

INSTRUCTIONS:
BACTERIAL-INDUCED CORROSION
PART No. 180-50

Casing, production, and drillstring tubulars have been known to suffer severe corrosion as the result of bacterial action. Microorganisms contribute to corrosion in different ways. Some act as cathodic depolarizers, while others form slimes or growths that shield a portion of the metal, scale and oxygen concentration cell. Generally, microorganisms affecting corrosion are classified according to oxygen requirements. Aerobic refers to a presence of oxygen. Anaerobic refers to an absence of oxygen or low oxygen.

In aerobic environments, the species thiobacillus accounts for most of the corrosion. This species converts sulfur to sulfuric acid, which stimulates attack. Sulfate-reducing bacteria are found in anaerobic environments. This mechanism involves both the direct attack of iron by hydrogen sulfide and cathodic depolarization. Even in aerated fluids, sulfate-reducing bacteria may be found within active corrosion pit areas where the oxygen content becomes low.

Microbiological testing using an extinction-dilution technique may be used in the Field Mud Laboratory to identify and count the number of organisms present. Bacterial testing vials are available for both aerobic (phenol red) and anaerobic (sulfate reducer) testing.

Testing procedures for both types of vials are as follows:

A. Inoculation of Serial Dilution Vials

1. Tape five to seven vials together in a row. Number vials 1 through 5 or 7 and label with sampling point, date and location.
2. Remove metal tab from top of vial without removing metal seal from the stopper.
3. Using a disposable syringe, inoculate the first serum vial with 1 ml of the sampled water (or filtrate) and shake thoroughly.
4. With a new syringe, withdraw 1 ml from the first vial. Inoculate the second vial and shake thoroughly.
5. Repeat step 4 until desired number of vials have been inoculated.

6. Incubate the vials at 37 deg. C (98 deg. F) [for within 5 deg. C (25 deg. F) of system temperature] and observe daily for growth. API RP 38 recommends a 28-day incubation period for anaerobic vials and minimum 5-day period for aerobic vials.

B. Interpretation of Results

1. Positive results:

<u>Media</u>	<u>Positive</u>
API or postgate media “B” sulfate-reducer vials	Black material forms in bottles
Phenol red vials	Media turns yellow

2. The number of vials that show positive results in the allotted time period can be used to calculate the bacteria level by Table 1.
3. When sampling a system with H₂S present, sulfate reducer vial no. 1 will often turn positive (black) within 15 – 60 seconds of inoculation. This occurrence should be considered no growth, if only this vial is turned after 28 days. If vial no. 2 turns black immediately, a new sample should be obtained and the H₂S purged with nitrogen to remove the H₂S.

TABLE 1. BACTERIAL TESTING LEVELS

BOTTLE NUMBER	DILUTION FACTOR	GROWTH INTERPRETATION
1	0	1 per ml
2	1:10	10 per ml
3	1:100	100 per ml
4	1:1000	1000 per ml
5	1:10,000	10,000 per ml
6	1:100,000	100,000 per ml
7	1:1,000,000	1,000,000 per ml

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