# Trending Low-Rate Events

It can be difficult to detect trends on infrequent events. However, such infrequent events can also be high severity events that we have the desire to detect significant changes in.

The current DOE-STD-1048-92 states that when trending counts of events, and the average number of events per time interval (month, quarter, year) plotted falls less than 5, one should not use control limits on the chart. This admonition is not commonly accepted in the statistical community, or textbooks. However, there is a practical problem when counting the number of events per time interval when the rate is low.

See the c-chart control chart below. The average rate of the event per month is equal to 1.0. It is difficult to determine if significant changes are occurring, although we do have September 1994 on the Upper Control Limit.
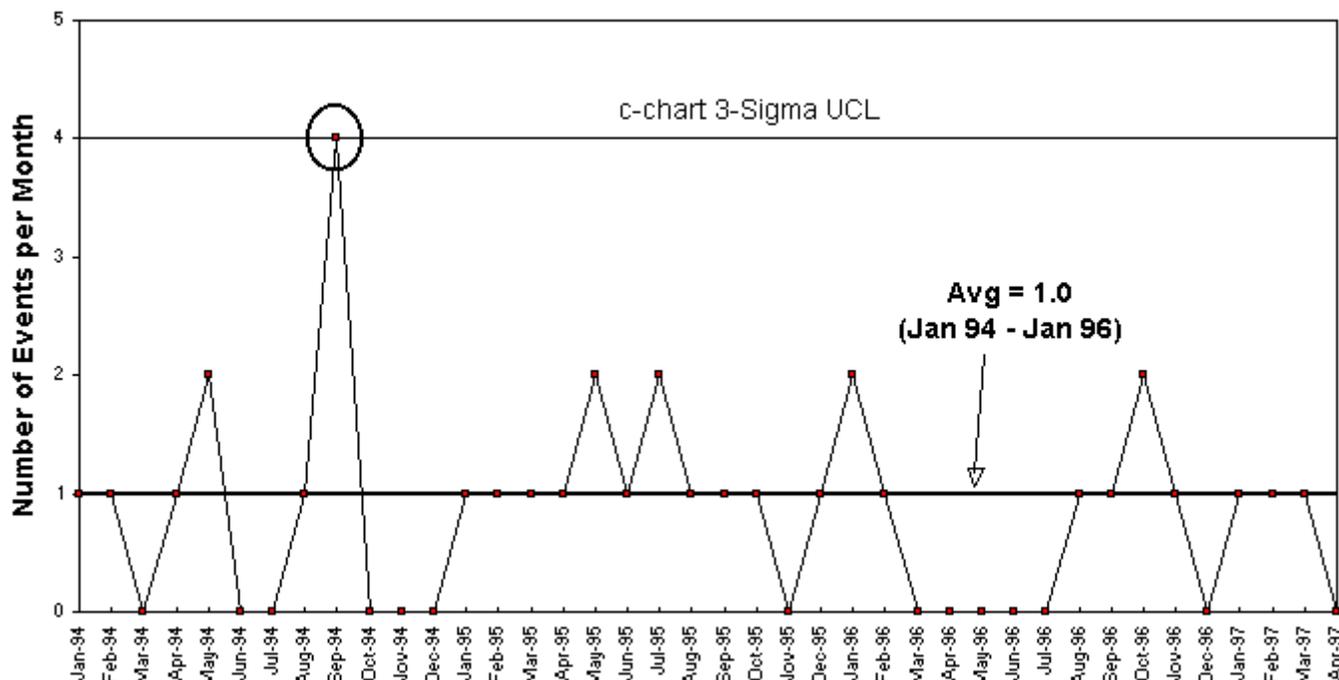
What can be done is to look at the time interval between events. We actually plot the annual rate of the event, based upon this time interval. The calculation process is:

1. Collect the dates of the events
2. Sort the dates in order from oldest to newest
3. Calculate the number of days between events
4. Divide the number of days between events into 365
5. Plot this data on an x-chart.

Below is part of the example set of data:

Event Date Days between Rate Average UCL

Event Date	Days between	Rate	Average	UCL
7/19/95				
8/23/95	35	10.4	12.5	34.6
9/12/95	20	18.2	12.5	34.6
10/30/95	48	7.6	12.5	34.6
12/5/95	36	10.1	12.5	34.6
1/19/96	45	8.1	12.5	34.6
1/19/96	1	365	12.5	34.6
2/28/96	40	9.1	12.5	34.6
8/12/96	166	2.1	12.5	34.6
9/5/96	24	15.2	12.5	34.6
10/10/96	35	10.4	12.5	34.6
10/23/96	13	28.1	12.5	34.6
11/6/96	14	26.1	12.5	34.6
1/12/97	67	5.4	12.5	34.6
2/20/97	39	9.3	12.5	34.6
3/17/97	25	14.6	12.5	34.6

The resulting control chart is below:
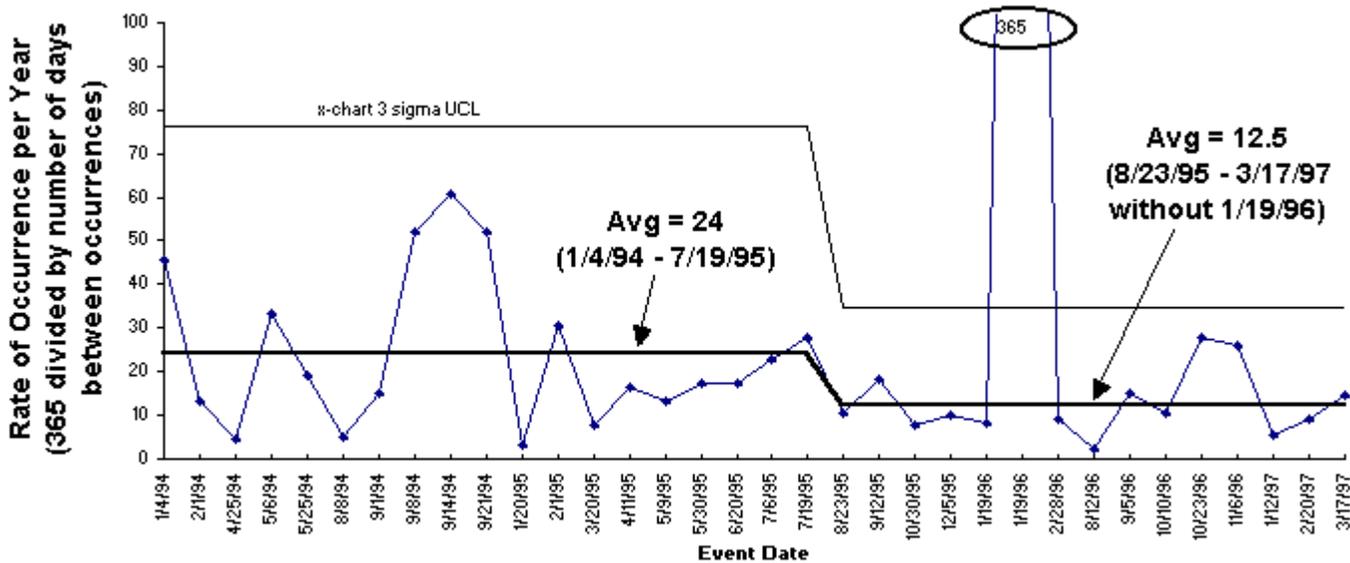
We can see that the event rate was stable at 24 per year from January 1994 through July 1995. After July 1995, there were ten out of eleven data points in a row below the average (24). So a new average and control limits were established. It is also noted that there were two events on the same day (11/19/96) which would be significantly unusual.

This technique is from Dr. Don Wheeler's book <u>Understanding Variation The Key to Managing Chaos</u>
Visit Dr. Wheeler's "SPC Press" Web Site.

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