



Using photocatalytic products in the real world.

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Cristal Global

Asia Pacific Trial: Manila - Guadalupe MRT

World's largest air cleaning paint trial

Baseline
Monitors



Manila - Nitrate Measurement

- ❖ ~26g of NO_x removed per 100m²/day
- ❖ Assuming average emissions of 0.75g NO_x/Km for each vehicle¹
- ❖ ~0.52cars/m²
- ❖ Exterior painted area: 4100 m²
- ❖ NO_x emissions of ~1420 cars cleaned per day
- ❖ Up to 390 kg of NO_x removed per year

¹ EMEP/EEA Emission Inventory Guidebook 2009, updated June 2010
NO_x emissions vary by vehicle and engine size and type, i.e. gas vs diesel
Actual Euro I emissions can vary from 0.4g/km up to over 9.0g/km NO_x



Conclusions thus far

- ❖ The Nitrate accumulation results prove that NO₂ conversion is occurring and this is the more reliable measure as the nitrate cannot come from any other source
- ❖ The Diffusion Tube provides a measure of the NO₂ that passes through the monitor, which is strongly impacted by weather impacts such wind and rain
- ❖ 9 Locations in the Manila trial are showing statistically significant NO₂ reductions using the Diffusion Tubes
- ❖ Monitors in confined areas combined with high NO₂ levels show that reduction is best observed when the NO₂ in those areas has more chance to impact the monitor for detection

Camden NOx Reduction Trial

- ❖ Trial site – courtyard in St Martin's College, Camden
- ❖ One wall in courtyard treated with CristalACTiV™ transparent colloid.
 - Area covered – 135m²
- ❖ Aim of trial to replicate lab performance of coating in real world scenario
 - Colloid applied expected to have greater impact on NO than NO₂



Camden NOx Reduction Trial

- ❖ Monitoring at the site from 2007 – 2010
 - Baseline data gathered 2007 – Feb 2009
 - CristalACTiV™ Colloid applied March 2009
 - Concrete surface of wall repaired
 - Surface area of 135m² applied
 - Wall covered in August 2010 to remove effect



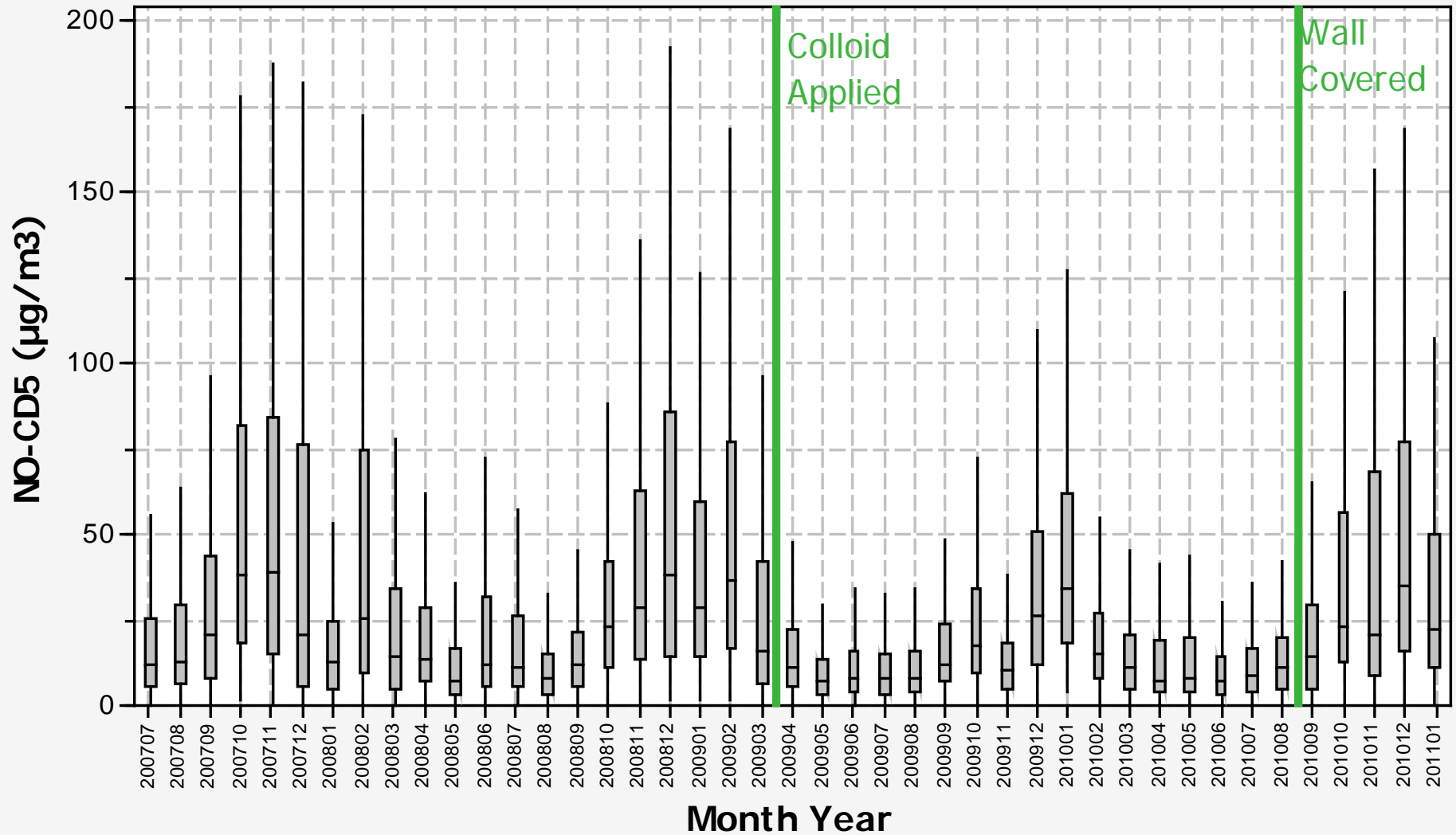
Data Gathering

- ❖ NO, NO₂ and NO_x readings every 15 minutes
 - Chemiluminescence monitor
 - Two sampling points
 - Next to wall (CD5)
 - 1.5 m from wall (CD4)
- ❖ Weather station data at St Martin's College and Bexley
 - Wind Speed and direction
 - Sunlight
 - Humidity / rain
 - Bexley data used for underlying wind direction

Trial Results

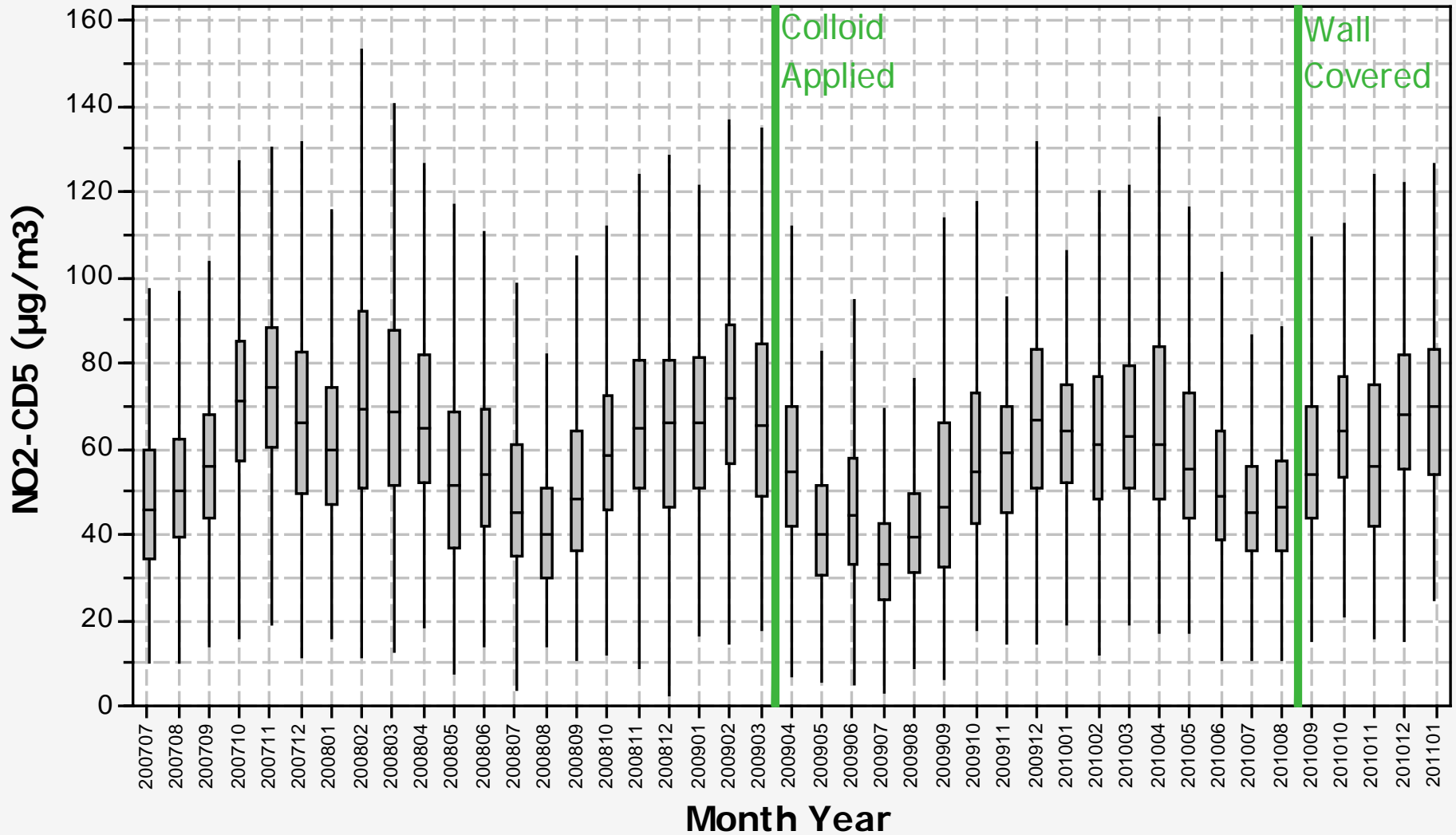
Monthly NO Readings - Trial Site - CD5

All Data - No filters



Monthly NO2 Readings - Trial Site - CD5

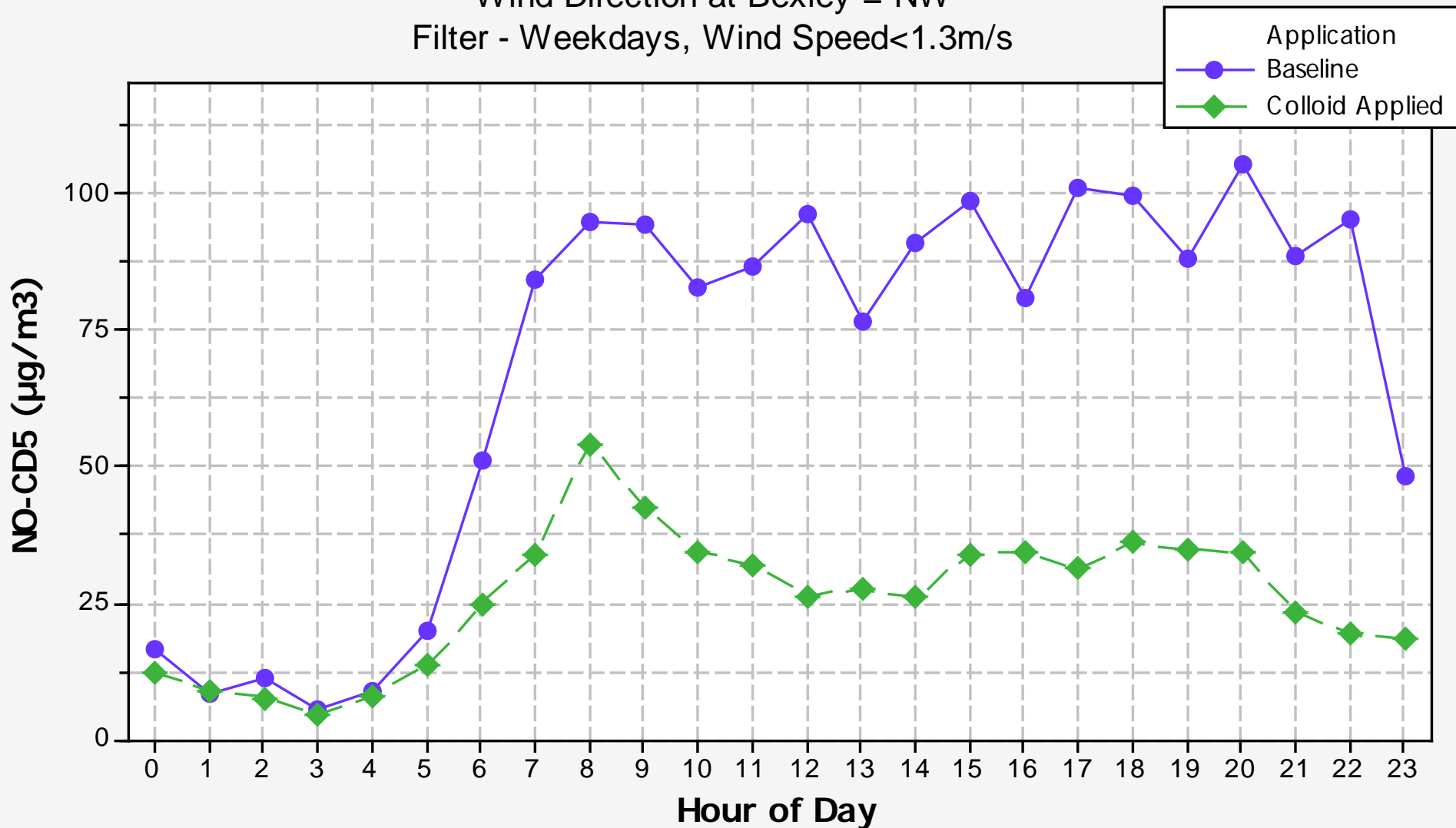
All Data - No filters



Comparison of NO CD5 - Baseline vs Colloid Applied

Wind Direction at Bexley = NW

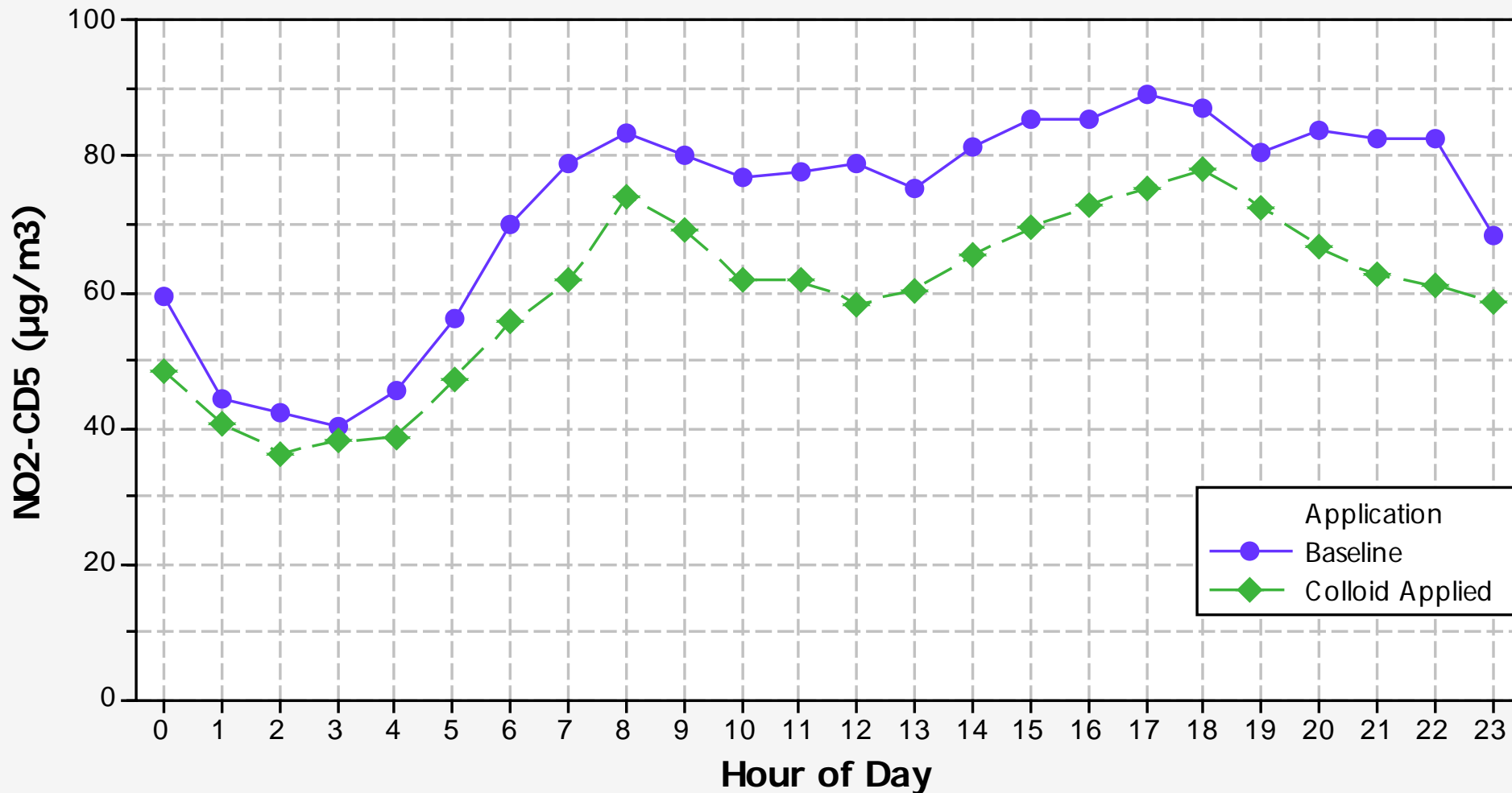
Filter - Weekdays, Wind Speed < 1.3m/s



Comparison of NO2 CD5 - Baseline vs Colloid Applied

Wind Direction at Bexley = NW

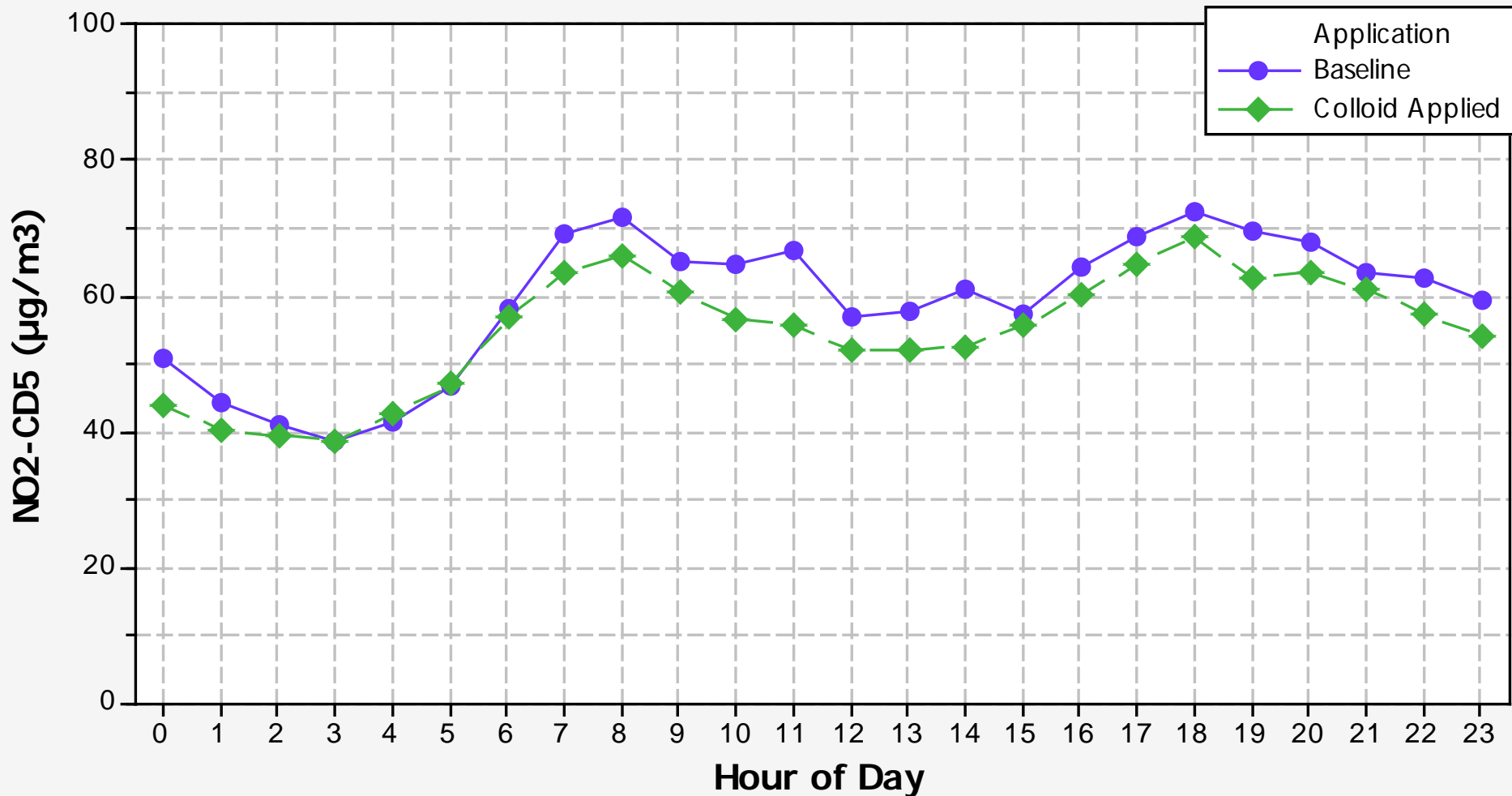
Filter - Weekdays, Wind Speed < 1.3m/s



Comparison of NO2 CD5 - Baseline vs Colloid Applied

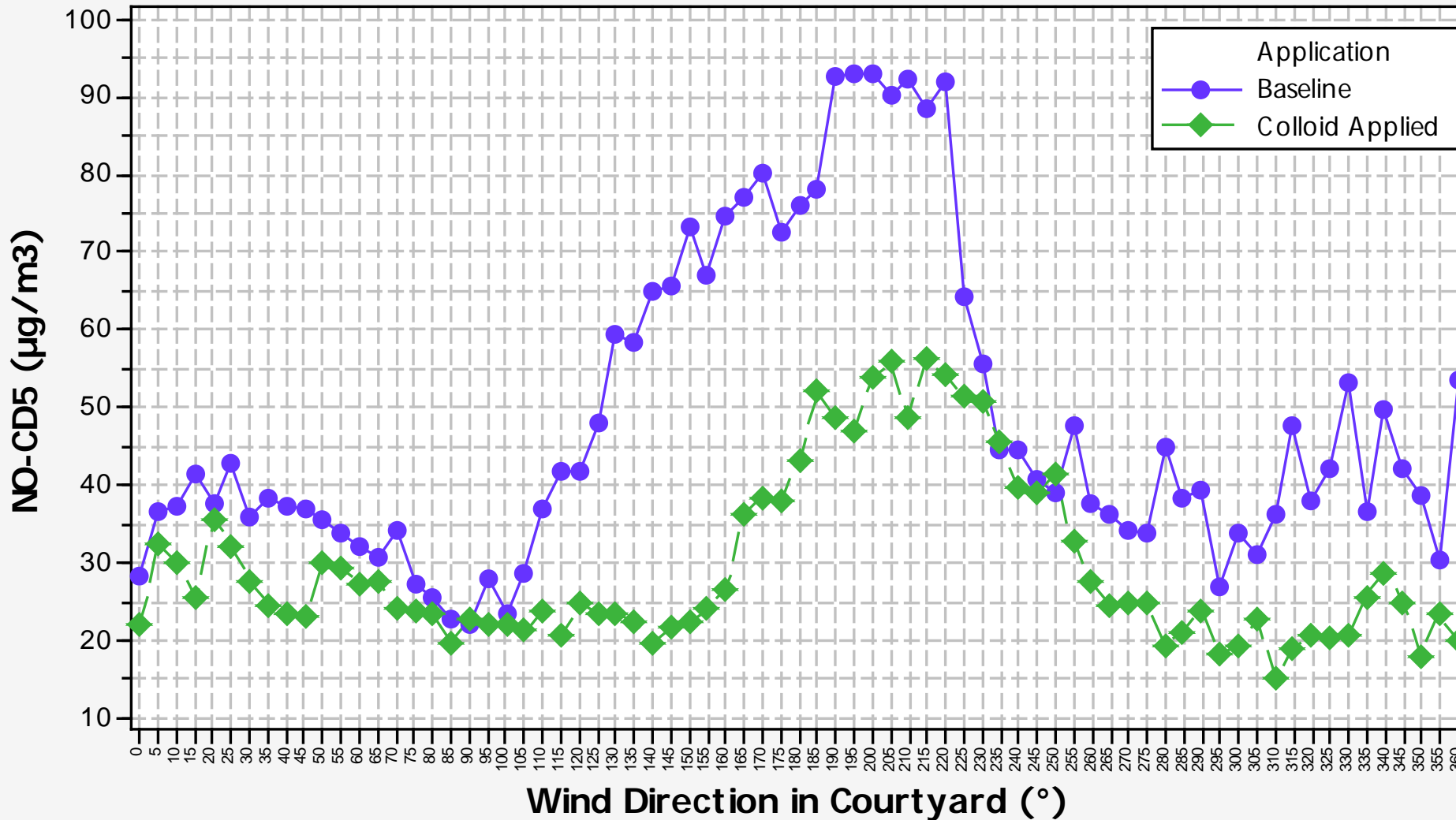
Wind Direction at Bexley = SW

Filter - Weekdays, Wind Speed < 1.3m/s



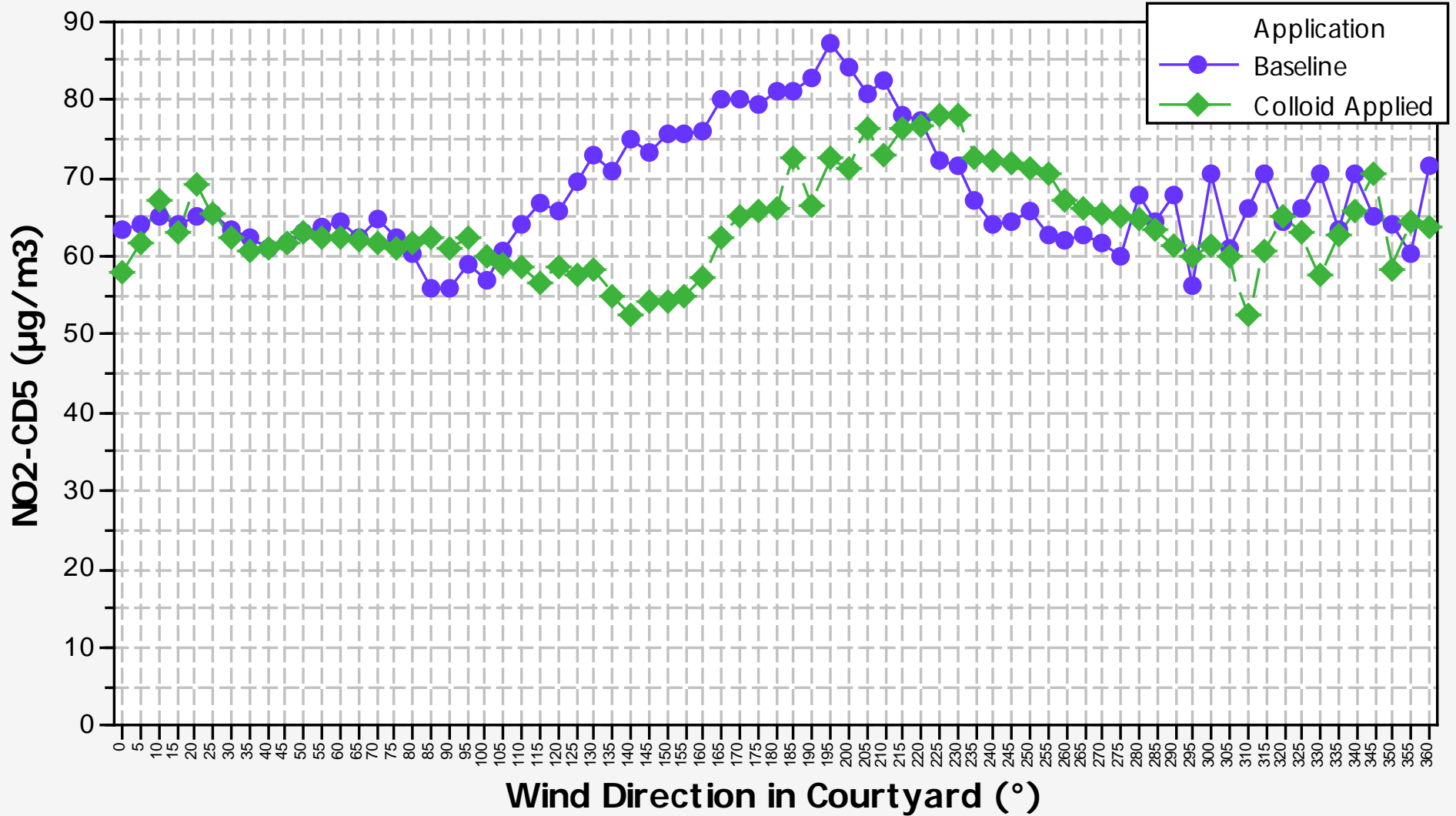
NO Levels at Trial Site by Wind Direction in the Courtyard

1 Year of data from both periods - May data excluded as no wind data in baseline



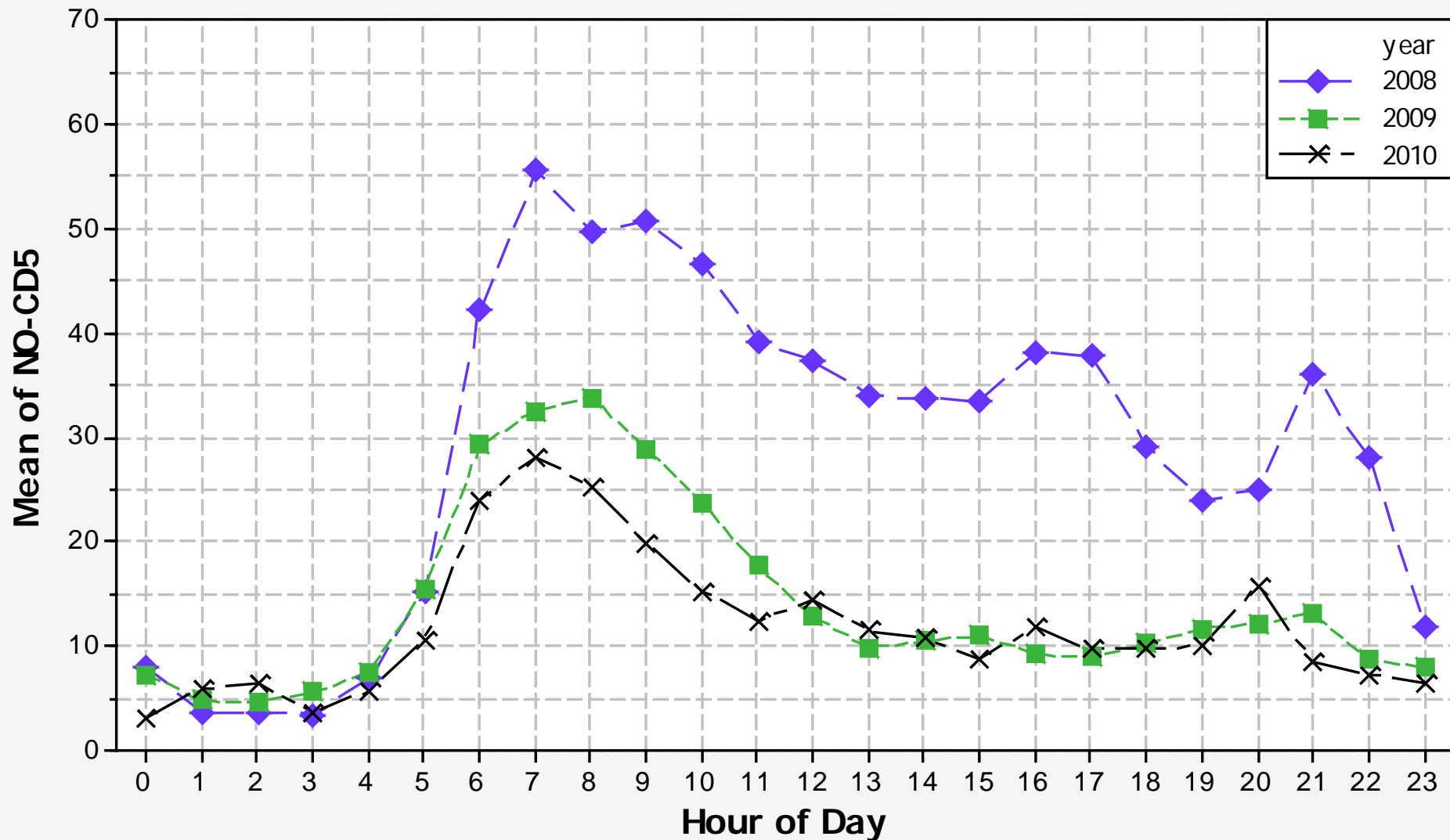
NO2 Levels at Trial Site by Wind Direction in the Courtyard

1 Year of data from both periods - May data excluded as no wind data in baseline



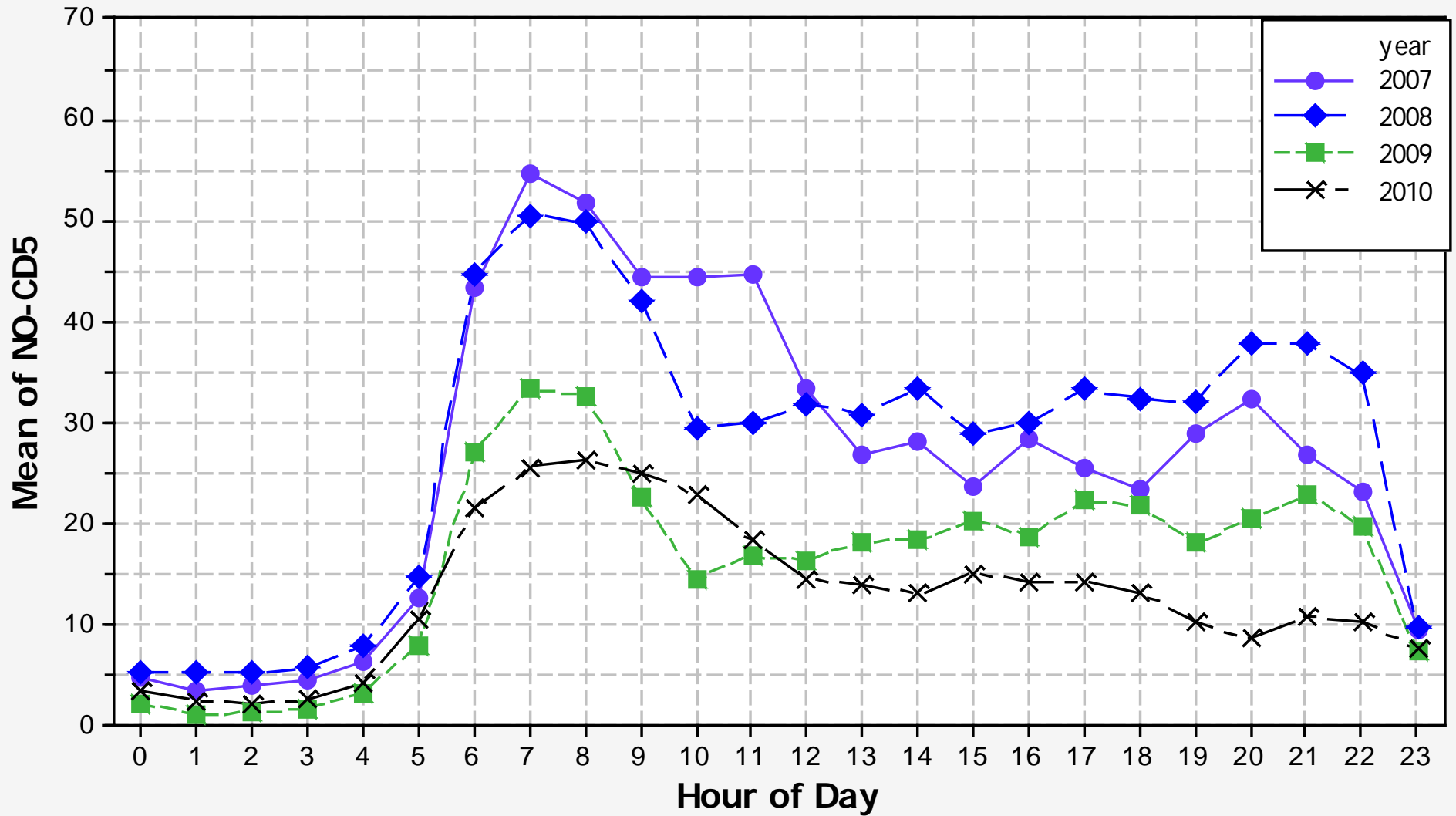
Comparison of NO Levels - Individual Month

Month of Year = June



Comparison of NO Levels - Individual Month

Month of Year = July



Conclusions from Intermediate Trial Period

- ❖ Significant reduction in NO concentrations observed in trial period
- ❖ Smaller effect can be seen on NO₂ concentrations
- ❖ Effect is mostly seen / especially strong when winds are from the W / NW.
 - This matches the fact that high NO levels are seen when the winds are from this direction
 - Effect seen when wind blowing along wall to monitor
- ❖ Drop in NO levels observed in June and July 2009
 - 2 Months after coating was applied
- ❖ Decision taken to cover the wall with board to return to baseline conditions
 - Wall covered with board in August 2010 to deactivate surface
 - Data gathering continued at CD5 until year end 2010

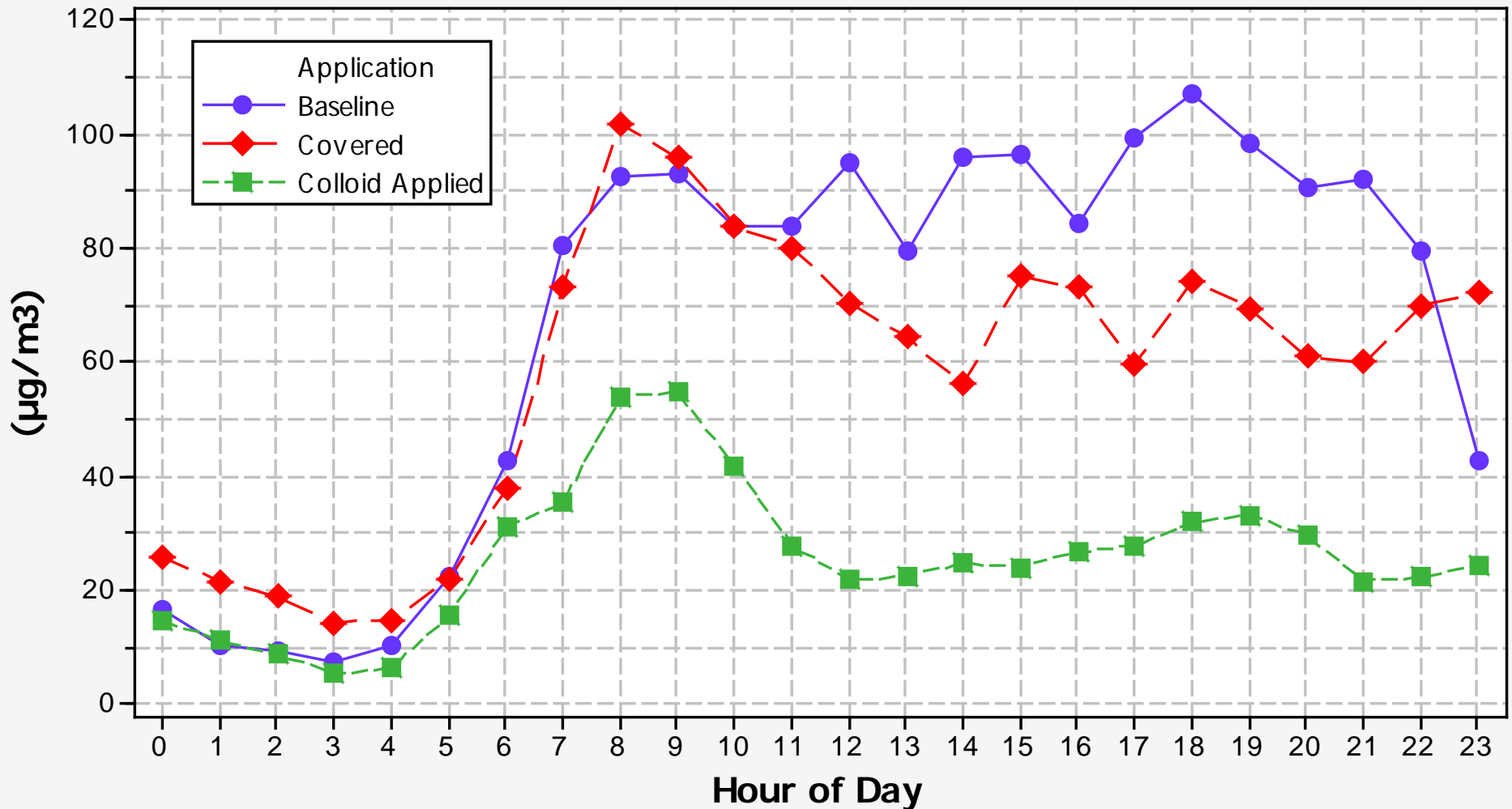
Covered Period



NO Levels at Trial Site - Including Covered Period

September, October, December

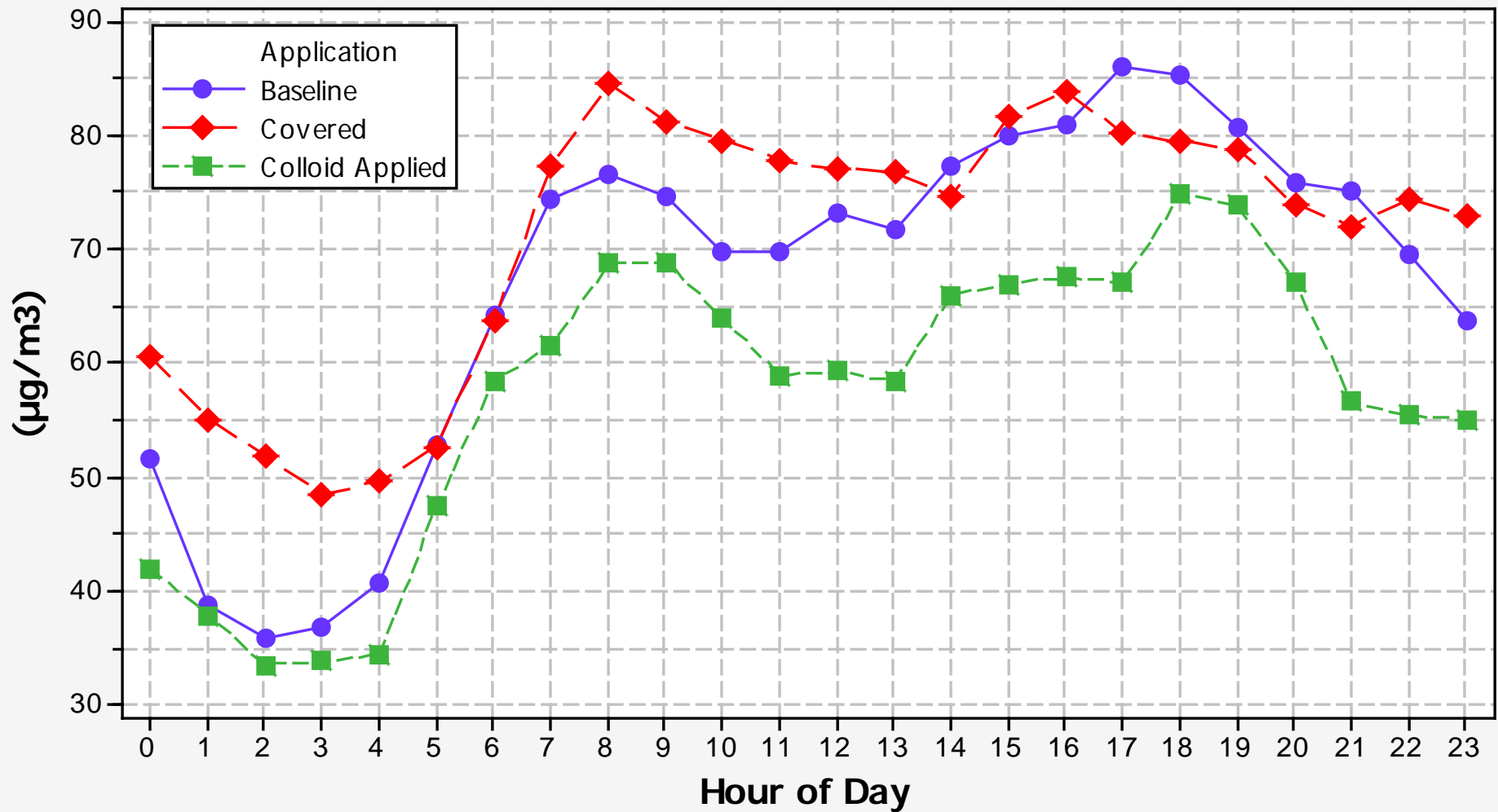
Filtered for Weekdays, Wind < 1.3m/s, Prevailing Wind = NW



NO2 Levels at Trial Site - Including Covered Period

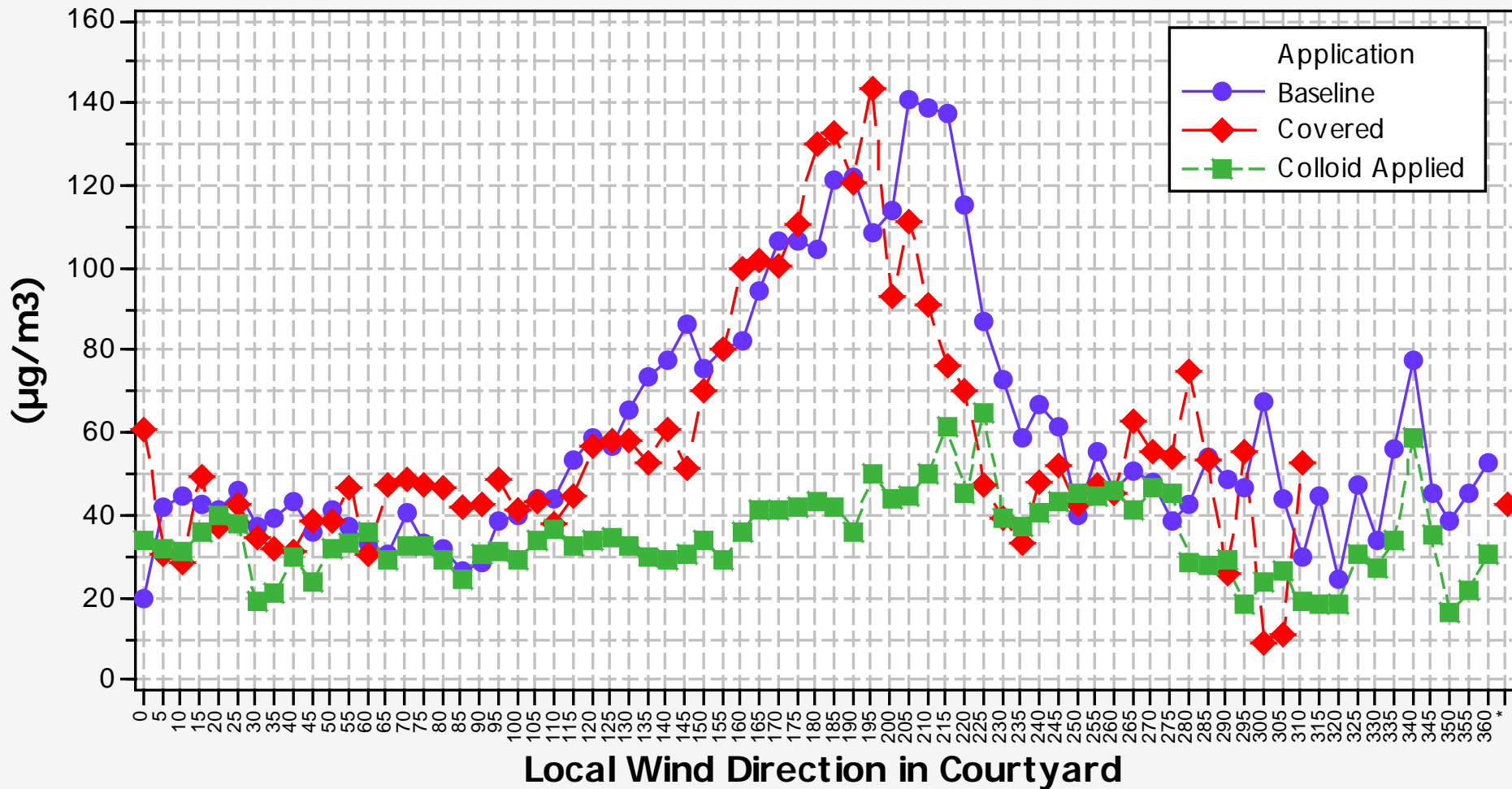
September, October, December

Filtered for Weekdays, Wind < 1.3m/s, Prevailing Wind = NW



NO Levels by Local Wind Direction at Trial Site

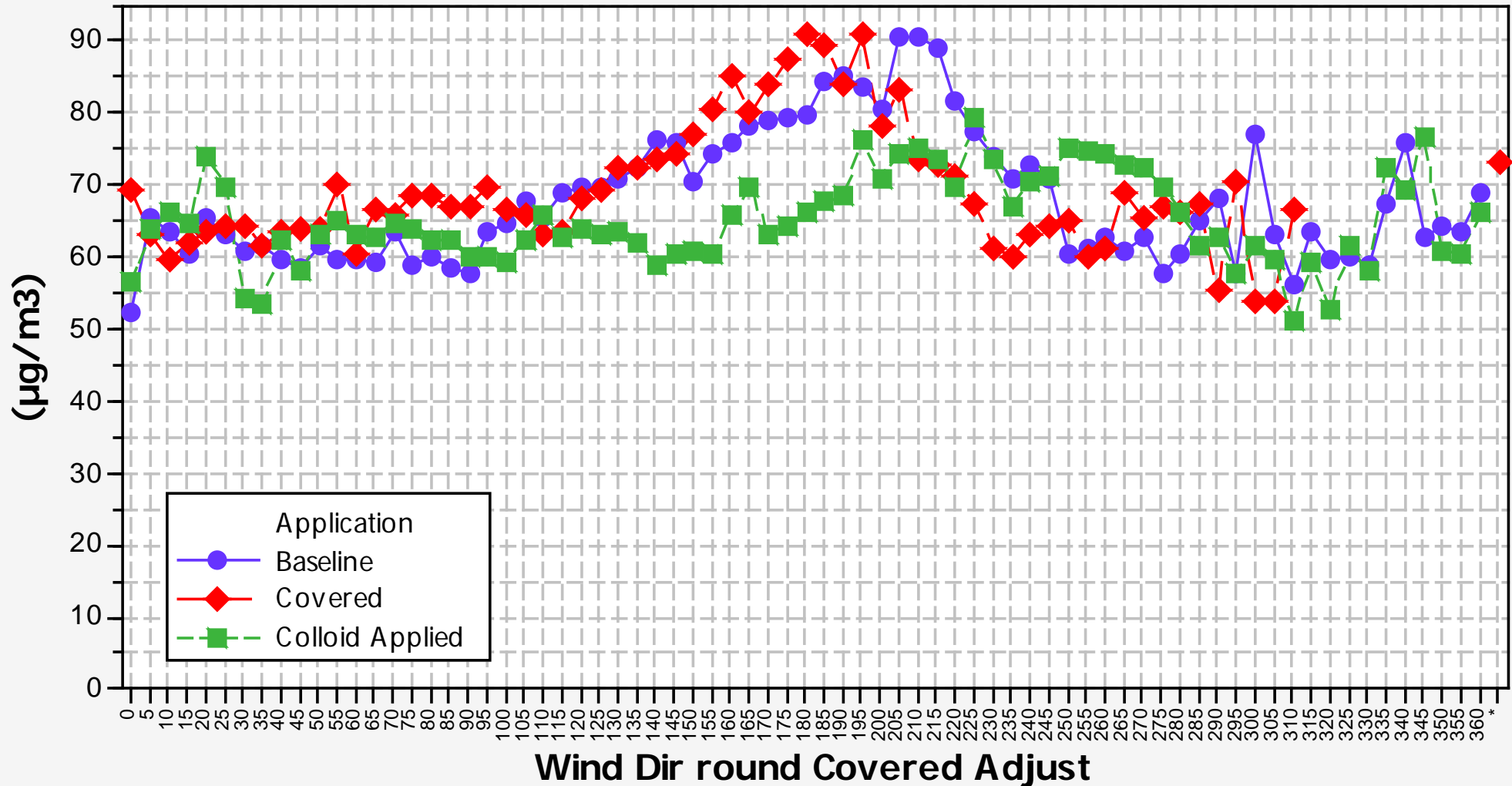
September, October and December Data
Filtered for Weekdays, Wind Speed <1.3m/s



NO2 Levels by Local Wind Direction at Trial Site

September, October and December Data

Filtered for Weekdays, Wind Speed <1.3m/s



Global

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Conclusions from Covered Period

- ❖ Covering the wall returned observed NO and NO₂ levels to the baseline concentrations.
- ❖ This confirmed that the reduction in NO and NO₂ observed during the trial period were due to the effect of the Colloid on the wall.
- ❖ The full year results discussed above are valid.

Size of Effect Observed in Camden Trial

- ❖ The size of the drop in mean concentrations is:-
 - NO –
 - A drop of up to 36 $\mu\text{g}/\text{m}^3$ (from 66 to 29 $\mu\text{g}/\text{m}^3$)
 - This represents up to a 55% reduction in NO Levels
 - NO₂ –
 - A drop of up to 15 $\mu\text{g}/\text{m}^3$ (From 75 to 60 $\mu\text{g}/\text{m}^3$)
 - Approximately 20% reduction in NO₂ levels
- ❖ Calculated rate of removal at average peak concentrations:-
 - NO
 - 100 mg/m²/hr
 - Every m² of the wall removing 0.9kg NO per year
 - NO₂
 - 44 mg/m²/hr
 - Every m² of the wall removing 0.38kg NO₂ per year

Coloured paints that clean the air.



Past trials.....

