EPA VINYL CHLORIDE STANDARD -- 1980

EPA VINYL CHLORIDE STANDARD -- 1980

EPA VINYL CHLORIDE
STANDARD

UCC
051409

1980

RECEIVED Dec 22, 1980

DEC 31 1980

J.F.E.

To Jack Erdmann
Texas City Plant

Jack: Enclosed are printouts of the 18 month values. the results are essentially the same. If anything perhaps a little better, because the new values were a little lower. The earlier remarks and commentary are still valid. I have enclosed only the computer printouts. If you need more prose or interpretation, call me.

Sincerely,

Jim Hansen

SUBMIT THIS TO:

TO - 1) Martin Brittain - EPA/Dallas (3 sets)

cc: - 2) John W. Kay @ TACB/AUSTIN

↳ 3) TIM BARAMER - TRW - for add'n to their file

bcc REO/NESHAPS (VCM) FILE
JBL/JSK *
JHB *
GRT/S.A. DICKERSON
RM Arnold *
DG Reese +
F Johnson +
R$^3$ - CLC
WT Gray *
DR Rea +

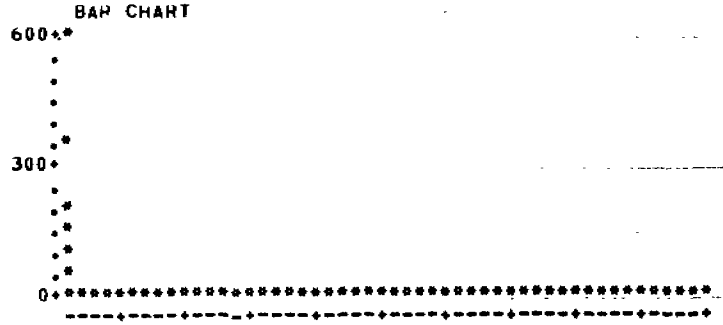
UCC
051411

UNIVARIATE

VARIABLE AD

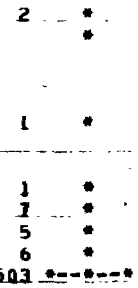
| MOMENTS | | | | QUANTILES | | | | EXTREMES | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | LOWEST | HIGHEST |
| N | 525 | SUM WGTS | 525 | 100% MAX | 611.95 | 99% | 178.582 | 0 | 181.66 |
| MEAN | 11.991 | SUM | 6295.29 | 75% Q3 | 6.8425 | 95% | 38.9996 | 0.03 | 208.45 |
| STD DEV | 47.1966 | VARIANCE | 2227.52 | 50% MED | 2.03 | 90% | 18.03 | 0.03 | 368.2 |
| SKEWNESS | 9.17263 | KURTOSIS | 101.738 | 25% Q1 | 0.4525 | 10% | 0.13 | 0.03 | 596.67 |
| SS | 1242708 | CSS | 1167221 | 0% MIN | 0 | 5% | 0.1 | 0.08 | 611.95 |
| CV | 393.6 | STD MEAN | 2.05983 | | | 1% | 0.0849999 | | |
| T:MEAN=0 | 5.82137 | PROB>\|T\| | 0.0001 | RANGE | 611.95 | | | | |
| D:NORMAL | 9.20867 | PROB>D | 0.0001 | Q3-Q1 | 6.39 | | | | |
| | | | | MODE | 0.1 | | | | |

BAR CHART

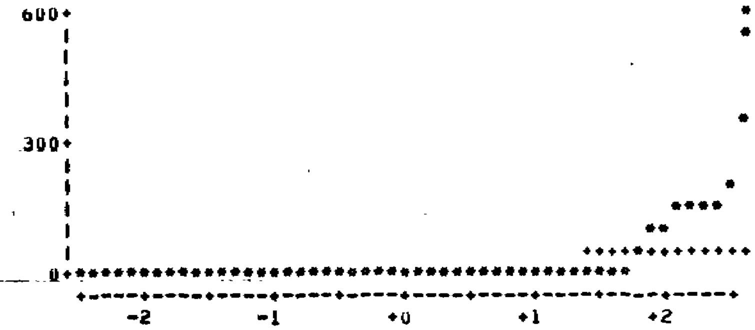



* MAY REPRESENT UP TO 10 COUNTS

# BOXPLOT




NORMAL PROBABILITY PLOT




FREQUENCY TABLE

| VALUE | COUNT | PERCENTS CELL | CUM | VALUE | COUNT | PERCENTS CELL | CUM | VALUE | COUNT | PERCENTS CELL | CUM | VALUE | COUNT | PERCENTS CELL | CUM |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 0.2 | 0.2 | 0.3 | 3 | 0.6 | 19.0 | 0.55 | 1 | 0.2 | 27.0 | 0.84 | 1 | 0.2 | 34.1 |
| 0.03 | 3 | 0.6 | 0.8 | 0.31 | 1 | 0.2 | 19.2 | 0.56 | 3 | 0.6 | 27.6 | 0.86 | 1 | 0.2 | 34.3 |
| 0.08 | 1 | 0.2 | 1.0 | 0.32 | 2 | 0.4 | 19.6 | 0.57 | 1 | 0.2 | 27.8 | 0.87 | 1 | 0.2 | 34.5 |
| 0.1 | 42 | 8.0 | 9.0 | 0.33 | 3 | 0.6 | 20.2 | 0.58 | 2 | 0.4 | 28.2 | 0.88 | 1 | 0.2 | 34.7 |
| 0.11 | 2 | 0.4 | 9.3 | 0.34 | 4 | 0.8 | 21.0 | 0.59 | 1 | 0.2 | 28.4 | 0.91 | 2 | 0.4 | 35.0 |
| 0.12 | 2 | 0.4 | 9.7 | 0.35 | 3 | 0.6 | 21.5 | 0.6 | 1 | 0.2 | 28.6 | 0.92 | 1 | 0.2 | 35.2 |
| 0.13 | 5 | 1.0 | 10.7 | 0.37 | 1 | 0.2 | 21.7 | 0.63 | 1 | 0.2 | 28.8 | 0.93 | 1 | 0.2 | 35.4 |
| 0.14 | 3 | 0.6 | 11.2 | 0.38 | 3 | 0.6 | 22.3 | 0.64 | 4 | 0.8 | 29.5 | 0.95 | 2 | 0.4 | 35.8 |
| 0.15 | 3 | 0.6 | 11.8 | 0.39 | 1 | 0.2 | 22.5 | 0.65 | 3 | 0.6 | 30.1 | 0.97 | 2 | 0.4 | 36.2 |
| 0.17 | 1 | 0.2 | 12.0 | 0.4 | 1 | 0.2 | 22.7 | 0.66 | 1 | 0.2 | 30.3 | 0.98 | 1 | 0.2 | 36.4 |
| 0.18 | 2 | 0.4 | 12.4 | 0.41 | 2 | 0.4 | 23.0 | 0.67 | 1 | 0.2 | 30.5 | 1 | 1 | 0.2 | 36.6 |
| 0.19 | 1 | 0.2 | 12.6 | 0.42 | 1 | 0.2 | 23.2 | 0.68 | 1 | 0.2 | 30.7 | 1.01 | 2 | 0.4 | 37.0 |
| 0.2 | 3 | 0.6 | 13.1 | 0.43 | 2 | 0.4 | 23.6 | 0.69 | 1 | 0.2 | 30.9 | 1.02 | 1 | 0.2 | 37.1 |
| 0.22 | 2 | 0.4 | 13.5 | 0.44 | 4 | 0.8 | 24.4 | 0.7 | 2 | 0.4 | 31.2 | 1.04 | 1 | 0.2 | 37.3 |
| 0.23 | 4 | 0.8 | 14.3 | 0.45 | 3 | 0.6 | 25.0 | 0.71 | 3 | 0.6 | 31.8 | 1.06 | 1 | 0.2 | 37.5 |
| 0.24 | 4 | 0.8 | 15.0 | 0.46 | 1 | 0.2 | 25.1 | 0.73 | 2 | 0.4 | 32.2 | 1.1 | 2 | 0.4 | 37.9 |
| 0.25 | 2 | 0.4 | 15.4 | 0.47 | 1 | 0.2 | 25.3 | 0.74 | 1 | 0.2 | 32.4 | 1.11 | 1 | 0.2 | 38.1 |
| 0.26 | 3 | 0.6 | 16.0 | 0.48 | 1 | 0.2 | 25.5 | 0.75 | 3 | 0.6 | 33.0 | 1.15 | 3 | 0.6 | 38.7 |
| 0.27 | 5 | 1.0 | 17.0 | 0.49 | 1 | 0.2 | 25.7 | 0.78 | 2 | 0.4 | 33.3 | 1.18 | 1 | 0.2 | 38.9 |
| 0.28 | 3 | 0.6 | 17.5 | 0.51 | 3 | 0.6 | 26.3 | 0.8 | 1 | 0.2 | 33.5 | 1.2 | 1 | 0.2 | 39.0 |
| 0.29 | 5 | 1.0 | 18.5 | 0.52 | 3 | 0.6 | 26.9 | 0.83 | 2 | 0.4 | 33.9 | 1.22 | 2 | 0.4 | 39.4 |

UNIVARIATE

VARIABLE AD

FREQUENCY TABLE (CONT.)

| VALUE | COUNT | PERCENTS CELL | PERCENTS CUM | VALUE | COUNT | PERCENTS CELL | PERCENTS CUM | VALUE | COUNT | PERCENTS CELL | PERCENTS CUM | VALUE | COUNT | PERCENTS CELL | PERCENTS CUM |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.25 | 1 | 0.2 | 39.6 | 2.27 | 1 | 0.2 | 52.8 | 3.7 | 1 | 0.2 | 63.4 | 6.76 | 1 | 0.2 | 74.5 |
| 1.29 | 3 | 0.6 | 40.2 | 2.28 | 1 | 0.2 | 53.0 | 3.73 | 1 | 0.2 | 63.6 | 6.77 | 1 | 0.2 | 74.7 |
| 1.31 | 3 | 0.6 | 40.8 | 2.32 | 1 | 0.2 | 53.1 | 3.75 | 1 | 0.2 | 63.8 | 6.82 | 1 | 0.2 | 74.9 |
| 1.35 | 2 | 0.4 | 41.1 | 2.33 | 1 | 0.2 | 53.3 | 3.89 | 2 | 0.4 | 64.2 | 6.85 | 1 | 0.2 | 75.0 |
| 1.36 | 1 | 0.2 | 41.3 | 2.36 | 1 | 0.2 | 53.5 | 3.93 | 1 | 0.2 | 64.4 | 6.89 | 1 | 0.2 | 75.2 |
| 1.37 | 1 | 0.2 | 41.5 | 2.37 | 2 | 0.4 | 53.9 | 3.95 | 1 | 0.2 | 64.6 | 6.9 | 1 | 0.2 | 75.4 |
| 1.38 | 2 | 0.4 | 41.9 | 2.4 | 1 | 0.2 | 54.1 | 3.97 | 1 | 0.2 | 64.8 | 6.91 | 1 | 0.2 | 75.6 |
| 1.4 | 2 | 0.4 | 42.3 | 2.41 | 1 | 0.2 | 54.3 | 4.06 | 2 | 0.4 | 65.1 | 7.01 | 1 | 0.2 | 75.8 |
| 1.41 | 1 | 0.2 | 42.5 | 2.43 | 1 | 0.2 | 54.5 | 4.07 | 1 | 0.2 | 65.3 | 7.15 | 2 | 0.4 | 76.2 |
| 1.43 | 1 | 0.2 | 42.7 | 2.45 | 2 | 0.4 | 54.9 | 4.09 | 1 | 0.2 | 65.5 | 7.17 | 1 | 0.2 | 76.4 |
| 1.45 | 1 | 0.2 | 42.9 | 2.51 | 1 | 0.2 | 55.0 | 4.11 | 1 | 0.2 | 65.7 | 7.22 | 1 | 0.2 | 76.6 |
| 1.46 | 2 | 0.4 | 43.2 | 2.52 | 1 | 0.2 | 55.2 | 4.19 | 1 | 0.2 | 65.9 | 7.27 | 2 | 0.4 | 77.0 |
| 1.49 | 1 | 0.2 | 43.4 | 2.54 | 1 | 0.2 | 55.4 | 4.2 | 1 | 0.2 | 66.1 | 7.31 | 1 | 0.2 | 77.1 |
| 1.5 | 1 | 0.2 | 43.6 | 2.62 | 1 | 0.2 | 55.6 | 4.21 | 1 | 0.2 | 66.3 | 7.45 | 1 | 0.2 | 77.3 |
| 1.52 | 1 | 0.2 | 43.8 | 2.68 | 1 | 0.2 | 55.8 | 4.24 | 1 | 0.2 | 66.5 | 7.48 | 1 | 0.2 | 77.5 |
| 1.58 | 3 | 0.6 | 44.4 | 2.69 | 1 | 0.2 | 56.0 | 4.3 | 1 | 0.2 | 66.7 | 7.59 | 1 | 0.2 | 77.7 |
| 1.63 | 1 | 0.2 | 44.6 | 2.7 | 2 | 0.4 | 56.4 | 4.33 | 1 | 0.2 | 66.9 | 7.61 | 1 | 0.2 | 77.9 |
| 1.65 | 1 | 0.2 | 44.8 | 2.71 | 1 | 0.2 | 56.6 | 4.36 | 1 | 0.2 | 67.0 | 7.66 | 1 | 0.2 | 78.1 |
| 1.66 | 1 | 0.2 | 45.0 | 2.74 | 1 | 0.2 | 56.8 | 4.37 | 1 | 0.2 | 67.2 | 7.68 | 1 | 0.2 | 78.3 |
| 1.69 | 1 | 0.2 | 45.1 | 2.8 | 1 | 0.2 | 57.0 | 4.48 | 2 | 0.4 | 67.6 | 7.87 | 1 | 0.2 | 78.5 |
| 1.73 | 2 | 0.4 | 45.5 | 2.81 | 1 | 0.2 | 57.1 | 4.49 | 2 | 0.4 | 68.0 | 7.88 | 1 | 0.2 | 78.7 |
| 1.75 | 1 | 0.2 | 45.7 | 2.85 | 1 | 0.2 | 57.3 | 4.53 | 1 | 0.2 | 68.2 | 7.93 | 1 | 0.2 | 78.9 |
| 1.76 | 1 | 0.2 | 45.9 | 2.86 | 1 | 0.2 | 57.5 | 4.6 | 2 | 0.4 | 68.6 | 7.96 | 1 | 0.2 | 79.0 |
| 1.77 | 1 | 0.2 | 46.1 | 2.87 | 1 | 0.2 | 57.7 | 4.8 | 1 | 0.2 | 68.8 | 8.01 | 1 | 0.2 | 79.2 |
| 1.78 | 1 | 0.2 | 46.3 | 2.89 | 1 | 0.2 | 57.9 | 4.9 | 1 | 0.2 | 69.0 | 8.09 | 1 | 0.2 | 79.4 |
| 1.79 | 2 | 0.4 | 46.7 | 2.93 | 1 | 0.2 | 58.1 | 4.97 | 2 | 0.4 | 69.3 | 8.36 | 1 | 0.2 | 79.6 |
| 1.8 | 1 | 0.2 | 46.9 | 2.96 | 1 | 0.2 | 58.3 | 4.99 | 1 | 0.2 | 69.5 | 8.38 | 1 | 0.2 | 79.8 |
| 1.81 | 1 | 0.2 | 47.0 | 2.99 | 1 | 0.2 | 58.5 | 5.02 | 1 | 0.2 | 69.7 | 8.4 | 1 | 0.2 | 80.0 |
| 1.83 | 1 | 0.2 | 47.2 | 3 | 1 | 0.2 | 58.7 | 5.17 | 1 | 0.2 | 69.9 | 8.43 | 1 | 0.2 | 80.2 |
| 1.84 | 1 | 0.2 | 47.4 | 3.02 | 1 | 0.2 | 58.9 | 5.33 | 1 | 0.2 | 70.1 | 8.48 | 1 | 0.2 | 80.4 |
| 1.86 | 1 | 0.2 | 47.6 | 3.09 | 1 | 0.2 | 59.0 | 5.44 | 1 | 0.2 | 70.3 | 8.5 | 1 | 0.2 | 80.6 |
| 1.89 | 2 | 0.4 | 48.0 | 3.12 | 1 | 0.2 | 59.2 | 5.51 | 1 | 0.2 | 70.5 | 8.57 | 1 | 0.2 | 80.8 |
| 1.91 | 1 | 0.2 | 48.2 | 3.13 | 1 | 0.2 | 59.4 | 5.57 | 1 | 0.2 | 70.7 | 8.58 | 1 | 0.2 | 81.0 |
| 1.92 | 1 | 0.2 | 48.4 | 3.16 | 1 | 0.2 | 59.6 | 5.58 | 1 | 0.2 | 70.9 | 8.6 | 1 | 0.2 | 81.1 |
| 1.93 | 2 | 0.4 | 48.8 | 3.19 | 1 | 0.2 | 59.8 | 5.62 | 1 | 0.2 | 71.0 | 8.73 | 1 | 0.2 | 81.3 |
| 1.94 | 2 | 0.4 | 49.1 | 3.23 | 1 | 0.2 | 60.0 | 5.63 | 1 | 0.2 | 71.2 | 8.79 | 1 | 0.2 | 81.5 |
| 1.95 | 1 | 0.2 | 49.3 | 3.25 | 1 | 0.2 | 60.2 | 5.68 | 1 | 0.2 | 71.4 | 8.9 | 1 | 0.2 | 81.7 |
| 1.99 | 1 | 0.2 | 49.5 | 3.26 | 1 | 0.2 | 60.4 | 5.74 | 1 | 0.2 | 71.6 | 9.02 | 1 | 0.2 | 81.9 |
| 2.02 | 1 | 0.2 | 49.7 | 3.27 | 1 | 0.2 | 60.6 | 5.79 | 1 | 0.2 | 71.8 | 9.08 | 1 | 0.2 | 82.1 |
| 2.03 | 3 | 0.6 | 50.3 | 3.28 | 1 | 0.2 | 60.8 | 5.85 | 1 | 0.2 | 72.0 | 9.13 | 1 | 0.2 | 82.3 |
| 2.04 | 1 | 0.2 | 50.5 | 3.31 | 1 | 0.2 | 61.0 | 5.88 | 1 | 0.2 | 72.2 | 9.42 | 1 | 0.2 | 82.5 |
| 2.07 | 1 | 0.2 | 50.7 | 3.34 | 1 | 0.2 | 61.1 | 5.97 | 2 | 0.4 | 72.6 | 9.47 | 1 | 0.2 | 82.7 |
| 2.09 | 1 | 0.2 | 50.9 | 3.36 | 1 | 0.2 | 61.3 | 6.12 | 1 | 0.2 | 72.8 | 9.5 | 1 | 0.2 | 82.9 |
| 2.11 | 1 | 0.2 | 51.0 | 3.48 | 1 | 0.2 | 61.5 | 6.23 | 1 | 0.2 | 73.0 | 9.59 | 2 | 0.4 | 83.2 |
| 2.12 | 2 | 0.4 | 51.4 | 3.49 | 1 | 0.2 | 61.7 | 6.33 | 1 | 0.2 | 73.1 | 9.73 | 1 | 0.2 | 83.4 |
| 2.16 | 2 | 0.4 | 51.8 | 3.51 | 1 | 0.2 | 61.9 | 6.42 | 1 | 0.2 | 73.3 | 9.91 | 1 | 0.2 | 83.6 |
| 2.19 | 1 | 0.2 | 52.0 | 3.52 | 3 | 0.6 | 62.5 | 6.44 | 2 | 0.4 | 73.7 | 10.02 | 1 | 0.2 | 83.8 |
| 2.2 | 1 | 0.2 | 52.2 | 3.57 | 2 | 0.4 | 62.9 | 6.49 | 1 | 0.2 | 73.9 | 10.07 | 1 | 0.2 | 84.0 |
| 2.21 | 1 | 0.2 | 52.4 | 3.62 | 1 | 0.2 | 63.0 | 6.64 | 1 | 0.2 | 74.1 | 10.21 | 1 | 0.2 | 84.2 |
| 2.22 | 1 | 0.2 | 52.6 | 3.69 | 1 | 0.2 | 63.2 | 6.75 | 1 | 0.2 | 74.3 | 10.28 | 1 | 0.2 | 84.4 |

UNIVARIATE

VARIABLE AD

FREQUENCY TABLE (CONT.)

| VALUE | COUNT | PERCENTS CELL | PERCENTS CUM |
|---|---|---|---|
| 10.76 | 1 | 0.2 | 84.6 |
| 11.02 | 1 | 0.2 | 84.8 |
| 11.6 | 2 | 0.4 | 85.1 |
| 11.67 | 1 | 0.2 | 85.3 |
| 11.68 | 1 | 0.2 | 85.5 |
| 11.86 | 1 | 0.2 | 85.7 |
| 12.1 | 1 | 0.2 | 85.9 |
| 12.47 | 1 | 0.2 | 86.1 |
| 12.65 | 1 | 0.2 | 86.3 |
| 12.7 | 1 | 0.2 | 86.5 |
| 13.28 | 1 | 0.2 | 86.7 |
| 13.47 | 1 | 0.2 | 86.9 |
| 14.09 | 1 | 0.2 | 87.0 |
| 14.13 | 1 | 0.2 | 87.2 |
| 14.35 | 1 | 0.2 | 87.4 |
| 14.4 | 1 | 0.2 | 87.6 |
| 14.49 | 1 | 0.2 | 87.8 |
| 15.71 | 1 | 0.2 | 88.0 |
| 16.01 | 1 | 0.2 | 88.2 |
| 16.28 | 1 | 0.2 | 88.4 |
| 16.61 | 1 | 0.2 | 88.6 |

| VALUE | COUNT | PERCENTS CELL | PERCENTS CUM |
|---|---|---|---|
| 16.72 | 1 | 0.2 | 88.8 |
| 17.14 | 1 | 0.2 | 89.0 |
| 17.15 | 1 | 0.2 | 89.1 |
| 17.52 | 1 | 0.2 | 89.3 |
| 17.58 | 1 | 0.2 | 89.5 |
| 17.97 | 1 | 0.2 | 89.7 |
| 18 | 1 | 0.2 | 89.9 |
| 18.06 | 1 | 0.2 | 90.1 |
| 18.14 | 1 | 0.2 | 90.3 |
| 18.4 | 1 | 0.2 | 90.5 |
| 18.58 | 1 | 0.2 | 90.7 |
| 18.66 | 1 | 0.2 | 90.9 |
| 18.8 | 1 | 0.2 | 91.0 |
| 19.3 | 1 | 0.2 | 91.2 |
| 19.37 | 1 | 0.2 | 91.4 |
| 20.54 | 1 | 0.2 | 91.6 |
| 20.76 | 1 | 0.2 | 91.8 |
| 22.4 | 1 | 0.2 | 92.0 |
| 23.56 | 1 | 0.2 | 92.2 |
| 23.7 | 1 | 0.2 | 92.4 |
| 24.71 | 1 | 0.2 | 92.6 |

| VALUE | COUNT | PERCENTS CELL | PERCENTS CUM |
|---|---|---|---|
| 25.41 | 1 | 0.2 | 92.8 |
| 26.06 | 1 | 0.2 | 93.0 |
| 26.95 | 1 | 0.2 | 93.1 |
| 27.33 | 1 | 0.2 | 93.3 |
| 30.33 | 1 | 0.2 | 93.5 |
| 30.87 | 1 | 0.2 | 93.7 |
| 31.61 | 1 | 0.2 | 93.9 |
| 31.71 | 1 | 0.2 | 94.1 |
| 32.52 | 1 | 0.2 | 94.3 |
| 34.6 | 1 | 0.2 | 94.5 |
| 37.36 | 1 | 0.2 | 94.7 |
| 37.86 | 1 | 0.2 | 94.9 |
| 39.38 | 1 | 0.2 | 95.0 |
| 40.56 | 1 | 0.2 | 95.2 |
| 41.84 | 1 | 0.2 | 95.4 |
| 43.73 | 1 | 0.2 | 95.6 |
| 44.42 | 1 | 0.2 | 95.8 |
| 49.26 | 1 | 0.2 | 96.0 |
| 52.84 | 1 | 0.2 | 96.2 |
| 54.93 | 1 | 0.2 | 96.4 |
| 58.61 | 1 | 0.2 | 96.6 |

| VALUE | COUNT | PERCENTS CELL | PERCENTS CUM |
|---|---|---|---|
| 60.82 | 1 | 0.2 | 96.8 |
| 73.9 | 1 | 0.2 | 97.0 |
| 101.06 | 1 | 0.2 | 97.1 |
| 114.73 | 1 | 0.2 | 97.3 |
| 116.74 | 1 | 0.2 | 97.5 |
| 118.33 | 1 | 0.2 | 97.7 |
| 134.67 | 1 | 0.2 | 97.9 |
| 147.27 | 1 | 0.2 | 98.1 |
| 167.13 | 1 | 0.2 | 98.3 |
| 168.35 | 1 | 0.2 | 98.5 |
| 173.59 | 1 | 0.2 | 98.7 |
| 178.05 | 1 | 0.2 | 98.9 |
| 178.76 | 1 | 0.2 | 99.0 |
| 181.66 | 1 | 0.2 | 99.2 |
| 208.45 | 1 | 0.2 | 99.4 |
| 368.2 | 1 | 0.2 | 99.6 |
| 596.67 | 1 | 0.2 | 99.8 |
| 611.95 | 1 | 0.2 | 100.0 |

UNIVARIATE

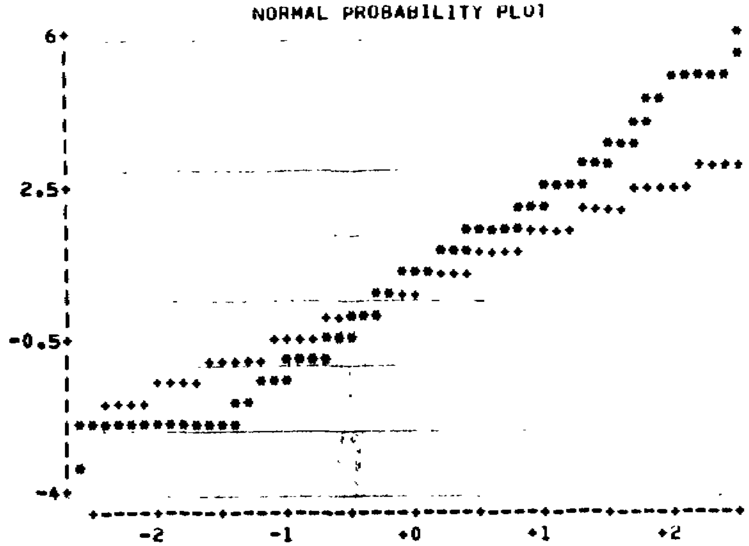
```
VARIABLE LNAD

                 MOMENTS                                                     QUANTILES                                   EXTREMES

N              524     SUM WGTS          524        100% MAX    6.41665        99%    5.18509          LOWEST       HIGHEST
MEAN      0.653211     SUM           342.283         75% Q3     1.92425        95%    3.66538        -3.50656      5.20214
STD DEV     1.8424     VARIANCE      3.39443         50% MED   0.708036        90%    2.89237        -3.50656       5.3397
SKEWNESS  0.220457     KURTOSIS    -0.181395         25% Q1   -0.776529        10%   -2.04022        -3.50656      5.90863
SS         1998.87     CSS           1775.29          0% MIN   -3.50656         5%   -2.30258        -2.52573      6.39136
CV         282.052     STD MEAN    0.0804855                                    1%   -2.30258        -2.30258      6.41665
T:MEAN=0   8.11589     PROB>|T|       0.0001        RANGE       9.92321
D:NORMAL   1.07456     PROB>D       0.198646        Q3-Q1       2.70078
                                                    MODE       -2.30258

                                                    MISSING VALUE       .
                                                             COUNT      1
                                                      % COUNT/NOBS   0.19

                BAR CHART                                                               #             BOXPLOT
      6+**                                                                              2                *
       .*                                                                               1                0
       .********                                                                        8                0
       .*****                                                                           5                0
       .*****                                                                           5                |
       .************                                                                   12                |
       .**************                                                                 14                |
    2.5+*********************************                                              33                |
       .***********************************************                                47                |
       .*************************************************                              49             +-----+
       .************************************************** U                           58             |     |
       .************************************************** U                           61             |     |
       .**********************************                                             34             *--+--*
       .*********************************************                                  45             |     |
   -0.5+**********************************                                             34             |     |
       .******************************************                                     42             +-----+
       .****************                                                               16                |
       .************************************************** U                           54                |
       .*                                                                               1                |
       .                                                                                                 |
       .***                                                                             3                0
     -4+
        ----+----+----+----+----+----+----+----+----+----+ U
        * MAY REPRESENT UP TO 1 COUNTS
```

UCC
051415

UNIVARIATE

VARIABLE LNAD

NORMAL PROBABILITY PLOT




FREQUENCY TABLE

| VALUE | COUNT | PERCENTS CELL | PERCENTS CUM | VALUE | COUNT | PERCENTS CELL | PERCENTS CUM | VALUE | COUNT | PERCENTS CELL | PERCENTS CUM | VALUE | COUNT | PERCENTS CELL | PERCENTS CUM |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| -3.50656 | 3 | 0.6 | 0.6 | -1.07881 | 4 | 0.8 | 20.8 | -.446287 | 4 | 0.8 | 29.4 | 0 | 1 | 0.2 | 36.5 |
| -2.52573 | 1 | 0.2 | 0.8 | -1.04982 | 3 | 0.6 | 21.4 | -.430783 | 3 | 0.6 | 30.0 | .0099503 | 2 | 0.4 | 36.8 |
| -2.30258 | 42 | 8.0 | 8.8 | -.994252 | 1 | 0.2 | 21.6 | -.415515 | 1 | 0.2 | 30.2 | .0198026 | 1 | 0.2 | 37.0 |
| -2.20727 | 2 | 0.4 | 9.2 | -.967584 | 3 | 0.6 | 22.1 | -.400478 | 1 | 0.2 | 30.3 | .0392207 | 1 | 0.2 | 37.2 |
| -2.12026 | 2 | 0.4 | 9.5 | -.941608 | 1 | 0.2 | 22.3 | -.385662 | 1 | 0.2 | 30.5 | .0582689 | 1 | 0.2 | 37.4 |
| -2.04022 | 5 | 1.0 | 10.5 | -.916291 | 1 | 0.2 | 22.5 | -.371064 | 1 | 0.2 | 30.7 | .0953102 | 2 | 0.4 | 37.8 |
| -1.96611 | 3 | 0.6 | 11.1 | -.891598 | 2 | 0.4 | 22.9 | -.356675 | 2 | 0.4 | 31.1 | 0.10436 | 1 | 0.2 | 38.0 |
| -1.89712 | 3 | 0.6 | 11.6 | -.867501 | 1 | 0.2 | 23.1 | -0.34249 | 3 | 0.6 | 31.7 | 0.139762 | 3 | 0.6 | 38.5 |
| -1.77196 | 1 | 0.2 | 11.8 | -0.84397 | 2 | 0.4 | 23.5 | -.314711 | 2 | 0.4 | 32.1 | 0.165514 | 1 | 0.2 | 38.7 |
| -1.7148 | 2 | 0.4 | 12.2 | -.820981 | 4 | 0.8 | 24.2 | -.301105 | 1 | 0.2 | 32.3 | 0.182322 | 1 | 0.2 | 38.9 |
| -1.66073 | 1 | 0.2 | 12.4 | -.798508 | 3 | 0.6 | 24.8 | -.287682 | 3 | 0.6 | 32.8 | 0.198851 | 2 | 0.4 | 39.3 |
| -1.60944 | 3 | 0.6 | 13.0 | -.776529 | 1 | 0.2 | 25.0 | -.248461 | 2 | 0.4 | 33.2 | 0.223144 | 1 | 0.2 | 39.5 |
| -1.51413 | 2 | 0.4 | 13.4 | -.755023 | 1 | 0.2 | 25.2 | -.223144 | 1 | 0.2 | 33.4 | 0.254642 | 3 | 0.6 | 40.1 |
| -1.46968 | 4 | 0.8 | 14.1 | -.733969 | 1 | 0.2 | 25.4 | -0.18633 | 2 | 0.4 | 33.8 | 0.270027 | 3 | 0.6 | 40.6 |
| -1.42712 | 4 | 0.8 | 14.9 | -0.71335 | 1 | 0.2 | 25.6 | -.174353 | 1 | 0.2 | 34.0 | 0.300105 | 2 | 0.4 | 41.0 |
| -1.38629 | 2 | 0.4 | 15.3 | -.673345 | 3 | 0.6 | 26.1 | -.150823 | 1 | 0.2 | 34.2 | 0.307485 | 1 | 0.2 | 41.2 |
| -1.34707 | 3 | 0.6 | 15.8 | -.653926 | 3 | 0.6 | 26.7 | -.139262 | 1 | 0.2 | 34.4 | 0.314811 | 1 | 0.2 | 41.4 |
| -1.30933 | 5 | 1.0 | 16.8 | -.597837 | 1 | 0.2 | 26.9 | -.127833 | 1 | 0.2 | 34.5 | 0.322083 | 2 | 0.4 | 41.8 |
| -1.27297 | 3 | 0.6 | 17.4 | -.579818 | 3 | 0.6 | 27.5 | -.094311 | 2 | 0.4 | 34.9 | 0.336472 | 2 | 0.4 | 42.2 |
| -1.23787 | 5 | 1.0 | 18.3 | -.562119 | 1 | 0.2 | 27.7 | -.083382 | 1 | 0.2 | 35.1 | 0.34359 | 1 | 0.2 | 42.4 |
| -1.20397 | 3 | 0.6 | 18.9 | -.544727 | 2 | 0.4 | 28.1 | -.072571 | 1 | 0.2 | 35.3 | 0.357674 | 1 | 0.2 | 42.6 |
| -1.17118 | 1 | 0.2 | 19.1 | -.527633 | 1 | 0.2 | 28.2 | -.051293 | 2 | 0.4 | 35.7 | 0.371564 | 1 | 0.2 | 42.7 |
| -1.13943 | 2 | 0.4 | 19.5 | -.510826 | 1 | 0.2 | 28.4 | -.030459 | 2 | 0.4 | 36.1 | 0.378436 | 2 | 0.4 | 43.1 |
| -1.10866 | 3 | 0.6 | 20.0 | -.462035 | 1 | 0.2 | 28.6 | -.020203 | 1 | 0.2 | 36.3 | 0.398776 | 1 | 0.2 | 43.3 |

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VARIABLE LNAD

FREQUENCY TABLE (CONT.)

| | | PERCENTS | | | | PERCENTS | | | | PERCENTS | | | | PERCENTS | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| VALUE | COUNT | CELL | CUM | VALUE | COUNT | CELL | CUM | VALUE | COUNT | CELL | CUM | VALUE | COUNT | CELL | CUM |
| 0.405465 | 1 | 0.2 | 43.5 | 0.963174 | 1 | 0.2 | 55.5 | 1.43746 | 1 | 0.2 | 66.2 | 2.00821 | 1 | 0.2 | 77.3 |
| 0.41871 | 1 | 0.2 | 43.7 | 0.985817 | 1 | 0.2 | 55.7 | 1.44456 | 1 | 0.2 | 66.4 | 2.01223 | 1 | 0.2 | 77.5 |
| 0.457425 | 3 | 0.6 | 44.3 | 0.989541 | 1 | 0.2 | 55.9 | 1.45861 | 1 | 0.2 | 66.6 | 2.02683 | 1 | 0.2 | 77.7 |
| 0.48858 | 1 | 0.2 | 44.5 | 0.993252 | 2 | 0.4 | 56.3 | 1.46557 | 1 | 0.2 | 66.8 | 2.02946 | 1 | 0.2 | 77.9 |
| 0.500775 | 1 | 0.2 | 44.7 | 0.996949 | 1 | 0.2 | 56.5 | 1.47247 | 1 | 0.2 | 67.0 | 2.03601 | 1 | 0.2 | 78.1 |
| 0.506818 | 1 | 0.2 | 44.8 | 1.00796 | 1 | 0.2 | 56.7 | 1.47476 | 1 | 0.2 | 67.2 | 2.03862 | 1 | 0.2 | 78.2 |
| 0.524728 | 1 | 0.2 | 45.0 | 1.02962 | 1 | 0.2 | 56.9 | 1.49962 | 2 | 0.4 | 67.6 | 2.06306 | 1 | 0.2 | 78.4 |
| 0.548121 | 2 | 0.4 | 45.4 | 1.03318 | 1 | 0.2 | 57.1 | 1.50185 | 2 | 0.4 | 67.9 | 2.06433 | 1 | 0.2 | 78.6 |
| 0.559616 | 1 | 0.2 | 45.6 | 1.04732 | 1 | 0.2 | 57.3 | 1.51072 | 1 | 0.2 | 68.1 | 2.07065 | 1 | 0.2 | 78.8 |
| 0.565314 | 1 | 0.2 | 45.8 | 1.05082 | 1 | 0.2 | 57.4 | 1.52606 | 2 | 0.4 | 68.5 | 2.07443 | 1 | 0.2 | 79.0 |
| 0.57098 | 1 | 0.2 | 46.0 | 1.05431 | 1 | 0.2 | 57.6 | 1.56862 | 1 | 0.2 | 68.7 | 2.08069 | 1 | 0.2 | 79.2 |
| 0.576613 | 1 | 0.2 | 46.2 | 1.06126 | 1 | 0.2 | 57.8 | 1.58923 | 1 | 0.2 | 68.9 | 2.09063 | 1 | 0.2 | 79.4 |
| 0.582216 | 2 | 0.4 | 46.6 | 1.075 | 1 | 0.2 | 58.0 | 1.60342 | 2 | 0.4 | 69.3 | 2.12346 | 1 | 0.2 | 79.6 |
| 0.587787 | 1 | 0.2 | 46.8 | 1.08519 | 1 | 0.2 | 58.2 | 1.60744 | 1 | 0.2 | 69.5 | 2.12585 | 1 | 0.2 | 79.8 |
| 0.593327 | 1 | 0.2 | 46.9 | 1.09527 | 1 | 0.2 | 58.4 | 1.61343 | 1 | 0.2 | 69.7 | 2.12823 | 1 | 0.2 | 80.0 |
| 0.604316 | 1 | 0.2 | 47.1 | 1.09861 | 1 | 0.2 | 58.6 | 1.64287 | 1 | 0.2 | 69.8 | 2.1318 | 1 | 0.2 | 80.2 |
| 0.609766 | 1 | 0.2 | 47.3 | 1.10526 | 1 | 0.2 | 58.8 | 1.67335 | 1 | 0.2 | 70.0 | 2.13771 | 1 | 0.2 | 80.3 |
| 0.620576 | 1 | 0.2 | 47.5 | 1.12817 | 1 | 0.2 | 59.0 | 1.69378 | 1 | 0.2 | 70.2 | 2.14007 | 1 | 0.2 | 80.5 |
| 0.636577 | 2 | 0.4 | 47.9 | 1.13783 | 1 | 0.2 | 59.2 | 1.70656 | 1 | 0.2 | 70.4 | 2.14827 | 1 | 0.2 | 80.7 |
| 0.647103 | 1 | 0.2 | 48.1 | 1.14103 | 1 | 0.2 | 59.4 | 1.71739 | 1 | 0.2 | 70.6 | 2.14943 | 1 | 0.2 | 80.9 |
| 0.652325 | 1 | 0.2 | 48.3 | 1.15057 | 1 | 0.2 | 59.5 | 1.71919 | 1 | 0.2 | 70.8 | 2.15176 | 1 | 0.2 | 81.1 |
| 0.65752 | 2 | 0.4 | 48.7 | 1.16002 | 1 | 0.2 | 59.7 | 1.72633 | 1 | 0.2 | 71.0 | 2.16077 | 1 | 0.2 | 81.3 |
| 0.662688 | 2 | 0.4 | 49.0 | 1.17248 | 1 | 0.2 | 59.9 | 1.72811 | 1 | 0.2 | 71.2 | 2.17361 | 1 | 0.2 | 81.5 |
| 0.667829 | 1 | 0.2 | 49.2 | 1.17865 | 1 | 0.2 | 60.1 | 1.73695 | 1 | 0.2 | 71.4 | 2.18605 | 1 | 0.2 | 81.7 |
| 0.688135 | 1 | 0.2 | 49.4 | 1.18173 | 1 | 0.2 | 60.3 | [illegible] | 1 | 0.2 | 71.6 | 2.19944 | 1 | 0.2 | 81.9 |
| 0.703097 | 1 | 0.2 | 49.6 | 1.18479 | 1 | 0.2 | 60.5 | 1.75613 | 1 | 0.2 | 71.8 | 2.20607 | 1 | 0.2 | 82.1 |
| 0.708036 | 3 | 0.6 | 50.2 | 1.18784 | 1 | 0.2 | 60.7 | 1.76644 | 1 | 0.2 | 71.9 | 2.21157 | 1 | 0.2 | 82.3 |
| 0.71295 | 1 | 0.2 | 50.4 | 1.19695 | 1 | 0.2 | 60.9 | 1.77156 | 1 | 0.2 | 72.1 | 2.24284 | 1 | 0.2 | 82.4 |
| 0.727549 | 1 | 0.2 | 50.6 | 1.20597 | 1 | 0.2 | 61.1 | 1.78675 | 2 | 0.4 | 72.5 | 2.24813 | 1 | 0.2 | 82.6 |
| 0.737164 | 1 | 0.2 | 50.8 | 1.21194 | 1 | 0.2 | 61.3 | 1.81156 | 1 | 0.2 | 72.7 | 2.25129 | 1 | 0.2 | 82.8 |
| 0.746688 | 1 | 0.2 | 51.0 | 1.24703 | 1 | 0.2 | 61.5 | 1.82938 | 1 | 0.2 | 72.9 | 2.26072 | 2 | 0.4 | 83.2 |
| 0.751416 | 2 | 0.4 | 51.3 | 1.2499 | 1 | 0.2 | 61.6 | 1.8453 | 1 | 0.2 | 73.1 | 2.27521 | 1 | 0.2 | 83.4 |
| 0.770108 | 2 | 0.4 | 51.7 | 1.25562 | 1 | 0.2 | 61.8 | 1.85942 | 1 | 0.2 | 73.3 | 2.29354 | 1 | 0.2 | 83.6 |
| 0.783902 | 1 | 0.2 | 51.9 | 1.25846 | 3 | 0.6 | 62.4 | 1.86253 | 2 | 0.4 | 73.7 | 2.30458 | 1 | 0.2 | 83.8 |
| 0.788457 | 1 | 0.2 | 52.1 | 1.27256 | 2 | 0.4 | 62.8 | 1.87026 | 1 | 0.2 | 73.9 | 2.30956 | 1 | 0.2 | 84.0 |
| 0.792992 | 1 | 0.2 | 52.3 | 1.28647 | 1 | 0.2 | 63.0 | 1.89311 | 1 | 0.2 | 74.0 | 2.32337 | 1 | 0.2 | 84.2 |
| 0.797507 | 1 | 0.2 | 52.5 | 1.30563 | 1 | 0.2 | 63.2 | 1.90954 | 1 | 0.2 | 74.2 | 2.3302 | 1 | 0.2 | 84.4 |
| 0.81978 | 1 | 0.2 | 52.7 | 1.30833 | 1 | 0.2 | 63.4 | 1.91102 | 1 | 0.2 | 74.4 | 2.37584 | 1 | 0.2 | 84.5 |
| 0.824175 | 1 | 0.2 | 52.9 | 1.31641 | 1 | 0.2 | 63.5 | 1.9125 | 1 | 0.2 | 74.6 | 2.39971 | 1 | 0.2 | 84.7 |
| 0.841567 | 1 | 0.2 | 53.1 | 1.32176 | 1 | 0.2 | 63.7 | 1.91986 | 1 | 0.2 | 74.8 | 2.451 | 2 | 0.4 | 85.1 |
| 0.845868 | 1 | 0.2 | 53.2 | 1.35841 | 2 | 0.4 | 64.1 | 1.92425 | 1 | 0.2 | 75.0 | 2.45702 | 1 | 0.2 | 85.3 |
| 0.858662 | 1 | 0.2 | 53.4 | 1.36864 | 1 | 0.2 | 64.3 | 1.93007 | 1 | 0.2 | 75.2 | 2.45788 | 1 | 0.2 | 85.5 |
| 0.86289 | 2 | 0.4 | 53.8 | 1.37372 | 1 | 0.2 | 64.5 | 1.93152 | 1 | 0.2 | 75.4 | 2.47317 | 1 | 0.2 | 85.7 |
| 0.875469 | 1 | 0.2 | 54.0 | 1.37877 | 1 | 0.2 | 64.7 | 1.93297 | 1 | 0.2 | 75.6 | 2.49321 | 1 | 0.2 | 85.9 |
| 0.879627 | 1 | 0.2 | 54.2 | 1.40118 | 2 | 0.4 | 65.1 | 1.94734 | 1 | 0.2 | 75.8 | 2.52332 | 1 | 0.2 | 86.1 |
| 0.887891 | 1 | 0.2 | 54.4 | 1.40364 | 1 | 0.2 | 65.3 | 1.96711 | 2 | 0.4 | 76.1 | 2.53766 | 1 | 0.2 | 86.3 |
| 0.896088 | 2 | 0.4 | 54.8 | 1.40854 | 1 | 0.2 | 65.5 | 1.9699 | 1 | 0.2 | 76.3 | 2.5416 | 1 | 0.2 | 86.5 |
| 0.920283 | 1 | 0.2 | 55.0 | 1.41342 | 1 | 0.2 | 65.6 | 1.97685 | 1 | 0.2 | 76.5 | 2.58626 | 1 | 0.2 | 86.6 |
| 0.924259 | 1 | 0.2 | 55.2 | 1.4327 | 1 | 0.2 | 65.8 | 1.98376 | 2 | 0.4 | 76.9 | 2.60046 | 1 | 0.2 | 86.8 |
| 0.932144 | 1 | 0.2 | 55.3 | 1.43508 | 1 | 0.2 | 66.0 | 1.98924 | 1 | 0.2 | 77.1 | 2.64546 | 1 | 0.2 | 87.0 |

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VARIABLE LNAD

FREQUENCY TABLE (CONT.)

| | | PERCENTS | | | | PERCENTS | | | | PERCENTS | | | | PERCENTS | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| VALUE | COUNT | CELL | CUM | VALUE | COUNT | CELL | CUM | VALUE | COUNT | CELL | CUM | VALUE | COUNT | CELL | CUM |
| 2.6483 | 1 | 0.2 | 87.2 | 2.91235 | 1 | 0.2 | 90.5 | 3.42978 | 1 | 0.2 | 93.7 | 4.30271 | 1 | 0.2 | 96.9 |
| 2.66375 | 1 | 0.2 | 87.4 | 2.92208 | 1 | 0.2 | 90.6 | 3.45347 | 1 | 0.2 | 93.9 | 4.61571 | 1 | 0.2 | 97.1 |
| 2.66723 | 1 | 0.2 | 87.6 | 2.92638 | 1 | 0.2 | 90.8 | 3.45663 | 1 | 0.2 | 94.1 | 4.74258 | 1 | 0.2 | 97.3 |
| 2.67346 | 1 | 0.2 | 87.8 | 2.93386 | 1 | 0.2 | 91.0 | 3.48185 | 1 | 0.2 | 94.3 | 4.75995 | 1 | 0.2 | 97.5 |
| 2.7543 | 1 | 0.2 | 88.0 | 2.9601 | 1 | 0.2 | 91.2 | 3.54385 | 1 | 0.2 | 94.5 | 4.77348 | 1 | 0.2 | 97.7 |
| 2.77321 | 1 | 0.2 | 88.2 | 2.96373 | 1 | 0.2 | 91.4 | 3.6206 | 1 | 0.2 | 94.7 | 4.90283 | 1 | 0.2 | 97.9 |
| 2.78994 | 1 | 0.2 | 88.4 | 3.02237 | 1 | 0.2 | 91.6 | 3.63389 | 1 | 0.2 | 94.8 | 4.99227 | 1 | 0.2 | 98.1 |
| 2.81 | 1 | 0.2 | 88.5 | 3.03303 | 1 | 0.2 | 91.8 | 3.67326 | 1 | 0.2 | 95.0 | 5.11677 | 1 | 0.2 | 98.3 |
| 2.81661 | 1 | 0.2 | 88.7 | 3.10906 | 1 | 0.2 | 92.0 | 3.70278 | 1 | 0.2 | 95.2 | 5.12604 | 1 | 0.2 | 98.5 |
| 2.84141 | 1 | 0.2 | 88.9 | 3.15955 | 1 | 0.2 | 92.2 | 3.73385 | 1 | 0.2 | 95.4 | 5.1567 | 1 | 0.2 | 98.7 |
| 2.842 | 1 | 0.2 | 89.1 | 3.16547 | 1 | 0.2 | 92.4 | 3.77803 | 1 | 0.2 | 95.6 | 5.18206 | 1 | 0.2 | 98.9 |
| 2.86334 | 1 | 0.2 | 89.3 | 3.20721 | 1 | 0.2 | 92.6 | 3.79369 | 1 | 0.2 | 95.8 | 5.18604 | 1 | 0.2 | 99.0 |
| 2.86676 | 1 | 0.2 | 89.5 | 3.23514 | 1 | 0.2 | 92.7 | 3.89711 | 1 | 0.2 | 96.0 | 5.20214 | 1 | 0.2 | 99.2 |
| 2.8887 | 1 | 0.2 | 89.7 | 3.2604 | 1 | 0.2 | 92.9 | 3.96727 | 1 | 0.2 | 96.2 | 5.3397 | 1 | 0.2 | 99.4 |
| 2.89037 | 1 | 0.2 | 89.9 | 3.29398 | 1 | 0.2 | 93.1 | 4.00606 | 1 | 0.2 | 96.4 | 5.90863 | 1 | 0.2 | 99.6 |
| 2.8937 | 1 | 0.2 | 90.1 | 3.30798 | 1 | 0.2 | 93.3 | 4.0709 | 1 | 0.2 | 96.6 | 6.39136 | 1 | 0.2 | 99.8 |
| 2.89812 | 1 | 0.2 | 90.3 | 3.41214 | 1 | 0.2 | 93.5 | 4.10792 | 1 | 0.2 | 96.8 | 6.41665 | 1 | 0.2 | 100.0 |

DEC 16, 1980

TO: JIM HANSEN
R+D, BLDG 770
TECH CENTER, S. CHAS

RE. STATISTICAL EVALUATION OF VINYL CHLORIDE DATA FOR SOLVENT VINYL RESINS STRIPPING - ADDITIONAL SIX MONTHS ANALYSES.

JIM:

IN CONNECTION WITH OUR APPEAL TO EPA FOR RELIEF FROM THE ANALYTICAL RESTRICTIONS IN THE NESHAPS REGULATION, IT COULD POSSIBLY BE A WAY TO GET THEM MOVING (BEFORE THE PRESIDENTIAL INAUGURATION) IF WE ADDED IN THE ATTACHED DATA BY YOUR LOG-NORMAL APPROACH.

I WILL BE ON VACATION UNTIL AFTER NEW YEAR'S SO YOU MAY SCHEDULE IT AT YOUR CONVENIENCE, UNLESS, OF COURSE, YOU MAY BE JAMMED UP AT YEAR'S END. THANKS FOR ANY HELP YOU CAN GIVE ME AGAIN - ANOTHER SET OF PRINT-OUTS COVERING THE WHOLE 18 MONTHS (12 MOS YOU PREVIOUSLY DID + THESE 6 HERE) WOULD BE GREAT.

ENJOY THE HOLIDAYS -

Thanks Jack Erdmann

UCC
051419

UNION CARBIDE INTERNAL CORRESPONDENCE

P. O. BOX 471, TEXAS CITY, TEXAS 77590

TO: J. F. Erdmann
Texas City Plant

Date: December 10, 1980

cc: S. A. Dickerson
J. B. Leverton
D. G. Reese
G. F. Tacquard
G. E. Vaughan

Subject: Semi-Annual EPA Report

Attached are the summary values of residual vinyl chloride in UCAR Solution Vinyls stripped varnish. The data includes the period from March 1 through August 31, 1980.

This should satisfy your requirements for the Semi-Annual EPA Report.

Sincerely,

Dean

P. D. Smith

PDS/st
Attachments

MARCH, 1980

| Date | Ati |
|---|---|
| 1 | 14.49 |
| 2 | 4.60 |
| 3 | 2.62 |
| 4 | 1.01 |
| 5 | .39 |
| 6 | .10 |
| 7 | 3.19 |
| 8 | 1.15 |
| 9 | .65 |
| 10 | .29 |
| 11 | <.1 |
| 12 | <.1 |
| 13 | .25 |
| 14 | .49 |
| 15 | .26 |
| 16 | .70 |
| 17 | .03 |
| 18 | .24 |
| 19 | .24 |
| 20 | 3.89 |
| 21 | 10.02 |
| 22 | 3.97 |
| 23 | .63 |
| 24 | 1.79 |
| 25 | <.1 |
| 26 | 7.27 |
| 27 | .38 |
| 28 | 1.22 |
| 29 | 1.40 |
| 30 | .56 |
| 31 | 2.70 |

APRIL, 1980

| Date | Ati |
|---|---|
| 1 | .44 |
| 2 | .95 |
| 3 | <.1 |
| 4 | .30 |
| 5 | 1.94 |
| 6 | .13 |
| 7 | .44 |
| 8 | 4.21 |
| 9 | Down |
| 10 | " |
| 11 | " |
| 12 | " |
| 13 | " |
| 14 | " |
| 15 | " |
| 16 | .70 |
| 17 | .15 |
| 18 | .11 |
| 19 | .10 |
| 20 | .24 |
| 21 | .33 |
| 22 | 16.01 |
| 23 | 2.09 |
| 24 | 14.09 |
| 25 | .95 |
| 26 | .20 |
| 27 | .13 |
| 28 | .97 |
| 29 | 1.10 |
| 30 | 8.40 |

MAY, 1980

| Date | Ati |
|---|---|
| 1 | 19.37 |
| 2 | .80 |
| 3 | .98 |
| 4 | .60 |
| 5 | .14 |
| 6 | 3.52 |
| 7 | <.1 |
| 8 | 1.36 |
| 9 | .23 |
| 10 | 18.00 |
| 11 | 1.31 |
| 12 | 1.94 |
| 13 | .29 |
| 14 | .34 |
| 15 | .27 |
| 16 | .75 |
| 17 | 16.61 |
| 18 | 11.86 |
| 19 | 14.13 |
| 20 | 116.74 |
| 21 | 18.40 |
| 22 | 101.06 |
| 23 | 7.96 |
| 24 | 7.48 |
| 25 | 16.28 |
| 26 | 7.27 |
| 27 | 8.43 |
| 28 | 9.08 |
| 29 | 6.23 |
| 30 | 12.10 |
| 31 | 3.93 |

JUNE, 1980

| Date | Ati |
|---|---|
| 1 | <.1 |
| 2 | Down |
| 3 | Down |
| 4 | Down |
| 5 | Down |
| 6 | Down |
| 7 | Down |
| 8 | Down |
| 9 | <.1 |
| 10 | <.1 |
| 11 | 4.06 |
| 12 | 7.22 |
| 13 | .30 |
| 14 | 1.80 |
| 15 | .42 |
| 16 | 1.35 |
| 17 | 1.31 |
| 18 | .66 |
| 19 | 1.25 |
| 20 | .68 |
| 21 | .75 |
| 22 | .74 |
| 23 | .83 |
| 24 | 1.73 |
| 25 | 5.85 |
| 26 | 12.65 |
| 27 | 4.24 |
| 28 | 4.48 |
| 29 | 1.65 |
| 30 | 7.68 |

UCC
051424

JULY, 1980

| Date | Ati |
|---|---|
| 1 | 26.95 |
| 2 | 10.07 |
| 3 | 3.69 |
| 4 | 7.01 |
| 5 | .64 |
| 6 | 3.73 |
| 7 | .75 |
| 8 | .52 |
| 9 | .44 |
| 10 | .78 |
| 11 | 1.78 |
| 12 | 1.45 |
| 13 | 1.58 |
| 14 | 4.11 |
| 15 | 1.83 |
| 16 | 3.70 |
| 17 | 3.95 |
| 18 | 1.02 |
| 19 | 7.88 |
| 20 | 1.58 |
| 21 | .24 |
| 22 | 3.27 |
| 23 | 1.84 |
| 24 | 2.22 |
| 25 | .29 |
| 26 | 3.62 |
| 27 | 3.16 |
| 28 | 39.38 |
| 29 | 2.37 |
| 30 | 8.60 |
| 31 | 2.81 |

UCC
051425

AUGUST, 1980

| Date | Ati |
|---|---|
| 1 | .73 |
| 2 | .73 |
| 3 | 5.63 |
| 4 | 8.36 |
| 5 | 1.89 |
| 6 | 2.45 |
| 7 | 3.09 |
| 8 | Down |
| 9 | Down |
| 10 | Down |
| 11 | Down |
| 12 | Down |
| 13 | Down |
| 14 | Down |
| 15 | Down |
| 16 | Down |
| 17 | Down |
| 18 | 5.62 |
| 19 | 4.97 |
| 20 | 4.97 |
| 21 | <.1 |
| 22 | 2.69 |
| 23 | 1.01 |
| 24 | .51 |
| 25 | 2.12 |
| 26 | 2.03 |
| 27 | 7.59 |
| 28 | 44.42 |
| 29 | 8.09 |
| 30 | 4.53 |
| 31 | .34 |

UCC
051426

UNION CARBIDE

UNION CARBIDE CORPORATION
CHEMICALS AND PLASTICS
P.O. BOX 471, TEXAS CITY, TEXAS 77590

December 15, 1980

Mr. Bill Stewart
Executive Director
Texas Air Control Board
6330 Highway 290 East
Austin, TX 78723

Subject: Semiannual Report for NESHAPS Regulation on Vinyl Chloride Monomer, For Solvent Vinyl Resins Process, Texas City Plant (41 CFR 46559, October 21, 1976) Reporting Period: March thru August, 1980

Dear Mr. Stewart:

The attached Semiannual Report for March thru August 1980 is submitted in accordance with Section 61.70 of the Vinyl Chloride Regulation noted above.

I apologize for the delay in preparation and submittal of this report. Our Production Records group must necessarily be involved in the determination of the daily weighted average values of VCM content in the stripped varnish ($A_{ti}$) in order to incorporate the final official daily production quantities of the various resins for the unit. There was an abnormally high turnover in the Production Records personnel at mid-year because of retirements, which required a realignment of responsibilities and training of new people. This caused a significant slowdown in their schedules and output, which has only recently begun to recover.

If there are any questions about this report, please refer them to my attention.

Very truly yours,

J. F. Erdmann

J. F. Erdmann, P.E.
Environmental Protection
Coordinator
(713) 948-5126

JFE:ir
Attachments

UCC
051427

UNION CARBIDE CORPORATION,
SOLVENTS AND INTERMEDIATES DIVISION
SEMIANNUAL REPORT FOR NESHAPS REGULATION
FOR VINYL CHLORIDE MONOMER
SOLVENT VINYL RESINS PROCESS, TEXAS CITY, TEXAS
DECEMBER 15, 1980

I. EXCESS EMISSIONS [§61.70 (c)(1)]

Under this section, parts A, B, and C do not apply as indicated in our March 15, 1979 semiannual report for the reasons listed therein.

The solvent and monomer recovery system operations are the same as described in this previous report and will not be repeated here.

There were no emergency discharges during this reporting period.

II. CONTINUOUS STRIPPING [§61.70 (c)(2)]

The description of our monomer stripping system has been previously submitted in the semiannual report dated March 15, 1979.

The attached reports for the months of March through August, 1980 continue to support our previously stated position that our monomer stripping operations are far more efficient than the suspension process for which the analytical procedures in the Regulation were written. We have obtained the approval of your staff for a proposed once-per-week random sampling/analytical schedule in order to reduce our analytical efforts to a more cost-productive basis. This request is now in the process of evaluation by EPA/Dallas, thru their various echelons, including Washington headquarters and the Research Triangle Park sections.

The data for this period indicates the highest level recorded was 116 ppm on May 20th, which is well within the 400 ppm upper limit. If necessary to help EPA/Dallas approve our previous request for the weekly analytical schedule, this data may be included with the previous 12 months for a total 18-month statistical analysis using the log-normal correlation.

UCC
051428

# MARCH, 1980

| Date | Ati |
|---|---|
| 1 | 14.49 |
| 2 | 4.60 |
| 3 | 2.62 |
| 4 | 1.01 |
| 5 | .39 |
| 6 | .10 |
| 7 | 3.19 |
| 8 | 1.15 |
| 9 | .65 |
| 10 | .29 |
| 11 | <.1 |
| 12 | <.1 |
| 13 | .25 |
| 14 | .49 |
| 15 | .26 |
| 16 | .70 |
| 17 | .03 |
| 18 | .24 |
| 19 | .24 |
| 20 | 3.89 |
| 21 | 10.02 |
| 22 | 3.97 |
| 23 | .63 |
| 24 | 1.79 |
| 25 | <.1 |
| 26 | 7.27 |
| 27 | .38 |
| 28 | 1.22 |
| 29 | 1.40 |
| 30 | .56 |
| 31 | 2.70 |

## APRIL, 1980

| Date | Ati |
|---|---|
| 1 | .44 |
| 2 | .95 |
| 3 | <.1 |
| 4 | .30 |
| 5 | 1.94 |
| 6 | .13 |
| 7 | .44 |
| 8 | 4.21 |
| 9 | Down |
| 10 | " |
| 11 | " |
| 12 | " |
| 13 | " |
| 14 | " |
| 15 | " |
| 16 | .70 |
| 17 | .15 |
| 18 | .11 |
| 19 | .10 |
| 20 | .24 |
| 21 | .33 |
| 22 | 16.01 |
| 23 | 2.09 |
| 24 | 14.09 |
| 25 | .95 |
| 26 | .20 |
| 27 | .13 |
| 28 | .97 |
| 29 | 1.10 |
| 30 | 8.40 |

MAY, 1980

| Date | Ati |
|---|---|
| 1 | 19.37 |
| 2 | .80 |
| 3 | .98 |
| 4 | .60 |
| 5 | .14 |
| 6 | 3.52 |
| 7 | <.1 |
| 8 | 1.36 |
| 9 | .23 |
| 10 | 18.00 |
| 11 | 1.31 |
| 12 | 1.94 |
| 13 | .29 |
| 14 | .34 |
| 15 | .27 |
| 16 | .75 |
| 17 | 16.61 |
| 18 | 11.86 |
| 19 | 14.13 |
| 20 | 116.74 |
| 21 | 18.40 |
| 22 | 101.06 |
| 23 | 7.96 |
| 24 | 7.48 |
| 25 | 16.28 |
| 26 | 7.27 |
| 27 | 8.43 |
| 28 | 9.08 |
| 29 | 6.23 |
| 30 | 12.10 |
| 31 | 3.93 |

## JUNE, 1980

| Date | Ati |
|---|---|
| 1 | <.1 |
| 2 | Down |
| 3 | Down |
| 4 | Down |
| 5 | Down |
| 6 | Down |
| 7 | Down |
| 8 | Down |
| 9 | <.1 |
| 10 | <.1 |
| 11 | 4.06 |
| 12 | 7.22 |
| 13 | .30 |
| 14 | 1.80 |
| 15 | .42 |
| 16 | 1.35 |
| 17 | 1.31 |
| 18 | .66 |
| 19 | 1.25 |
| 20 | .68 |
| 21 | .75 |
| 22 | .74 |
| 23 | .83 |
| 24 | 1.73 |
| 25 | 5.85 |
| 26 | 12.65 |
| 27 | 4.24 |
| 28 | 4.48 |
| 29 | 1.65 |
| 30 | 7.68 |

JULY, 1980

| Date | Ati |
|---|---|
| 1 | 26.95 |
| 2 | 10.07 |
| 3 | 3.69 |
| 4 | 7.01 |
| 5 | .64 |
| 6 | 3.73 |
| 7 | .75 |
| 8 | .52 |
| 9 | .44 |
| 10 | .78 |
| 11 | 1.78 |
| 12 | 1.45 |
| 13 | 1.58 |
| 14 | 4.11 |
| 15 | 1.83 |
| 16 | 3.70 |
| 17 | 3.95 |
| 18 | 1.02 |
| 19 | 7.88 |
| 20 | 1.58 |
| 21 | .24 |
| 22 | 3.27 |
| 23 | 1.84 |
| 24 | 2.22 |
| 25 | .29 |
| 26 | 3.62 |
| 27 | 3.16 |
| 28 | 39.38 |
| 29 | 2.37 |
| 30 | 8.60 |
| 31 | 2.81 |

AUGUST, 1980

| Date | Ati |
|---|---|
| 1 | .73 |
| 2 | .73 |
| 3 | 5.63 |
| 4 | 8.36 |
| 5 | 1.89 |
| 6 | 2.45 |
| 7 | 3.09 |
| 8 | Down |
| 9 | Down |
| 10 | Down |
| 11 | Down |
| 12 | Down |
| 13 | Down |
| 14 | Down |
| 15 | Down |
| 16 | Down |
| 17 | Down |
| 18 | 5.62 |
| 19 | 4.97 |
| 20 | 4.97 |
| 21 | $<.1$ |
| 22 | 2.69 |
| 23 | 1.01 |
| 24 | .51 |
| 25 | 2.12 |
| 26 | 2.03 |
| 27 | 7.59 |
| 28 | 44.42 |
| 29 | 8.09 |
| 30 | 4.53 |
| 31 | .34 |

Attachments consisted of -

1) LTR to HOWARD HOUSTON @TACB - 1/21/80 request for change in Samp + Anal. Program - from JE (complete w/ all 3 attachments)

2) LTR TO H. HOUSTON @TACB - 4/21/80 - add'nal a-mos of data + statistical correlation

3) LTR to JE from JIM DRAPER, TACB/AUSTIN - Questioning the above results - STATISTICAL CORRELATION.

4) LTR to JOHN KEY TACB from JE - 8/6/80 w/ log-normal correlation by JIM Hanes

5) LTR to Martin Brittain from John Key indicating approval + forwarding to EPA for their review + approval.

DAY OF THE YEAR DAYS REMAINING

~~307 - SAT., NOV. 3 - 58   308 - SUN., NOV. 4 - 57~~

UCC
051435

Mr. Martin Brittain of EPA/Dallas has indicated he has forwarded the latter information which the TACB has approved to appropriate sections in both the RTP and Washington offices for their review and approval before they make a decision from the Dallas location.

We would appreciate any support you can provide for this request and similar ones for which the original NESHAPS regulation was not particularly written. We will be pleased to provide any additional information and/or conduct an inspection of these facilities with you to resolve any pertinent questions that may arise. Thank you for your interest in this problem.

Very truly,

Erdmann

J. F. Erdmann, P.E.
Environmental Protection
Coordinator (713) 948-5126

JFE:ir
Attachments
cc: (cover letter only)
Mr. Martin Brittain, EPA/Dallas
Mr. John W. Key, TACB/Austin
Mr. Sabino Gomez, TACB/Bellaire

bcc: (cover letter only)
R. M. Arnold
J. H. Barrett
W. T. Gray, Jr.
J. B. Leverton/J. S. Knight
R. R. Rankin - CLC
D. R. Reem
Dr. D. G. Reese/P. D. Smith
G. F. Tacquard/S. A. Dickerson
L. B. Feldcamp - Baker & Botts

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Very truly,

J. F. Erdmann, P.E.
Environmental Protection
Coordinator (713) 948-5126

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Mr. Sabino Gomez, TACB/Bellaire

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Dr. D. G. Reese/P. D. Smith
G. F. Tacquard/S. A. Dickerson
L. B. Feldcamp - Baker & Botts

UC 149-2

UNION CARBIDE

INTERNAL CORRESPONDENCE

P. O. BOX 471, TEXAS CITY, TEXAS 77590

To: Messrs. R. M. Arnold
J. H. Barrett
W. T. Gray, Jr.
J. B. Leverton/J. S. Knight
R. R. Rankin - CLC
D. R. Reem
Dr. D. G. Reese/P. D. Smith
G. F. Tacquard/S. A. Dickerson

October 21, 1980

Copy to: J. L. Hansen - 511

Subject: Request for Change in Sampling and Analytical Program Under Part 61, NESHAPS Regulation for Vinyl Chloride Monomer Control (TACB Account No. GB-0076-J)

Gentlemen:

Attached is the response we have been awaiting from TACB as the first step in getting this test program operating in a cost effective manner. As you can see from this letter, the supplemental information we submitted in August based on Jim Hansen's application of the log-normal distribution was a major factor in obtaining this approval. For Jim's help in coming up with this approach, I am highly appreciative.

I plan to contact Mr. Brittain at the Dallas EPA office in a few days to see what new problems may appear in this scenario. If any suggestions or comments are cluttering up your thoughts, please send them to me.

Very truly yours,

Jack

[redacted]

MARTIN BRITTAIN
EPA/DALLAS
(214) 767-2755

11/4/80 - checked with him - their approval at (Regional HQ / EPA/Dallas) must be backed by the concurrence of Planning + Standards Section @ RTP (DON GOODWIN'S SECT) and to a STATIONARY SOURCE ENFORCEMENT GP in WASH. D.C.

JFE:ir
Attachment

sent out OCT 31, 80

→ give em a week or two more

12/16/80 - Checked w/ Brittain - no word from his EPA groups - he'll check into it + we'll discuss further after JAN 1ST - I offered an old val base of data for him if needed - perhaps should send it to Hansen to run while I'm on VAC - This was worked up by Hansen + I sent it to Brittain on JAN 9, 1981

UCC
051438

# TEXAS AIR CONTROL BOARD

6330 HWY. 290 EAST
AUSTIN, TEXAS 78723
512/451-5711



October 14, 1980

Mr. Martin Brittain, P. E.
NESHAP Coordinator 6AEAE
United States Environmental Protection Agency
Region VI
1201 Elm Street
Dallas, TX 75270

RECEIVED
OCT 20 1980
J. F. E.

Re: Union Carbide Corporation
Alternative Testing Method
Texas City, Galveston County
TACB Account No. GB-0076-J

Dear Mr. Brittain:

I am forwarding to you a request by Union Carbide for a change in the sampling and analytical procedures specified in Part 61, Subparts A and F and Appendix B, Methods 106 and 107. My staff reviewed the original request and found it to be deficient; however, supplemental information provided by Union Carbide now seems to support the request. We are recommending approval of the proposed procedure and have enclosed copies of all pertinent documents for your consideration.

If we can be of further assistance, please contact Mr. Charles Shevlin of my staff at extension 251. Please advise us of your final determination concerning this matter.

Sincerely,

John W. Key, P. E., Chief
Source Evaluation Section

Enclosures

cc: Mr. Cecil Bradford, Compliance Division
Mr. Sabino Gomez, Region 7
Mr. J. F. Erdmann, P. E., Union Carbide Corporation

UCC
051439

QA

QUALITY ASSURANCE

**INTERNAL CORRESPONDENCE**

~~RECEIVED~~
SEP 22 1980
J. F. E.

To (Name) ~~Mr. J. F. Erdmann~~
Location Bldg. 1
TEXAS CITY PLANT

Date September 18, 1980

Originating Dept Vinyls Lab - Texas City

Copy to Mr. S. A. Dickerson
Dr. D. G. Reese
Mr. P. D. Smith/
Mr. J. R. Rex
Mr. G. F. Tacquard

Subject

Jack:

Steve informed me of your request to lower from 400 ppm to 250 ppm, the point at which the Q.C. Laboratory will automatically recheck the ppm VCM value on any stripping still sample from Bldg. 117.

To comply with this request, effective today the Laboratory SOP will be revised to state that any stripping still sample which exceeds 250 ppm VCM will automatically be rechecked.

We hope this revision will be of assistance to you in your continuing effort to attain a reduction in sampling/analyzing frequency.

Please advise if we can be of any further assistance.

Regards,

G. E. Vaughan

G. E. Vaughan

GEV/pl

UNION CARBIDE CHEMICALS AND PLASTICS

UCC 051440

TOLD STEVE DICKERSON - This AM

10-14-80 - Phone call from John Key
@ TACB, AUSTIN - he said that
TACB has approved their request +
will be sending their correspondence
+ letter of approval to EPA/Dallas
by mid week (OCT 15-16 or so) -
I should get copy by end of week
or early next week -
Plan to call EPA/Dallas
about mid-week (OCT 22-23) to
see who has it + approx how they
plan to review, etc - how long? -

E

UCC
051441

To. JJE

Date. 6/2 Time 1:50

WHILE YOU WERE OUT

Mr. Gary Whipple

of. O.S.G.

Phone 5256

| | | | |
|---|---|---|---|
| TELEPHONED | | PLEASE CALL HIM HER | |
| CALLED TO SEE YOU | | WILL CALL AGAIN | |
| RETURNED YOUR CALL | ✓ | RUSH | |

Message

CT-1406

UCC
051442

SEPT 9

TUES — AT TACB, AUSTIN

See JOHN KEY of Permits + Source ~~[illegible]~~ Rm 243 Evaluation.

abt the latest statistical Sit'n.

or Charles B. Sherlin Extn Rm 468 — coming Thurs for look @ TKE w/ BOB JAMES

[illegible]

~~or Tim [illegible] Source Eval. Chief.~~

He's writing it up → Where does this now stand?

[illegible] → What can we do to recommend to EPA for relief? It's costing us lots of extra $ for week-end runs + unnecessary analytical effort that could be better spent on productive items

[illegible] Pete Bill Eli [illegible] [illegible]

→ Any time estimate? — Poss. decision from EPA/Dallas

he'll try to push as hard as he

UCC
051443

To Jack

Date 9-8 Time 2:20

WHILE YOU WERE OUT

Mr. Geo. Jacquard

of

Phone 5174

ASAP

| | | | |
|---|---|---|---|
| TELEPHONED | ✓ | PLEASE CALL HIM HER | ✓ |
| CALLED TO SEE YOU | | WILL CALL AGAIN | |
| RETURNED YOUR CALL | | RUSH | |

Message

CT-1406

UCC
051444

I file copy
w/ originals from
J. M. Hanson

UNION CARBIDE CORPORATION
CHEMICALS AND PLASTICS
P. O. BOX 471, TEXAS CITY, TEXAS 77590

August 6, 1980

Mr. John W. Key
Source Evaluation Section
Texas Air Control Board
6330 Highway 290 East
Austin, TX 78723

Attn: Mr. Charles B. Shevlin

Subject: TACB Account No. GB-0076-J, Request for Change in Sampling and Analytical Program Under Part 61, NESHAPS Regulation for Vinyl Chloride Monomer Control

Gentlemen:

Following the receipt of the letter of May 20, 1980 from James P. Draper in response to our original requests for a change in the analytical schedule under this regulation, we submitted the data to our statistical staff in the R and D groups at the South Charleston Technical Center. They have evaluated the data in the same manner we did and have shown, as you did, that the distribution by that method is not normal and the first set of conclusions we reached were not proper.

However, in addition, they have used a computer program for a log-normal distribution and applied the same statistical tests to this manner of computation. These new results show that the statistical analysis, when applied to the logarithms of the daily data values, does exhibit a log-normal distribution and the previous method of evaluation and determination of adequate samples for a 99.9% confidence level can be used. From this, we can show that if a total of six samples is taken in a six month period and the geometric mean value does not exceed 35 ppm, we have 99.9% confidence that the 400 ppm limit has not been exceeded.

On this basis we are still willing to proceed with weekly random sampling (one day out of seven), which is over four times more frequent than the statistical data indicate is necessary. Provided we analyze samples on this basis of one day out of every seven for a total of 26 tests every six months, we have 99.9% confidence that the 400 ppm level has not been exceeded, if the geometric mean of the 26 samples comes out to less than 124 ppm. The statistical evaluation by our Technical Center group which supports these statements is attached for your inspection and review.

In connection with the randomness of sampling and analysis, the following is our preferred method:

1) The sampling schedule will not be changed from the present, which calls for a stripped varnish sample from each stripper for each regular shift of operation. We have four strippers and three shifts/day, which results in up to 12 samples/day, depending on how many strippers are operating. These samples will be sent directly to the laboratory in the usual manner.

2) The laboratory will provide a random analytical schedule for one day out of seven to be predetermined on a weekly basis for selecting which day the varnish samples will be run. We must operate on a weekly schedule to optimize our manpower needs in the laboratory and eliminate as much overtime as possible.

Please review the attached documents and let me know of any problems you see which could limit your support for this request. We understand any official changes in the regulation must be approved by the EPA, and to that end we plan to submit this same request and information to the TRW contractor's team that is presently scheduled for a review of the NESHAPS regulation at our plant in the near future. If you have any suggestions for ways to speed up this approval process, please share them with us.

Thank you,

JFErdmann

J. F. Erdmann, P.E.
Environmental Protection
Coordinator
(713) 948-5126

JFE:ir
Attachments
cc: Mr. Howard Houston, TACB, Austin
Mr. Sabino Gomez, TACB, Bellaire
Dr. E. R. Ibert, GCACD

bcc: R. E. O'Bryan/NESHAPS (VCM) File ✓
*J. B. Leverton/J. S. Knight
*J. H. Barrett
G. F. Tacquard/S. A. Dickerson ✓
*R. M. Arnold
*D. G. Reese
*P. D. Smith
R. R. Rankin - CLC ✓
*W. T. Gray, Jr.
*D. R. Reem

* cover letter only

Tom Hect - special copy of reduced tables (

UCC
051447

UNION CARBIDE

INTERNAL CORRESPONDENCE

CHEMICALS AND PLASTICS • P. O. BOX 8361, SOUTH CHARLESTON, WEST VIRGINIA 25303

| | | | |
|---|---|---|---|
| To (Name) Division Location | Jack Erdmann, Texas City | Date | July 22, 1980 |
| | | Originating Dept. | |
| Copy to | John Leverton<br>Charlie Hendrix | Subject | Statistical Evaluation of Vinyl Chloride Data for Solvent Vinyl Resins Stripping - Use of Lognormal Distribution |

Dear Jack:

I have analyzed the Vinyl Chloride concentration data you sent me. I am returning 3 attachments with this letter: a rewrite of your April letter to the Texas Air Control Board using all the data and log-normal statistics; copies of computer printouts; and a copy of a discussion of the lognormal distribution from a NIOSH publication (number 77-173).

The raw data are not normally distributed (Kolmogorov-Smirnov D = 7.58, which is significant at the 99.99% level). However, when this test is applied to the logarithmsof the data, we find D = .93, which is not significant impling the data are normally distributed.

"LARGE NUMBER" IS >2, WHICH WOULD INDICATE NON-NORMAL DISTRIBUTION.

Therefore, the data should be transformed before analyzing, and the statistics which should be used when reporting these data are the geometric mean (GM) and the geometric standard deviation (GSD). The GM corresponds to the median or middle of the distribution and for these data is a better indication of the distribution's center than the arithmetic average.

The calculations you performed before are all valid for log-normal distributions, and the final results can be transformed back to the original scale by taking antilogarithms.

Another simple way to look at these data are simply to rank the scores and look at percentiles. For example, 99% of this years data are less than 200 ppm. I included a printout of the ranked data so that you can see the distribution.

If I have been too terse, and you have questions, please call.

Sincerely,

Jim Hansen

Jim Hansen

JH:dm
Attachments

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# DATA EVALUATION, MARCH 1979 - FEBRUARY 1980

Individual twenty-four hour weighted average VCM concentrations (dry resin basis), $A_{Ti}$, were determined and reported for this period in our last two Semiannual Reports.

The following statistical parameters were determined from these daily VCM concentrations:

1) Number of daily average values of $A_{Ti}$ = n = 364

2) Geometric Mean, $\mu_g$ = 2.1 ppm

3) Geometric Standard Deviation, $S_g$ = 6.88

4) Predicted upper range for geometric mean values, 99% confidence level,

$$\ln(\mu_g)_5 = \overline{X}_g + \frac{S_g}{\sqrt{n}}\left( Z \right),$$ Z for 99% level = 2.33, for n > 30, upper limit only.

$\ln(\mu_g)$ = $\underline{.771}$

$\mu_g$ = $\underline{2.2}$

This valuation indicates that the Geometric mean value for the VCM concentrations based on this years data period would be below 2.2 ppm 99% of the time. This compares to an upper limit of 400 ppm specified by the regulation.

$$\text{Determine } t = \frac{\mu_g - \ln(\text{maximum specification level})}{\text{standard deviation, } S_g}$$

$$t = \frac{.752 - 5.99}{1.93} = \frac{-5.24}{1.93} = -2.72$$

However, from Table A in the text, a t-value of -3.1 is shown for a 99.9% confidence level (0.0010).

By using the following notation, a calculation can be made to determine the sample size (n), which would provide 99.9% confidence that we would not exceed the 400 ppm limit.

Let $\alpha$ = risk of rejecting an acceptable value = 0.001 and

let $\beta$ = risk of accepting a rejectable value = 0.001

$$\text{for } \alpha = 0.001,\ T_1 = 3.1 = \frac{\ln K - \mu}{\frac{S_x}{\sqrt{n}}} = \frac{\ln K - .752}{\frac{1.93}{\sqrt{n}}} \qquad \text{(A)}$$

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051449

For $\beta = 0.001$, $T_2 = -3.1 = \dfrac{\ln K - \text{upper limit}}{\dfrac{S_x}{\sqrt{n}}} = \dfrac{\ln K - 5.99}{\dfrac{1.93}{\sqrt{n}}}$ (B)

Subtracting equation (A) from equation (B):

$$T_2 - T_1 = -3.1 - (3.1) = \frac{\ln K - 5.99}{\frac{1.93}{\sqrt{n}}} - \frac{\ln K - .752}{\frac{1.93}{\sqrt{n}}}$$

$$-6.2 = \frac{\ln K - 5.99 - \ln K + .752}{\frac{1.93}{\sqrt{n}}} = \frac{-5.24}{\frac{1.93}{\sqrt{n}}}$$

$$6.2 = \frac{5.24\sqrt{n}}{1.93}, \quad \sqrt{n} = 2.29, \quad n = 5.23$$ (just over five samples required)

This value for n is slightly greater than 5, so a sample of 6 is the next nearest whole number.

If we use this value of n = 5.23 to solve for K, the mean value of $A_{Ti}$ that would assure not exceeding 400 ppm more than 0.1% of the time, we get the following:

$$-3.1 = \frac{\ln K - 5.99}{\frac{1.93}{2.29}} \qquad -3.1 = \frac{\ln K - 5.99}{.843}$$

$\ln K - 5.99 = -2.62$; $\ln K = 3.38$; $K = 29.4$

However, we can't take part of a sample, so using $n = 6$, $\sqrt{n} = 2.45$

$$-3.1 = \frac{\ln K - 5.99}{\frac{1.93}{2.45}} \qquad -3.1 = \frac{\ln K - 5.99}{.788}$$

$\ln K - 5.99 = -2.44$ $\qquad K = \underline{34.8}$

which is the value of $A_{Ti}$ for six samples for every six months reporting period below which there is over 99.9% confidence that the 400 ppm limit has not been exceeded.

However, we plan to sample once per week to get $A_{Ti}$ for a regular 3-shift day, sampling each stripper each shift for a total of 12 samples from which one weighted average concentration can be determined for that day. In six months, 26 such $A_{Ti}$ values would be available, and if their mean value doesn't exceed the following K value, there is

99.9% chance that all values are below the 400 ppm limit.

$$-3.1 = \frac{\ln K - 5.99}{\frac{1.93}{\sqrt{26}}} = \frac{\ln K - 5.99}{\frac{1.93}{5.1}} = \frac{\ln K - 5.99}{.378}$$

$$-(3.1)\,(.378) = \ln K - 5.99 = -1.17$$

or $\ln K = 4.82$

or $K = \underline{124}$ ppm (Geometric Mean)

# TECHNICAL APPENDIX M*

## NORMAL AND LOGNORMAL FREQUENCY DISTRIBUTIONS

The statistical methods discussed in this manual assume that concentrations in random occupational environmental samples are lognormally and independently distributed both within any particular workshift and over many daily exposure averages. Additionally, it is assumed that the sampling and analytical errors of an industrial hygiene measurement sample are normally and independently distributed. The technical reasons for the choice of these two distributions for modeling our data distributions are given below. There is nothing sacred about the choice of these distribution models. They were chosen because they occur very frequently in industrial hygiene applications, and they are easy to use because their properties have been thoroughly investigated. The empirical observation that the data usually are well-fitted by the normal and lognormal models is no guarantee that all data fit these models. If there is any doubt about the appropriate application of the normal or lognormal model, the first step in the data analysis should be to sketch a distribution histogram or use probability paper as discussed in Technical Appendix I. Also refer to Technical Appendix I for examples of data that might not be adequately described by the lognormal model.

Before sample data can be statistically analyzed, we must have knowledge of the frequency distribution of the results or some assumptions must be made. Roach (M-2–M-4) and Kerr (M-5) have assumed that environmental data are normally distributed. However, it is well established (M-6–M-9) that most community air pollution environmental data are better described by a lognormal distribution. That is, the logarithms (either base $e$ or base 10) of the data are approximately normally distributed. Most importantly, Breslin et al. (M-10), Sherwood (M-11, M-12), Jones and Brief (M-13), Gale (M-14, M-15), Coenen (M-16, M-17), Hounam (M-18), and Juda and Budzinski (M-19, M-20) have shown that occupational environmental data from both open air and confined work spaces for both short (seconds) and long (days) time periods are lognormally distributed.

What are the differences between normally and lognormally distributed data? First, it should be remembered that a "normal" distribution is completely determined by the arithmetic mean $\mu$ and the standard deviation $\sigma$ of the distribution. On the other hand, a lognormal distribution is completely determined by th median or geometric mean (*GM*) and the geometric standard deviation (*GSD*). For lognormally distributed data, a logarithmic transformation of the original data is normally distributed. The *GM* and *GSD* of the lognormal distribution are the antilogs of the mean and standard deviation of the logarithmic transformation. Normally distributed data have a symmetrical distribution curve whereas lognormally distributed environmental data are generally positively skewed (long "tail" to the right indicating a larger probability of very large concentrations when compared with a lower probability expected of normally distributed data). Figure M-1 compares a lognormal distribution to a normal distributi n with the same arithmetic mean $\mu$ and standard deviation $\sigma$. The conditions conducive to (but not all necessary for) the occurrence of lognormal distributions are found in occupational

*This material in part was originally presented in Leidel and Busch, *Exposure Measurement Action Level and Occupational Exposure Variability* (NIOSH Technical Information, HEW Publication No. (NIOSH) 76-131, Cincinnati, Ohio, December 1975) and Reference M-1.

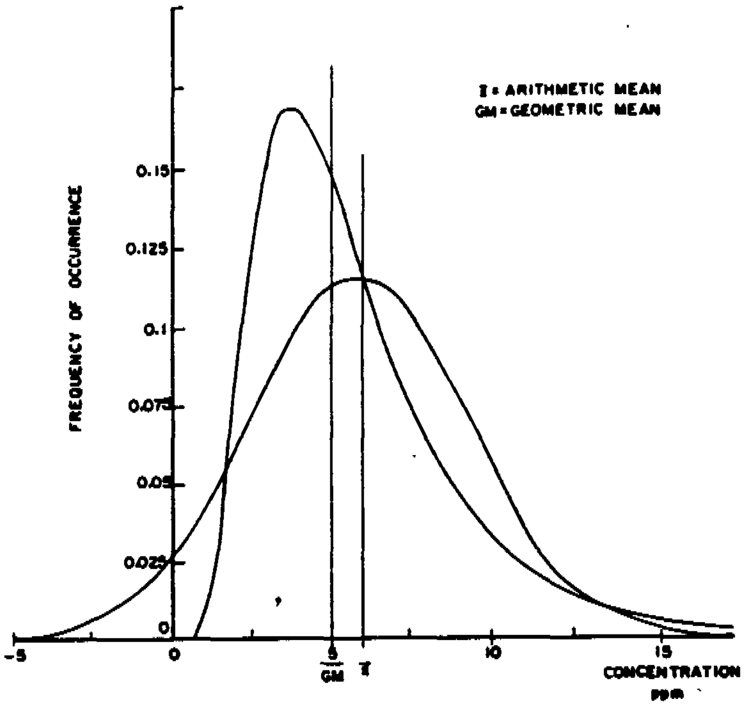


*Figure M-1. Lognormal and normal distributions with the same arithmetic mean and standard deviation.*

environmental data (M-16). These conditions are that

- the concentrations cover a wide range of values, often several orders of magnitude,
- the concentrations lie close to a physical limit (zero concentration),
- the variation of the measured concentration is of the order of the size of the measured concentration, and
- a finite probability exists of very large values (or data "spikes") occurring.

The variation of occupational environmental data (differences between repeated measurements at the same site) can usually be broken into three major components: random errors of the sampling method; random errors of the analytical method; and variation of the environment with time. The first two components of the variation are usually known in advance and are approximately normally distributed. The environmental fluctuations of a contaminant in a plant, however, usually greatly exceed the variation of known instruments (often by factors of 10 or 20). The above components of variation were discussed in an article by LeClare et al. (M-21).

When several samples are taken in a plant to determine the average concentration of the contaminant and estimate the average exposure of an employee, the lognormal distribution should be assumed. However, the normal distribution may be used in the special cases of taking a sample to check compliance with a ceiling standard, and taking a sample (or samples) for the entire time period for which the standard is defined. In these cases, the entire time interval of interest in represented in the sample, with only normally distributed sampling and analytical variations affecting the measurement.

The relative variation of a normal distribution (such as the random errors of the sampling and analytical procedures) is commonly measured by the coefficient of variation (*CV*). The *CV* is also known as the relative standard deviation. The *CV* is a useful index of dispersion in that limits consisting of the true mean of a set of data, plus or minus twice the *CV*, will contain about 95% of the data measurements. Thus, if an analytical procedure with a *CV* of 10% is used to repeatedly measure some nonvarying physical property (such as the concentration of a chemical in a beaker of solution), then about 95% of the measurements will fall within plus or minus 20% (2 times the *CV*) of the true concentration.

Unfortunately, the property we are trying to measure — the employee's exposure concentration — is not a fixed physical property. The exposure concentrations are fluctuating in a lognormal manner. First, they are fluctuating over the 8-hour period of the TWA exposure measurement. Breathing zone grab samples (samples of less than about 30 minutes' duration, typically only a few minutes) tend to reflect the environmental variation within a day so that grab sample results have relatively high variation. However, this variation in the sample results can be eliminated by going to a full period sampling strategy as discussed by Leidel and Busch (M-1). Second, the day-to-day variation of the true 8-hour TWA exposures is also lognormally distributed.

Environmental variation is expressed by the *GSD*. A *GSD* of 1.0 represents absolutely no variation in the environment. *GSD*'s of 2.0 and above represent relatively high variation. Hald (M-22) states that the shape of lognormal distributions with low variations, such as those with *GSD*'s less than about 1.4, roughly approximate normal distribution shapes. For this range of *GSD*'s, there is a rough equivalence between the quantity $(GSD-1)$ and the *CV*, as follows:

| *GSD* | *(GSD−1)* | *CV* |
|---|---|---|
| 1.05 | 0.05 | 0.049 |
| 1.10 | 0.10 | 0.096 |
| 1.20 | 0.20 | 0.18 |
| 1.30 | 0.30 | 0.27 |
| 1.40 | 0.40 | 0.35 |

For those interested in a detailed study of the lognormal distribution, Aitchinson and Brown (M-23) is an excellent reference. Figure M-2 shows four different lognormal distributions that share a common arithmetic mean of 10 ppm. Four different variations are shown with *GSD*'s of 1.2, 1.5, 2.0, and 3.0.

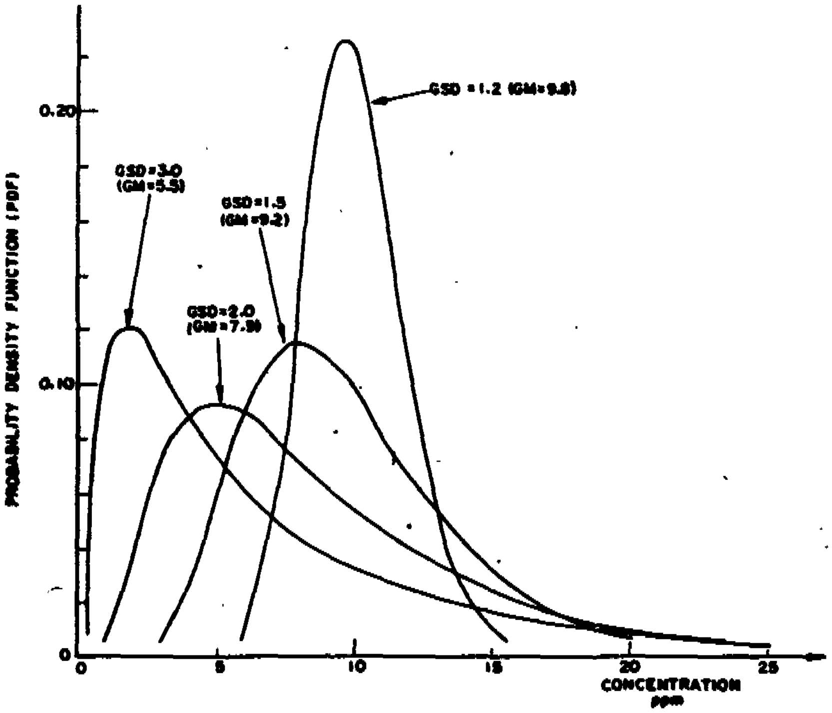


*Figure M-2. Lognormal distributions for arithmetic mean concentration of 10 ppm.*



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## CONVERSION FORMULAS FOR A LOGNORMAL FREQUENCY DISTRIBUTION

If the variable ($\ln x$) is normally distributed (the variable $x$ has a lognormal distribution), we can define

$\mu$ = true arithmetic mean of $x$-distribution

$\sigma$ = true standard deviation of $x$-distribution

$\mu_l$ = true arithmetic mean of ($\ln x$) values

$\sigma_l$ = true standard deviation of ($\ln x$) values

$GM$ = geometric mean of $x$-distribution

$GSD$ = geometric standard deviation = exp ($\sigma_l$) where ($\ln x$) was used to calculate $\sigma_l$

$GSD$ = antilog$_{10}$ ($\sigma_l$) where ($\log_{10} x$) was used. The conversion relations between the above six parameters are given in Table M-1.

*Notes:*

1. The relations apply *only* to the true parameter of the parent distribution. They *should not* be used for parameters of a sample except as a very rough approximation.
2. The $GM$ and $GSD$ are used to describe parameters of either a sample or the parent distribution, but they cannot be used in the relations unless they are calculated from the true parent distribution.
3. The $GSD$ of the $x$-distribution is the same regardless of whether base 10 or base $e$ logarithms were used to calculate $\sigma_l$.

**TABLE M-1. CONVERSION RELATIONS BETWEEN LOGARITHMIC PARAMETERS AND ARITHMETIC PARAMETERS OF A LOGNORMAL DISTRIBUTION**

| Given | To obtain | Use |
|---|---|---|
| $\mu_l$ | $GM=$ | $\exp(\mu_l)$ |
| $\mu, \sigma$ | $GM=$ | $\mu^2/\sqrt{\mu^2+\sigma^2}$ |
| $\sigma_l$ | $GSD=$ | $\exp(\sigma_l)$ |
| $\mu, \sigma$ | $GSD=$ | $\exp\sqrt{\ln\left(1+\frac{\sigma^2}{\mu^2}\right)}$ |
| $\mu_l, \sigma_l$ | $\mu=$ | $\exp\left(\mu_l+\frac{1}{2}\sigma_l^2\right)$ |
| $GM, \sigma_l$ | $\mu=$ | $(GM)\exp\left(\frac{1}{2}\sigma_l^2\right)$ |
| $\mu_l, \sigma_l$ | $\sigma=$ | $\sqrt{[\exp(2\mu_l+\sigma_l^2)][\exp(\sigma_l^2)-1]}$ |
| $GM, \sigma_l$ | $\sigma=$ | $\sqrt{(GM)^2[\exp(\sigma_l^2)][\exp(\sigma_l^2)-1]}$ |
| $GM$ | $\mu_l=$ | $\ln(GM)$ |
| $\mu, \sigma_l$ | $\mu_l=$ | $\ln\mu-\frac{1}{2}\sigma_l^2$ |
| $GSD$ | $\sigma_l=$ | $\ln(GSD)$ |
| $\mu, \sigma$ | $\sigma_l=$ | $\sqrt{\ln\left(1+\frac{\sigma^2}{\mu^2}\right)}$ |
| $\mu_l, \sigma_l$ | *mode* | $\exp(\mu_l-\sigma_l^2)$ = most frequent value |

Raw data.

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| MOMENTS | | | |
|---|---|---|---|
| N | 365 | SUM WGTS | 365 |
| MEAN | 14.9198 | SUM | 5445.74 |
| STD DEV | 55.6855 | VARIANCE | 3100.88 |
| SKEWNESS | 7.86602 | KURTOSIS | 73.442 |
| SS | 1209968 | CSS | 1128719 |
| CV | 373.231 | STD MEAN | 2.91471 |
| T:MEAN=0 | 5.1188 | PROB>\|T\| | 0.0001 |
| D:NORMAL | 7.58414 | PROB>D | 0.0001 |

Kolmogorov-Smirnov D-statistic.

⇒ data not normally distributed

| QUANTILES | | | |
|---|---|---|---|
| 100% MAX | 611.95 | 99% | 191.033 |
| 75% Q3 | 7.165 | 95% | 51.9441 |
| 50% MED | 2.24 | 90% | 22.9797 |
| 25% Q1 | 0.4525 | 10% | 0.115 |
| 0% MIN | 0 | 5% | 0.1 |
| | | 1% | 0.0624999 |
| RANGE | 611.95 | | |
| Q3-Q1 | 6.7125 | | |
| MODE | 0.1 | | |

| EXTREMES | | | |
|---|---|---|---|
| LOWEST | ID | HIGHEST | ID |
| 0( | 26) | 181.66( | 25) |
| 0.03( | 5) | 206.45( | 26) |
| 0.03( | 25) | 368.2( | 29) |
| 0.08( | 24) | 596.67( | 4) |
| 0.1( | 2) | 611.95( | 4) |

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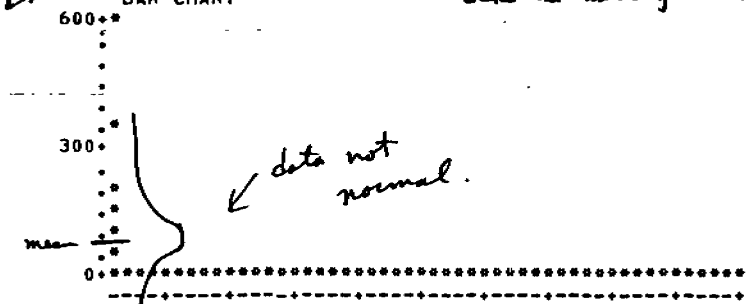
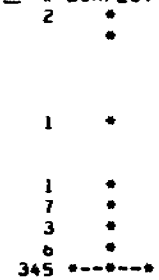
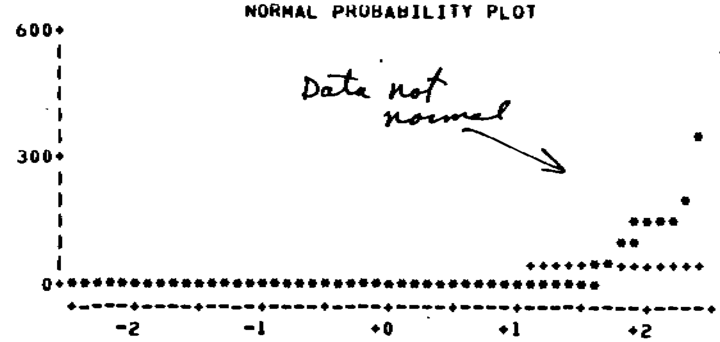



* MAY REPRESENT UP TO 7 COUNTS

BOXPLOT




NORMAL PROBABILITY PLOT




FREQUENCY TABLE

| VALUE | COUNT | PERCENTS CELL | PERCENTS CUM |
|---|---|---|---|
| 0 | 1 | 0.3 | 0.3 |
| 0.03 | 2 | 0.5 | 0.8 |
| 0.08 | 1 | 0.3 | 1.1 |
| 0.1 | 31 | 8.5 | 9.6 |
| 0.11 | 1 | 0.3 | 9.9 |
| 0.12 | 2 | 0.5 | 10.4 |
| 0.13 | 3 | 0.8 | 11.2 |
| 0.14 | 2 | 0.5 | 11.8 |
| 0.15 | 2 | 0.5 | 12.3 |
| 0.17 | 1 | 0.3 | 12.6 |
| 0.18 | 2 | 0.5 | 13.2 |
| 0.19 | 1 | 0.3 | 13.4 |
| 0.2 | 2 | 0.5 | 14.0 |
| 0.22 | 2 | 0.5 | 14.5 |
| 0.23 | 3 | 0.8 | 15.3 |
| 0.25 | 1 | 0.3 | 15.6 |
| 0.26 | 2 | 0.5 | 16.2 |
| 0.27 | 4 | 1.1 | 17.3 |
| 0.28 | 3 | 0.8 | 18.1 |
| 0.29 | 2 | 0.5 | 18.6 |
| 0.3 | 1 | 0.3 | 18.9 |
| 0.31 | 1 | 0.3 | 19.2 |
| 0.32 | 2 | 0.5 | 19.7 |
| 0.33 | 2 | 0.5 | 20.3 |
| 0.34 | 2 | 0.5 | 20.8 |
| 0.35 | 3 | 0.8 | 21.6 |
| 0.37 | 1 | 0.3 | 21.9 |
| 0.38 | 2 | 0.5 | 22.5 |
| 0.4 | 1 | 0.3 | 22.7 |
| 0.41 | 2 | 0.5 | 23.3 |
| 0.43 | 2 | 0.5 | 23.8 |
| 0.44 | 1 | 0.3 | 24.1 |
| 0.45 | 3 | 0.8 | 24.9 |
| 0.46 | 1 | 0.3 | 25.2 |
| 0.47 | 1 | 0.3 | 25.5 |
| 0.48 | 1 | 0.3 | 25.8 |
| 0.51 | 2 | 0.5 | 26.3 |
| 0.52 | 2 | 0.5 | 26.8 |
| 0.55 | 1 | 0.3 | 27.1 |
| 0.56 | 2 | 0.5 | 27.7 |
| 0.57 | 1 | 0.3 | 27.9 |
| 0.58 | 2 | 0.5 | 28.5 |
| 0.59 | 1 | 0.3 | 28.8 |
| 0.64 | 3 | 0.8 | 29.6 |
| 0.65 | 2 | 0.5 | 30.1 |
| 0.67 | 1 | 0.3 | 30.4 |
| 0.69 | 1 | 0.3 | 30.7 |
| 0.71 | 3 | 0.8 | 31.5 |
| 0.78 | 1 | 0.3 | 31.8 |
| 0.83 | 1 | 0.3 | 32.1 |
| 0.84 | 1 | 0.3 | 32.3 |
| 0.86 | 1 | 0.3 | 32.6 |
| 0.87 | 1 | 0.3 | 32.9 |
| 0.88 | 1 | 0.3 | 33.2 |
| 0.91 | 2 | 0.5 | 33.7 |
| 0.92 | 1 | 0.3 | 34.0 |
| 0.93 | 1 | 0.3 | 34.2 |
| 0.97 | 1 | 0.3 | 34.5 |
| 1 | 1 | 0.3 | 34.8 |
| 1.04 | 1 | 0.3 | 35.1 |
| 1.06 | 1 | 0.3 | 35.3 |
| 1.1 | 1 | 0.3 | 35.6 |
| 1.11 | 1 | 0.3 | 35.9 |
| 1.15 | 2 | 0.5 | 36.4 |
| 1.18 | 1 | 0.3 | 36.7 |
| 1.2 | 1 | 0.3 | 37.0 |
| 1.22 | 1 | 0.3 | 37.3 |
| 1.29 | 3 | 0.8 | 38.1 |
| 1.31 | 1 | 0.3 | 38.4 |
| 1.35 | 1 | 0.3 | 38.6 |
| 1.37 | 1 | 0.3 | 38.9 |
| 1.38 | 2 | 0.5 | 39.5 |
| 1.4 | 1 | 0.3 | 39.7 |
| 1.41 | 1 | 0.3 | 40.0 |
| 1.43 | 1 | 0.3 | 40.3 |
| 1.46 | 2 | 0.5 | 40.8 |
| 1.49 | 1 | 0.3 | 41.1 |
| 1.5 | 1 | 0.3 | 41.4 |
| 1.52 | 1 | 0.3 | 41.6 |
| 1.58 | 1 | 0.3 | 41.9 |
| 1.63 | 1 | 0.3 | 42.2 |
| 1.66 | 1 | 0.3 | 42.5 |
| 1.69 | 1 | 0.3 | 42.7 |
| 1.73 | 1 | 0.3 | 43.0 |

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FREQUENCY TABLE (CONT.)

| | | PERCENTS | | | | PERCENTS | | | | PERCENTS | | | | PERCENTS | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| VALUE | COUNT | CELL | CUM | VALUE | COUNT | CELL | CUM | VALUE | COUNT | CELL | CUM | VALUE | COUNT | CELL | CUM |
| 1.75 | 1 | 0.3 | 43.3 | 3.13 | 1 | 0.3 | 57.8 | 6.77 | 1 | 0.3 | 72.9 | 17.97 | 1 | 0.3 | 87.4 |
| 1.76 | 1 | 0.3 | 43.6 | 3.23 | 1 | 0.3 | 58.1 | 6.82 | 1 | 0.3 | 73.2 | 18.06 | 1 | 0.3 | 87.7 |
| 1.77 | 1 | 0.3 | 43.8 | 3.25 | 1 | 0.3 | 58.4 | 6.85 | 1 | 0.3 | 73.4 | 18.14 | 1 | 0.3 | 87.9 |
| 1.79 | 1 | 0.3 | 44.1 | 3.26 | 1 | 0.3 | 58.6 | 6.89 | 1 | 0.3 | 73.7 | 18.58 | 1 | 0.3 | 88.2 |
| 1.81 | 1 | 0.3 | 44.4 | 3.28 | 1 | 0.3 | 58.9 | 6.9 | 1 | 0.3 | 74.0 | 18.66 | 1 | 0.3 | 88.5 |
| 1.86 | 1 | 0.3 | 44.7 | 3.31 | 1 | 0.3 | 59.2 | 6.91 | 1 | 0.3 | 74.2 | 18.8 | 1 | 0.3 | 88.8 |
| 1.89 | 1 | 0.3 | 44.9 | 3.34 | 1 | 0.3 | 59.5 | 7.15 | 2 | 0.5 | 74.8 | 19.3 | 1 | 0.3 | 89.0 |
| 1.91 | 1 | 0.3 | 45.2 | 3.36 | 1 | 0.3 | 59.7 | 7.17 | 1 | 0.3 | 75.1 | 20.54 | 1 | 0.3 | 89.3 |
| 1.92 | 1 | 0.3 | 45.5 | 3.48 | 1 | 0.3 | 60.0 | 7.31 | 1 | 0.3 | 75.3 | 20.76 | 1 | 0.3 | 89.6 |
| 1.93 | 2 | 0.5 | 46.0 | 3.49 | 1 | 0.3 | 60.3 | 7.45 | 1 | 0.3 | 75.6 | 22.4 | 1 | 0.3 | 89.9 |
| 1.95 | 1 | 0.3 | 46.3 | 3.51 | 1 | 0.3 | 60.5 | 7.61 | 1 | 0.3 | 75.9 | 23.56 | 1 | 0.3 | 90.1 |
| 1.99 | 1 | 0.3 | 46.6 | 3.52 | 2 | 0.5 | 61.1 | 7.66 | 1 | 0.3 | 76.2 | 23.7 | 1 | 0.3 | 90.4 |
| 2.02 | 1 | 0.3 | 46.8 | 3.57 | 2 | 0.5 | 61.6 | 7.87 | 1 | 0.3 | 76.4 | 24.71 | 1 | 0.3 | 90.7 |
| 2.03 | 2 | 0.5 | 47.4 | 3.75 | 1 | 0.3 | 61.9 | 7.93 | 1 | 0.3 | 76.7 | 25.41 | 1 | 0.3 | 91.0 |
| 2.04 | 1 | 0.3 | 47.7 | 3.89 | 1 | 0.3 | 62.2 | 8.01 | 1 | 0.3 | 77.0 | 26.06 | 1 | 0.3 | 91.2 |
| 2.07 | 1 | 0.3 | 47.9 | 4.06 | 1 | 0.3 | 62.5 | 8.38 | 1 | 0.3 | 77.3 | 27.33 | 1 | 0.3 | 91.5 |
| 2.11 | 1 | 0.3 | 48.2 | 4.07 | 1 | 0.3 | 62.7 | 8.48 | 1 | 0.3 | 77.5 | 30.33 | 1 | 0.3 | 91.8 |
| 2.12 | 1 | 0.3 | 48.5 | 4.09 | 1 | 0.3 | 63.0 | 8.5 | 1 | 0.3 | 77.8 | 30.87 | 1 | 0.3 | 92.1 |
| 2.16 | 2 | 0.5 | 49.0 | 4.19 | 1 | 0.3 | 63.3 | 8.57 | 1 | 0.3 | 78.1 | 31.61 | 1 | 0.3 | 92.3 |
| 2.19 | 1 | 0.3 | 49.3 | 4.2 | 1 | 0.3 | 63.6 | 8.58 | 1 | 0.3 | 78.4 | 31.71 | 1 | 0.3 | 92.6 |
| 2.2 | 1 | 0.3 | 49.6 | 4.3 | 1 | 0.3 | 63.8 | 8.73 | 1 | 0.3 | 78.6 | 32.52 | 1 | 0.3 | 92.9 |
| 2.21 | 1 | 0.3 | 49.9 | 4.33 | 1 | 0.3 | 64.1 | 8.79 | 1 | 0.3 | 78.9 | 34.6 | 1 | 0.3 | 93.2 |
| 2.27 | 1 | 0.3 | 50.1 | 4.36 | 1 | 0.3 | 64.4 | 8.9 | 1 | 0.3 | 79.2 | 37.36 | 1 | 0.3 | 93.4 |
| 2.28 | 1 | 0.3 | 50.4 | 4.37 | 1 | 0.3 | 64.7 | 9.02 | 1 | 0.3 | 79.5 | 37.86 | 1 | 0.3 | 93.7 |
| 2.32 | 1 | 0.3 | 50.7 | 4.46 | 1 | 0.3 | 64.9 | 9.13 | 1 | 0.3 | 79.7 | 40.56 | 1 | 0.3 | 94.0 |
| 2.33 | 1 | 0.3 | 51.0 | 4.49 | 2 | 0.5 | 65.5 | 9.42 | 1 | 0.3 | 80.0 | 41.84 | 1 | 0.3 | 94.2 |
| 2.36 | 1 | 0.3 | 51.2 | 4.6 | 1 | 0.3 | 65.8 | 9.47 | 1 | 0.3 | 80.3 | 43.73 | 1 | 0.3 | 94.5 |
| 2.37 | 1 | 0.3 | 51.5 | 4.8 | 1 | 0.3 | 66.0 | 9.5 | 1 | 0.3 | 80.5 | 49.26 | 1 | 0.3 | 94.8 |
| 2.4 | 1 | 0.3 | 51.8 | 4.9 | 1 | 0.3 | 66.3 | 9.59 | 2 | 0.5 | 81.1 | 52.84 | 1 | 0.3 | 95.1 |
| 2.41 | 1 | 0.3 | 52.1 | 4.99 | 1 | 0.3 | 66.6 | 9.73 | 1 | 0.3 | 81.4 | 54.93 | 1 | 0.3 | 95.3 |
| 2.43 | 1 | 0.3 | 52.3 | 5.02 | 1 | 0.3 | 66.8 | 9.91 | 1 | 0.3 | 81.6 | 58.61 | 1 | 0.3 | 95.6 |
| 2.45 | 1 | 0.3 | 52.6 | 5.17 | 1 | 0.3 | 67.1 | 10.21 | 1 | 0.3 | 81.9 | 60.82 | 1 | 0.3 | 95.9 |
| 2.51 | 1 | 0.3 | 52.9 | 5.33 | 1 | 0.3 | 67.4 | 10.28 | 1 | 0.3 | 82.2 | 73.9 | 1 | 0.3 | 96.2 |
| 2.52 | 1 | 0.3 | 53.2 | 5.44 | 1 | 0.3 | 67.7 | 10.76 | 1 | 0.3 | 82.5 | 114.73 | 1 | 0.3 | 96.4 |
| 2.54 | 1 | 0.3 | 53.4 | 5.51 | 1 | 0.3 | 67.9 | 11.02 | 1 | 0.3 | 82.7 | 118.33 | 1 | 0.3 | 96.7 |
| 2.68 | 1 | 0.3 | 53.7 | 5.57 | 1 | 0.3 | 68.2 | 11.6 | 2 | 0.5 | 83.3 | 134.67 | 1 | 0.3 | 97.0 |
| 2.7 | 1 | 0.3 | 54.0 | 5.58 | 1 | 0.3 | 68.5 | 11.67 | 1 | 0.3 | 83.6 | 147.27 | 1 | 0.3 | 97.3 |
| 2.71 | 1 | 0.3 | 54.2 | 5.68 | 1 | 0.3 | 68.8 | 11.68 | 1 | 0.3 | 83.8 | 167.13 | 1 | 0.3 | 97.5 |
| 2.74 | 1 | 0.3 | 54.5 | 5.74 | 1 | 0.3 | 69.0 | 12.47 | 1 | 0.3 | 84.1 | 168.35 | 1 | 0.3 | 97.8 |
| 2.8 | 1 | 0.3 | 54.8 | 5.79 | 1 | 0.3 | 69.3 | 12.7 | 1 | 0.3 | 84.4 | 173.59 | 1 | 0.3 | 98.1 |
| 2.85 | 1 | 0.3 | 55.1 | 5.88 | 1 | 0.3 | 69.6 | 13.28 | 1 | 0.3 | 84.7 | 178.05 | 1 | 0.3 | 98.4 |
| 2.86 | 1 | 0.3 | 55.3 | 5.97 | 2 | 0.5 | 70.1 | 13.47 | 1 | 0.3 | 84.9 | 178.76 | 1 | 0.3 | 98.6 |
| 2.87 | 1 | 0.3 | 55.6 | 6.12 | 1 | 0.3 | 70.4 | 14.35 | 1 | 0.3 | 85.2 | 181.66 | 1 | 0.3 | 98.9 |
| 2.89 | 1 | 0.3 | 55.9 | 6.33 | 1 | 0.3 | 70.7 | 14.4 | 1 | 0.3 | 85.5 | 208.45 | 1 | 0.3 | 99.2 |
| 2.93 | 1 | 0.3 | 56.2 | 6.42 | 1 | 0.3 | 71.0 | 15.71 | 1 | 0.3 | 85.8 | 368.2 | 1 | 0.3 | 99.5 |
| 2.96 | 1 | 0.3 | 56.4 | 6.44 | 2 | 0.5 | 71.5 | 16.72 | 1 | 0.3 | 86.0 | 596.67 | 1 | 0.3 | 99.7 |
| 2.99 | 1 | 0.3 | 56.7 | 6.49 | 1 | 0.3 | 71.8 | 17.14 | 1 | 0.3 | 86.3 | 611.95 | 1 | 0.3 | 100.0 |
| 3 | 1 | 0.3 | 57.0 | 6.64 | 1 | 0.3 | 72.1 | 17.15 | 1 | 0.3 | 86.6 | | | | |
| 3.02 | 1 | 0.3 | 57.3 | 6.75 | 1 | 0.3 | 72.3 | 17.52 | 1 | 0.3 | 86.8 | | | | |
| 3.12 | 1 | 0.3 | 57.5 | 6.76 | 1 | 0.3 | 72.6 | 17.58 | 1 | 0.3 | 87.1 | | | | |

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log$_e$(Concentration)

UNIVARIATE

VARIABLE LNCONC

| MOMENTS | | | | QUANTILES | | | | EXTREMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | LOWEST | ID | HIGHEST | ID |
| N | 364 | SUM WGTS | 364 | 100% MAX | 6.41665 | 99% | 5.25164 | -3.50656( | 25) | 5.20214( | 25) |
| MEAN | 0.752128 | SUM | 273.775 | 75% Q3 | 1.9699 | 95% | 3.95322 | -3.50656( | 5) | 5.3397( | 26) |
| STD DEV | 1.92948 | VARIANCE | 3.7229 | 50% MED | 0.61976 | 90% | 3.13935 | -2.52573( | 24) | 5.90863( | 29) |
| SKEWNESS | 0.219412 | KURTOSIS | -0.237927 | 25% Q1 | -0.776529 | 10% | -2.12026 | -2.30258( | 29) | 6.39136( | 4) |
| SS | 1557.33 | CSS | 1351.41 | 0% MIN | -3.50656 | 5% | -2.30258 | -2.30258( | 26) | 6.41665( | 4) |
| CV | 256.536 | STD MEAN | 0.101132 | | | 1% | -2.38292 | | | | |
| T:MEAN=0 | 7.43707 | PROB>\|T\| | 0.0001 | RANGE | 9.92321 | | | | | | |
| D:NORMAL | 0.930435 | PROB>D | 0.354066 | Q3-Q1 | 2.74643 | | | | | | |
| | | | | MODE | -2.30258 | | | | | | |

52 ppm

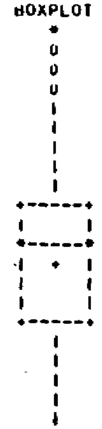
Implies logarithms are normally distributed.

MISSING VALUE .
COUNT 1
% COUNT/NOBS 0.27

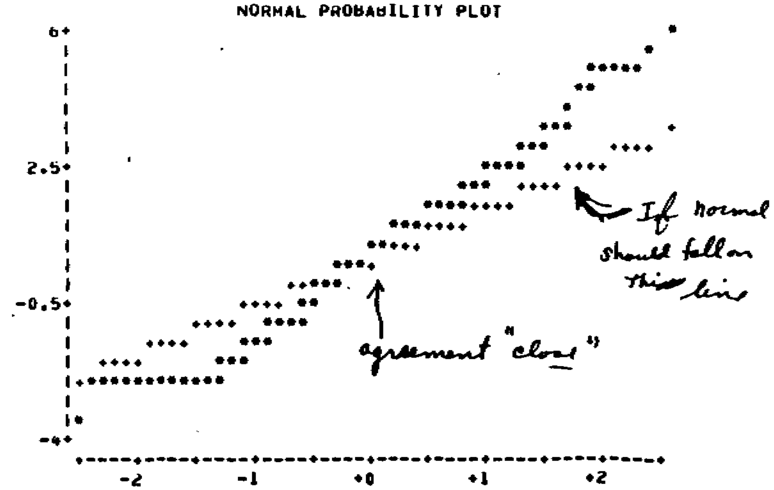
Data approx normal

```
STEM LEAF                                          #
   6 44                                            2
   5 9                                             1
   5 01122223                                      8
   4 789                                           3
   4 00113                                         5
   3 5555667789                                   10
   3 000122223344                                 12
   2 5555556677888899999999                       22
   2 0000000111111122222223333333344              31
   1 555555566666777777888888999999999999         39
   1 0000001111111112222222223333444444           37
   0 5555666666667777777777788888888889999         43
   0 111112223333333333344444                     24
   0 44444443332222111111000                      23
   0 99988888886877777666555                      23
  -1 4333333333222211111000000                    26
  -1 9987776655555                                13
  -2 333333333333333333333333333333321100000      39
  -2 5                                             1
  -3
  -3 55                                            2
  -4
     ----+----+----+----+----+----+----+----+
```

BOXPLOT



NORMAL PROBABILITY PLOT




Geometric mean = 2.1

" St. dev. = 6.88

95% tol pt. = 51 ppm

UCC 051458