Precovid multilinear regression model

Bawana

### ANOVA for Cubic model

**Response 1: Ozone**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Source** | **Sum of Squares** | **df** | **Mean Square** | **F-value** | **p-value** |  |
| **Model** | 7.010E+05 | 164 | 4274.35 | 5.49 | < 0.0001 | significant |
| A-PM2.5 | 52.99 | 1 | 52.99 | 0.0681 | 0.7942 |  |
| B-PM10 | 394.11 | 1 | 394.11 | 0.5062 | 0.4770 |  |
| C-NO | 680.03 | 1 | 680.03 | 0.8734 | 0.3503 |  |
| D-NO2 | 681.22 | 1 | 681.22 | 0.8750 | 0.3499 |  |
| E-NOX | 665.29 | 1 | 665.29 | 0.8545 | 0.3556 |  |
| F-NH3 | 2.69 | 1 | 2.69 | 0.0034 | 0.9532 |  |
| G-SO2 | 318.24 | 1 | 318.24 | 0.4087 | 0.5228 |  |
| H-CO | 1007.96 | 1 | 1007.96 | 1.29 | 0.2555 |  |
| AB | 1072.67 | 1 | 1072.67 | 1.38 | 0.2408 |  |
| AC | 92.08 | 1 | 92.08 | 0.1183 | 0.7310 |  |
| AD | 100.10 | 1 | 100.10 | 0.1286 | 0.7200 |  |
| AE | 96.36 | 1 | 96.36 | 0.1238 | 0.7251 |  |
| AF | 4629.54 | 1 | 4629.54 | 5.95 | 0.0150 |  |
| AG | 941.74 | 1 | 941.74 | 1.21 | 0.2717 |  |
| AH | 0.8361 | 1 | 0.8361 | 0.0011 | 0.9739 |  |
| BC | 595.20 | 1 | 595.20 | 0.7645 | 0.3822 |  |
| BD | 598.08 | 1 | 598.08 | 0.7682 | 0.3810 |  |
| BE | 591.76 | 1 | 591.76 | 0.7601 | 0.3836 |  |
| BF | 630.25 | 1 | 630.25 | 0.8095 | 0.3685 |  |
| BG | 496.64 | 1 | 496.64 | 0.6379 | 0.4247 |  |
| BH | 121.34 | 1 | 121.34 | 0.1559 | 0.6931 |  |
| CD | 271.79 | 1 | 271.79 | 0.3491 | 0.5548 |  |
| CE | 260.26 | 1 | 260.26 | 0.3343 | 0.5633 |  |
| CF | 98.43 | 1 | 98.43 | 0.1264 | 0.7223 |  |
| CG | 178.85 | 1 | 178.85 | 0.2297 | 0.6319 |  |
| CH | 915.71 | 1 | 915.71 | 1.18 | 0.2785 |  |
| DE | 270.67 | 1 | 270.67 | 0.3476 | 0.5556 |  |
| DF | 97.93 | 1 | 97.93 | 0.1258 | 0.7229 |  |
| DG | 208.15 | 1 | 208.15 | 0.2673 | 0.6053 |  |
| DH | 899.70 | 1 | 899.70 | 1.16 | 0.2827 |  |
| EF | 103.41 | 1 | 103.41 | 0.1328 | 0.7156 |  |
| EG | 187.30 | 1 | 187.30 | 0.2406 | 0.6239 |  |
| EH | 885.35 | 1 | 885.35 | 1.14 | 0.2866 |  |
| FG | 1926.80 | 1 | 1926.80 | 2.47 | 0.1161 |  |
| FH | 156.58 | 1 | 156.58 | 0.2011 | 0.6539 |  |
| GH | 244.69 | 1 | 244.69 | 0.3143 | 0.5752 |  |
| A² | 351.84 | 1 | 351.84 | 0.4519 | 0.5016 |  |
| B² | 1505.42 | 1 | 1505.42 | 1.93 | 0.1647 |  |
| C² | 261.14 | 1 | 261.14 | 0.3354 | 0.5626 |  |
| D² | 282.77 | 1 | 282.77 | 0.3632 | 0.5469 |  |
| E² | 258.96 | 1 | 258.96 | 0.3326 | 0.5643 |  |
| F² | 634.38 | 1 | 634.38 | 0.8148 | 0.3670 |  |
| G² | 6.84 | 1 | 6.84 | 0.0088 | 0.9254 |  |
| H² | 762.84 | 1 | 762.84 | 0.9798 | 0.3225 |  |
| ABC | 1393.14 | 1 | 1393.14 | 1.79 | 0.1814 |  |
| ABD | 1433.37 | 1 | 1433.37 | 1.84 | 0.1752 |  |
| ABE | 1412.35 | 1 | 1412.35 | 1.81 | 0.1784 |  |
| ABF | 305.38 | 1 | 305.38 | 0.3922 | 0.5313 |  |
| ABG | 19.10 | 1 | 19.10 | 0.0245 | 0.8756 |  |
| ABH | 724.60 | 1 | 724.60 | 0.9307 | 0.3350 |  |
| ACD | 114.03 | 1 | 114.03 | 0.1465 | 0.7020 |  |
| ACE | 110.47 | 1 | 110.47 | 0.1419 | 0.7065 |  |
| ACF | 4017.62 | 1 | 4017.62 | 5.16 | 0.0234 |  |
| ACG | 1396.51 | 1 | 1396.51 | 1.79 | 0.1808 |  |
| ACH | 0.5096 | 1 | 0.5096 | 0.0007 | 0.9796 |  |
| ADE | 118.36 | 1 | 118.36 | 0.1520 | 0.6967 |  |
| ADF | 3996.73 | 1 | 3996.73 | 5.13 | 0.0237 |  |
| ADG | 1372.52 | 1 | 1372.52 | 1.76 | 0.1846 |  |
| ADH | 0.7934 | 1 | 0.7934 | 0.0010 | 0.9745 |  |
| AEF | 4026.57 | 1 | 4026.57 | 5.17 | 0.0232 |  |
| AEG | 1394.31 | 1 | 1394.31 | 1.79 | 0.1812 |  |
| AEH | 0.6890 | 1 | 0.6890 | 0.0009 | 0.9763 |  |
| AFG | 528.55 | 1 | 528.55 | 0.6789 | 0.4102 |  |
| AFH | 636.71 | 1 | 636.71 | 0.8178 | 0.3661 |  |
| AGH | 2172.13 | 1 | 2172.13 | 2.79 | 0.0952 |  |
| BCD | 951.16 | 1 | 951.16 | 1.22 | 0.2694 |  |
| BCE | 958.65 | 1 | 958.65 | 1.23 | 0.2675 |  |
| BCF | 492.24 | 1 | 492.24 | 0.6322 | 0.4268 |  |
| BCG | 777.78 | 1 | 777.78 | 0.9990 | 0.3178 |  |
| BCH | 103.59 | 1 | 103.59 | 0.1331 | 0.7154 |  |
| BDE | 940.05 | 1 | 940.05 | 1.21 | 0.2722 |  |
| BDF | 483.78 | 1 | 483.78 | 0.6214 | 0.4308 |  |
| BDG | 757.20 | 1 | 757.20 | 0.9725 | 0.3243 |  |
| BDH | 108.81 | 1 | 108.81 | 0.1398 | 0.7086 |  |
| BEF | 492.39 | 1 | 492.39 | 0.6324 | 0.4267 |  |
| BEG | 768.20 | 1 | 768.20 | 0.9867 | 0.3208 |  |
| BEH | 106.05 | 1 | 106.05 | 0.1362 | 0.7122 |  |
| BFG | 369.60 | 1 | 369.60 | 0.4747 | 0.4910 |  |
| BFH | 176.80 | 1 | 176.80 | 0.2271 | 0.6338 |  |
| BGH | 1324.60 | 1 | 1324.60 | 1.70 | 0.1925 |  |
| CDE | 33.77 | 1 | 33.77 | 0.0434 | 0.8351 |  |
| CDF | 658.40 | 1 | 658.40 | 0.8456 | 0.3581 |  |
| CDG | 88.70 | 1 | 88.70 | 0.1139 | 0.7358 |  |
| CDH | 483.73 | 1 | 483.73 | 0.6213 | 0.4308 |  |
| CEF | 678.74 | 1 | 678.74 | 0.8718 | 0.3507 |  |
| CEG | 75.06 | 1 | 75.06 | 0.0964 | 0.7563 |  |
| CEH | 479.35 | 1 | 479.35 | 0.6157 | 0.4329 |  |
| CFG | 1549.95 | 1 | 1549.95 | 1.99 | 0.1586 |  |
| CFH | 324.19 | 1 | 324.19 | 0.4164 | 0.5189 |  |
| CGH | 48.91 | 1 | 48.91 | 0.0628 | 0.8022 |  |
| DEF | 673.13 | 1 | 673.13 | 0.8646 | 0.3527 |  |
| DEG | 95.93 | 1 | 95.93 | 0.1232 | 0.7257 |  |
| DEH | 462.75 | 1 | 462.75 | 0.5944 | 0.4410 |  |
| DFG | 1529.52 | 1 | 1529.52 | 1.96 | 0.1614 |  |
| DFH | 316.51 | 1 | 316.51 | 0.4065 | 0.5239 |  |
| DGH | 47.64 | 1 | 47.64 | 0.0612 | 0.8047 |  |
| EFG | 1544.07 | 1 | 1544.07 | 1.98 | 0.1594 |  |
| EFH | 321.12 | 1 | 321.12 | 0.4124 | 0.5209 |  |
| EGH | 48.53 | 1 | 48.53 | 0.0623 | 0.8029 |  |
| FGH | 1081.15 | 1 | 1081.15 | 1.39 | 0.2390 |  |
| A²B | 121.07 | 1 | 121.07 | 0.1555 | 0.6934 |  |
| A²C | 613.74 | 1 | 613.74 | 0.7883 | 0.3749 |  |
| A²D | 639.16 | 1 | 639.16 | 0.8209 | 0.3652 |  |
| A²E | 620.37 | 1 | 620.37 | 0.7968 | 0.3723 |  |
| A²F | 1497.39 | 1 | 1497.39 | 1.92 | 0.1659 |  |
| A²G | 3078.58 | 1 | 3078.58 | 3.95 | 0.0471 |  |
| A²H | 808.84 | 1 | 808.84 | 1.04 | 0.3084 |  |
| AB² | 387.65 | 1 | 387.65 | 0.4979 | 0.4806 |  |
| AC² | 106.32 | 1 | 106.32 | 0.1366 | 0.7118 |  |
| AD² | 122.06 | 1 | 122.06 | 0.1568 | 0.6922 |  |
| AE² | 114.72 | 1 | 114.72 | 0.1473 | 0.7012 |  |
| AF² | 407.89 | 1 | 407.89 | 0.5239 | 0.4694 |  |
| AG² | 1446.04 | 1 | 1446.04 | 1.86 | 0.1733 |  |
| AH² | 42.08 | 1 | 42.08 | 0.0540 | 0.8162 |  |
| B²C | 1905.71 | 1 | 1905.71 | 2.45 | 0.1181 |  |
| B²D | 1945.20 | 1 | 1945.20 | 2.50 | 0.1143 |  |
| B²E | 1932.72 | 1 | 1932.72 | 2.48 | 0.1155 |  |
| B²F | 16.28 | 1 | 16.28 | 0.0209 | 0.8850 |  |
| B²G | 1707.02 | 1 | 1707.02 | 2.19 | 0.1391 |  |
| B²H | 645.34 | 1 | 645.34 | 0.8289 | 0.3629 |  |
| BC² | 969.22 | 1 | 969.22 | 1.24 | 0.2649 |  |
| BD² | 931.94 | 1 | 931.94 | 1.20 | 0.2742 |  |
| BE² | 947.36 | 1 | 947.36 | 1.22 | 0.2703 |  |
| BF² | 181.80 | 1 | 181.80 | 0.2335 | 0.6291 |  |
| BG² | 1484.34 | 1 | 1484.34 | 1.91 | 0.1677 |  |
| BH² | 43.26 | 1 | 43.26 | 0.0556 | 0.8137 |  |
| C²D | 45.39 | 1 | 45.39 | 0.0583 | 0.8093 |  |
| C²E | 55.59 | 1 | 55.59 | 0.0714 | 0.7894 |  |
| C²F | 663.54 | 1 | 663.54 | 0.8522 | 0.3562 |  |
| C²G | 68.74 | 1 | 68.74 | 0.0883 | 0.7664 |  |
| C²H | 500.02 | 1 | 500.02 | 0.6422 | 0.4231 |  |
| CD² | 25.22 | 1 | 25.22 | 0.0324 | 0.8572 |  |
| CE² | 43.07 | 1 | 43.07 | 0.0553 | 0.8141 |  |
| CF² | 344.90 | 1 | 344.90 | 0.4430 | 0.5059 |  |
| CG² | 80.02 | 1 | 80.02 | 0.1028 | 0.7486 |  |
| CH² | 547.13 | 1 | 547.13 | 0.7027 | 0.4021 |  |
| D²E | 16.11 | 1 | 16.11 | 0.0207 | 0.8856 |  |
| D²F | 651.62 | 1 | 651.62 | 0.8369 | 0.3605 |  |
| D²G | 111.02 | 1 | 111.02 | 0.1426 | 0.7058 |  |
| D²H | 466.73 | 1 | 466.73 | 0.5995 | 0.4390 |  |
| DE² | 23.34 | 1 | 23.34 | 0.0300 | 0.8626 |  |
| DF² | 338.31 | 1 | 338.31 | 0.4345 | 0.5100 |  |
| DG² | 81.69 | 1 | 81.69 | 0.1049 | 0.7461 |  |
| DH² | 558.13 | 1 | 558.13 | 0.7169 | 0.3974 |  |
| E²F | 693.79 | 1 | 693.79 | 0.8911 | 0.3455 |  |
| E²G | 81.67 | 1 | 81.67 | 0.1049 | 0.7461 |  |
| E²H | 458.49 | 1 | 458.49 | 0.5889 | 0.4431 |  |
| EF² | 347.80 | 1 | 347.80 | 0.4467 | 0.5041 |  |
| EG² | 78.43 | 1 | 78.43 | 0.1007 | 0.7510 |  |
| EH² | 546.66 | 1 | 546.66 | 0.7021 | 0.4023 |  |
| F²G | 1691.05 | 1 | 1691.05 | 2.17 | 0.1409 |  |
| F²H | 880.84 | 1 | 880.84 | 1.13 | 0.2878 |  |
| FG² | 2194.58 | 1 | 2194.58 | 2.82 | 0.0935 |  |
| FH² | 306.65 | 1 | 306.65 | 0.3939 | 0.5304 |  |
| G²H | 3686.31 | 1 | 3686.31 | 4.73 | 0.0298 |  |
| GH² | 1842.60 | 1 | 1842.60 | 2.37 | 0.1243 |  |
| A³ | 108.21 | 1 | 108.21 | 0.1390 | 0.7094 |  |
| B³ | 993.89 | 1 | 993.89 | 1.28 | 0.2589 |  |
| C³ | 68.68 | 1 | 68.68 | 0.0882 | 0.7665 |  |
| D³ | 10.02 | 1 | 10.02 | 0.0129 | 0.9097 |  |
| E³ | 31.52 | 1 | 31.52 | 0.0405 | 0.8406 |  |
| F³ | 422.16 | 1 | 422.16 | 0.5422 | 0.4617 |  |
| G³ | 9850.99 | 1 | 9850.99 | 12.65 | 0.0004 |  |
| H³ | 591.45 | 1 | 591.45 | 0.7597 | 0.3837 |  |
| **Residual** | 6.501E+05 | 835 | 778.58 |  |  |  |
| **Cor Total** | 1.351E+06 | 999 |  |  |  |  |

Factor coding is **Coded**.  
Sum of squares is **Type III - Partial**

The **Model F-value** of 5.49 implies the model is significant. There is only a 0.01% chance that an F-value this large could occur due to noise.

**P-values** less than 0.0500 indicate model terms are significant. In this case AF, ACF, ADF, AEF, A²G, G²H, G³ are significant model terms. Values greater than 0.1000 indicate the model terms are not significant. If there are many insignificant model terms (not counting those required to support hierarchy), model reduction may improve your model.

### Final Equation in Terms of Actual Factors

|  |  |
| --- | --- |
| Ozone | = |
| +99.43271 |  |
| -0.094295 | PM2.5 |
| +0.535577 | PM10 |
| -601.82128 | NO |
| -391.47003 | NO2 |
| +732.85638 | NOX |
| -3.04598 | NH3 |
| +11.65050 | SO2 |
| -89.56101 | CO |
| +0.003385 | PM2.5 \* PM10 |
| +0.288106 | PM2.5 \* NO |
| +0.176460 | PM2.5 \* NO2 |
| -0.336374 | PM2.5 \* NOX |
| -0.018056 | PM2.5 \* NH3 |
| -0.003961 | PM2.5 \* SO2 |
| +0.346348 | PM2.5 \* CO |
| +0.975718 | PM10 \* NO |
| +0.641651 | PM10 \* NO2 |
| -1.20926 | PM10 \* NOX |
| +0.006229 | PM10 \* NH3 |
| +0.010570 | PM10 \* SO2 |
| -0.367808 | PM10 \* CO |
| +326.39822 | NO \* NO2 |
| -602.97507 | NO \* NOX |
| -1.64718 | NO \* NH3 |
| +41.11554 | NO \* SO2 |
| +131.76139 | NO \* CO |
| -408.88621 | NO2 \* NOX |
| -1.04423 | NO2 \* NH3 |
| +26.65847 | NO2 \* SO2 |
| +87.33735 | NO2 \* CO |
| +2.07492 | NOX \* NH3 |
| -50.30427 | NOX \* SO2 |
| -162.04012 | NOX \* CO |
| -0.195665 | NH3 \* SO2 |
| +0.502890 | NH3 \* CO |
| +1.05002 | SO2 \* CO |
| -0.003273 | PM2.5² |
| -0.001168 | PM10² |
| +240.49163 | NO² |
| +110.59041 | NO2² |
| +377.83845 | NOX² |
| +0.032588 | NH3² |
| -0.455709 | SO2² |
| +40.50433 | CO² |
| +0.009683 | PM2.5 \* PM10 \* NO |
| +0.006407 | PM2.5 \* PM10 \* NO2 |
| -0.011955 | PM2.5 \* PM10 \* NOX |
| -0.000020 | PM2.5 \* PM10 \* NH3 |
| -0.000010 | PM2.5 \* PM10 \* SO2 |
| -0.000770 | PM2.5 \* PM10 \* CO |
| -0.752546 | PM2.5 \* NO \* NO2 |
| +1.39621 | PM2.5 \* NO \* NOX |
| -0.081627 | PM2.5 \* NO \* NH3 |
| +0.116817 | PM2.5 \* NO \* SO2 |
| -0.024758 | PM2.5 \* NO \* CO |
| +0.942486 | PM2.5 \* NO2 \* NOX |
| -0.053065 | PM2.5 \* NO2 \* NH3 |
| +0.075561 | PM2.5 \* NO2 \* SO2 |
| -0.020204 | PM2.5 \* NO2 \* CO |
| +0.100209 | PM2.5 \* NOX \* NH3 |
| -0.143149 | PM2.5 \* NOX \* SO2 |
| +0.035398 | PM2.5 \* NOX \* CO |
| -0.000314 | PM2.5 \* NH3 \* SO2 |
| -0.004733 | PM2.5 \* NH3 \* CO |
| -0.012920 | PM2.5 \* SO2 \* CO |
| +0.730502 | PM10 \* NO \* NO2 |
| -1.37043 | PM10 \* NO \* NOX |
| +0.018609 | PM10 \* NO \* NH3 |
| -0.057852 | PM10 \* NO \* SO2 |
| +0.282497 | PM10 \* NO \* CO |
| -0.893729 | PM10 \* NO2 \* NOX |
| +0.012029 | PM10 \* NO2 \* NH3 |
| -0.037293 | PM10 \* NO2 \* SO2 |
| +0.189107 | PM10 \* NO2 \* CO |
| -0.022827 | PM10 \* NOX \* NH3 |
| +0.070579 | PM10 \* NOX \* SO2 |
| -0.350961 | PM10 \* NOX \* CO |
| +0.000171 | PM10 \* NH3 \* SO2 |
| +0.001673 | PM10 \* NH3 \* CO |
| +0.006669 | PM10 \* SO2 \* CO |
| -22.42631 | NO \* NO2 \* NOX |
| -4.58853 | NO \* NO2 \* NH3 |
| -3.51159 | NO \* NO2 \* SO2 |
| -96.40642 | NO \* NO2 \* CO |
| +8.79924 | NO \* NOX \* NH3 |
| +6.03657 | NO \* NOX \* SO2 |
| +180.21345 | NO \* NOX \* CO |
| -0.624061 | NO \* NH3 \* SO2 |
| +2.58647 | NO \* NH3 \* CO |
| -1.59636 | NO \* SO2 \* CO |
| +5.68372 | NO2 \* NOX \* NH3 |
| +4.47574 | NO2 \* NOX \* SO2 |
| +115.48668 | NO2 \* NOX \* CO |
| -0.404222 | NO2 \* NH3 \* SO2 |
| +1.66680 | NO2 \* NH3 \* CO |
| -1.02911 | NO2 \* SO2 \* CO |
| +0.763811 | NOX \* NH3 \* SO2 |
| -3.15689 | NOX \* NH3 \* CO |
| +1.95167 | NOX \* SO2 \* CO |
| -0.053476 | NH3 \* SO2 \* CO |
| +3.27493E-06 | PM2.5² \* PM10 |
| -0.004195 | PM2.5² \* NO |
| -0.002791 | PM2.5² \* NO2 |
| +0.005169 | PM2.5² \* NOX |
| +0.000042 | PM2.5² \* NH3 |
| +0.000123 | PM2.5² \* SO2 |
| +0.000618 | PM2.5² \* CO |
| -3.23464E-06 | PM2.5 \* PM10² |
| -0.557134 | PM2.5 \* NO² |
| -0.253908 | PM2.5 \* NO2² |
| -0.874528 | PM2.5 \* NOX² |
| +0.000092 | PM2.5 \* NH3² |
| +0.000499 | PM2.5 \* SO2² |
| +0.017132 | PM2.5 \* CO² |
| -0.004644 | PM10² \* NO |
| -0.003064 | PM10² \* NO2 |
| +0.005740 | PM10² \* NOX |
| -1.50112E-06 | PM10² \* NH3 |
| -0.000032 | PM10² \* SO2 |
| +0.000280 | PM10² \* CO |
| +0.560127 | PM10 \* NO² |
| +0.238197 | PM10 \* NO2² |
| +0.838328 | PM10 \* NOX² |
| -0.000040 | PM10 \* NH3² |
| -0.000345 | PM10 \* SO2² |
| +0.012376 | PM10 \* CO² |
| +10.80507 | NO² \* NO2 |
| -22.39996 | NO² \* NOX |
| -3.55212 | NO² \* NH3 |
| -2.35766 | NO² \* SO2 |
| -75.17549 | NO² \* CO |
| +5.18467 | NO \* NO2² |
| +23.70663 | NO \* NOX² |
| +0.074443 | NO \* NH3² |
| -0.098431 | NO \* SO2² |
| -44.64454 | NO \* CO² |
| -5.00721 | NO2² \* NOX |
| -1.48151 | NO2² \* NH3 |
| -1.28860 | NO2² \* SO2 |
| -30.89399 | NO2² \* CO |
| +11.25580 | NO2 \* NOX² |
| +0.048075 | NO2 \* NH3² |
| -0.064965 | NO2 \* SO2² |
| -29.46782 | NO2 \* CO² |
| -5.44914 | NOX² \* NH3 |
| -3.85852 | NOX² \* SO2 |
| -107.92654 | NOX² \* CO |
| -0.091666 | NOX \* NH3² |
| +0.119668 | NOX \* SO2² |
| +54.83151 | NOX \* CO² |
| +0.001751 | NH3² \* SO2 |
| +0.018055 | NH3² \* CO |
| +0.003275 | NH3 \* SO2² |
| -0.228037 | NH3 \* CO² |
| +0.077195 | SO2² \* CO |
| -0.569682 | SO2 \* CO² |
| -1.67258E-06 | PM2.5³ |
| +9.26644E-07 | PM10³ |
| +6.92386 | NO³ |
| +0.706040 | NO2³ |
| -8.15485 | NOX³ |
| -0.000216 | NH3³ |
| +0.004513 | SO2³ |
| -2.00492 | CO³ |

The equation in terms of actual factors can be used to make predictions about the response for given levels of each factor. Here, the levels should be specified in the original units for each factor. This equation should not be used to determine the relative impact of each factor because the coefficients are scaled to accommodate the units of each factor and the intercept is not at the center of the design space.

