



## E/CRC NOTES

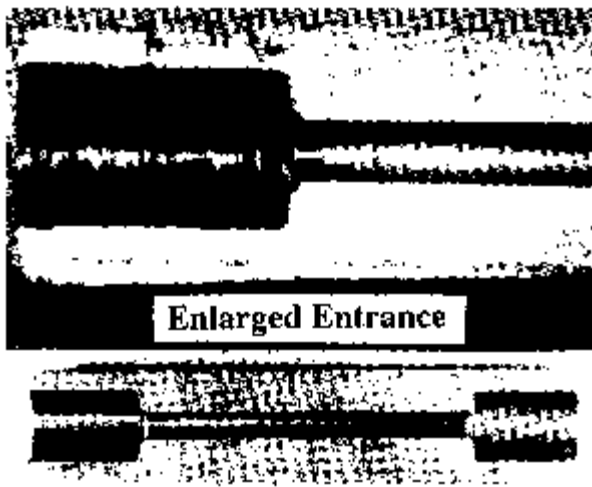
Fall 1995

A publication of The Erosion/Corrosion Research Center at  
The University of Tulsa, 600 S. College Avenue, Tulsa, OK 74104-3189  
Ph: (918) 631-2997, FAX: (918) 631-2397, E-Mail: me\_tsb@vax1.utulsa.edu

### Erosion of Chokes

Erosion and corrosion damage of piping, flow lines, couplings, pipe fittings, and chokes are major problems in many production situations. In many pipe geometries (such as in elbows and tees) a change in flow direction causes "direct impingement" of sand particles onto the pipe wall resulting in severe erosion damage (see E/CRC Notes, Fall 1994). In other pipe geometries such as couplings, and chokes, both "direct impingement" and "random impingement" of particles occur due to random turbulent flow velocity fluctuations.

Computational models have been developed at the Erosion/Corrosion Research Center (E/CRC) to predict erosion rates resulting from both direct and random impingement. However, the complexity in erosion and corrosion mechanisms also results in some "unexpected" behaviors. For example, small changes in geometry is a factor that is often ignored in modeling erosion/corrosion patterns. But, after a series of experimental and numerical studies of erosion rates in chokes, the investigators at the E/CRC found that a slight rounding at the throat entrance (Figure 1) due to erosion had a significant effect on the erosion pattern in the throat.

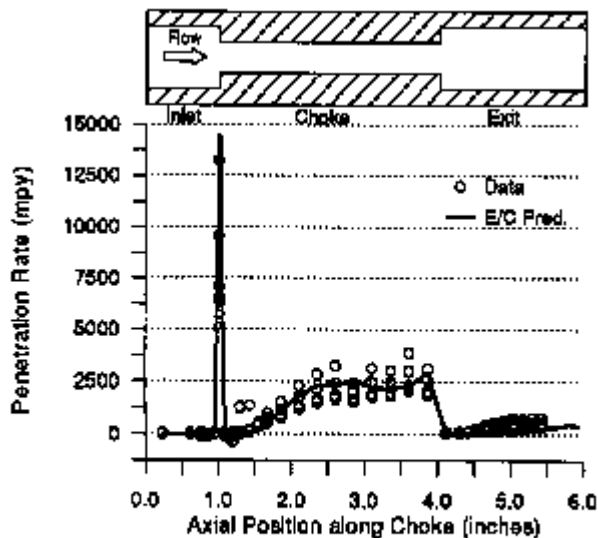


**Figure 1. Eroded Choke**

To validate the models developed at the E/CRC, a series of experiments was conducted on several chokes including a "wafer choke" (a choke that was sliced into wafers to facilitate local weight loss and penetration rate measurements). This choke was then subjected to severe erosion conditions with sand entrained in a liquid.

A comparison of measured and predicted local penetration rates for the wafer choke are shown in Figure 2. Note a deep penetration at the entrance of the choke due to direct impingement is observed both by the experimental data and the numerical simulation. It is important to note that a significant amount of erosion also occurs in the throat of the choke (downstream of the inlet) which tends to increase the

choke diameter. The erosion of the choke throat is mainly due to the random impingement of particles as a result of high turbulent kinetic energy. **The predictions agree well with experimental data only after accounting for the change in geometry at the entrance of the choke (due to erosion) in the flow and particle tracking models.**



**Figure 2. Comparison of Predicted Erosion and Measurements in the Choke**

We are currently using the E/CRC models to predict erosion rates in many different choke sizes with different flow and sand conditions to extend E/CRC guidelines for predicting erosion and penetration rates in chokes.

### **Erosion/Corrosion Research Center News**

The information on erosion in chokes presented on the front side of this issue will be presented in a more complete form at CORROSION/96 in Denver in a paper titled, "The Effect of Changing Geometry in a Choke on Resulting Erosion-Corrosion Behavior," by B. S. McLaury, S. A. Shirazi, J. R. Shadley, and E. F. Rybicki.

Results of this research are being incorporated into E/CRC's erosion prediction computer program, SPPS (Sand Production Pipe Saver). A demonstration version of SPPS is available on a 3-1/2" disk. Just check "other" on the enclosed reply card and specify "demo disk."

Another exciting project going at E/CRC is the development of a separator that will separate liquid, gas, and sand. This project, sponsored by BDM Oklahoma, will enable us to study erosion and erosion-corrosion when the solid particle carrier fluid is a gas-liquid mixture.

### **Brief Info on E/CRC**

Erosion and corrosion are common problems to oil and gas companies. The Erosion/Corrosion Research Center (E/CRC) at The University of Tulsa was formed to address these problems. The goal of the E/CRC is to help companies identify and evaluate ways of controlling erosion and corrosion through the development of predictive tools and design and operating guidelines. Currently, the E/CRC is supported by twelve companies from six different countries. Semiannual meetings are held in May and November

at The University of Tulsa. Members receive the results of the work in the form of presentations, reports, and user-friendly computer programs. Members provide input to the research through planning meetings and questionnaires. If you would like to receive information on joining The Erosion/Corrosion Research Center, please indicate on the enclosed reply card.

### **Reply Card**

We are in the process of expanding our mailing list for the E/CRC NOTES and encourage you to return the enclosed reply card with the names and addresses of persons who would be interested in receiving the E/CRC NOTES.

If you would like to receive a three-ring binder in which to store your E/CRC NOTES, please so indicate on the enclosed reply card and return to E/CRC.

### **E/CRC Meetings**

The fall E/CRC Advisory Board Meeting is to be held November 15, 1995, at The University of Tulsa. The spring meeting is scheduled for May 22, 1996. If you would like to attend a meeting as a guest, please return the enclosed reply card and indicate that you would like to receive further information on hotel reservations and the specific location of the meeting.