

A.1 Technology Name

Radiello Sampler

A.1.1 Source

Eric M. Fujita, David E. Campbell, W. Patrick Arnott, Virginia Lau & Philip T. Martien (2013) Spatial variations of particulate matter and air toxics in communities adjacent to the Port of Oakland, Journal of the Air & Waste Management Association, 63:12, 1399-1411, DOI: 10.1080/10962247.2013.824393

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A.1.2 Summary

| | |
|--------------------------|---------------------------|
| Media: | Outdoor air |
| Study Type: | Side-by-side study |
| Technology: | Radiello Passive Samplers |
| Peer Reviewed: | Yes |
| Publication Date: | November 18, 2013 |

A.1.3 Site Description

- The Port of Oakland and neighboring communities of West Oakland and Alameda, all in California's Bay Area. Samples were collected in industrial areas, as well as mixed-use commercial and residential areas. Sampling conditions included both summer and winter seasonal weather.
- Contaminants of concern (COCs): nitrogen dioxide (NO₂), oxides of nitrogen (NO_x), sulfur dioxide (SO₂), benzene/ toluene/ ethylbenzene/ xylenes (collectively known as BTEX), carbonyl compounds (formaldehyde, acetaldehyde, and acrolein), PM_{2.5}, organic carbon (OC), elemental carbon (EC), and metals.
- This study was conducted over two approximately month-long periods in the summer of 2009 and the winter of 2009/2010. During each sampling event, the passive samplers were deployed for four one-week periods. Additional spatial surveys were conducted during select days within these monitoring events using a "mobile monitoring van." The vans would collect real-time measurements from the sampling locations twice-a-day.
- Samples were collected and/or analyzed using the following technologies:
 - BTEX and carbonyl compounds: Radiello passive samplers
 - NO₂, NO_x, and SO₂: Ogawa passive samplers
 - PM_{2.5}: collected using 7-day Teflon and quartz filter samples with portable Airmetrics MiniVol samplers and analyzed by gravimetry
 - OC and EC: thermal-optical reflectance with the IMPROVE protocol

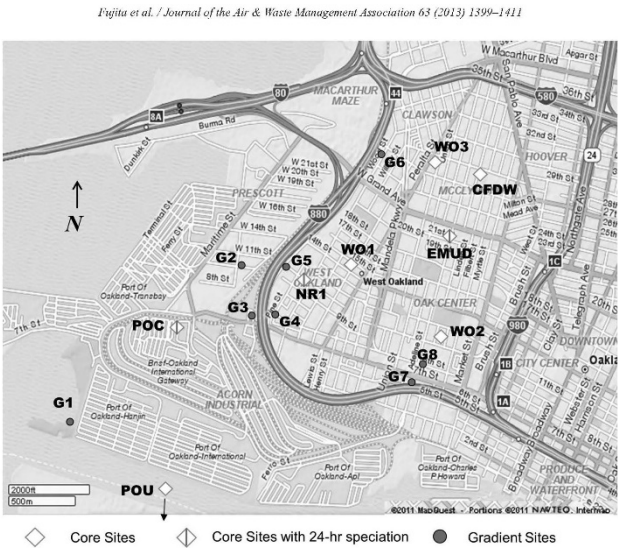


Table 2. Replicate precision of passive NO₂, NO_x, SO₂, BTEX, and aldehyde measurements at EMUD site during summer and winter WOMS

| Pollutant | MDL ^a (ppb) | 4-Week Mean (ppb) | Differences of Replicates | |
|-------------------------------------|------------------------|-------------------|---|------------------|
| | | | Mean (ppb) ^b | %RD ^c |
| WOMS summer | | | | |
| Nitorgen dioxide (NO ₂) | 0.32 | 9.0 | 1.3 | 14.0% |
| Nitrogen oxides (NO _x) | 0.32 | 17.5 | 0.7 | 4.2% |
| Sulfur Dioxide (SO ₂) | 0.54 | 0.09 | 0.03 | 33.9% |
| Benzene | 0.015 | 0.16 | Not available. See text for explanation. | |
| Toluene | 0.002 | 0.19 | | |
| Ethyl benzene | 0.002 | 0.08 | | |
| Xylenes | 0.002 | 0.36 | | |
| Formaldehyde | 0.07 | 1.4 | 0.03 | 1.8% |
| Acetaldehyde | 0.05 | 0.55 | 0.03 | 4.7% |
| Acrolein | 0.12 | 0.009 | 0.005 | 57.7% |
| WOMS winter | | | | |
| Nitorgen Dioxide (NO ₂) | 0.32 | 5.7 | 0.1 | 1.7% |
| Nitrogen Oxides (NO _x) | 0.32 | 25.9 | 0.8 | 3.1% |
| Sulfur Dioxide (SO ₂) | 0.54 | 1.0 | 0.8 | 81.5% |
| Benzene | 0.015 | 0.26 | 0.02 | 7.8% |
| Toluene | 0.002 | 0.78 | 0.04 | 5.1% |
| Ethylbenzene | 0.002 | 0.15 | 0.01 | 5.1% |
| Xylenes | 0.002 | 0.63 | 0.03 | 5.0% |
| Formaldehyde | 0.07 | 1.3 | 0.1 | 5.1% |
| Acetaldehyde | 0.05 | 0.5 | 0.1 | 18.9% |
| Acrolein | 0.12 | 0.028 | 0.009 | 65.5% |

Notes: ^aMinimum detection limits (MDLs) are based upon manufacturer's specification for 7-day exposure. ^bMean of the absolute differences between mean of the triplicates and individual sample (up to 12 values per season). ^cMean of the absolute differences normalized to mean of the triplicate in percent.

A.1.4 Remedial Phase

In 2004, the Bay Area Air Quality Management District (BAAQMD) initiated the Community Air Risk Evaluation (CARE) program to evaluate “health risks associated with exposure to toxic air contaminants (TACs). It’s objectives were to identify at-risk communities within the nine San Francisco Bay Area (Bay Area) counties and subsequently establish policies to address these concerns. Under the CARE program, initial modeling identified West Oakland, a mixed residential/ industrial area that borders the Port of Oakland, as one of these “at-risk communities.” This study, known as the West Oakland Monitoring Study (WOMS) was conducted to collect supplemental air quality data for the evaluation of local-scale dispersion modeling of diesel emissions and other toxic air contaminants. WOMS’ objectives were to evaluate if gradients in pollutant concentrations exist within West Oakland, the adequacy of existing air quality monitoring in the area, mean pollutant concentrations compared to other Bay Area urban areas, and if the results are consistent with the modeled results from the CARB and BAAQMD’s 2005 health risk assessment (HRA).

A.1.5 Outcome

The analytical data was compared to the three other air monitoring networks in the Bay Area (San Francisco, Fremont, and San Jose). BTEX concentrations in all four networks were similar. Aldehyde levels were lower in West Oakland than in Fremont and San Jose, “reflecting greater contribution of atmospheric formation of aldehydes from photo-oxidation of hydrocarbons in downwind area of the Bay Area.” Compared to San Jose, West Oakland had a similar estimated mass concentrations of diesel particulate matter (DPM), but higher fractions of DPM to TC and PM_{2.5}. The results of the study also indicated that estimated concentrations of DPM in the WOMS were consistent with those of the 2005 HRA “after adjustments were made for recent mitigation measures and corrections were made to truck traffic volumes.” The WOMS indicated the effectiveness of the diesel reduction projects, updated regulatory requirements, and focused enforcement near the Port of Oakland; however, did recommend continued monitoring to further

assess the higher pollutant concentrations along major roadways in West Oakland that had been identified.

Table 7. Comparisons of DPM ($\mu\text{g}/\text{m}^3$) estimated from the WOMS saturation monitoring data with modeled results from the CARB/BAAQMD health risk assessment

| Site | WOMS Summer | WOMS Winter | WOMS Average Summer and Winter | Annual Average HRA Estimates | Adjusted HRA Estimates | HRA/ WOMS | Adjusted HRA/ WOMS |
|-----------------------|-----------------------------------|-----------------------------------|--------------------------------|------------------------------|------------------------|------------|--------------------|
| POU | 0.44 ± 0.22 | 1.77 ± 0.46 | 1.1 | < 1.6 | 0.6–0.9 | 1.4 | 0.7 |
| POC & POC2 | 0.64 ± 0.24 | 2.66 ± 0.66 | 1.7 | 4.7 | 1.8–2.8 | 2.9 | 1.4 |
| NR1 | 0.92 ± 0.29 | 2.03 ± 0.52 | 1.5 | 3.1 | 1.2–1.9 | 2.1 | 1.0 |
| WO1 | 0.81 ± 0.27 | 2.05 ± 0.54 | 1.4 | 3.1 | 1.2–1.9 | 2.2 | 1.1 |
| WO3 | 0.89 ± 0.28 | 2.06 ± 0.53 | 1.5 | 3.1 | 1.2–1.9 | 2.1 | 1.0 |
| WO2 | 0.84 ± 0.28 | 1.85 ± 0.48 | 1.3 | 3.1 | 1.2–1.9 | 2.3 | 1.1 |
| EMUD | | 1.93 ± 0.51 | 1.3 | 3.1 | 1.2–1.9 | 2.3 | 1.1 |
| CFDW | 0.66 ± 0.25 | 1.98 ± 0.51 | 1.3 | 3.1 | 1.2–1.9 | 2.4 | 1.2 |
| Community mean | 0.81 ± 0.11 | 1.98 ± 0.21 | 1.4 | 3.1 | 1.2–1.9 | 2.2 | 1.1 |
| STN San Jose | 0.93 | 2.54 | 1.7 | | | | |

A.1.6 References

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