NACE Standard SP0273-2016
Item No. 21009

Revised 2016-02-012
Reaffirmed 2007-03-11
Reaffirmed 2001-03-15
Approved 1973

Handling and Proper Usage of Inhibited Oilfield Acids

ABSTRACT

Outlines methods and procedures for the handling and use of inhibited hydrochloric acid for oilfield applications. Includes general considerations when using inhibited acid in wells, such as material and equipment checks, acid solution preparation, acid solution pumping and injection, and return fluids handling; field testing of 15% or less hydrochloric acid solution for presence or absence of corrosion inhibitors; and dispersibility tests for corrosion inhibitors in oilfield acids.

KEYWORDS

corrosion inhibitors, inhibited acids, wells.

ISBN 1-57590-122-6

Foreword

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. The term should is used to state something considered good and is recommended but is not mandatory. The term may is used to state something considered optional.

This standard practice outlines methods and procedures for handling and using inhibited stimulation acid in 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.

Acids are used to improve the fluid production from, or injection into, subterranean formations. Hydrochloric acid is the most commonly used acid, yet these solutions are safety hazards and corrosive to metals. This standard practice outlines methods and procedures for the handling and use of inhibited stimulation 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 practice also outlines field tests for corrosion inhibitor presence and its dispersibility/solubility using a 15% (or less) HCl solution.

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API[1]/NACE Subcommittee on Oilfield Acid Corrosion Inhibitor Evaluation and jointly issued as API Bulletin D-15 (now withdrawn) and NACE Standard RP0273-73.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 and 2007 by Specific Technology Group (STG) 31 on Oil and Gas Production—Corrosion and Scale Inhibition. It was revised in 2015 by TG 496—Review and Revise as Necessary SP0273-2007. It is issued by NACE International under the auspices of STG 31.

[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 in oilfield environments. Corrosion mechanisms include general corrosion, pitting, and stress corrosion cracking (SCC). Topics covered include well preparation, acid solution preparation, pumping, and injection, and return fluids handling.

1.2 This standard presents a field test of oilfield acid with HCl concentrations of 15% or less in the presence or absence of corrosion inhibitors.

1.3 This standard presents a laboratory test for corrosion inhibitor solubility and dispersibility in oilfield acids.

Section 2: General Guidelines for Using Inhibited Acid in Wells

2.1 This section provides guidelines to minimize acid-associated general corrosion, pitting, and SCC. Guidelines pertaining to well preparation, acid preparation, acid injection, and subsequent well cleanup are presented. These guidelines may not be applicable for all acid treatment, and the merits of each shall be evaluated carefully. The user shall document their decisions taken in following these guidelines.

2.2 Well Preparation Guidelines

2.2.1 Pipe Conditions: The well-pipe should be examined for evidence of corrosion or scale deposition. Leaks may result from the removal of scale or corrosion products and not directly from acid attack on the pipe material. Acid effects on nonmetallic materials (e.g., plastic-coated or cement-lined tubular goods) shall also be considered.

2.2.2 Metallic Material Precautions: Acid inhibitors do not protect certain metals from corrosion by acid solutions. These metals may include aluminum, magnesium, chrome-plated metals, and galvanized metals. Consideration shall be given to removing these metals prior to treatment. In addition, stainless steel may be susceptible to SCC and other corrosion mechanisms. Lastly, acetic acid can be inhibited for use with chrome-plated metal, stainless steels, and aluminum, but cannot be adequately inhibited for use with magnesium or galvanized metal.

2.2.3 Leak Check: Precautions shall be taken to ensure that the tubing string and the packer do not leak. Pressure tests should be performed with water or brine to ensure the absence of leaks in pressure piping, tubing, and packer. If acid solution becomes trapped in the annular space, it can cause damage even if the acid was properly inhibited. Severe damage resulting from trapped acid cannot be attributed to lack of inhibitor or inhibitor failure.

2.2.4 Hydrogen Sulfide (H2S) Precautions: Inorganic inhibitors can be precipitated by H_2S. Thus, the presence of H_2S in the acid may contribute to increasing corrosion and SCC. Hydrogen sulfide can also be produced if the acid dissolves FeS solids on the pipe surface, therefore, sour fluids should be displaced to prevent H_2S from contaminating the acid. Organic inhibitors are preferred for H_2S service although they too can be adversely affected by H_2S.

2.2.5 Well Cooling Considerations: Consideration should be given to cooling a very hot well by injecting oil or water ahead of the acid solution. However,