Question Received from NRC Division of License Renewal:

For the GALL AMP XI.M17, "Flow-Accelerated Corrosion" program, NEI submitted a comment (TID issue 0019 000007) to include NSAC-202L, Revision 4 as being applicable. Although NSAC-202L Rev 4 is publicly available, this revision added three new methods for calculating component wear, but did not describe the details of the new methods. Instead Revision 4 states that these "methods are described in a number of references including [22, 25, 37]." However, the cited references are currently not publicly available. Because of this, the NRC does not have access to the information that we need to perform our review for acceptability of NSAC-202L Rev 4.

The cited references are as follows:
22. Mentoring Guide for Flow-Accelerated Corrosion Engineers, EPRI, Palo Alto, CA: 2010, 1022295.
25. CHECWORKS™ Steam/Feedwater: Application Guidelines for Plant Modeling and Evaluation of Component Inspection Data. EPRI, Palo Alto, CA and CSI Technologies, Inc., Elgin, IL: 2009. 1019176.
37. CHECWORKS™ User Group (CHUG) Position Paper 8, "Determination of Measured Wear", December 2010.

It is not clear which document(s) we would need to in order to have sufficient information to evaluate the three new methods for calculating component wear in order to determine the acceptability of NSAC-202L Rev 4.

Response to provide sufficient information to assess three new methods identified in NSAC-202L, Rev 4.

The information provided below summarizes the additional methods cited in NSAC-202L, Rev 4 that had not previously been described in NSAC-202L, Rev 3. This information is comparable to the method summaries included in NSAC-202L, Rev 3.

Descriptions for Three New Methods for Calculating Wear (NSAC-202L-R4)

Strip or Axial Band Method

The Strip method is similar to the band method, except longitudinal strips are used rather than circumferential bands. The Strip method was included in version 4.0 of CHECWORKS™ SFA.

Least Squares Slope Method

During the evaluation of the Least Squares Point to Point (LSPTP) method, another method was developed which appears to be slightly superior to the LSPTP method. This is known as the least squares slope (LSS) method. As is the case with the LSPTP method, a least squares straight line is fit through the thickness data at each grid point. The wear rate is taken as largest, negative slope.

As demonstrated in EPRI report 1018456, "Least Squares Methods for Evaluating Inspection Data," both the LSPTP and the LSS methods generally give wear rates as low as or lower than the corresponding wear rates determined by the maximum delta PTP method. This is discussed at length in report 1018456. Although, there is limited experience in the U.S. with these methods, they seem preferable to other PTP approaches for this situation.

Total Points Method

The total points method (TPM) is an *ad hoc* method developed in the course of the work described in EPRI report 1019175, Statistical Methods for the Analysis of Multiple Inspection Flow-Accelerated Corrosion Data. It is an extension of the Least Squares Slope Method and the discussion of histograms found in the body of CHUG Position Paper 8- Determination of Measured Wear.

Recall that in the LSS method, a least squares straight line is fit though every inspection location and that the maximum negative slope is chosen as the wear rate. The TPM method uses a very similar approach:

- Through every inspection location a linear least squares fit of the thickness versus operating time is performed.
- All of the slopes are collected and a histogram is generated using the negative of the slope (i.e., the negative of the slope is the wear rate).
- The histogram is interpreted and a 'wear' or a 'no wear' call is made.

Experience with this method shows that there are four shapes of the histogram encountered. These are shown as Figures A-4 through A-7.

Interpretation of Histograms

The following information will describe how the histograms produced by the TPM should be interpreted.

- **Definite Wear -** Figure A-4 shows a case where there is definitely wear occurring as the median of the values is definitely positive and the shape of the histogram is skewed positively.
- **Definite No Wear -** Figure A-5 shows a case where there is definitely not wear occurring as the median of the values is near zero and the shape of the histogram is roughly symmetrical around zero wear.
- **Definite Wear - Bimodal Distribution** - Figure A-6 shows a case where there is a bimodal distribution. Typically one of the peaks will be near zero wear, and the other peak will be near the positive wear end. This situation indicates that wear is definitely occurring. Note that there is no counterpart of having a bimodal distribution with one peak at the negative end of the abscissa.

  Although not common, there may be another way to have a bimodal distribution. General practice is to perform an initial calibration, an intermediate calibration (generally for a large number of points taking an extended period of time), and a final calibration. If one of the calibrations is in error, then a bimodal wear distribution could possibly occur.

- **Histogram Showing No Clear Cut Interpretation** – Figure A-7 shows a case where there is no obvious interpretation. When encountering this situation, the analyst should review the data and consider using one of the formal statistical methods that are described below.

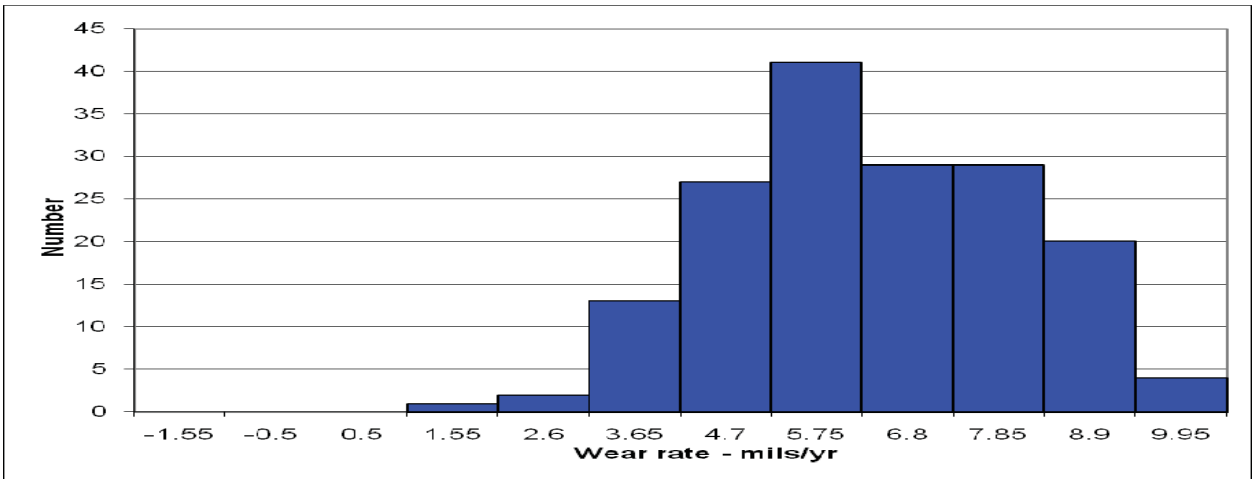

Figure A- 4
Histogram Showing Definite Wear

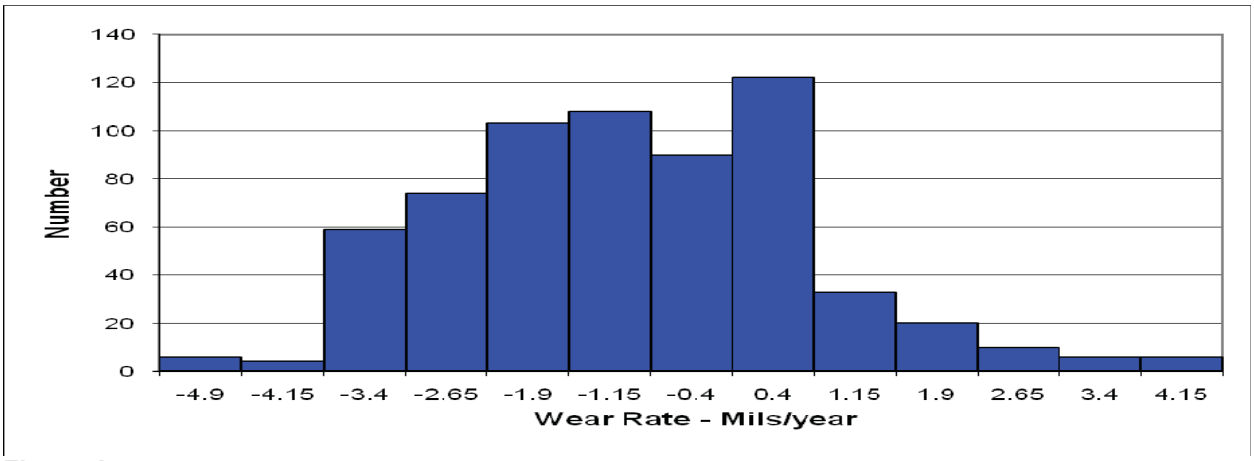

Figure A- 5
Histogram Showing No Wear

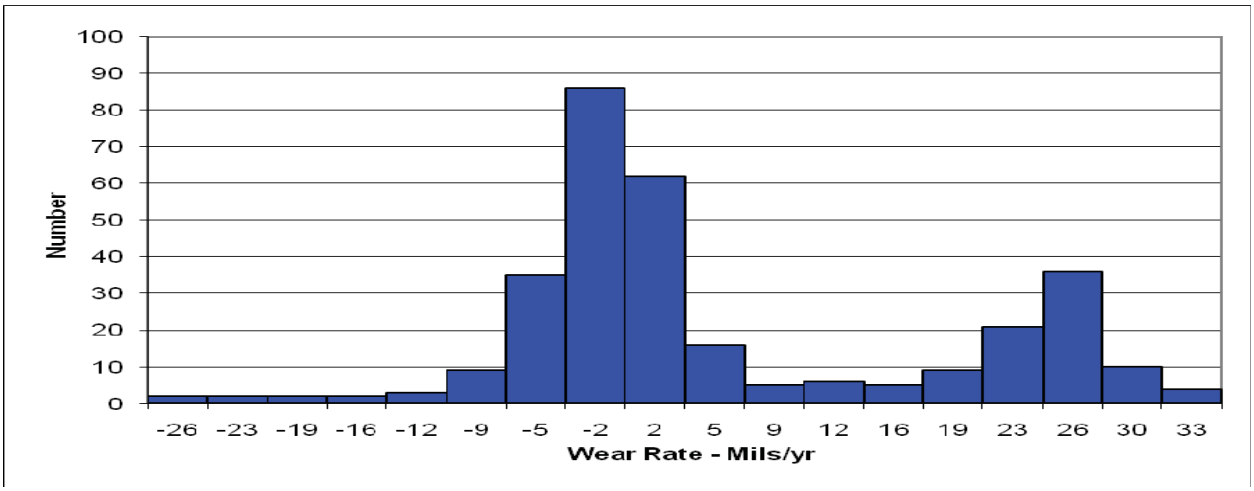

Figure A- 6
Histogram Showing a Bimodal Distribution

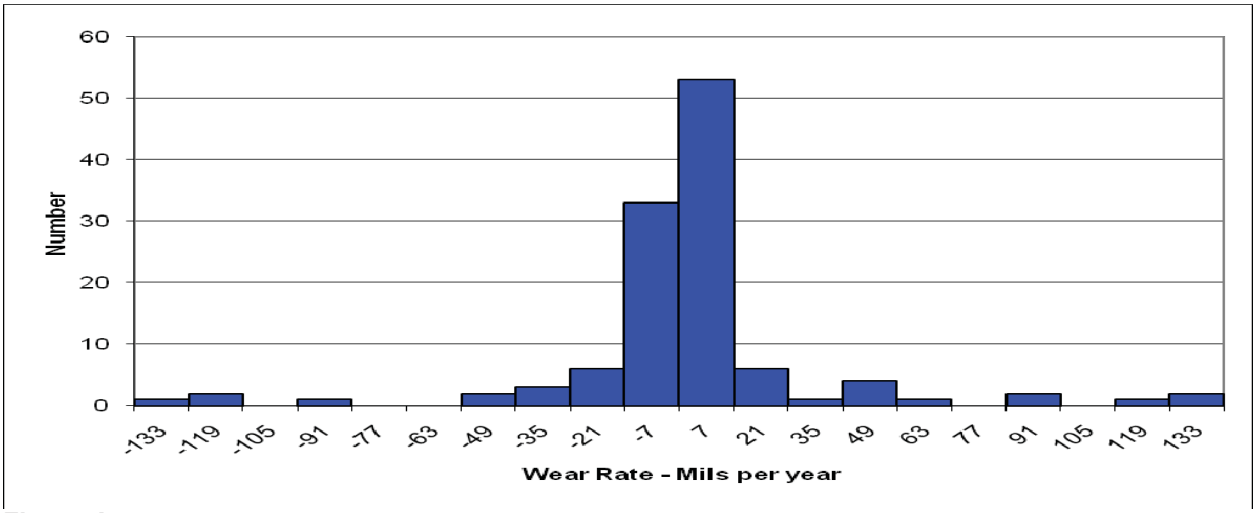

Figure A- 7
Histogram Showing Indeterminate Situation

These methods are also described in the EPRI reports listed below:

- CHECWORKS Steam/Feedwater Application Guide for Plant Modelling – 1019176
- Mentoring Guide for Flow Accelerated Corrosion Engineers – 1022295
- Least Squares Methods for Evaluating Inspection Data – 1018456 (Publicly available from EPRI.COM)
- Statistical Methods for the Analysis of Multiple-Inspection Flow-Accelerated Corrosion Data – 1019175
- Implementation Test Project on the Total Points Method - 1022575
- CHUG Position Paper 8 – Determination of Measured Wear
- CHUG Position Paper 11- Investigation into Statistical Methods of Analyzing Multiple Inspection Data