Status Update
API Standard 6ACRA

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API SC6 Winter Meeting
January 23, 2019
San Antonio, Texas
Status Update

**API 6ACRA Addendum 2**
- Published in September
- Added the definition of corrosion resistant alloy from API 6A
- Revised Table 1 footnote c to delete “to suppress formation of deleterious phases”
- Revised the CVN re-test requirements to match API 6A 21st Edition
- Added Annex B with requirements for adding a new alloy or material designation

**API 6ACRA Addendum 3**
- Ballot passed in December with no negative votes
- Meeting held 15 January 2019 to resolve editorial comments
- Revised copy sent to Ed Baniak for publication
- Adds UNS N07718 at 45 HRC max (150 KSI SMYS)
- Adds UNS N09955 at 40 HRC max & 42 HRC max (120 KSI SMYS and 140 KSI SMYS)
- Adds Hydrogen Embrittlement cautionary note
Status Update

TG discussing development of two new SRRRs

Test Methods and Acceptance Criteria
• SRRR for funding to investigate alternate test methods and acceptance criteria to prevent hydrogen embrittlement of PHNAs
• James Buchanan, Chevron coordinating development efforts
• Ongoing JIPs being run by other organizations may preclude the need for this SRRR

New Mechanical Property Acceptance Criteria
• SRRR for action to develop new mechanical property acceptance criteria based on mill production data in order to eliminate outliers (and prevent HE of PHNAs?)
• Tim Haeberle, Baker Hughes coordinating development efforts
• May require funding for an independent company to collect and analysis the data
• Certs could be supplied by equipment manufacturers or by alloy manufacturers
• Would need to trust sources that data is not cherry picked.
## Field Failures

<table>
<thead>
<tr>
<th>Component</th>
<th>Application</th>
<th>Alloy</th>
<th>Fractography</th>
<th>Potential Hydrogen Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subsurface safety valve</td>
<td>Seawater injection well</td>
<td>UNS N07716</td>
<td>Brittle IG fracture with multiple initiation sites</td>
<td>Galvanic couple with carbon steel casing in contact with 1.09 sg NaCl brine treated with oxygen scavenger and biocide ¹</td>
</tr>
<tr>
<td>Tubular crossover</td>
<td>Deep water well</td>
<td>UNS N07725</td>
<td>TG brittle fracture</td>
<td>Reaction of chemicals and dope compounds sealed within the box connection ²</td>
</tr>
<tr>
<td>Subsea seals</td>
<td>Subsea</td>
<td></td>
<td>IG brittle fracture</td>
<td>Cathodic Protection (CP) ³</td>
</tr>
<tr>
<td>Casing hanger</td>
<td>HTHP Production well</td>
<td>UNS N07718</td>
<td>Brittle IG fracture</td>
<td>Chemical decomposition of completion brine (Cesium formate)</td>
</tr>
<tr>
<td>Tubing hanger</td>
<td></td>
<td></td>
<td></td>
<td>Cu-platting and/or by galvanic coupling with carbon steel in contact with CO₂-containing brine.</td>
</tr>
</tbody>
</table>

1. P. Nice et al. NACE CORROSION 2014, Paper no. 3892  
2. S. Shademan et al. NACE CORROSION 2012, Paper no. 1095  
Joint Industry Projects on Hydrogen Embrittlement of API 6ACRA Alloys

- **DNVGL**
  Rapid Characterization of Materials Performance for HPHT Applications
  Status: Ongoing

- **DNVGL**
  Development of Guidelines for Use of PH725/625+ for O&G Applications
  Status: Scoping phase

- **Institut de la Corrosion / Southwest Research Institute**
  Hydrogen Stress Cracking of PH Nickel Alloys
  Status: Completed

- **Material Center Leoben (MCL)**
  High Strength Hydrogen Resistant Alloys – Module 2: Role of Microstructure on HE resistance of Precipitation Hardenable Ni-alloys
  Status: Ongoing