Mountain View Corridor Air Quality Working Group
Meeting Minutes
October 14, 2013

Attendees:
- Reed Soper – Former UDOT (MVC EIS), still representative
- Kathy Van Dame – Wasatch Clean Air Coalition
- Linda Hansen - PTA
- David Gourley – Asst. Supt. of Support Services, Granite School District
- Jay Parks – Granite School District HVAC foreman
- Michelle Hofmann (phone) - MD, Faculty at Univ. of Utah, Breathe Utah, Governor’s UCAIR Bd.
- Bo Call (phone) – Air Monitoring Section Manager, Division of Air Quality
- Paul Roberts (phone) – Sonoma Technology, Inc.
- David Vaughn (phone) – Sonoma Technology, Inc.
- Jerry Ludwig (phone) – Environmental Health & Engineering, Inc.
- Andy Neff – The Langdon Group (facilitator)
- Jennifer Tays – The Langdon Group (co-facilitator)

Minutes:
1. Review / Approval of 8/26/13 Meeting Minutes
   - Accepted
2. Review / Discuss 8/26/13 Action Items
3. Conference call and slide presentation (copy as addendum below following minutes) with Paul Roberts, Jerry Ludwig, and David Vaughn to discuss mitigation objectives and assumptions
   - Assumptions which influence mitigation costs
     - Three categories of assumption:
       - Financial
       - Operating Conditions
       - Technical conditions
   - Sonoma wants to be sure the assumptions align with the school district’s
   - Want feedback on time horizon, time value of money, inflation, district labor cost, HVAC operating hours
     - Time horizon (years) – expected life of the equipment or years to next major school renovation
       - Building life varies
       - Generally expect 30 years for schools before renovations are required
       - Schools have maximum life cycle of approximately 65 years
       - Group agreed to change High School and Jr. High life cycle from 20 to 30 years
     - Time value of money (%) over expected time horizon – can be thought of as borrowing cost or interest rate
Like interest rate to be paid on a loan; what does school pay on a bond?
- Group agreed 3-4% is a reasonable range
  - Inflation (%) over expected time horizon
    - Group agreed 4% is reasonable
  - District labor cost for filter replacement
    - Group agreed $40/hr. is accurate
- HVAC operating hours
  - Not entirely defined
  - Working to be more efficient with the HVAC
  - Can often just turn on needed areas rather than run air condition in whole school
  - David Gourley provided additional data to clarify operating hours
- Jerry will finish calculations based on the refined assumptions.

4. Next Meeting
- Monday, November 4 @ 1 – 2:30 p.m., Hunter High School
- Proposed school tour from 2:30-3:30 p.m.

Action Items:
- Post prior meeting minutes to web – Andy & Jennifer
- Look up location of technically untreatable areas of schools – Jerry
- Email powerpoint to David Gourley – Sonoma
- Create powerpoint with watermark to be appended to minutes – Sonoma
- Create meeting minutes with powerpoint appended and distribute to group for review – Andy
- Propose moving Nov. 4 meeting to Hunter High School and have a tour of schools
  - Schedule meeting room at Hunter High School – David Gourley
  - See if Bo or GJ can schedule a van – Andy
- Additional agenda items for Nov. 4 – Andy
  - Other questions outside of the direct air quality responsibility: recommendations for mitigation, health effects of ultrafine particles, presentations for AWG members to take to other venues
Mitigation of Air Pollutants in Schools in Close Proximity to the MVC

Prepared for October 14, 2013, AWG Meeting

Jerry F. Ludwig
Environmental Health & Engineering, Inc.

David L. Vaughn, Paul T. Roberts
Sonoma Technology, Inc.
Outline of Mitigation Report and December Presentation to AWG

- Mitigation objectives
- Background on Mitigation and HVAC systems in schools
- Summary of recommendations and costs
- Assumptions which influence mitigation costs
- Cost estimate of first cost, increased operating cost, and net present cost.
- Breakdown of all costs by school.
- Discuss high cost treatment areas.
- A discussion of cost uncertainties.
- Tradeoffs regarding how to best spend the mitigation resources (dollars).
- Cost estimates are currently being refined and finalized.

Today’s discussion
Outline of Mitigation Discussion

• Objectives
• Summary of background on mitigation
• Introduction to HVAC systems in schools
• Summary of steps to reduce particle concentrations indoors in schools
• Discussion of assumptions which influence mitigation costs
Introduction and Background

• Objective: Make recommendations to mitigate the impacts of the MVC on near-road air quality at 5 schools.

• Previous studies in Las Vegas and elsewhere have significantly reduced particles (but not gases) by filtration.
Why are we Upgrading Filtration?

MVC is expected to produce an increase in ambient near-road particles 0.01 to 1.0 μm
General HVAC System in a School

Expectation: Filtration systems could remove 80-95% of outdoor black carbon particles, per results from Las Vegas schools.
Overall Steps in Mitigation Analysis

- Evaluate existing system design.
- Evaluate available filters and their performance specifications.
- Setup costing spreadsheet.
- Perform engineering and cost analysis of potential equipment to be upgraded.
- Evaluate sensitivity of costs to assumptions.
Components of Mitigation Costs

• First Cost: purchase of replacement or new equipment, required modifications, adjustments, etc.
• Operating Costs: increase in filter costs, increase in energy costs, reduction in labor due to fewer filter changes
• Time value of money
• Inflation
Outline of Assumptions for Mitigation Cost Estimates

The following assumptions have a significant influence on the mitigation cost estimates. We want these assumptions to be consistent with how the Granite School District views their projects. The assumptions can be classified in 3 groups:

• Financial
• Operating conditions
• Technical conditions
<table>
<thead>
<tr>
<th>Assumption</th>
<th>HS and Jr HS</th>
<th>Elementary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time horizon</td>
<td>20</td>
<td>30</td>
</tr>
<tr>
<td>Time value of money (%)</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Inflation (%)</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>District labor cost ($/hr)</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>HVAC operating hours</td>
<td>65 hrs/wk, 42 wks</td>
<td>45 hr/wk, 34 wks</td>
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<tr>
<td>Particulate matter concentration (µg/m3)</td>
<td>21</td>
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</tr>
<tr>
<td>District electricity cost ($/kWh)</td>
<td>0.037507</td>
<td>0.037507</td>
</tr>
<tr>
<td>District electricity max demand cost ($/kW)</td>
<td>17.69</td>
<td>17.69</td>
</tr>
<tr>
<td>Filter costs ($)</td>
<td>Varies</td>
<td>Varies</td>
</tr>
<tr>
<td>Filter pressure drop limit</td>
<td>Varies</td>
<td>varies</td>
</tr>
</tbody>
</table>
Financial Assumptions for Mitigation Cost Estimates

- Expected time horizon for this mitigation project. (Expected life of the equipment, or years to next major school renovation?)
- Time value of money over the expected time horizon.
- Inflation over the expected time horizon.
- District labor cost for filter replacement.
Operating Assumptions for Mitigation Cost Estimates

Winter hours: Is winter during the school year?
- Whittier - 6:00am - 7:00pm
- West Valley - 6:30am - 6:30pm
- Hillside - 6:00am - 5:00pm
- Hunter Jr HS - 6:00am - 5:00pm
- Hunter HS - 6:00am - 10:00pm All rooms until 10pm every night, including Friday?
- All schools are occupied Monday through Friday.
- Winter hours are set by the Schools request. Systems off during winter and spring break?

Summer hours
- Whittier - 7:00am - 3:00pm
- West Valley - 7:00am - 3:00pm
- Hillside - 7:00am - 3:00pm
- Hunter Jr HS - 7:00am - 3:00pm
- Hunter HS - 6:00am - 10:00pm All rooms until 10pm every night, including Friday?
- Systems off during summer staff break?
Technical Assumptions for Mitigation Cost Estimates

• Electric costs based on current values
• Electric cost inflation will track general inflation assumed for the project
• Filter performance based on filter test and specification data for products currently available and priced by vendor for this project.
• Ability of Air Handler Units based on original design drawings for Whittier Elementary, Hillside Elementary and West Valley Elementary
Technical Assumptions for Mitigation Cost Estimates (continued)

- Ability of Air Handler Units to accommodate the enhanced filters based on limitations prescribed by the “engineer of record” for the recent air conditioning projects completed at Hunter High and Hunter Jr. High.
- First Cost Estimates are based on estimates from vendors that currently have been or are vendors to the school district.
## Relative Treatment Area per School

<table>
<thead>
<tr>
<th>School</th>
<th>Number of Air Handling Units (AHUs)</th>
<th>Percent of Floor Area</th>
<th>Building Design Circa</th>
<th>HVAC Remodel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whittier Total</td>
<td>10</td>
<td>14%</td>
<td>2002*</td>
<td>–</td>
</tr>
<tr>
<td>Hillside</td>
<td>4</td>
<td>7%</td>
<td>1983</td>
<td>–</td>
</tr>
<tr>
<td>West Valley</td>
<td>9</td>
<td>12%</td>
<td>1998</td>
<td>–</td>
</tr>
<tr>
<td>Hunter Jr. High</td>
<td>15</td>
<td>23%</td>
<td>1983</td>
<td>2011</td>
</tr>
<tr>
<td>Hunter High School</td>
<td>34</td>
<td>45%</td>
<td>1987</td>
<td>2011</td>
</tr>
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* Additional area for medical sensitive students added circa 2011.
Example: Point of Diminishing Returns (cost versus % treated area)

Note the significant increase in First cost starting at about 70%, and in operating cost starting at about 90%. Most of these higher-cost areas are in the HS.
Preliminary Operating Cost Analysis By School
Areas that For Technical Reasons Cannot Be Treated

<table>
<thead>
<tr>
<th>Building</th>
<th>Unit Designation</th>
<th>Area Served</th>
<th>Approx. Square Feet</th>
<th>Percent of Building</th>
<th>Percent of the Five Schools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hunter High</td>
<td>AH-21</td>
<td>Classrooms</td>
<td>8,000</td>
<td>2%</td>
<td>1.0%</td>
</tr>
<tr>
<td>Hunter High</td>
<td>AH-25</td>
<td>Kitchen/Dining</td>
<td>14,000</td>
<td>4%</td>
<td>1.8%</td>
</tr>
<tr>
<td>Hunter Jr. High</td>
<td>AH-5</td>
<td>Instruments</td>
<td>3,100</td>
<td>2%</td>
<td>0.4%</td>
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The AHUs serving these areas have insufficient capacity to handle the improved filters.
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