Pipeline Erosion In Solution Mining Application

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Introduction

The Strategic Petroleum Reserve (SPR) piping system was originally designed using the API erosion velocity limiting criteria (API-RP-14E) given by

$$V_e = \frac{C}{\sqrt{\rho}} \qquad (1)$$

where C is a constant equalling 125 for intermittent service and ρ is the fluid density in lb/ft^3. This criteria limited brine flow velocities to approximately 15 fps and oil velocities to approximately 20 fps with some modification depending on application. As leach and fill progressed at the SPR sites, it became desirable to attempt to extend these limits and the Aerospace Corporation was asked to investigate the basis and validity of the API criteria. It was soon found (Ref. 1) that the origin of the criteria was unknown, even to the API, and that it appeared to neglect most of the erosion variables thought to be pertinent such as entrained particle content, material hardness, etc. In oil line applications, true erosion velocities are probably seldom reached because of pump economics. Use was then made of data from an experimental erosion study undertaken at the Massachusetts Institute of Technology (Ref. 2) to develop a new erosion correlation in an attempt to put more realistic limits on SPR flow velocities. This present paper develops a modification of the Areospace correlation using

the M.I.T. data and applies the results to the recent brine line failure at Bryan Mound. Flow modification techniques for reducing the amount of erosion are also presented. For the purposes of this paper, erosion is defined as the mechanical removal of wall material either by fatigue or abrasion. Corrosion is defined as the chemical degradion of the wall material.