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THE CORROSION SOCIETY

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Standard
Recommended Practice

Handling and Proper Usage of Inhibited Oilfield Acids

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NACE International
1440 South Creek Drive
Houston, Texas 77084-4906
+1 281/228-6200

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Foreword

Acid solutions are often used to improve the production of fluids from, or injection of fluids in, subterranean formations. The most commonly used acid is hydrochloric acid and solutions thereof, and these solutions are hazardous to personnel and are very corrosive to metal equipment. This standard recommended practice outlines methods and procedures for the handling and use of inhibited hydrochloric acid for oilfield applications. It is intended for individuals who wish to supplement their understanding of oilfield acidizing processes or who handle or use inhibited acids in oilfield operations.

This standard was originally prepared in 1973 by the API(1)/NACE Subcommittee on Oilfield Acid Corrosion Inhibitor Evaluation and jointly issued as API Bulletin D-15 (now withdrawn) and NACE Standard RP0273-73. This standard was revised in 1995 by NACE Task Group T-1D-37, a component of Unit Committee T-1D on Corrosion Monitoring and Control of Corrosion Environments in Petroleum Production Operations. It was reaffirmed in 2001 by Specific Technology Group (STG) 31 on Oil and Gas Production – Corrosion and Scale Inhibition and is issued by NACE International under the auspices of STG 31.

In NACE standards, the terms *shall*, *must*, *should*, and *may* are used in accordance with the definitions of these terms in the *NACE Publications Style Manual*, 4th ed., Paragraph 7.4.1.9. *Shall* and *must* are used to state mandatory requirements. *Should* is used to state something considered good and is recommended but is not mandatory. *May* is used to state something considered optional.

(1) American Petroleum Institute (API), 1220 L Street NW, Washington, DC 20005.

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Section 1: General

1.1 This standard presents guidelines for minimizing acid corrosion, including general corrosion, pitting, and stress corrosion cracking (SCC), in the oil field. Topics covered include preparation of the well, preparation of the acid solution, acid solution pumping and injection, and return fluids handling.

1.2 This standard presents a field test of oilfield acids of 15% or less concentration for the presence or absence of corrosion inhibitors.

1.3 This standard presents a laboratory test for solubility-dispersibility of corrosion inhibitors in oilfield acids.

Section 2: General Guidelines for Using Inhibited Acid in Wells

2.1 This section provides guidelines that should be followed to minimize acid corrosion problems including general corrosion, pitting, and SCC. Guidelines pertaining to preparation of the well, preparation of the acid, injection of the acid, and subsequent cleanup of the well are presented. While all these guidelines may not be applicable for each acid treatment, the merits of each should be weighed carefully.

2.2 Well-Preparation Guidelines

2.2.1 Pipe Conditions: The condition of the pipe in the well should be examined for evidence of corrosion or scaling. Leaks may result from the removal of scale or corrosion products and not from acid corrosion of pipe material. Effects of the acid solution on downhole nonmetallic materials (e.g., plastic-coated or cement-lined tubular goods) should be considered.

2.2.2 Metallic Material Precautions: Acid inhibitors do not protect certain metals from corrosion by acid solutions. Consideration should be given to removal of galvanized metal, aluminum, magnesium, and chrome-plated metal from the well prior to initiating treatment. Stainless steel may be susceptible to SCC. Acetic acid can be inhibited for use in the presence of chrome-plated metal, stainless steels, and aluminum, but cannot be adequately inhibited for use in the presence of magnesium or galvanized metal.

2.2.3 Leak Check: Precautions should be taken to ensure that the tubing string and/or the packer do not leak. If acid solution becomes trapped in the annular space, it can cause damage even if the acid initially was properly inhibited. Severe damage resulting from trapped acid cannot be attributed to lack of inhibitor or inhibitor failure.

2.2.4 Hydrogen Sulfide (H_2S) Precautions: Although inorganic acids can cause general corrosion and/or SCC, H_2S may contribute to increasing corrosiveness and/or SCC of metals. Therefore, sour fluids should be displaced to prevent contamination of the acid solution with H_2S. In addition, H_2S can be produced by acid contact with iron sulfide present on the pipe surface. It should be recognized that inorganic inhibitors can be precipitated by H_2S. Organic inhibitors are preferred for H_2S service although they too can be adversely affected by H_2S.

2.2.5 Well Cool-Down Considerations: Consideration should be given to the practice of cooling a very hot well by injecting oil or water ahead of the acid solution to lower the temperature of the tubular goods. However, precautions should be taken so that the tubular goods will not be cooled to the point of tensile failure or packer release. If the well cannot be cooled below 163°C (325°F), use of organic acids should be considered. These organic acids can be effectively inhibited for safe use above 204°C (400°F).

2.2.6 Displacement into Formation: If possible, an acceptable pump-in rate should be established in advance using an inert fluid such as oil or water. This procedure makes certain that the formation is open to receive the acid solution in order to prevent trapping of acid in the tubular goods with no means to effectively displace the acid solution.

2.2.7 Vent Piping: Piping shall be arranged to prevent venting of gases near the wellhead or anywhere rig operators or other personnel may be present. This is especially important if any sulfide or arsenic compounds are present in the well. Personnel must be warned that H_2S and arsine gases are heavier than air and tend to collect in low spots (gullies, draws, ravines, etc.), creating a lethal environment. Lethal amounts of H_2S or arsine gas can be produced (1) when wells containing sulfides or arsenic materials are acidized, or (2) when acid containing arsenic materials is being used. If the possibility of H_2S or arsine gas exists, testing equipment and appropriate safety equipment shall be on hand to monitor the working area and protect personnel in the area. Special scrubbing equipment may be required for removal of toxic gases.

2.2.8 Arsenic Inhibitor Precautions: Arsenic inhibitors are still occasionally used in acidizing deep, hot wells. Many refineries use catalysts that can be severely damaged by traces of arsenic in the parts-per-billion range. Some pipelines and/or refineries refuse delivery of production containing trace quantities of arsenic.