API Introduction and API HF Standards for the Oil and Natural Gas Industry

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Topics

- API History, Structure and Mission
- API Standards and Standards Development
- API HF related standards and publications
- Use of API Standards
- Conclusions

API History

- 1919: API founded as non-profit national trade association, New York City
  - Three initial priorities – taxes, statistics, and equipment and operational standards
- 1969: API relocates to Washington, DC
  - Heightened interest in public policy issues

API Structure

Staff of 200 led by Board of Directors made up of member company CEO's

Over 400 member companies involved in all aspects of the oil and natural gas industry

Over 700 committees and task forces covering various advocacy and technical issues

API Mission

- Influence public policy in support of strong US oil and natural gas industry
- Engage in legislative and regulatory advocacy
- Provide a forum to develop consensus industry policies
- Work collaboratively with other associations
- Develop industry standards that ensure safety, reliability, and codify best practices

Background on API Standards Program

The API Standardization Department was formed in 1923, and the first API standard was published the following year on drilling threads.

All industry segments now active in standardization:

- Exploration and Production
- Refining
- Marketing
- Pipeline Transportation

API Standards

- API now publishes ~550 technical standards covering all aspects of the oil and natural gas industry
- Foundation of Self Supporting Programs
- Basis for Worldwide Operations
- Core of Institute’s Technical Authority

Standards Development Process

- API is accredited by the American National Standards Institute (ANSI)
  - Openness, Balance, Consensus, Due Process
  - Regular program audits (conducted by ANSI)
- Transparent process (anyone can comment on any document)
  - All comments must be considered

Standards Development Process

- Developed by consensus (does not mean unanimity)
- Committee balance between users, manufacturers/service-supply and general interest categories
- General interest category includes government, academia, and engineering consultants
- Standards developed using ANSI approved API Standards Development Procedures (available on-line at www.api.org)

HF Related Documents and Standards

- HF1, *Hydraulic Fracturing Operations – Well Construction and Integrity Guidelines*, 1st Edition, October 2009
- Guidance Document contains 10 sections:
  - Scope, References, General Principles, Casing Guidance, Cementing and Casing
  - Well Logging and Other Testing, Well Construction Guidelines, Perforating, Data Collection, Analysis, and Monitoring

HF Related Documents and Standards

- HF1, *Hydraulic Fracturing Operations – Well Construction and Integrity Guidelines*, 1st Edition, October 2009

- Scope: The purpose of this guidance document is to provide guidance and highlight industry recommended practices for well construction and integrity for wells that will be hydraulically fractured. The guidance provided here will help to ensure that shallow groundwater aquifers and the environment will be protected, while also enabling economically viable development of oil and natural gas resources. This document is intended to apply equally to wells in either vertical, directional, or horizontal configurations.

HF Related Documents and Standards

- HF1, *Hydraulic Fracturing Operations – Well Construction and Integrity Guidelines*, 1st Edition, October 2009

Section 7 – Well Construction Guidelines - Key Environmental Protection

Covers the four main components of conductor, surface, intermediate, and production casing

Various Casing strings are used to ensure ground protection

Section notes that in addition to the recommendations, operators must be aware of local geological conditions and state regulations

Casing depths are determined in advance as part of the drilling plan:

Assure isolation, Meet regulatory requirements, Achieve well integrity, Contain well pressure

HF Related Documents and Standards

- HF1, *Hydraulic Fracturing Operations – Well Construction and Integrity Guidelines*, 1st Edition, October 2009

Section 7 – Well Construction Guidelines - Key Environmental Protection

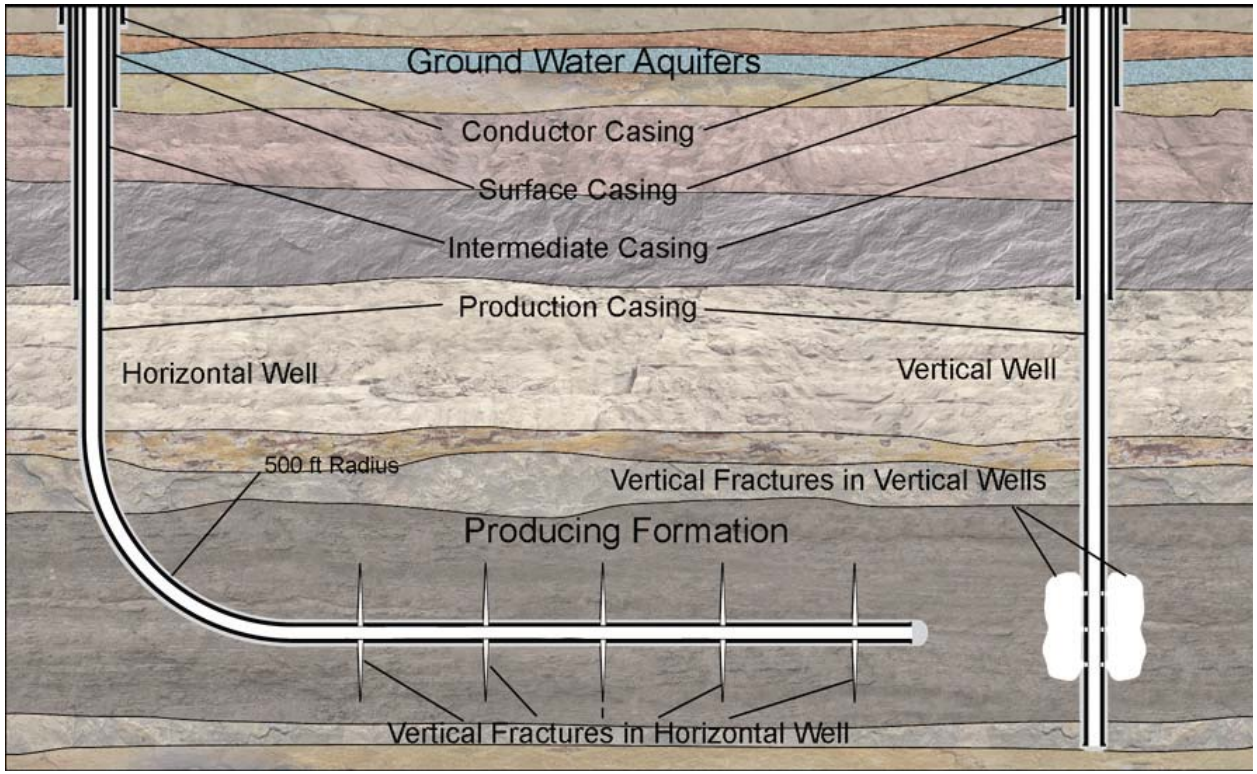
Actual length of casing string is adjusted based on well logs, drill cutting analysis, and pressure and drilling loads

Cement may be required back to surface on each string based on well design and state regulations

Cement should have a compressive strength of at least 500 psi at the casing shoe and 1200 psi at bottomhole, and for production casing must withstand the anticipated fracturing pressure

Each casing string (except for the conductor casing) should be pressure tested prior to “drill out”

HF Related Documents and Standards – HF1 diagram



HF Related Documents and Standards

- HF2, *Water Management Associated with Hydraulic Fracturing*, 1st Edition, June 2010

- Guidance Document contains 7 sections:

  - Scope, Definitions, Introduction and Overview, Hydraulic Fracturing Process

  - Water Use and Management Associated with Hydraulic Fracturing, Obtaining Water Supply for Fracturing, Water Management and Disposal Associated with Hydraulic Fracturing

HF Related Documents and Standards

- HF2, *Water Management Associated with Hydraulic Fracturing*, 1st Edition, June 2010

- Scope:The purpose of this guidance document is to identify and describe many of the current industry best practices used to minimize environmental and societal impacts associated with the acquisition, use, management, treatment, and disposal of water and other fluids associated with the process of hydraulic fracturing. While this document focuses primarily on issues associated with hydraulic fracturing pursued in deep shale gas development, it also describes the important distinctions related to hydraulic fracturing in other applications.

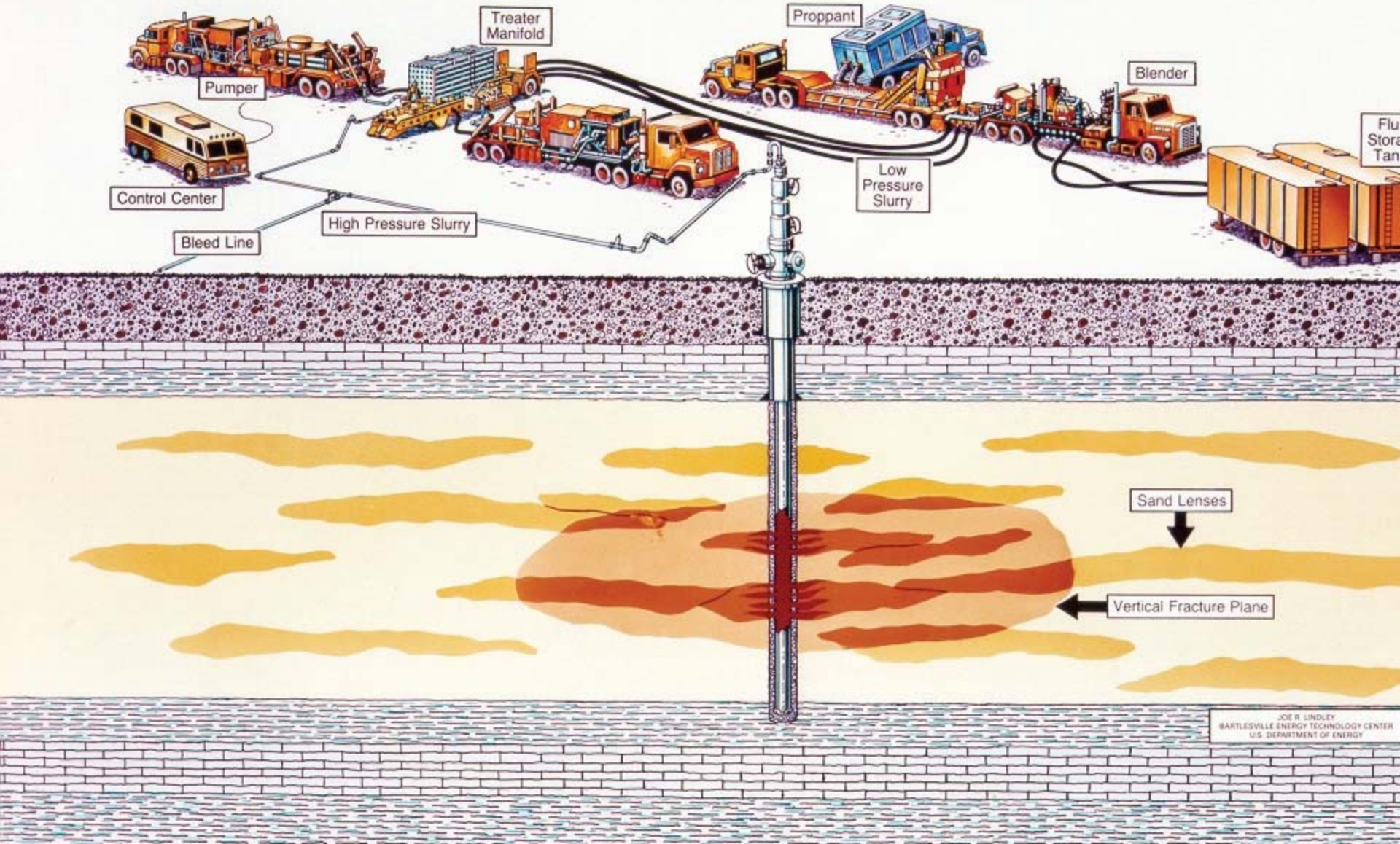
HF Related Documents and Standards – HF2

Section 7 - Water Management And Disposal Associated With Hydraulic Fracturing – Key Environmental Protection

Well permits specify all fluids, including fracturing fluids and flow back water, must be removed
Water disposal can include:
•UIC well
•Treatment at a facility or on site
•Reused/recycled
Operators should prepare for proper management and disposal by working with state, regional and local regulators to ensure surface and groundwater quality
Primary potential destinations for flow back/production fluids generally include the following:
- injection wells, which are regulated under either a state or federal UIC program;
- municipal waste water treatment facilities;
- industrial waste treatment facilities;
- other industrial uses;
- fracture flow back water recycling/reuse.

HYDRAULIC FRACTURING

Hydraulic fracturing is a means of creating fractures emanating from the well bore in a producing formation to provide increased flow channels for production. A viscous fluid containing a proppant such as sand is injected under high pressure until the desired fracturing is achieved. The pressure is then released allowing the fluid to return to the well. The proppant, however, remains in the fractures preventing them from closing.



HF Related Documents and Standards

- HF3, *Practices for Mitigating Surface Impacts Associated with Hydraulic Fracturing*, 1st Edition, January 2011

- Guidance Document contains 15 sections:

  - Scope, Terms & Definitions, Introduction & Overview, Stakeholder Engagement, Wide-scale Development, Selection of Hydraulic Fracturing Fluids, Management of Chemicals and Materials, Transport of Chemicals and other Materials

  - Pre-job Planning, Water Management, Maintaining Equipment & Facilities, Minimizing Surface Disturbance, Protecting Air Quality, Preserving Visual Resources, Mitigating Noise Impacts

HF Related Documents and Standards

- HF3, *Practices for Mitigating Surface Impacts Associated with Hydraulic Fracturing*, 1st Edition, January 2011

- Scope: The purpose of this guidance document is to identify and describe practices currently used in the oil and natural gas industry to minimize surface environmental impacts—potential impacts on surface water, soils, wildlife, other surface ecosystems and nearby communities—associated with hydraulic fracturing operations. While this document focuses primarily on issues associated with operations in deep shale gas developments, it also describes the important distinctions related to hydraulic fracturing in other applications.

HF Related Documents and Standards

- HF3, *Practices for Mitigating Surface Impacts Associated with Hydraulic Fracturing*, 1st Edition, January 2011

Section 7 – Management of Chemicals and Materials, Key Environmental Section:

Like other exploration and production activities, both service companies and operators have key roles in managing the chemicals and materials stored and utilized on site for fracturing operations. It is the responsibility of the service companies to educate operators about the various fluids and additives that may be used as a part of a fracture fluid. An essential first step is providing operators with the Material Safety and Data Sheets (MSDS) for products used in their wells.

Operating companies have the responsibility to understand the base fluids and additives that may be used as a part of a fracture fluid and to utilize proper handling procedures of the fluid during fracture treatment and flowback. Service companies work with operators for optimal fracturing designs, which should include a full complement of suggested fluid alternatives, along with the potential environmental impacts and costs associated with each alternative. Training and procedures for operating and handling for each chemical utilized in the fracturing process improve responsiveness to potential surface incidents. As part of the overall operation plan, service companies should provide operating and handling procedures for each chemical utilized, including those for emergencies and disposal.

API recommends that operators be prepared to disclose information on chemical additives and their ingredients

HF Related Documents and Standards

- 51R, *Environmental Protection for Onshore Oil and Gas Production Operations and Leases, 1st* Edition, July 2009
- Recommended Practice contains 8 sections:
  - Scope, References, Acronyms and Abbreviations, Government Agencies
  - Lease Roads, Production, Injection/Disposal Wells, Lease Gathering and System Lines, Production and Water Handling Facilities

HF Related Documents and Standards

- 51R, *Environmental Protection for Onshore Oil and Gas Production Operations and Leases, 1st* Edition, July 2009

- Scope: This standard provides environmentally sound practices for domestic onshore oil and gas production operations. It is intended to be applicable to contractors as well as operators. Facilities within the scope of this document include all production facilities, including produced water handling facilities. Offshore and arctic areas are beyond the scope of this document. Operational coverage begins with the design and construction of access roads and well locations, and includes reclamation, abandonment, and restoration operations. Gas compression for transmission purposes or production operations, such as gas lift, pressure maintenance, or enhanced oil recovery (EOR) is included; however, gas processing for liquids recovery is not addressed. Annex A provides guidance for a company to consider as a “good neighbor.”

HF Related Documents and Standards

Plugging and Abandonment – Key Environmental Protection

- Subsurface – knowledge of subsurface aquifers and isolation of downhole formations
- Plugging Purpose – prevention of interzonal migration of fluids and aquifer damage
- Fluid Confinement – Essential to protect all formations bearing usable quality water
- Surface – includes cutting off the surface casing below ground level, restoring the surface to conditions near those that existed prior to the well being drilled, and marking the surface of the wellbore
- Cleanup and Remediation – includes both surface and subsurface
- Soil Erosion – to be completed in accordance with lease terms
- Inspection – final step in process

HF Related Documents and Standards

- 65-2, *Isolating Potential Flow Zones During Well Construction, 2nd* Edition, December May 2010

- Recommended Practice contains 6 sections:

  - Scope, Definitions and Abbreviated Terms, Mechanical Barriers

  - Cementing Practices and Factors Affecting Cementing Success, Leak Off Tests, Post-Cement Job Analysis and Evaluations

HF Related Documents and Standards

- 65-2, *Isolating Potential Flow Zones During Well Construction, 2nd* Edition, December 2010

- Scope: This document contains best practices for zone isolation in wells to prevent annular pressure and/or flow through or past pressure-containment barriers that are installed and verified during well construction. Barriers that seal wellbore and formation pressures or flows may include temporary pressure-containment barriers like hydrostatic head pressure during cement curing and permanent ones such as mechanical seals, shoe formations, and cement. Other well construction (well design, drilling, leak-off tests, etc.) practices that may affect barrier sealing performance are mentioned along with methods to help ensure positive effects or to minimize any negative ones.

HF Related Documents and Standards

Section 4 – Cementing Practices and Factors that affect Cementing Success – Key Environmental Protection

- Hole Geometry - Drilling Fluid Type - Casing Hardware

- Close Tolerance and Flow Restrictions - Engineering Design – Slurry Design and Testing

- Wellbore Preparation – Cement Job Evaluation – Post Cementing Operations

Use of API Standards

- National Technology Transfer and Advancement Act
  - API standards are cited in regulations by the various agencies including the OSHA, EPA, DOT and BOEM per the NTTAA
  - NTTAA requires Federal Agencies to use voluntary consensus standards and encourages participation in the standards development process
  - 100 API standards are cited over 270 times in the U.S. Code of Federal Regulations

Use of API Standards

- Internationally recognized standards, with 225 cited in international regulations
- Increased adoption by federal agencies
  - API does not promote adoption - prefer voluntary use
- Written for flexibility as performance based documents

Conclusions

- API standards represents industry's collective wisdom on operational practices, developed and refined over many years
- API standards are most widely cited here and around the world
- API has all its government-cited and safety standards available for free on-line viewing, and can establish a password protected website for any standards of interest

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Thank you!

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