Changes to NACE Standard MR0175-2003

The following information is intended to provide strategy and guide users through the new edition of MR0175, but it does not provide interpretations.

Purpose of Revisions:

Work was begun in 1995 to make NACE Standard MR0175, Metals for Sulfide Stress Cracking and Stress Corrosion Cracking Resistance in Sour Oilfield Environments," an ISO standard. This was agreed and discussed at CORROSION/1996 in Denver, Colorado.

However, the groundwork was laid beginning as early as 1950. After World War II, people became interested in providing gas to industry. As a result of gas discoveries, several technical committee reports, including 1A152, "Sour Oil Well Corrosion," and 1B159, "Well Completion and Corrosion Control of High-Pressure Gas Wells," were published during the 1950s.

In the 1960s, Unit Committee T-1B on Corrosion in Oil and Gas Well Equipment, Calgary Area, published NACE Publication 1B163, "Recommendations on Materials for Sour Service," which included Tentative Specifications 150 on valves, 51 on severe weight loss, 60 on tubular goods, and 50 on nominal weight loss. Then the report considered to be MR0175's predecessor, NACE Publication 1F166, "Sulfide Cracking-Resistant Metallic Materials for Valves for Production and Pipeline Service," was published.

In the 1970s, the industry began dealing with harsher environments, so metals needed to be able to withstand higher temperatures and higher pressures, and 41XX tubulars and high-strength CRAs were introduced. 1F166 was revised in 1973, and in 1975 the original version of MR0175, "Materials for Valves for Resistance to Sulfide Stress Cracking in Production and Pipeline Service," was published. MR0175 was revised in 1978, and NACE Standard TM0177, "Testing of Metals for Resistance to Sulfide Stress Cracking at Ambient Temperatures," was published as a complement to MR0175.

During the 1980s, operators continued to search for materials resistant to harsh environments. Technology improved, and laboratory testing and CRAs were prevalent. NACE Standard TM0284, "Evaluation of Pipeline Steels for Resistance to Stepwise Cracking," another complementary standard, was published. Yearly updates to MR0175 started in 1988 and have continued until 2003.

In the 1990s, technology changed again in response to the North Sea environment, which was a milder environment. Users began asking whether the same restrictions on strength were needed for materials in this environment. Hardness vs. H_2S limits was discussed. Several standards and reports were published, including European Federation of Corrosion (EFC) #16, "Guidelines on materials requirements for carbon and low alloy steels for H_2S-containing environments in oil and gas production," and EFC #17, "Corrosion resistant alloys for oil and gas production: guidelines on general requirements and test methods for H_2S service." The EFC developed domains, and Vickers weld hardness testing came into use. Stepwise cracking (SWC), stress-oriented hydrogen-induced cracking (SOHIC), and soft-zone cracking (SZC) began to be

industry problems and EFC included information on these, which were not covered by MR0175. Partially in response to these concerns, the "rewrite" of MR0175 was begun in 1995 and a proposal to ISO was made to prepare an international standard to cover the needed topics. ISO approved the work item to write a standard to address material requirements in H_2S service. NACE and EFC members became co-leaders of the ISO/TC 67/WG 7 project, which is now nearing completion (ISO 15156, "Petroleum and natural gas industries—Materials for use in H_2S containing environments in oil and gas production"). The plan is for this ISO standard to merge with MR0175 in 2004, and the new standard will be designated NACE MR0175/ISO 15156 in the United States. The ISO working group leaders and NACE task group members have been working closely to make sure the two documents are technically aligned prior to the merger, and a Maintenance Panel has been formed to maintain the combined standard. An oversight committee, NACE Task Group 299, has also been formed to vote on changes to the standard. Changes will then be submitted to ISO/TC 67 for vote.

This achievement was made possible because of an identified industry need, funding made available for parts of the effort, dedication of many people including EFC and NACE volunteers, NACE staff support, and ISO support. NACE committee leaders involved in this effort are excited about the new direction for this world-recognized standard.

The impact of MR0175 on mitigating cracking has been very high, and overall, use of MR0175 has reduced the cost of materials.

MR0175 is not expected to be technically changed before it is combined with ISO 15156. ISO 15156 is in a different format, with most information provided in tables, so it will not look the same, but it will be technically equivalent. Committee leaders are working on making sure the technical explanations are correct.

Interpretations:

The Maintenance Panel will handle interpretations, similar to the way NACE Task Group 081 handled requests for interpretation of MR0175. There may be a delay in the short term regarding getting replies to inquirers, until the process is refined.

Three Objectives for Maintenance Panel:

50-50 split between users and manufacturers and international vs. domestic, with 2 not from Europe or North America. Members will serve a two-year term, so more people will have a chance to serve.

There is much more of a need for the user to talk to the materials supplier. The ISO approach to CRAs is identical to that of NACE Standard MR0175.

MR0175-2003

One of the most important paragraphs in the 2003 edition of MR0175 is 1.2 on Procurement. The first sentence states, "It is the responsibility of the user to determine the operating conditions

and to specify when the standard applies." A definition of *user* has been added to the Definitions section:

"User: Someone who is responsible for operating the equipment that is installed and operated in the field."

The task group tried to define who is ultimately responsible for materials selection. There are two more sentences on responsibility: "The *manufacturer* is responsible for meeting metallurgical requirements. It is the *user's* responsibility to ensure that a material will be satisfactory in the intended environment."

Paragraph 1.6.2 is a disclaimer-type of statement: "Materials included in this standard are resistant to, but not necessarily immune to, SSC and/or SCC in stated conditions. Improper design, manufacturing, installation, selection, or handling can cause resistant materials to become susceptible to SSC and/or SCC." This is telling the user: *You are responsible for materials selection. We cannot guarantee successful use or no failures or cracking, etc*.

Paragraph 1.7 or 1.7.2: The task group has been asked more questions on this than any other paragraph, and inquirers are more often not satisfied with the reply: "This is not a quality assurance document." These are voluntary guidelines; it is up to the user to determine how many test to take, where to take tests, etc. THIS HAS NOT CHANGED.

The new edition spells out more clearly that materials selection is up to the user—NACE cannot give advice and will not get involved in negotiations or a dispute between users and manufacturers. Paragraph 1.8.3.3.3 describes how materials are listed in the standard, and a diagram on the same page gives a "Road Map" for navigating the standard.

Paragraph 1.10.2 is new. In the past, the way the general section was used was that "If I purchased an alloy in the past and used it for a Christmas tree, if I replace it, I have to use material that is acceptable according to the new MR0175." In the new standard, "I can continue to use existing materials, if I feel the field has stayed the same, etc." Companies may be using marginal alloys that have worked out all right.

The title of Section 4 has been changed to include alloys for general use that are not covered in Section 3. Another problem in the old MR0175 was a "laundry list" of alloys—frequently people requested an interpretation, saying they had an alloy that "looks like __ SS, but it is *__SS." The result would be a ballot for this material, and the committee received feedback expressing frustration. Therefore, the task group created alloy categories, with limits for a particular category so that all 300 SS would fit within it.

However, it isn't that simple, so there are categories with specific alloy requirements.

Following the general Sections 3 and 4, there are sections on specific equipment and the requirements—this is the most changed area. The committee reinserted alloys from the general section that are no longer there and put them in Sections 9 and 10 with restrictions on

environmental limits for wellheads and Christmas trees, e.g., 17-4 PH (UNS S17400) and UNS N04400.

Sometimes a specific type of equipment is prohibited for general use. Section 10 is designed to give more flexibility to certain types of equipment. *The user must review the requirements.*

New sections (Sections 13, 14, and 15) have been added to the end of the standard, giving guidance on the ballot process. Section 16, "Materials for Application-Specific Cases Without Proposing Adding New Materials to MR0175," was added to be consistent with the ISO strategy. Users may submit their own data to support usage in the following instances:

(1) alloys in the specific categories outside MR0175,
(2) alloys included in MR0175 but used outside the acceptable environments of MR0175, or
(3) alloys not listed in MR0175 and not included in a specific category.

NACE will make these data available to the public. In some cases these data may lead to changes in NACE MR0175/ISO 15156, or the user may decide to propose changes in the standard—in this case the user must submit a proposal to the Maintenance Panel.

Some new materials are harder and stronger, and it may be possible to use them in H_2S service. Users may submit data supporting the use of materials that are not listed or are outside the scope of the standard.

If a manufacturer simply wants to make data available to customers, that is acceptable, **but** if the manufacturer wishes to change industry's mind, data need to be submitted to NACE. It is the committee's attempt to give people another opportunity and not to restrict usage unnecessarily. However, manufacturers may have trouble marketing to some customers. The user must accept responsibility for materials selection. Even if data are not within environmental limits, others may still review the data if they are submitted to NACE. Data give confidence that "if I engage in a testing program and show successful results, I can use the material."

Question: If a manufacturer decides to qualify a material outside the standard and above the limits, is he required to inform the user and get his approval? **Answer**: The user is responsible for what he uses. The manufacturer is not responsible for what actually goes into the well.

Question: Will the ISO document solve the problems with black-and-white tables? **Answer**: Tables will not require interpretations because it will be black and white.

For detailed information on ISO 15156, refer to Paper #03090 presented at CORROSION/2003 (available via the NACE Store at www.nace.org).