Advanced Locomotive Emissions Control System (ALECS®)

Advanced Cleanup Technologies, Incorporated
Pollution Control Specialists
ARB 2006 Emission Reduction Plan for Ports and Goods Movement

2020 Projected PM Statewide Emissions

- Ships: 65%
- Trucks: 17%
- Locomotives: 5%
- Harbor Craft: 1%
- Cargo Handling: 12%
Elevated Cancer Risks Near Railyards

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Risk Range (per Million)

- > 500: 645 (Railyard Contribution), 360 (Ambient Background)
- 100 - 500: 171 (Railyard Contribution), 360 (Ambient Background)
- < 100: 40 (Railyard Contribution), 360 (Ambient Background)

The Higher Risk Ranges are closer to the railyard.

Roseville Railyard Study 2004
Government Efforts

- Locomotives are subject to federal standards (EPA) and memoranda of mutual understanding (MOU) negotiated with the ARB
  - 1998 – SCAQMD MOU Early Introduction of Tier 2 Clean Locomotives by 2010
  - 2004 – ARB Low Sulfur Diesel Rule
  - 2005 – ARB MOU to cut PM Statewide
  - 2006 – Idle Enforcement Training
  - 2007 – Intrastate traffic must use CARB fuel
  - 9/9/2009 – Staff recommended Further Reductions
  - 2011 – 2010 – Concentrate Tier 3 Locos in Southern CA
Successful Demonstration Program (2005)
Emissions Treatment Subsystem

Picture of the Actual System
Demonstrated and Tested in Roseville, California
Successful Demonstration Program (continued)

• The objective of the test at Union Pacific Railroad’s J. R. Davis rail-yard in Roseville, California was to demonstrate ALECS capability to:
  - Remotely attach to a railroad locomotive around the exhaust opening
  - Capture the exhaust gas and direct it via an overhead manifold system into the Emissions Treatment Subsystem
Successful Demonstration Program (continued)

- Maintain attachment and exhaust capture while the railroad locomotive is underway within designated area

• The test of ALECS was a success, meeting all the goals described above and more

• The same treatment system has also been tested on AMECS
Pollutants Removed in Tons per Year

- NOx: 68.5 Tons per Year, 97.8%
- PM: 45.4 Tons per Year, 92.1%
- VOCs: 8.5 Tons per Year, 62.7%
- SOx: 0.74 Tons per Year, 97.3%
Cancer Risk in South Coast Air Basin
Data from AQMD Draft 2007 AQMP, Appendix 1

Figure 1. Major pollutants contributing to Air Toxics Cancer Risk in the South Coast Air Basin

- Diesel Exhaust: 71%
- 1,3-Butadiene: 11%
- Benzene: 8%
- Carbonyls: 7%
- Others: 3%
# Annual California PM2.5 and O3 Health Impacts

**CARB Data for 2009 in 2007 dollars**

<table>
<thead>
<tr>
<th>Health Outcome</th>
<th>Cases per Year</th>
<th>Uncertainty Range(^1) (Cases per Year)</th>
<th>Valuation(^2) (Millions)</th>
<th>Uncertainty Range(^3) (Valuation - Millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Premature Death</td>
<td>19,000</td>
<td>6,000 to 33,000</td>
<td>$170,000</td>
<td>$55,000 to $300,000</td>
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<tr>
<td>Hospital Admissions (Respiratory &amp; Cardiovascular)</td>
<td>9,400</td>
<td>5,600 to 14,000</td>
<td>$370</td>
<td>$220 to $540</td>
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<tr>
<td>Asthma and Other Lower Respiratory Symptoms</td>
<td>280,000</td>
<td>110,000 to 430,000</td>
<td>$5.6</td>
<td>$2.3 to $8.6</td>
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<tr>
<td>Acute Bronchitis</td>
<td>22,000</td>
<td>0 to 44,000</td>
<td>$10</td>
<td>$0 to $20</td>
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<tr>
<td>Work Loss Days</td>
<td>1,900,000</td>
<td>1,600,000 to 2,100,000</td>
<td>$370</td>
<td>$310 to $420</td>
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<tr>
<td>Minor Restricted Activity Days</td>
<td>13,000,000</td>
<td>9,700,000 to 16,000,000</td>
<td>$830</td>
<td>$620 to $1,000</td>
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<tr>
<td>TOTAL VALUATION</td>
<td>NA</td>
<td>NA</td>
<td>$170,000</td>
<td>$56,000 to $300,000</td>
</tr>
</tbody>
</table>
ALECS Production System

- Located at maintenance and testing locations
- ALECS attaches to multiple locomotives, in multiple locations, and directs exhaust to a single, centrally located ETS
- ALECS operates automatically and does not interfere with railyard operations
Example Application

Multiple Locomotive Exhaust Capture System – Railroad Maintenance & Service Facility
Automated Operation

- A Locomotive enters the treatment zone
- ALECS detects the locomotive, locates the stack, and attaches automatically
- ALECS treats exhaust during idling and testing
- When the locomotive moves away, ALECS automatically disconnects
Initial Market Potential

- **Initial Markets**
  - UP Roseville: 22 Stations
  - BNSF Barstow: 8 Stations
  - BNSF Sheila Mechanical: 6 Stations
  - UP Colton: 6 Stations
  - UP Commerce: 4 Stations
  - UP ICTF: 3 Stations
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