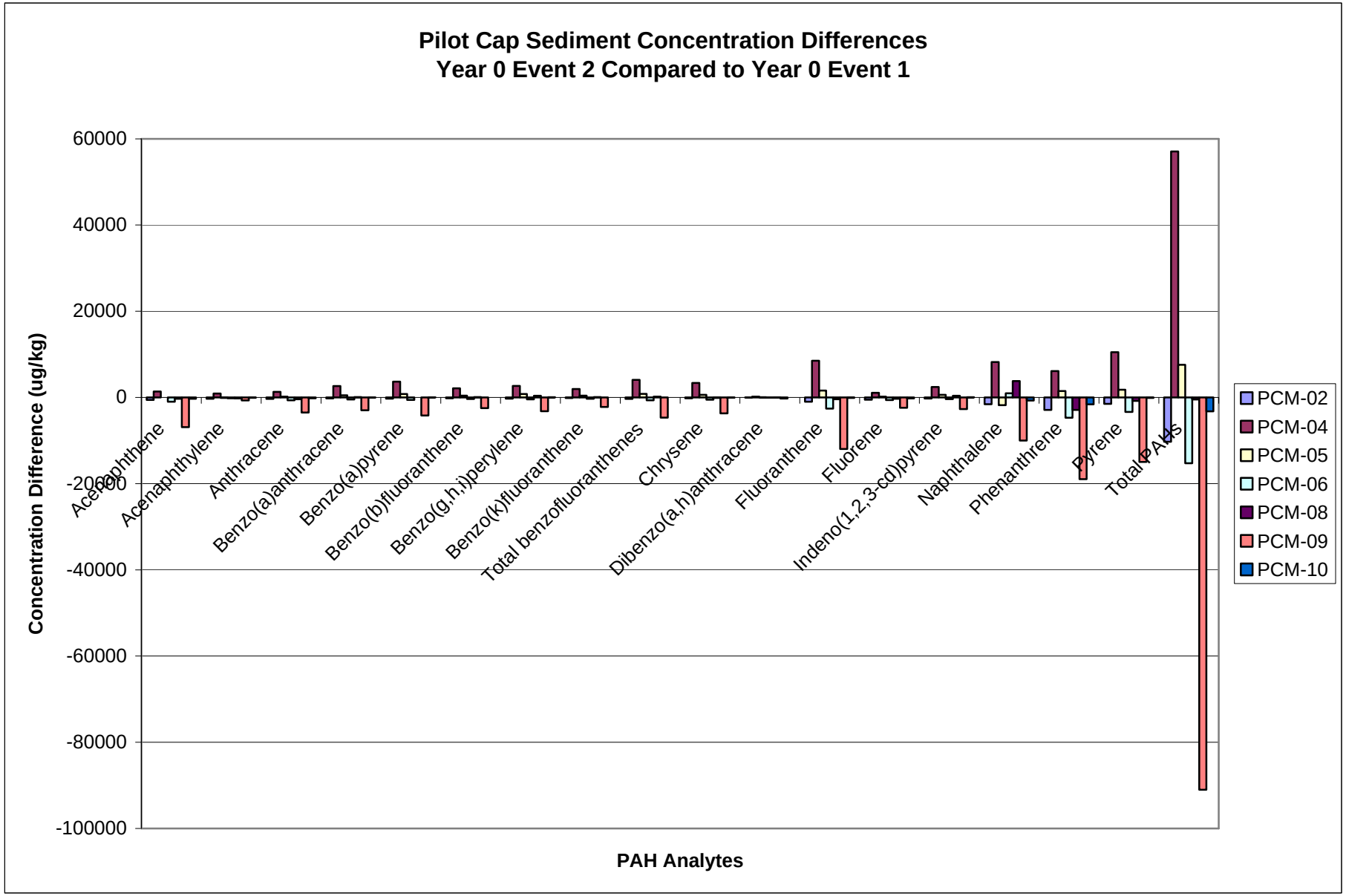


Figure A-1
Pilot Cap Sediment Concentration Differences
Year 0 Event 2 Compared to Year 0 Event 1

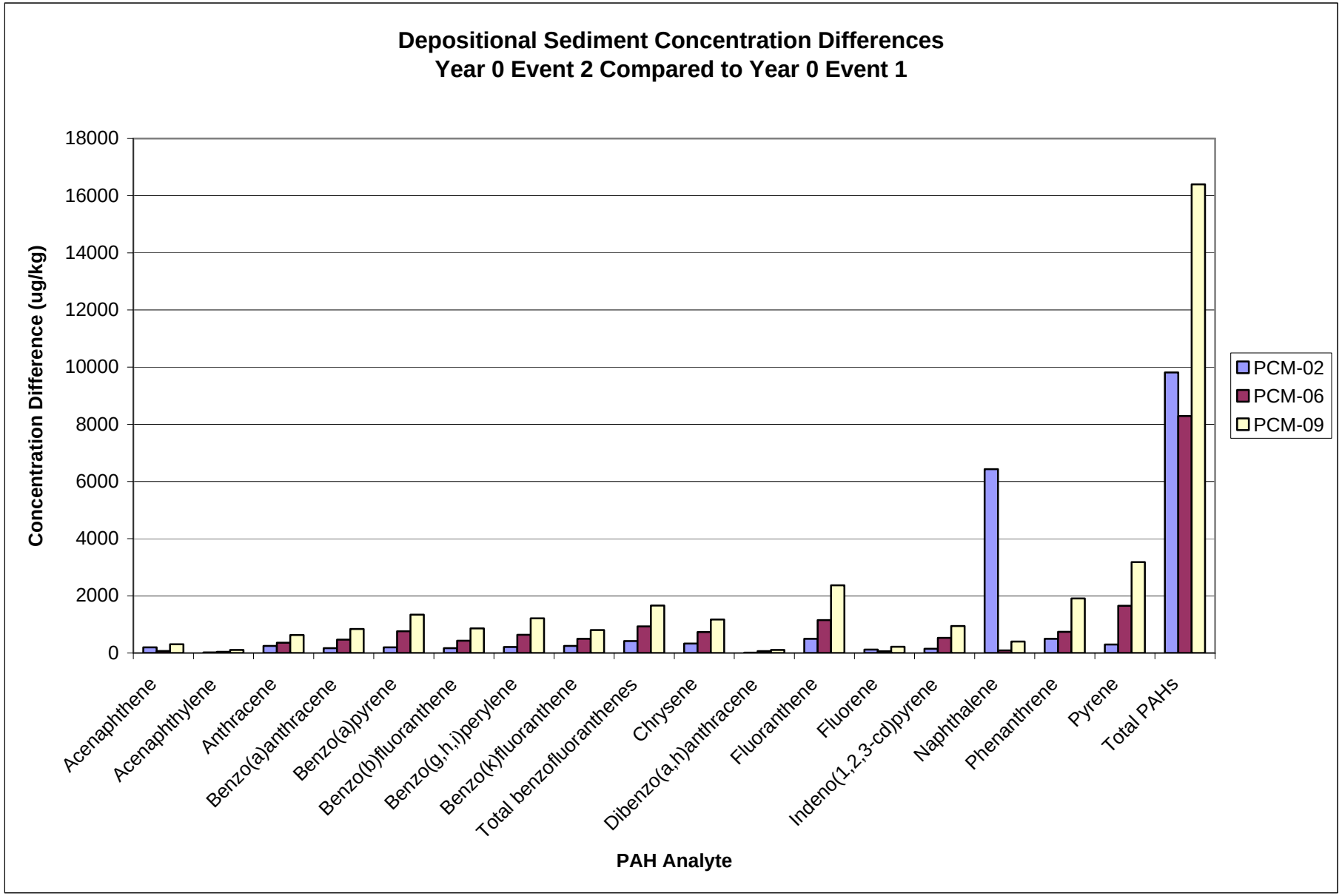


Figure A-2
Depositional Sediment Concentration Differences
Year 0 Event 2 Compared to Year 0 Event 1

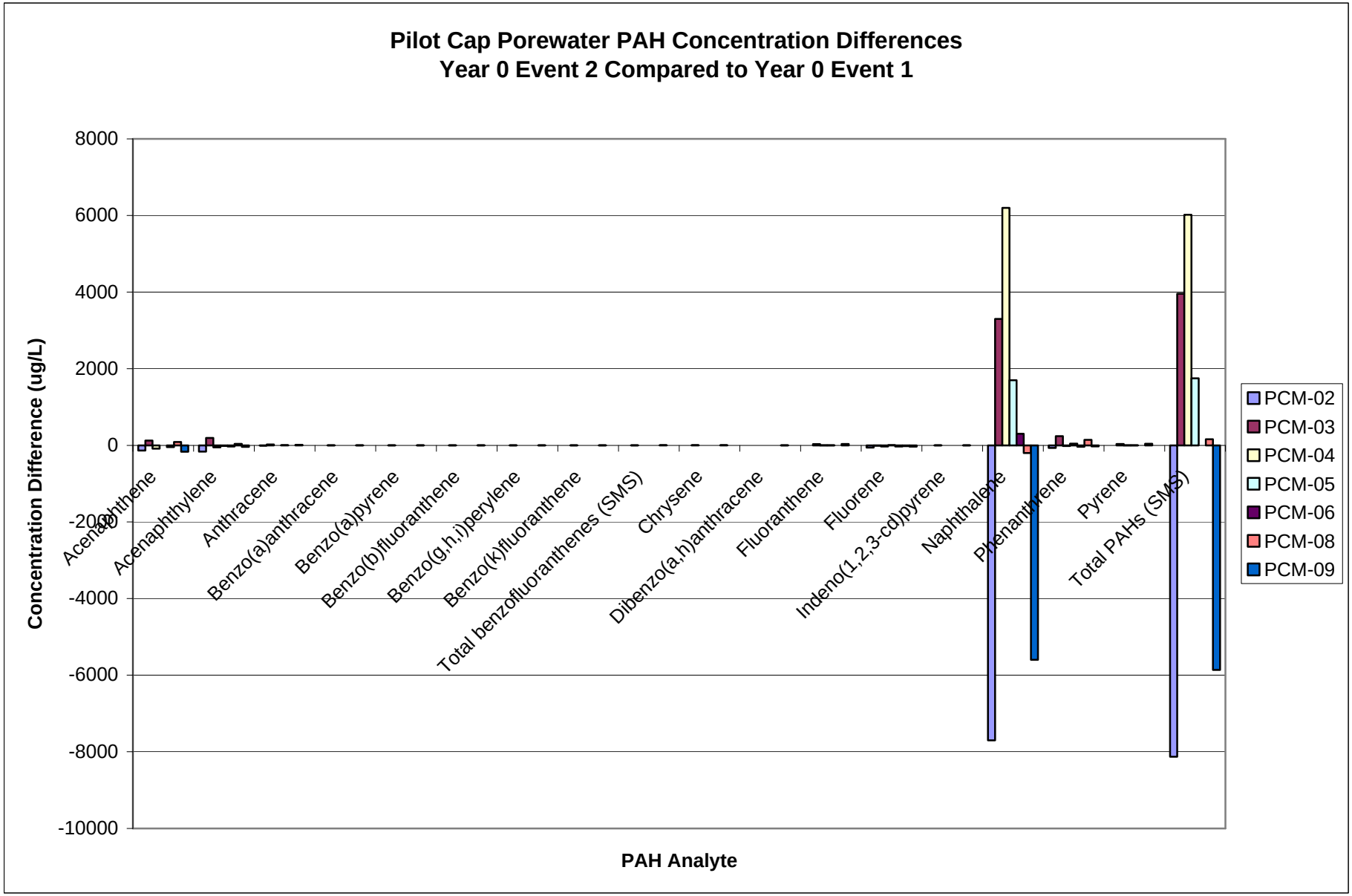


Figure A-3
Pilot Cap Porewater PAH Concentration Differences
Year 0 Event 2 Compared to Year 0 Event 1

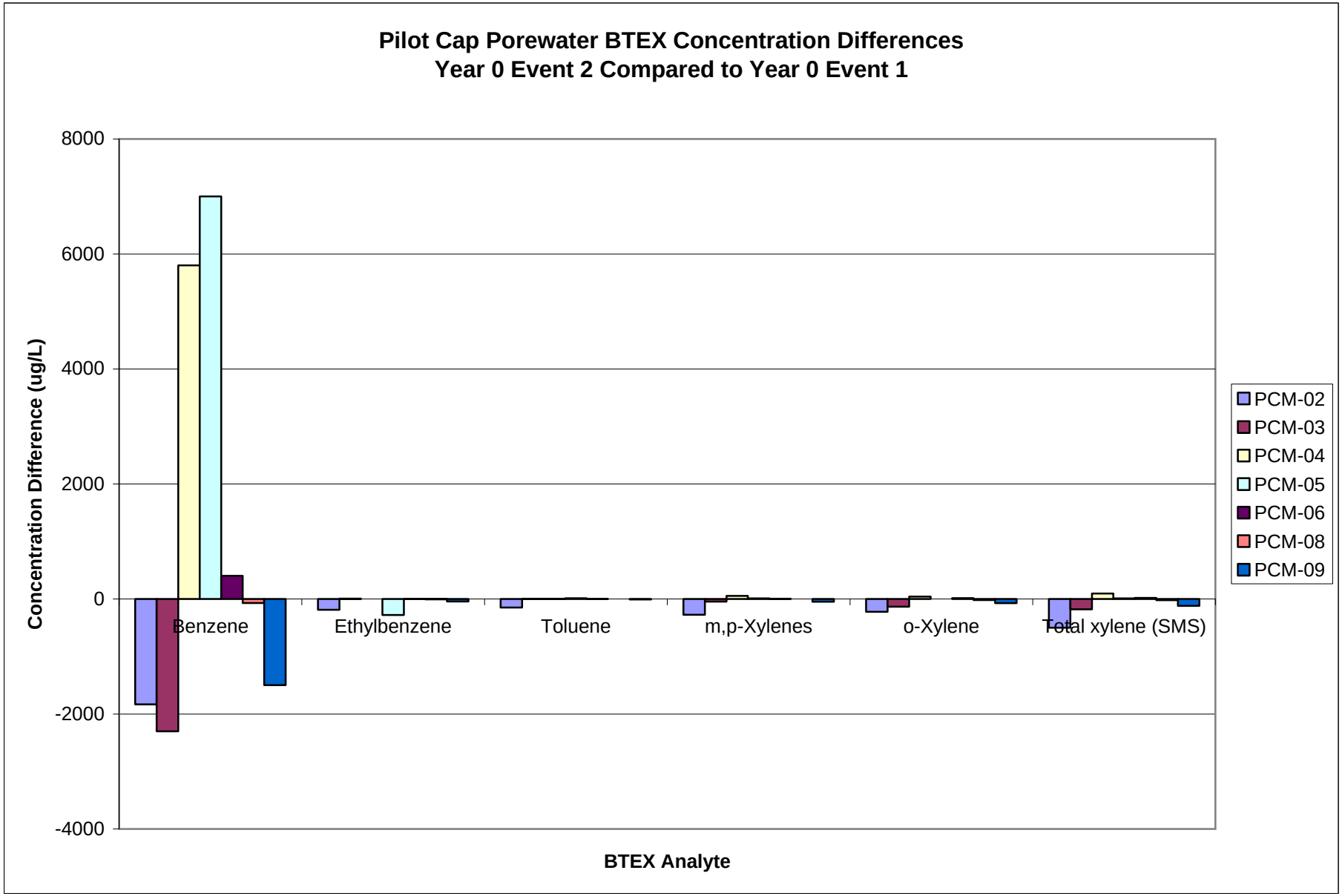


Figure A-4
Pilot Cap Porewater BTEX Concentration Differences
Year 0 Event 2 Compared to Year 0 Event 1

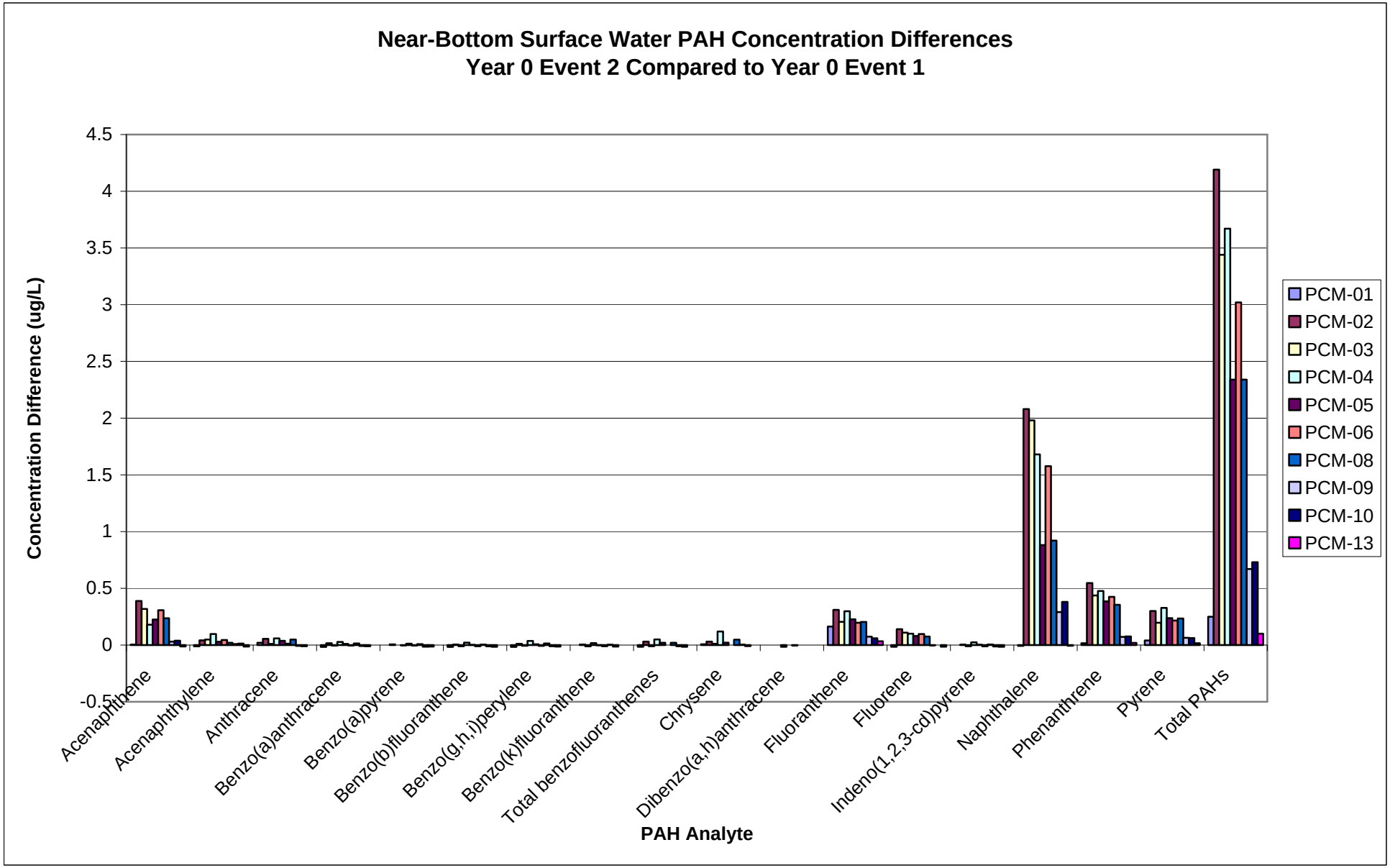
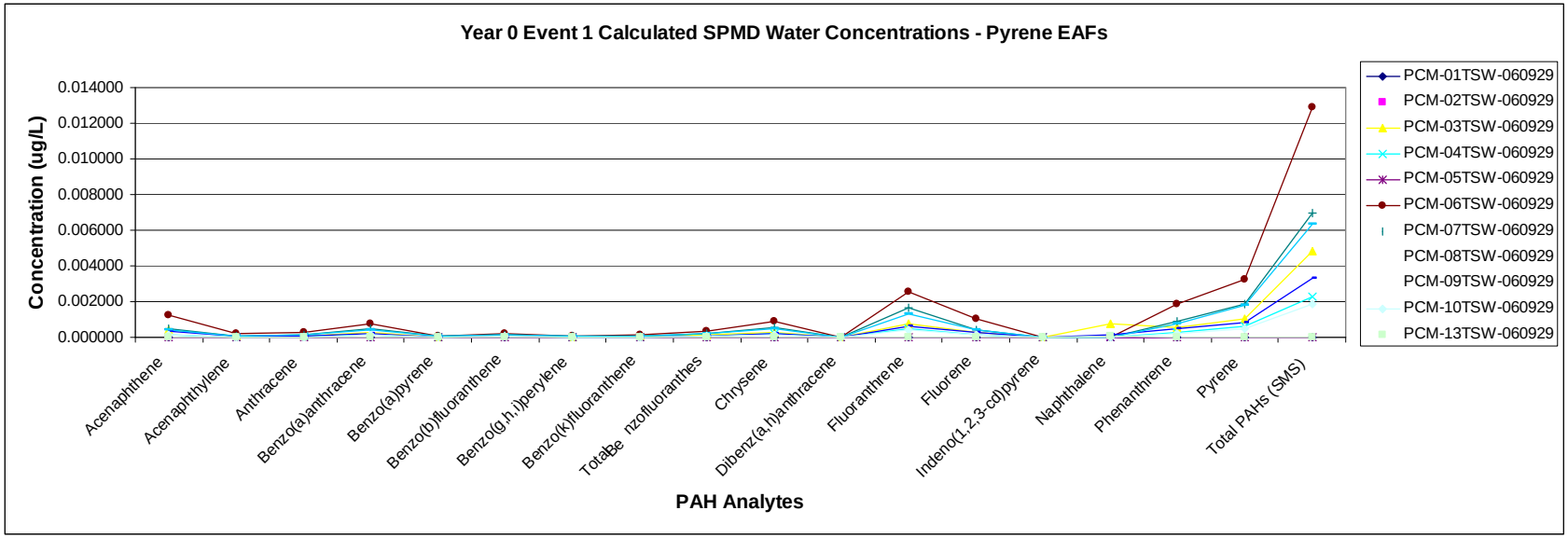


Figure A-5
Near-Bottom Surface Water PAH Concentration Differences
Year 0 Event 2 Compared to Year 0 Event 1



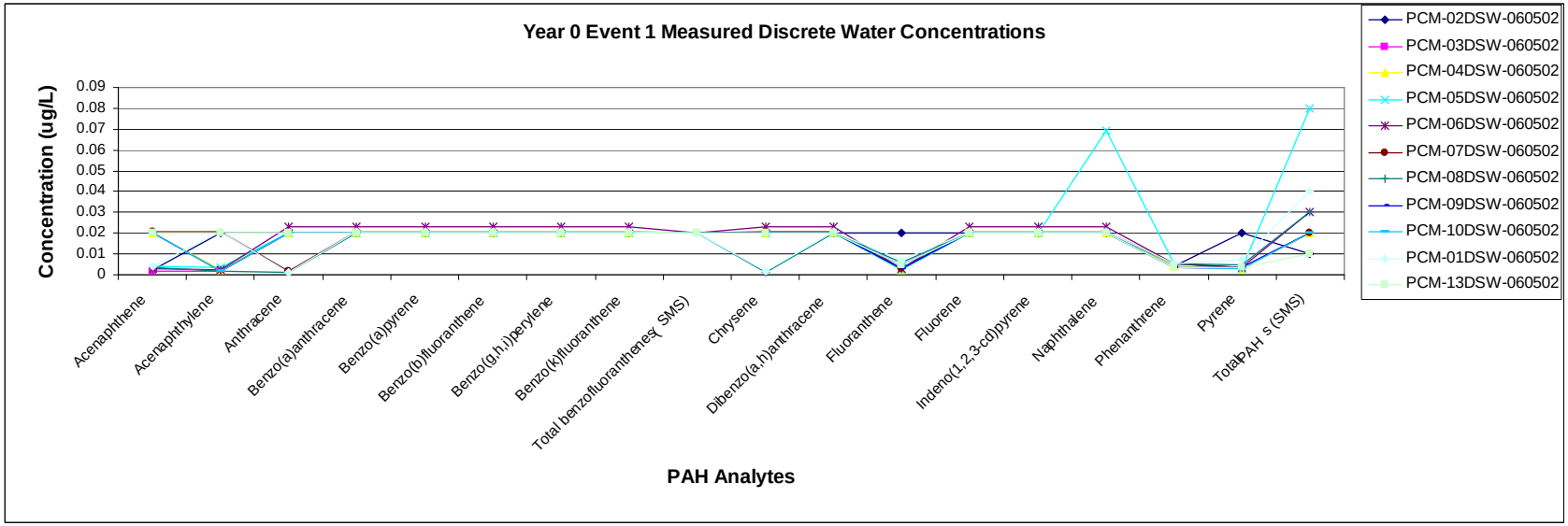
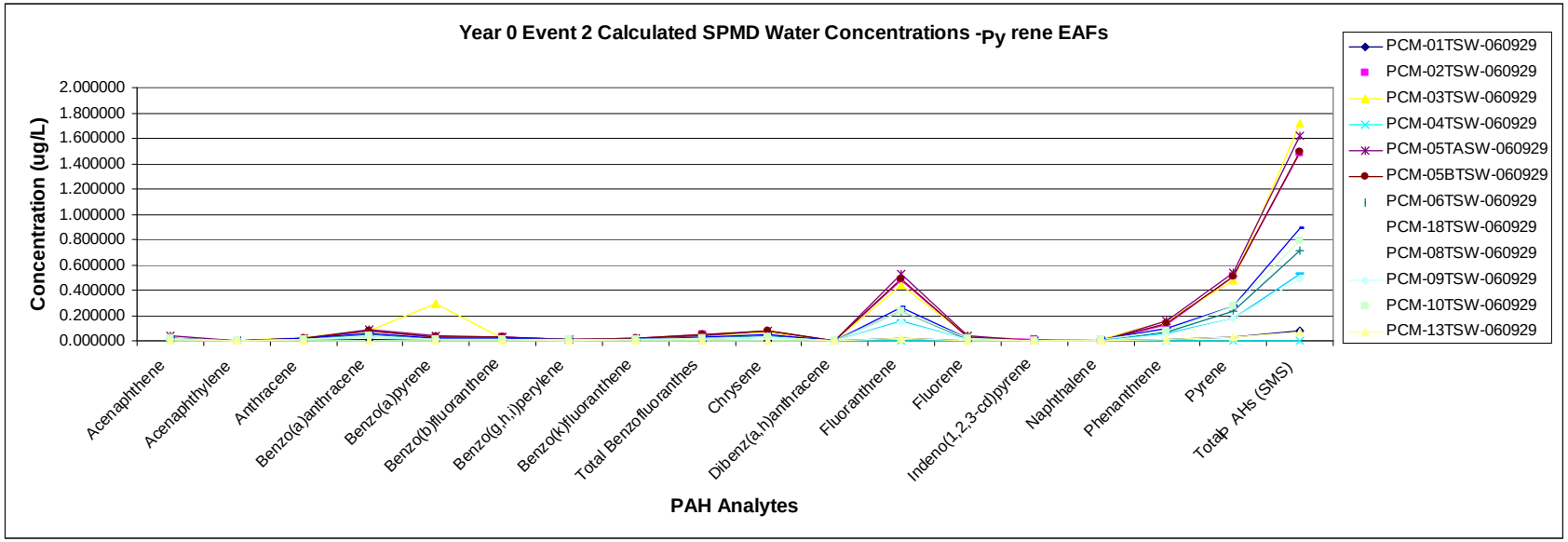


Figure A-6
Year 0 Event 1 Calculated Time-Integrated (Pyrene EAF) and Measured Near-Bottom Surface Water Concentrations



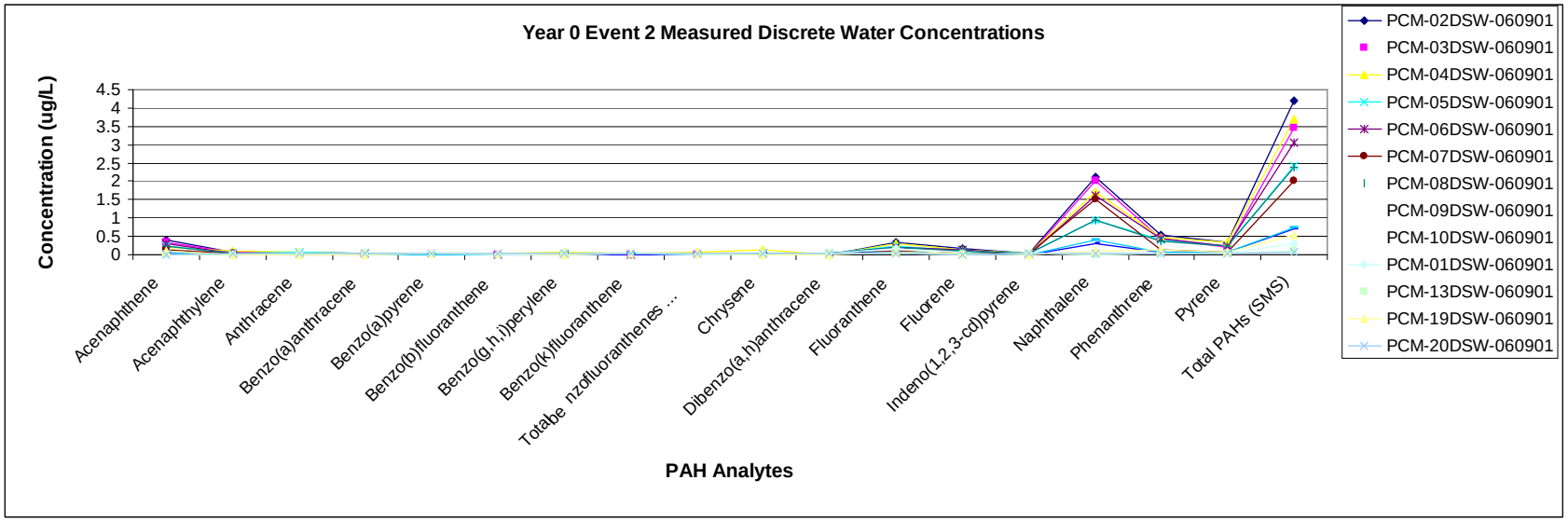
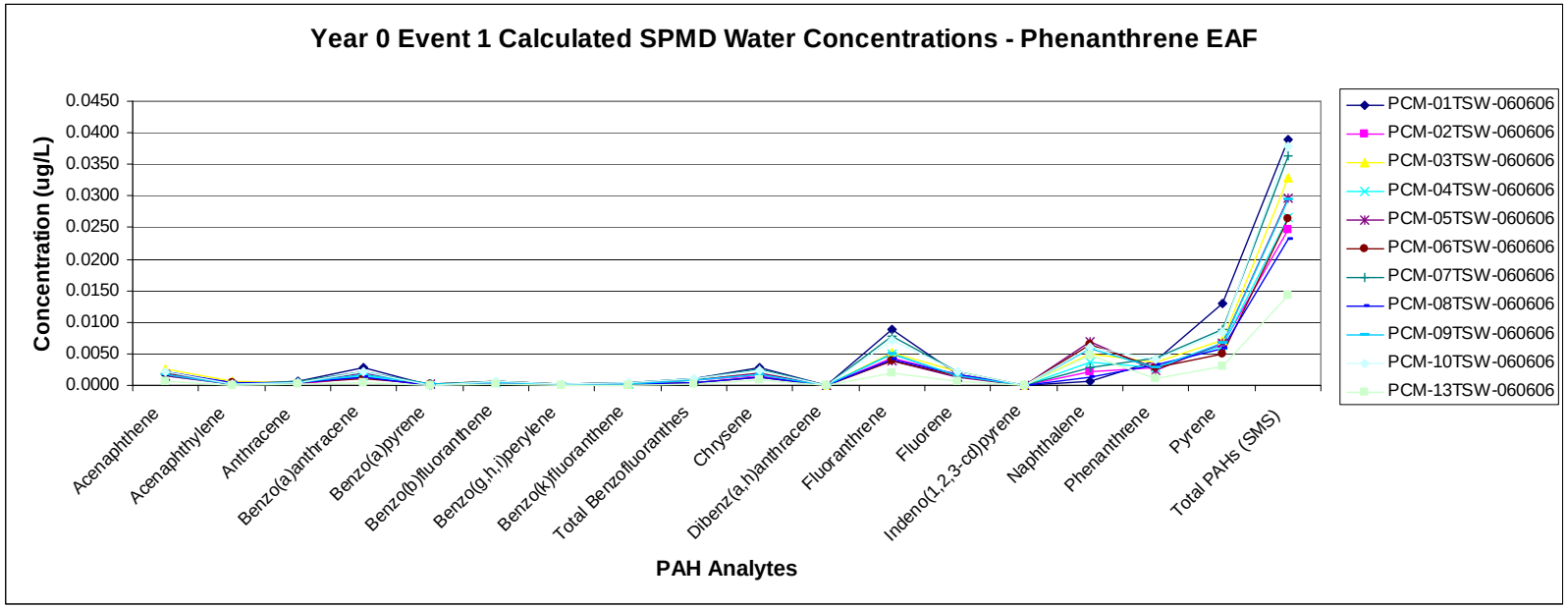


Figure A-7
Year 0 Event 2 Calculated Time-Integrated (Pyrene EAF) and Measured Near-Bottom Surface Water Concentrations



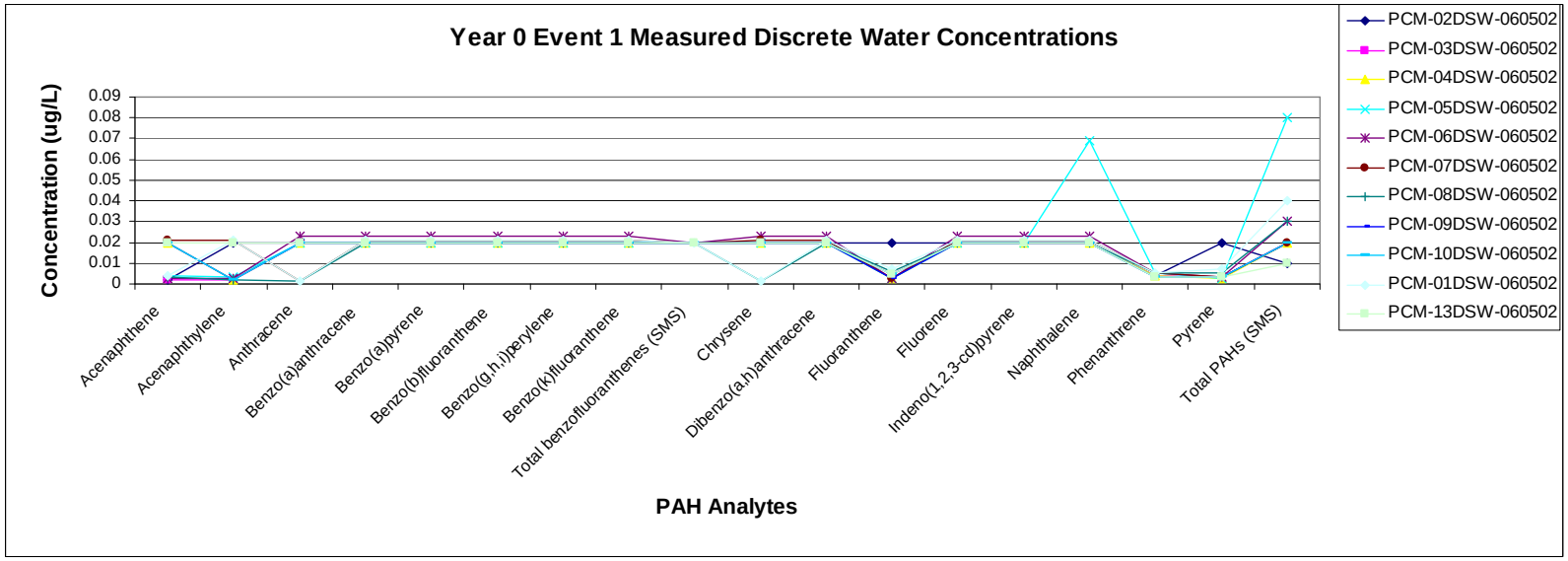
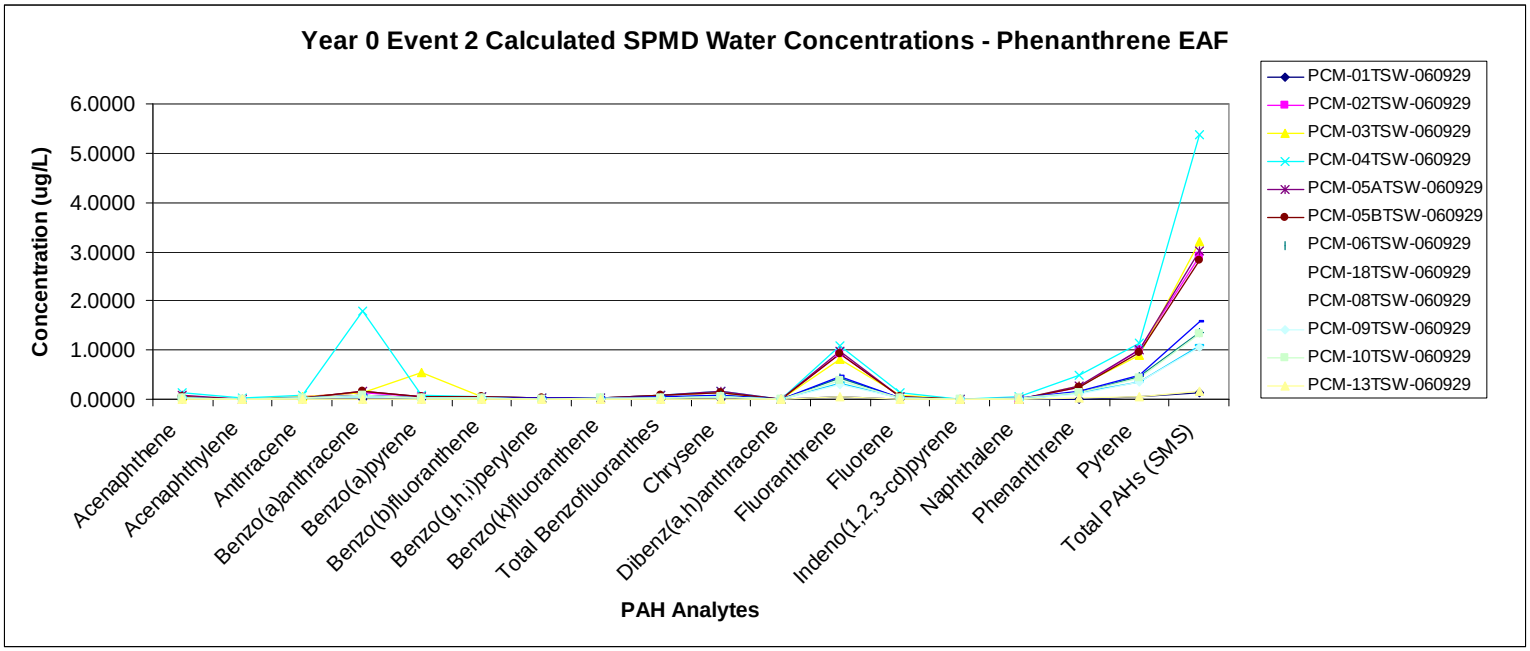


Figure A-8
Year 0 Event 1 Calculated Time-Integrated (Phenanthrene EAF) and Measured Near-Bottom Surface Water Concentrations



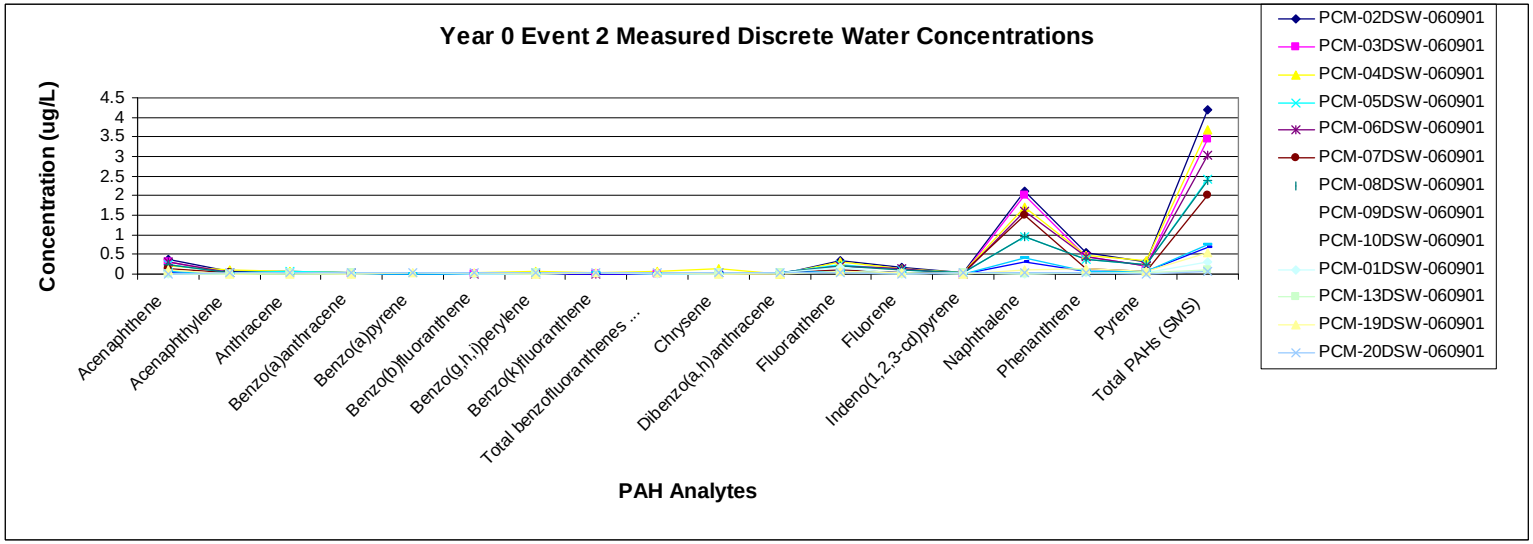


Figure A-9
Year 0 Event 2 Calculated Time-Integrated (Phenanthrene EAF) and Measured Near-Bottom Surface Water Concentrations

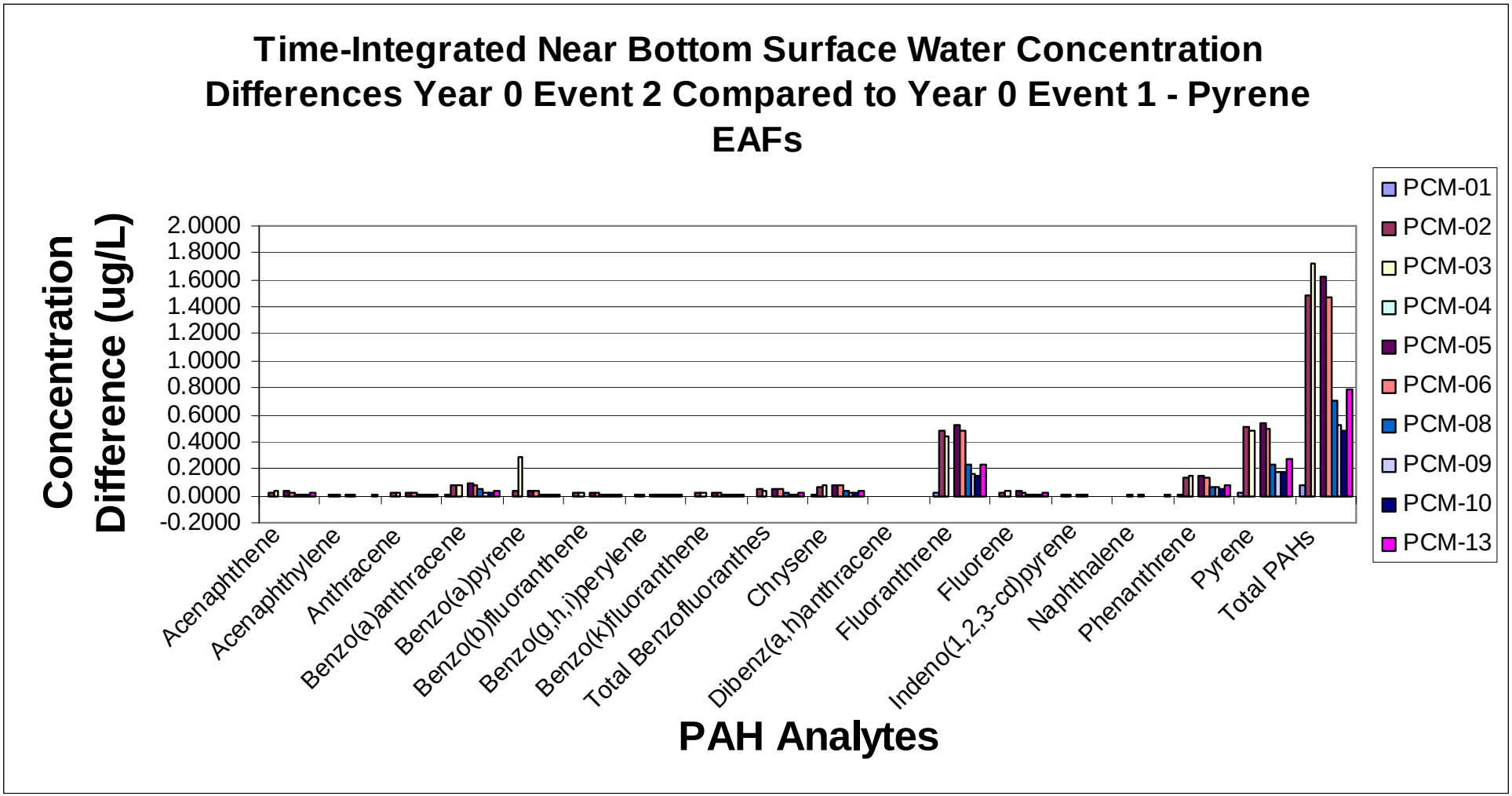


Figure A-10
Time-Integrated Near Bottom Surface Water Concentration Differences - Year 0 Event 2 Compared to Year 0 Event 1 (Pyrene EAF)

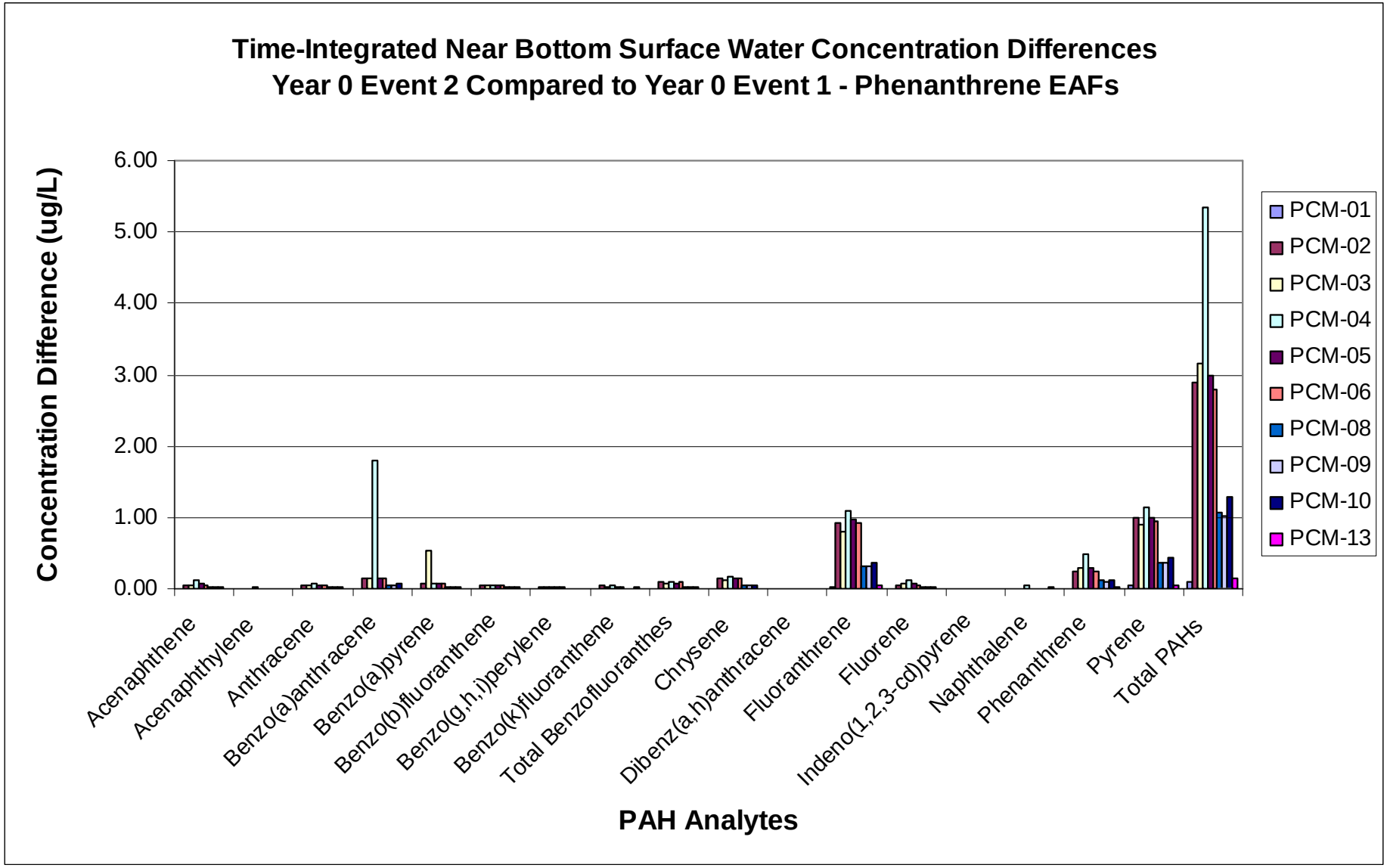


Figure A-11
Time-Integrated Near Bottom Surface Water Concentration Differences - Year 0 Event 2 Compared to Year 0 Event 1 (Phenanthrene EAF)

ATTACHMENT B

SPMD Calculations for Estimation of Dissolved Water Concentrations

The calculated SPMD concentrations are estimates of dissolved water concentrations based upon PAH extraction from SPMD lipid bags. The calculations are presented below. Two sets of interrelated calculations were used: 1) using an empirical model based upon published uptake rates for each chemical; and 2) adjusting the empirical model using exposure adjustment factors (EAFs) which are based on partitioning (loss) of chemicals spiked into the SPMD (deuterated PAHs) prior to their deployment. The deuterated PAHs spiked into the SPMDs are termed performance reference compounds (PRCs) and the model that incorporates these chemicals is termed the PRC-based estimation model in the discussion below.

As mentioned above, two sets of calculations are required, first the EAF is calculated based upon the recovery of the PRC and then the average dissolved water concentration is estimated using this result.

Calculation of Exposure Adjustment Factor (EAF) for Deuterated PAHs

Equations from API publication #4690 (2002) were used to calculate an EAF. The EAF provides an estimate of the observed sampling efficiency relative to the sampling efficiency under calibration conditions using the recovery of the PRC. The applicable PRCs for this study were:

- Pyrene-d10
- Phenanthrene-d10

EAF = Ke PRC / Ke PRC cal

Ke PRC = (ln(Cspmd initial /Csmpd final))/t

Ke PRC cal = SPMD K1/ (Kspmd*Vspmd*Dspmd)

Where:

Ke PRC = measured PRC loss constant (assumed to be linear)
Ke PRC cal = PRC loss constant under calibration conditions
Cspmd = Concentration of chemical in SPMD at beginning or end of sampling (initial or final) (pg/SPMD)
t = time in days
SPMD K1 = SPMD uptake rate constant
Kspmd = SPMD-water partitioning coefficient
Vspmd = volume of SPMD; 0.0047 L for a standard SPMD
Dspmd = density of SPMD; 0.957 for a standard SPMD

Estimation of Dissolved Water Concentration using EAF

Dissolved water concentrations were estimated using the following calculation:

Cwd= ((Cspmd/Ms)/((Rs/Ms)*EAF*t))

Where:

Rs = sampling rate in liters/day (from API 2002)
Ms = mass of SPMD (layflat tube and triolein); 4.5 g for standard SPMD
t = time in days