EROSION/CORROSION RESEARCH CENTER

E/CRC NOTES Fall 1994

A publication of The Erosion / Corrosion Research Center at The University of Tulsa, 600 S. College Avenue, Tulsa, OK 74104-3189
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Threshold Velocities

How fast can you flow and still avoid sand erosion problem?

Even for "sand free" or clean service where the sand production rate is as low as a few pounds per day, erosion damage can be severe for many conditions typical in oil and gas production. The Erosion/ Corrosion Research Center at The University of Tulsa has developed a computer program for computing threshold velocities for sand production. The threshold velocity is a production velocity you want to stay below to limit erosion damage to only a few mils per year.

Figure 1 below shows how the threshold velocity depends on pipe size for production of 350 ,um sand through a carbon steel elbow. If the produced fluid is crude oil, any practical velocity is below the threshold velocity. Even if the produced fluid is water no problems should be encountered except for pipe sizes under 4 inches.

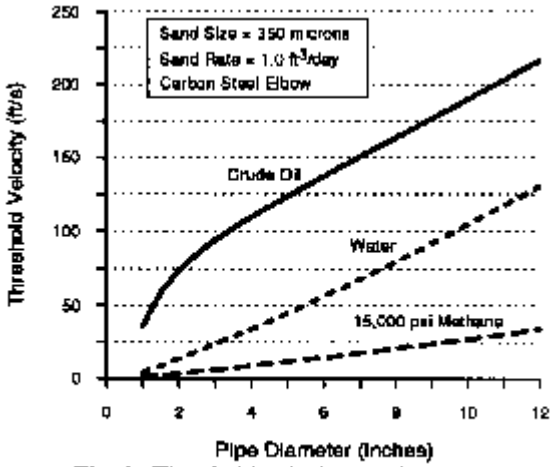

Fig. 1. Threshold velocity vs. pipe size.

But, if the fluid is methane, there is really no way to avoid trouble, at least when the sand production rate is a cubic foot per day or more. Threshold velocities are so low that for some pipe sizes the sand would not even stay suspended in the flow.

The threshold velocity depends on the size of the sand too. Figure 2 shows how the threshold velocity in a 6 inch elbow goes down as the size of the sand increases. If the sand is small enough, no problems should be encountered in any of the three fluids represented in Figure 2. But, if you want to produce methane at 80 ft/s or so, problems arise for any sand size greater than about 50 or 100 um. Sand in water can be a problem too if the sand is large enough.

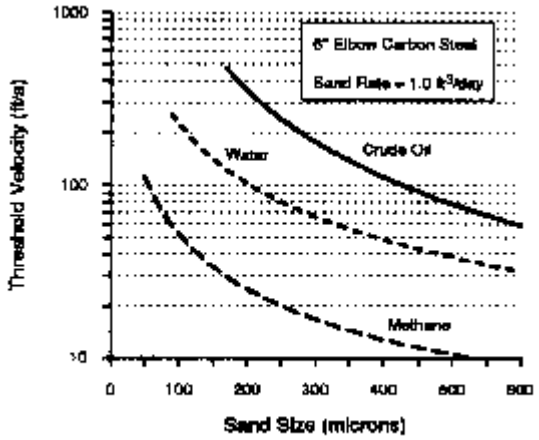

Fig. 2. Threshold velocity vs. sand size.

Density and viscosity of the produced fluids affect the threshold velocity. That is why water and crude oil have threshold velocities that are so much higher than thresholds for methane - they are more dense and more

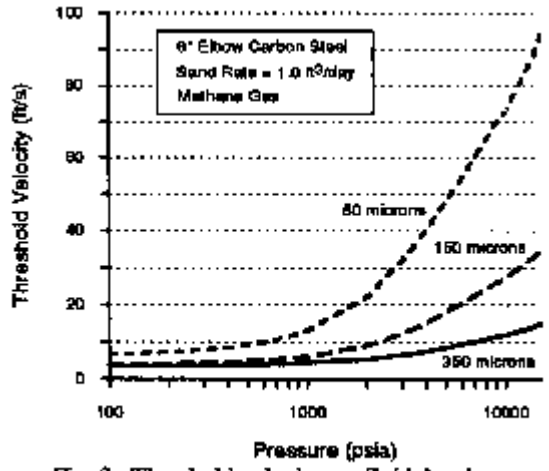

Fig. 3. Threshold velocity vs. fluid density.

viscous than methane. Figure 3 shows how the threshold velocity in methane changes as the density of the gas increases for several sand sizes.

Erosion/Corrosion Research Center News

The graphs on threshold velocities for sand erosion presented on the front side of this issue were taken from Paper No. SPE 28518 to be presented at the Society of Professional Engineers Conference on September 25-28, in New Orleans. The paper is titled "Generalization of the API RP 14E Guidelines for Erosive Service," and is authored by S. A. Shirazi, B. S. McLaury, J. R. Shadley, and E. F. Rybicki. Dr. Shirazi is the co-principal investigator of research at The Erosion/Corrosion Research Center at The University of Tulsa and will be presenting the paper at the conference.

Many other threshold velocity examples are provided in the paper as well as is the basis for the computational procedure and PC-based computer program. If you would like an advance copy of the paper, call Tommie Sue Hampton at (918) 631-2997 and she will send you one.

Also, a demonstration version of the erosion prediction program is available. The program is user

friendly and computes erosion penetration rate given information about the flow, the geometry, the sand, etc. It also computes threshold velocities and threshold particle sizes for a penetration rate you can select. Please call Tommie if you are interested in a copy of the demonstration version of the program on a 3-1/2" disk or so indicate on the enclosed reply card box marked "other" by specifying demo disk.

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 eleven companies from seven 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 Fall Meeting

The next E/CRC Advisory Board Meeting is to be held November 16th, 1994, at The University of Tulsa, Tulsa Oklahoma. If you would like to attend the 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.