Emissions from Standard M-151 Jeep

February 1970

Michael A. Caggiano
Division of Motor Vehicle Pollution Control
National Air Pollution Control Administration
Department of Health, Education, and Welfare
Subject: Emissions from Standard M-151 Jeep

A series of tests have been completed on a standard Army
M-151 Jeep, No. 2D4284. The testing consisted of hot and
cold starts as received, hot starts with a vacuum advance
distributor and hot start with leaned idle A/F. Emissions
were measured simultaneously by the 1970 Federal procedure
and the Constant Volume Sampling (CVS) procedure. In
addition, oxides of nitrogen (NOₓ) were measured in the CVS
sample bag by the Saltzman technique.

A summary of the data is included in Table I.

In the "as received" condition the idle CO was 7 to 8 percent
with a warm engine. By reducing the idle CO to approximately
3 percent, seven-cycle hot start hydrocarbons were reduced
about 140 ppm and CO about 1 percent. The vacuum advance
distributor supplied by ATAC increased both hydrocarbon and
CO and caused a slight, perhaps insignificant, decrease in
NOₓ.
### TABLE I

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**TOTAL FOR CYCLE 1**

795.0 PPM HC 3.89 CO

| 054.6| 9.87| 8.85| 1.03   | 564.5| 10.20| 023.7| 0.43 |
| 097.3*| 5.93| 10.49| 1.00   | 969.5| 5.92 | 236.6| 1.44 |
| 037.4| 2.70| 12.91| 0.99   | 369.8| 2.67 | 043.6| 0.32 |
| 0213.8*| 7.46| 8.23| 1.02   | 2167.9| 7.58 | 134.3| 0.47 |
| 0417.4| 8.62| 9.30| 1.03   | 430.4| 8.88 | 021.5| 0.44 |
| 0309.9| 2.71| 12.82| 1.00   | 300.6| 2.71 | 136.8| 1.23 |
| 0388.5*| 7.47| 6.75| 0.99   | 3839.8| 7.38 | 111.3| 0.21 |

**TOTAL FOR CYCLE 2**

707.5 PPM HC 4.54 CO

| 0488.9| 10.06| 8.40| 1.04   | 507.3| 10.45| 021.3| 0.44 |
| 0707.3*| 6.65| 10.16| 1.02   | 718.8| 6.75 | 175.3| 1.65 |
| 0299.1| 3.09| 12.68| 1.00   | 298.9| 3.08 | 032.5| 0.36 |
| 01535.5*| 7.30| 8.54| 1.05   | 1695.3| 7.63 | 099.5| 0.47 |
| 0346.1| 8.00| 9.68| 1.03   | 356.8| 8.25 | 017.8| 0.41 |
| 0263.1| 3.17| 12.59| 1.00   | 264.6| 3.18 | 119.9| 1.44 |
| 03769.5*| 7.11| 6.96| 0.99   | 3739.3| 7.07 | 108.4| 0.20 |

**TOTAL FOR CYCLE 3**

577.0 PPM HC 4.98 CO

| 0397.5| 8.89| 9.11| 1.04   | 418.8| 9.21 | 017.3| 0.39 |
| 0869.3*| 6.56| 10.09| 1.01   | 880.3| 6.64 | 214.7| 1.62 |
| 0273.9| 2.87| 12.84| 0.99   | 272.5| 2.85 | 032.1| 0.34 |
| 01699.5*| 7.10| 8.77| 1.02   | 1739.5| 7.26 | 107.8| 0.45 |
| 0321.5| 7.51| 10.00| 1.03   | 331.4| 7.72 | 016.5| 0.39 |
| 0241.6| 3.55| 12.38| 1.00   | 242.8| 3.57 | 110.5| 1.62 |
| 04466.5*| 7.35| 6.77| 0.95   | 4264.1| 6.97 | 123.0| 0.20 |

**TOTAL FOR CYCLE 4**

621.5 PPM HC 5.00 CO

| 0379.9| 8.89| 9.16| 1.03   | 383.6| 9.19 | 016.1| 0.39 |
| 0699.3*| 5.53| 10.86| 1.01   | 705.6| 5.57 | 171.9| 1.36 |
| 0273.0| 3.65| 12.35| 1.00   | 273.5| 3.66 | 032.3| 0.43 |
| 01558.5*| 7.47| 8.65| 1.03   | 1605.8| 7.69 | 099.5| 0.48 |
| 0292.9| 7.22| 10.14| 1.03   | 301.5| 7.44 | 015.1| 0.37 |
| 0235.8| 3.58| 12.36| 1.00   | 237.2| 3.60 | 107.9| 1.64 |
| 03797.8*| 7.51| 6.99| 0.98   | 3733.3| 7.18 | 108.3| 0.21 |

**TOTAL FOR CYCLE 5**

650.8 PPM HC 4.87 CO

| 0333.1| 8.71| 9.29| 1.03   | 344.6| 9.02 | 014.5| 0.38 |
| 0610.8| 6.21| 10.34| 1.03   | 627.3| 6.38 | 153.0| 1.56 |
| 0271.5| 4.04| 12.12| 1.00   | 272.5| 4.06 | 032.1| 0.48 |
| 01259.9*| 6.53| 9.21| 1.05   | 1310.0| 6.85 | 081.2| 0.42 |
| 0551.0*| 7.19| 10.15| 1.01   | 556.8| 7.26 | 027.8| 0.36 |
| 0229.2| 3.52| 12.38| 1.01   | 230.8| 3.55 | 105.0| 1.61 |
| 03779.3*| 7.24| 6.95| 0.99   | 3737.3| 7.16 | 108.3| 0.21 |

**TOTAL FOR CYCLE 6**

581.5 PPM HC 5.02 CO

| 0477.6| 9.71| 8.92| 1.03   | 458.9| 9.02 | 014.5| 0.38 |

**AVE 1-4**

675.0 PPM HC 4.60 CO

| 0477.6| 9.71| 8.92| 1.03   | 458.9| 9.02 | 014.5| 0.38 |

**AVE 5-7**

536.0 PPM HC 4.94 CO

**TRIP COMPOSITE**

584.5 PPM HC 4.82 CO

**HC MASS = 5.40**

**CO MASS = 83.66**

5-0031 11-06-69 ARMY JEEP 204284 13567 MILES 3000#

1962 EXPERIMENTAL HOT START STANDARD TRANS. (73°F / 0°F CHP°)

**HC MASS = 5.40**

**CO MASS = 83.66**

5-0031 11-06-69 ARMY JEEP 204284 13567 MILES 3000#

1962 EXPERIMENTAL HOT START STANDARD TRANS. (73°F / 0°F CHP°)
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<th>CO2</th>
<th>FACTOR</th>
<th>CHC</th>
<th>CCO</th>
<th>WHC</th>
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TOTAL FOR CYCLE 1 851.8 PPM HC 5.44 CO

| 1522.8* | 8.52  | 8.61  | 1.00   | 1520.6 | 8.50  | 063.9 | 0.36  |
| 921.8*  | 6.16  | 10.60 | 0.99   | 910.3  | 6.08  | 222.0 | 1.48  |
| 566.8*  | 4.50  | 11.90 | 0.98   | 556.5  | 4.42  | 065.6 | 0.52  |
| 2480.4* | 6.24  | 8.56  | 1.01   | 2504.9 | 6.30  | 155.2 | 0.39  |
| 436.9   | 8.29  | 9.47  | 1.03   | 450.1  | 8.52  | 022.5 | 0.43  |
| 358.5   | 5.18  | 11.43 | 1.01   | 360.8  | 5.21  | 164.1 | 2.37  |
| 5080.0* | 6.93  | 6.40  | 0.94   | 4798.8 | 6.54  | 139.1 | 0.19  |

TOTAL FOR CYCLE 2 832.3 PPM HC 5.73 CO

| 1657.5* | 8.18  | 8.54  | 1.00   | 1665.5 | 8.22  | 069.9 | 0.35  |
| 1447.3* | 6.42  | 10.34 | 0.96   | 1386.1 | 6.16  | 336.5 | 1.50  |
| 772.8*  | 5.08  | 11.45 | 0.98   | 755.8  | 4.96  | 089.1 | 0.59  |
| 1237.8* | 6.36  | 8.83  | 1.09   | 1343.8 | 6.90  | 083.3 | 0.43  |
| 462.9   | 8.77  | 9.11  | 1.03   | 478.9  | 9.07  | 023.9 | 0.45  |
| 353.5   | 5.14  | 11.45 | 1.01   | 355.6  | 5.17  | 161.8 | 2.35  |
| 4091.8* | 6.86  | 6.65  | 1.00   | 4091.8 | 6.86  | 118.7 | 0.20  |

TOTAL FOR CYCLE 3 884.8 PPM HC 5.86 CO

| 1442.8* | 8.33  | 8.77  | 1.00   | 1442.8 | 8.33  | 060.6 | 0.35  |
| 1205.0* | 6.52  | 10.32 | 0.97   | 1173.8 | 6.35  | 286.3 | 1.55  |
| 721.3*  | 5.40  | 11.23 | 0.98   | 710.5  | 5.32  | 083.8 | 0.63  |
| 1022.9* | 5.76  | 9.55  | 1.07   | 1095.1 | 6.17  | 067.9 | 0.38  |
| 485.4   | 8.33  | 9.41  | 1.03   | 498.6  | 8.55  | 024.9 | 0.43  |
| 349.3   | 4.58  | 11.74 | 1.01   | 351.3  | 4.61  | 159.8 | 2.10  |
| 4134.8* | 6.66  | 6.61  | 1.01   | 4160.1 | 6.70  | 120.7 | 0.19  |

TOTAL FOR CYCLE 4 803.3 PPM HC 5.62 CO

| 1470.6* | 8.21  | 8.75  | 1.00   | 1475.5 | 8.23  | 062.0 | 0.35  |
| 1160.1* | 7.00  | 9.64  | 0.99   | 1169.9 | 6.94  | 285.3 | 1.69  |
| 721.3*  | 5.02  | 11.48 | 0.98   | 707.8  | 4.93  | 083.5 | 0.58  |
| 1301.8* | 6.39  | 8.60  | 1.10   | 1429.1 | 7.02  | 088.6 | 0.44  |
| 438.5   | 8.76  | 9.12  | 1.04   | 454.8  | 9.08  | 022.7 | 0.45  |
| 359.4   | 5.62  | 11.09 | 1.01   | 364.3  | 5.70  | 165.7 | 2.59  |
| 3731.3* | 6.32  | 6.89  | 1.03   | 3842.8 | 6.51  | 111.4 | 0.19  |

TOTAL FOR CYCLE 5 818.8 PPM HC 6.29 CO

| 1757.3* | 8.20  | 8.40  | 1.01   | 1769.5 | 8.25  | 074.3 | 0.35  |
| 1395.0* | 6.69  | 10.14 | 0.97   | 1349.0 | 6.46  | 329.0 | 1.58  |
| 634.5*  | 5.15  | 11.41 | 0.99   | 626.5  | 5.09  | 073.9 | 0.60  |
| 2181.6* | 6.94  | 8.32  | 1.02   | 2234.4 | 7.11  | 138.4 | 0.44  |
| 793.0*  | 8.14  | 9.48  | 1.01   | 797.8  | 8.19  | 039.9 | 0.41  |
| 576.8*  | 4.79  | 11.61 | 0.99   | 571.5  | 4.75  | 259.9 | 2.16  |
| 4783.0* | 6.91  | 6.44  | 0.96   | 4603.5 | 6.65  | 133.4 | 0.19  |

TOTAL FOR CYCLE 7 1048.8 PPM HC 5.72 CO

AVE 1-4 842.8 PPM HC 5.66 CO  AVE 6-7 933.8 PPM HC 6.01 CO

TRIP COMPOSITE 901.3 PPM HC 5.88 CO

HC MASS = 8.32 CO MASS = 0.213

5-0039 11-12-69 FORD ARMY JEEP #2D4284 13589 MILES #3000
EXP. W/NEW DIST. 4 SPEED TRANS. HOT START (102)
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<th>CCC</th>
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<td>1.02</td>
<td>1415.0</td>
<td>4.50</td>
<td>087.7</td>
<td>0.28</td>
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<td>7.64</td>
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<td>0.99</td>
<td>193.0</td>
<td>1.90</td>
<td>087.8</td>
<td>0.87</td>
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<tr>
<td>3477.5*</td>
<td>4.16</td>
<td>8.95</td>
<td>0.98</td>
<td>3490.1</td>
<td>4.07</td>
<td>098.8</td>
<td>0.12</td>
</tr>
</tbody>
</table>

**TOTAL FOR CYCLE 1** 429.1 PPM HC 3.15 CO

| 248.7 | 2.85  | 13.19 | 0.97   | 242.3| 2.77 | 010.2| 0.12 |
| 371.1 | 4.35  | 12.07 | 0.99   | 367.3| 4.31 | 089.6| 1.05 |
| 282.0 | 5.48  | 11.47 | 1.00   | 281.5| 5.47 | 033.2| 0.65 |
| 1478.5*| 3.64  | 10.84 | 1.02   | 1582.4| 3.70 | 093.1| 0.23 |
| 257.3 | 6.88  | 10.65 | 1.01   | 259.5| 6.94 | 013.0| 0.35 |
| 218.6 | 3.38  | 12.71 | 0.99   | 216.4| 3.34 | 098.5| 1.52 |
| 3477.5*| 4.16  | 8.95  | 0.98   | 3490.1| 4.07| 098.8| 0.12 |

**TOTAL FOR CYCLE 2** 436.1 PPM HC 4.03 CO

| 284.5 | 2.94  | 13.46 | 0.98   | 278.8| 2.00 | 011.7| 0.08 |
| 352.1 | 4.24  | 12.14 | 0.99   | 348.6| 4.20 | 085.0| 1.02 |
| 253.4 | 5.40  | 11.54 | 1.00   | 253.0| 5.39 | 029.9| 0.64 |
| 1696.3*| 3.10  | 10.82 | 1.02   | 1730.8| 3.17| 107.3| 0.20 |
| 216.8 | 6.22  | 11.06 | 1.01   | 218.2| 6.26 | 010.9| 0.31 |

**TOTAL FOR CYCLE 3** 438.5 PPM HC 3.49 CO

| 219.8 | 1.91  | 13.50 | 0.99   | 216.8| 1.88 | 009.1| 0.08 |
| 283.6 | 4.07  | 12.24 | 0.99   | 281.9| 4.04 | 068.8| 0.99 |
| 234.2 | 4.60  | 12.04 | 0.99   | 232.7| 4.57 | 027.4| 0.54 |
| 1683.5*| 3.13  | 10.63 | 1.03   | 1740.5| 3.23| 107.9| 0.20 |
| 204.6 | 5.74  | 11.36 | 1.00   | 205.2| 5.76 | 010.3| 0.29 |
| 184.9 | 2.99  | 12.95 | 0.99   | 183.0| 2.95 | 083.3| 1.34 |
| 3715.8*| 3.41  | 8.83  | 0.99   | 3687.5| 3.39| 106.9| 0.10 |

**TOTAL FOR CYCLE 4** 413.4 PPM HC 3.53 CO

| 436.6 | 1.39  | 13.29 | 1.00   | 437.6| 1.40 | 018.4| 0.06 |
| 425.4 | 4.12  | 12.09 | 0.99   | 421.9| 4.09 | 022.9| 1.00 |
| 234.6 | 4.63  | 12.04 | 0.99   | 232.8| 4.59 | 027.5| 0.54 |
| 1923.8*| 2.60  | 10.45 | 1.05   | 2015.6| 2.73| 125.0| 0.17 |
| 226.1 | 6.44  | 10.92 | 1.01   | 227.6| 6.49 | 011.4| 0.32 |
| 181.1 | 3.03  | 13.00 | 0.98   | 178.4| 2.98 | 081.1| 1.36 |
| 3775.3*| 3.45  | 8.72  | 1.00   | 3767.5| 3.44| 109.2| 0.10 |

**TOTAL FOR CYCLE 5** 475.3 PPM HC 3.54 CO

| 390.6 | 1.35  | 13.55 | 0.99   | 386.4| 1.33 | 016.2| 0.06 |
| 365.5 | 4.39  | 11.96 | 1.00   | 364.0| 4.37 | 088.5| 1.07 |
| 255.8 | 6.42  | 10.88 | 1.01   | 255.0| 6.47 | 030.4| 0.76 |
| 1428.1*| 3.15  | 10.73 | 1.05   | 1493.6| 3.29| 092.6| 0.20 |
| 202.2 | 5.58  | 11.47 | 1.00   | 202.3| 5.58 | 010.1| 0.28 |
| 164.9 | 2.50  | 13.25 | 0.99   | 162.9| 2.47 | 074.1| 1.12 |
| 3585.8*| 3.10  | 9.00  | 1.00   | 3600.5| 3.12| 104.4| 0.09 |

**TOTAL FOR CYCLE 6** 416.4 PPM HC 3.58 CO

**A**

VE 1-4  429.1 PPM HC 3.55 CO  AVE 6-7  445.9 PPM HC 3.56 CO

TRIP COMPOSITE  439.8 PPM HC 3.56 CO

HC MASS = 4.06  CO MASS = 61.70

5-0048 12-03-69 FORD ARMY JEEP #2D4284 13636 MILES 3000#

EXP. CARB RESET 4 SPEED

Sta Mechanical Advance Distributor