Overview

- **Inventory updates**
  - Construction/mining/industrial equipment
  - Airport ground support equipment

- **Regulatory concepts**
  - Rule structure
  - Changes since January '06 version
  - Response to other comments received

- **Compliance for example fleet**

- **Preliminary cost analysis**

- **Next steps**

### Inventory Updates: Construction/ Mining/ Industrial

- **Annual Use**
  - Average annual use updated based on:
    - 2003 and 2005 ARB surveys
  - Varied annual use vs. age for construction/mining
    - Annual use declines 30-90% over life

- **Crawler Tractor: Proposed Usage vs. Time**
  - New Use
  - Old Use

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**July 21, 2006**
Sacramento and El Monte, California

Heavy-Duty Diesel In Use Strategies Branch

California Environmental Protection Agency

Air Resources Board
Equipment Populations

- Updated based on:
  - U.S. EPA NONROAD estimates
- Construction/mining populations about 8% lower than previous estimates
- Industrial populations about 90% higher
- New year 2000 populations
  - ~148,000 construction/mining
  - ~15,000 industrial

Longer Useful Lives

- Updated based on:
  - MacKay (2003) average age scrapped
  - Mini-survey of fleet equipment ages
  - 2003 and 2005 survey “average age when scrapped or sold”
- Construction/mining lives ~ double
- Much more Tier 0 equipment (close to 50% in 2005)

Example Survival Curve Change

- Crawler tractor – changed median useful life from 16 to 29 years

Inventory Updates: Airport Ground Support Equipment
Annual Use, Equipment Population, and Useful Life

- Average annual use and equipment population updated based on 2005 ARB survey
  - Population up about 12%
  - Year 2000: 1,640 pieces
  - Hours of operation constant over equipment life
- Useful life updated based on 2004 Air Transport Association (ATA) survey
  - Survey included data on average age of equipment by equipment type
  - Useful lives increased about 40%

Regulatory Concept Changes

- Summary of rule structure
- Definition changes
- Fleet average changes
  - Compliance dates
  - Electric/alternative fuel equipment
  - New Appendix A factors for uncertified engines
  - New targets and how set
- Technology off-ramp (BACT)
  - Never require more than 10%/yr turnover
- Idling changes
- Encouraging NOx reductions
- No more ban on sale/purchase of Tier 0
- Labeling details
- Reporting

Proposed Rule Structure

- Must meet fleet average target
  - Compliance dates start in 2009 (large fleets only), 2010 (medium fleets), and 2015 (small fleets)
  - Separate fleet average targets for Construction/Mining/Industrial and GSE
  - “Technology off-ramp” if fleet average cannot be met at any time (BACT)
Off-Ramp Provisions

- If fleet average is not met must demonstrate off-ramp (BACT) provisions were met

<table>
<thead>
<tr>
<th>Year</th>
<th>Off-Ramp (BACT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009 (large fleets only)</td>
<td>Retrofit equipment older than 5 years with highest level VDECS</td>
</tr>
<tr>
<td>2010-12 (2015-17 for small fleets)</td>
<td>Retrofit equipment older than 5 years with highest level VDECS</td>
</tr>
<tr>
<td>2013-20 (2018-25 for small fleets)</td>
<td>Same as 2010 and also replace up to 10% of max power per year. Replace engines older than 10 years with no VDECS, and Tier 0/1 engines not certified to a PM standard with no Level 3 VDECS. For engines with a Level 1 or 2 VDECS installed more than 6 years before compliance date, if a Level 3 VDECS has been verified, install the Level 3 VDECS</td>
</tr>
</tbody>
</table>

Definition Changes

- Agricultural operations
  - Now includes agricultural crop preparation services
  - Packinghouses, cotton gins, nut hullers and processors, dehydrators, and feed and grain mills
- Alternative fuel – new definition
- Construction/mining/industrial equipment fleet
  - combined construction/mining and industrial for fleet average purposes
- Engine/vehicle identification number
  - not sequential
  - assigned by ARB

Definition Changes: Fleet Definitions

- Fleet
  - Mobile diesel off-road engines 25 hp or greater
  - Owned equipment plus equipment rented or leased for a period of one year or more or reasonably expected to be rented or leased for a period of one year or more
- Total equipment under common ownership defines fleet size
- United States and California agencies may report separately, but must meet the large fleet requirements
- Fleet size - defined by total maximum power, not number of pieces; better correlation with emissions

Survey Results

<table>
<thead>
<tr>
<th>Total max power [hp]</th>
<th>% of total hp</th>
<th>% of Equipment</th>
<th>% of Fleets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large &gt;20,000</td>
<td>67</td>
<td>51</td>
<td>5</td>
</tr>
<tr>
<td>Medium 1,500-20,000</td>
<td>29</td>
<td>37</td>
<td>30</td>
</tr>
<tr>
<td>Small &lt;1,500</td>
<td>4</td>
<td>12</td>
<td>65</td>
</tr>
</tbody>
</table>

Definition Changes: Low-use Equipment

- Operates less than 100 hours per year, based on a three calendar-year rolling engine-hour average
- Proposed at 50 hrs/year in Jan. '06
- Will improve cost-effectiveness
- Give up <4% of potential emission reductions
- Low-use equipment must meet BACT or fleet average in 2020

Survey Results

<table>
<thead>
<tr>
<th>% PM Emissions</th>
<th>% Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;=0.8%</td>
<td>10.5%</td>
</tr>
<tr>
<td>&lt;=3.3%</td>
<td>22.7%</td>
</tr>
<tr>
<td>&lt;=13.8%</td>
<td>47.9%</td>
</tr>
</tbody>
</table>

Assumptions:
- Construction/mining equipment, load factor and hp for low-use same as for general population; EF for low-use=0.72 g/bhp-hr, EF for general population = 0.5 g/bhp-hr. Percent emissions are for 50 hrs/yr, 100 hrs/yr, and 200 hrs/yr operation, respectively
**Definition Changes: Off-Road Definition**

1. Is a drill rig, crane, or concrete pump truck used predominantly off of public roads? 
   - Yes: Does the equipment meet the off-road definition? 
     - Yes: Engine certified to off-road engine standards? 
       - Yes: Has CA Special Construction Equipment plate? 
         - Yes: Has permanently mounted auger or blower for snow removal? 
           - Yes: OFF-ROAD 
           - No: ON-ROAD 
         - No: ON-ROAD 
       - No: ON-ROAD 
   - No: ON-ROAD 

**Fleet Average Changes**

- Shift compliance dates from January 1 to March 1
  - Spread out device purchases/installations from those for other diesel ATCMs
  - Allows retrofit installation during winter down-time
- Fleet average must be met between compliance dates and maintained after 2020
- If add equipment to the fleet, have 3 months to meet the previous fleet average target
- Must meet the overall fleet average target
  - Do not have to meet the individual horsepower group fleet average targets

**Electric and Alternative Fuel Equipment in Fleet Average**

- Electric emission factor is 0
- If bought 1/1/07 or later, may count in the fleet average if:
  - Serves same function and performs same work as diesel equipment
  - Is not already counted in large spark ignition fleet average, and
  - Has certified NOx less than the diesel NOx standard for the same model year and horsepower
- Stationary or portable electric equipment used to replace mobile diesel equipment, such as a conveyor system at a mine, may also count
- Electric airport GSE bought before 1/1/07
  - May count 20% toward fleet average
- Other electric and alternative fuel equipment bought before 1/1/07 may be counted if it is certain that diesel equipment would have otherwise been purchased to accomplish the same work

**Fleet Average Emission Factors:**

- Based on engine certification standard or Appendix A
  - Appendix A factors are surrogates for uncertified engines
  - Carl Moyer Program zero-hour emission factors representative of new equipment
    - Not appropriate for average fleet
    - May change in next revision
- Certification values (i.e., test values) are not enforceable and may not be representative of all engines covered in certification EO
How Proposed Fleet Average Targets Set

- Set at level that could be achieved through aggressive turnover and retrofits
  - For example, could meet through ~20% turn over to new, ~60% Level 3 retrofit
- But can be no more stringent than fleet average from 5-year turnover with no retrofits
- Proposed construction/mining/industrial fleet averages
  - 2010: Fleet average PM down 66% from 2000 baseline, expect >50% reduction in PM emissions
  - 2020: Fleet average PM down 93% from 2000 baseline, expect ~85% reduction in PM emissions
- Proposed airport ground support equipment fleet averages
  - 2010: Fleet average PM down 69% from 2000 baseline, expect ~60% reduction in PM emissions
  - 2020: Fleet average PM down 95% from 2000 baseline, expect ~90% reduction in PM emissions

Construction/Mining/Industrial Fleet Averages [g/bhp-hr PM]

<table>
<thead>
<tr>
<th></th>
<th>Large and Medium Fleet Compliance Date: 3/1 of</th>
<th>Small Fleet Compliance Date: 3/1 of</th>
<th>25-99 hp</th>
<th>100-750 hp</th>
<th>&gt;750 hp</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009 (large fleets only)</td>
<td>Not applicable</td>
<td></td>
<td>0.40</td>
<td>0.25</td>
<td>0.25</td>
</tr>
<tr>
<td>2010</td>
<td>2015</td>
<td></td>
<td>0.34</td>
<td>0.19</td>
<td>0.20</td>
</tr>
<tr>
<td>2013</td>
<td>2018</td>
<td></td>
<td>0.27</td>
<td>0.15</td>
<td>0.17</td>
</tr>
<tr>
<td>2017</td>
<td>2022</td>
<td></td>
<td>0.09</td>
<td>0.05</td>
<td>0.06</td>
</tr>
<tr>
<td>2020</td>
<td>2025</td>
<td></td>
<td>0.06</td>
<td>0.03</td>
<td>0.06</td>
</tr>
</tbody>
</table>

Airport GSE Fleet Averages [g/bhp-hr PM]

<table>
<thead>
<tr>
<th></th>
<th>Large and Medium Fleet Compliance Date: 3/1 of</th>
<th>Small Fleet Compliance Date: 3/1 of</th>
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<th>100-750 hp</th>
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<tr>
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<td>Not applicable</td>
<td></td>
<td>0.40</td>
<td>0.25</td>
<td>0.25</td>
</tr>
<tr>
<td>2010</td>
<td>2015</td>
<td></td>
<td>0.34</td>
<td>0.19</td>
<td>0.20</td>
</tr>
<tr>
<td>2013</td>
<td>2018</td>
<td></td>
<td>0.27</td>
<td>0.15</td>
<td>0.17</td>
</tr>
<tr>
<td>2017</td>
<td>2022</td>
<td></td>
<td>0.09</td>
<td>0.05</td>
<td>0.06</td>
</tr>
<tr>
<td>2020</td>
<td>2025</td>
<td></td>
<td>0.06</td>
<td>0.03</td>
<td>0.06</td>
</tr>
</tbody>
</table>

Accelerated Turnover (BACT Off-Ramp)

- Accelerated Turnover Engines include:
  - Engines older than 10 years with no VDECS, and Tier 0/1 engines not certified to a PM standard with no Level 3 VDECS
  - Turn over 10% of fleet horsepower each year
- Order of Accelerated Turnover:
  1. All uncontrolled (i.e., not retrofit with a VDECS) pre-1988 model year Tier 0 engines, before
  2. All pre-1988 model year Tier 0 engines retrofit with a Level 1 VDECS, before
  3. Other remaining Tier 0 and Tier 1 engines that must be replaced, before
  4. Other remaining Tier 2 and Tier 3 engines that must be replaced, before
  5. Tier 4 interim engines that must be replaced.
Expand Idling Exemptions

- Idle limits remain at \( \leq 5 \) minutes
  - Except when queuing, verifying safe operation, testing, servicing, repairing, or when necessary to accomplish work for which equipment designed.
- Added exemptions for:
  - Idling to bring machine to operating temperature (CIAQC)
  - Idling to provide for safe operation of the equipment

Encouraging NOx Reductions

- Need to place greater emphasis reducing NOx:
  - Mortality from secondary particulate matter formed from diesel NOx emissions can be as significant as that due to direct diesel PM
  - South Coast and San Joaquin Valley attainment deadlines for PM2.5 and eight-hour ozone in 2015-2025
- Ways to more strongly encourage NOx reductions in rule:
  - Include a mandatory level of turnover of all Tier 0 and 1 engines
  - Include a NOx or secondary PM fleet average requirement.
  - Mandate a maximum allowed percentage of Tier 0 and Tier 1 engines in each fleet. The maximum allowed percentage would decline each year until all Tier 0 and 1 engines have been phased out.
  - Other ideas?

Removed Ban on Sale/Purchase of Tier 0 Equipment

- Major concerns from stakeholders re: devaluing fleets, inability to “bond” projects
- Much more Tier 0 equipment than we originally thought
- Would have involved an additional set of stakeholders (auction-houses, dealers)
- Still strong incentive to retire Tier 0 equipment to meet fleet average

Labeling Changes

- ARB assigns unique identification number
- Identification number stays with equipment no matter who owns it, like a license plate
- Permanently affix or paint on left side of vehicle
- All equipment, even if low-use or small fleet, must be labeled and reported by 2008
  - Apply for number by 1/1/08
  - Label within 30 days of receipt
Example Label

ARB193746

Reporting Changes

- Report April 1 annually beginning in 2008, not just on compliance dates
- If engine family, serial number unknown
  - No enforcement penalty for reporting “unknown”
  - For fleet average purposes, assign unknowns highest emission factor (same as dirtiest Tier 0)
  - Assume no VDECS if engine family unknown
  - Considered “Accelerated Turnover Engine” under BACT

No Project Requirements

- Project Requirements:
  - Some stakeholders asked for stricter project requirements near sensitive sites (schools, hospitals, etc.)
  - Some asked for option to do project averages only in lieu of owned fleet averages
- Difficult to enforce
  - Project duration temporary
  - Equipment rotate in and out of project
  - Many more projects than owned fleets
  - Would require more frequent than annual reporting
- May shift dirty equipment to smaller projects
- Tracking equipment and sensitive sites would significantly add to complexity
- CEQA process addresses specific site issues
No Hours or Load Factor In Fleet Avg

- Fleet average = \[ \frac{\sum_{i} bhp \times EmissionFactor_{i}}{\sum_{i} bhp} \]

- Stakeholders asked us to include hours of operation and load factor
- Why we did not include hours and load factor:
  - Avoids added complexity, recordkeeping, reporting
  - Avoids risk of mis-reported use
  - Difficult to enforce use, impossible to enforce load
  - Avoids spending time debating appropriate equipment type, load factor
  - Some equipment does not have hour meters
  - Use and load may vary from year to year
  - Overall goal is to have all equipment controlled

Compliance for Example Fleet:
Actual fleet from 2003 TIAAX survey

Example Fleet: Baseline

<table>
<thead>
<tr>
<th>Id Number</th>
<th>Equipment</th>
<th>Engine Model Year</th>
<th>Rated HP</th>
<th>Tier</th>
<th>Emission Factor [g/bhp-hr]</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-100 HP GROUP</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Backhoe Loader</td>
<td>1996</td>
<td>95</td>
<td>0</td>
<td>1.006</td>
</tr>
<tr>
<td>3</td>
<td>Backhoe Loader</td>
<td>1997</td>
<td>96</td>
<td>0</td>
<td>0.988</td>
</tr>
<tr>
<td>4</td>
<td>Backhoe Loader</td>
<td>1999</td>
<td>90</td>
<td>0</td>
<td>1.006</td>
</tr>
<tr>
<td>5</td>
<td>Backhoe Loader</td>
<td>1999</td>
<td>90</td>
<td>0</td>
<td>0.996</td>
</tr>
<tr>
<td>100-750 HP GROUP</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Wheel Loader</td>
<td>1996</td>
<td>375</td>
<td>0</td>
<td>0.660</td>
</tr>
<tr>
<td>7</td>
<td>Tractor/Dozer</td>
<td>1997</td>
<td>375</td>
<td>1</td>
<td>0.4</td>
</tr>
<tr>
<td>8</td>
<td>Wheel Loader</td>
<td>1987</td>
<td>375</td>
<td>1</td>
<td>0.6</td>
</tr>
<tr>
<td>Total HP: 1506</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2005 Baseline Fleet Average = 0.65 g/bhp-hr</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Fleet Average Targets for Construction/Mining/Industrial Equipment

<table>
<thead>
<tr>
<th>HP Group</th>
<th>2010</th>
<th>2013</th>
<th>2017</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;100 hp</td>
<td>0.25</td>
<td>0.29</td>
<td>0.12</td>
<td>0.04</td>
</tr>
<tr>
<td>100-750 hp</td>
<td>0.40</td>
<td>0.16</td>
<td>0.36</td>
<td>0.04</td>
</tr>
<tr>
<td>&gt;750 hp</td>
<td>0.70</td>
<td>0.72</td>
<td>0.38</td>
<td>0.04</td>
</tr>
</tbody>
</table>

Example Fleet: Scenario if Lots of Level 3 Retrofits Available

<table>
<thead>
<tr>
<th>Id #</th>
<th>Equipment</th>
<th>Model Year</th>
<th>Hp</th>
<th>Tier</th>
<th>2010</th>
<th>2013</th>
<th>2017</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Backhoe Loader</td>
<td>1996</td>
<td>95</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>Backhoe Loader</td>
<td>1997</td>
<td>95</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>Backhoe Loader</td>
<td>1998</td>
<td>96</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>Backhoe Loader</td>
<td>1999</td>
<td>96</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>Wheel Loader</td>
<td>1996</td>
<td>375</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>7</td>
<td>Tractor/Dozer</td>
<td>1997</td>
<td>375</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>Wheel Loader</td>
<td>1987</td>
<td>375</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Action by:
- Assume the 1986 MY equipment was replaced between 2005 and 2010 due to normal turnover
- Shading indicates vehicles replaced through normal 20-year turnover (i.e., when >=20 years old)
**Example Fleet:**

**BACT: Replace 10% HP per Year if Retrofits Not Widely Available**

<table>
<thead>
<tr>
<th>ID #</th>
<th>Equipment</th>
<th>Model Year</th>
<th>hp</th>
<th>Tier</th>
<th>2010</th>
<th>2013</th>
<th>2017</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Backhoe Loader</td>
<td>1986</td>
<td>95</td>
<td>0</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>Backhoe Loader</td>
<td>1997</td>
<td>96</td>
<td>0</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>4</td>
<td>Backhoe Loader</td>
<td>1999</td>
<td>96</td>
<td>0</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>5</td>
<td>Backhoe Loader</td>
<td>1999</td>
<td>96</td>
<td>0</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>6</td>
<td>Wheel Loader</td>
<td>1986</td>
<td>375</td>
<td>0</td>
<td>Replaced with Tier 3*</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>7</td>
<td>Tractor/Dozer</td>
<td>1997</td>
<td>375</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>8</td>
<td>Wheel Loader</td>
<td>1997</td>
<td>375</td>
<td>1</td>
<td>Replace with Tier 4</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

*Assume the 1986 MV equipment was replaced between 2005 and 2010 due to normal turnover. Shading indicates vehicles replaced through normal 20-year turnover (i.e., when >=20 years old).

**Fleet Average PM:**
- 0.456
- 0.361
- 0.067
- 0.033

**Fleet Target PM:**
- 0.238
- 0.190
- 0.075
- 0.052

---

**Cost Analysis Example**

- **Example:** 1998 Backhoe, 92 hp
- **New price =** $78,000
- **Used price for 11-year old equipment =** $13,000
- **Used price for 18-year old equipment =** $9,300
- **Equipment useful life = 18 yrs**
  - Retrofit or replace in 2009
  - In 2009, would be replacing 7 years early
- **Interest rate = 7%**
- **VDECS life = 10 years**
- **PM EF = 1.09 g/bhp-hr**
- **Operates 1,346 hrs/year**
- **Load factor = 0.5**
- **Repower at normal rebuild time**

---

**Preliminary Cost and Cost-Effectiveness Analysis**

- **Cost Analysis Example**
  - **Example:** 1998 Backhoe, 92 hp
  - **New price =** $78,000
  - **Used price for 11-year old equipment =** $13,000
  - **Used price for 18-year old equipment =** $9,300
  - **Equipment useful life = 18 yrs**
    - Retrofit or replace in 2009
    - In 2009, would be replacing 7 years early
  - **Interest rate = 7%**
  - **VDECS life = 10 years**
  - **PM EF = 1.09 g/bhp-hr**
  - **Operates 1,346 hrs/year**
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  - **Repower at normal rebuild time**

---

**Most Compliance Options Are Cost Effective**

<table>
<thead>
<tr>
<th>Equipment Type</th>
<th>Tier</th>
<th>% PM Reduction</th>
<th>% NOx Reduction</th>
<th>Up-front Cost</th>
<th>Annualized Cost in 2006 dollars *</th>
<th>Cost effectiveness ($/lb PM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1 Retrofit</td>
<td>25%</td>
<td>0%</td>
<td>0%</td>
<td>$2,000</td>
<td>$232</td>
<td>$6.35</td>
</tr>
<tr>
<td>Level 2 Retrofit</td>
<td>50%</td>
<td>0%</td>
<td>0%</td>
<td>$6,000</td>
<td>$697</td>
<td>$9.38</td>
</tr>
<tr>
<td>Level 3 Retrofit</td>
<td>85%</td>
<td>0%</td>
<td>0%</td>
<td>$15,000</td>
<td>$1,743</td>
<td>$13.80</td>
</tr>
<tr>
<td>Repower to Tier 3</td>
<td>72%</td>
<td>61%</td>
<td>61%</td>
<td>$31,000</td>
<td>$3,603</td>
<td>$33.44</td>
</tr>
<tr>
<td>Tier 3 Replacement</td>
<td>72%</td>
<td>61%</td>
<td>61%</td>
<td>$65,000**</td>
<td>$2,502</td>
<td>$30.27</td>
</tr>
</tbody>
</table>

*Cost adjusted by net present value & capital recovery factor
** New equipment cost ($78,000) - Used equipment cost ($13,000)
Return on Equity Analysis

- Trying to design rule to not have significant adverse impact on profitability of affected industries
  - Used 10% change in return on equity (ROE) as threshold for significant adverse impact (ROE = Profit / Equity)
- Looked at each SIC code affected by rule – various mining, construction, equipment rental SIC codes
- Net worth and profit for typical companies in each SIC code from Dun and Bradstreet report (2003)

Return on Equity Analysis Cont’d

- Analyzed “worst-case” scenario where no retrofits are available, and fleets have to turn over whole fleet to brand new
  - Retrofits highly likely to be available (2013)
    - Less expensive
  - Could upgrade to less expensive used equipment
- Conclusions:
  - Majority of companies can absorb cost of 10%/year turnover without exceeding 10% change in ROE
  - Many of those that cannot are likely have small fleets which under proposal can delay compliance

Next Steps

- Workshop this fall
  - Off-road retrofits
  - Regulatory language
  - Emission benefits
  - Cost and economic impacts
- To Board December 2006
Contacts

Kim Heroy-Rogalski
(Lead staff)
kheroyro@arb.ca.gov
(916)327-2200

Michael Baker
mbaker@arb.ca.gov
(916)323-2791

Elizabeth Yura
eyura@arb.ca.gov
(916)323-2397

Tony Brasil
(Manager, In-Use Control Measures Section)
abrasil@arb.ca.gov
(916) 323-2927

Annette Hebert
(Chief, Mobile Source Operations Division)
ahebert@arb.ca.gov
(626)575-6973

Websites:
Control Measure
http://www.arb.ca.gov/msprog/ordiesel/ordiesel.htm

Verified Devices
http://www.arb.ca.gov/diesel/verdev/verdev.htm