An Overview of the Uses of an Holistic QMS Standard for Improved Operational Performance in the Oil & Gas Industries

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Topics

- Overview of the Oil & Gas Industries
  - Industry segmentation through the Carbon Value Chain
  - Globalization of markets and infrastructure
  - Complexity of projects

- QMS Standards in Practice
  - Challenges for unified (holistic) QMS standards
  - Recent history of QMS standards for the oil & gas industries
  - Value of further harmonization of standards

- Summary
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- Summary
The New Carbon Value Chain

1. Production at Wellhead or Minemouth
2. Transport to Processing
3. Refinement / Processing
4. Transport to End-User
5. Consumption to Produce:
   - Electric Power
   - New Materials
   - Surface or Air Transportation
6. Capture Waste Gases
7. Transport to Geologic Repository
8. Storage in Geologic Repository
Carbon Industry Segmentation: Upstream

- **Upstream Energy**
  1. Extraction of natural carbon from Earth’s sub-surface
  2. Transportation of raw, natural carbon to facilities where it can be refined

- **Examples:**
  - Oil & gas exploration & production
  - Oil & gas pipelines
  - Oil tankers
  - Coal mining
  - Coal barges & trains
Carbon Industry Segmentation: Midstream

- Midstream Energy
  3. Refinement of raw carbon into marketable commodities
  4. Transportation of carbon commodities to markets

Examples:
- Oil refineries
- Petrochemical plants
- Natural gas processing plants
- Pipelines
- Product storage facilities
- Natural gas liquefaction plants
- Liquefied natural gas (LNG) tankers
Carbon Industry Segmentation: Downstream

- **Downstream Energy**
  
  5. End-user distribution or consumption of carbon commodities
     
     a) Fuel to provide heating
     b) Fuel to generate electrical power
     c) Fuel to transport goods or people
     d) Raw material for manufacturing

- **Examples:**
  
  - Natural gas distribution companies
  - Electric power plants
  - Planes, trains & automobiles
  - Fertilizer, plastics & pharmaceutical manufacturing
Industrial Contrast of Gas vs. Oil

Oil Play (with Associated Gas)

Natural Gas Play (no Oil)

Pipelines, Ocean Tankers & Trucking

Oil

Pipelines

Wet Gas

Pipelines

Dry Natural Gas (NG)

Pipelines

Ocean Tankers

Natural Gas Liquids (NGLs)

Pipelines

Refinery or Petrochemical Plant

Liquid Fuels & Chemical Feedstocks

Pipelines

Refined-Product Markets

Gas Processing Plant

NGL Markets

NG Markets
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● Summary
Globalization of Crude Oil Markets

1 Tonne = 7.33 Barrels = 307.86 US Gallons

Global Net Oil Movements

Balance of Trade in Crude Oil as of 2007
(Millions of Barrels per Day)

- Net Export
- Net Import

Data Source
BP Statistical Review of World Energy 2008
Globalization of Natural Gas Markets

1 Billion m$^3$ = 35.3 Billion ft$^3$
= 0.73 Million Tonnes LNG
= 0.90 Million Tonnes Oil-Equivalent

Balance of Trade in Natural Gas as of 2007
(Billions of Cubic Feet per Day)

Data Source:
BP Statistical Review of World Energy 2008
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- Summary
Complexity of Oil & Gas Projects as a Challenge for QMS* Standards

- Many different companies employed for specialized skills
  - Resource administration
  - Exploration & drilling
  - Equipment manufacturing
  - Pipeline construction
  - Production operations
  - Shipping operations
- Geographically extended (global) supply chains
- Long lead times for project completion
  - Typically 10-15 years from oil first discovered to commercial production (sometimes faster for gas-only resources)
  - Frequent mergers & acquisitions involving participating companies

* Quality Management System (QMS), possibly including also Safety & Loss Management System (SLMS) and/or Risk Management System (RMS)
Complexity of Oil & Gas Projects
USA Natural Gas Pipelines

302,000 total miles as of 2007

Legend
- Interstate Pipelines
- Intrastate Pipelines

Source: Energy Information Administration, Office of Oil & Gas, Natural Gas Division, Gas Transportation Information System
Complexity of Oil & Gas Projects
Example: The Independence Hub

- **Location & Purpose**
  - Gulf of Mexico, Lease Block Mississippi Canyon 920
  - Produce & gather 1 Bcf / d of natural gas and condensate from 10 different fields in 4 different lease blocks

- **Physical Challenges**
  - Deepest setting for pipelines & risers: 8,000 ft (2,440 m)
  - Deepest setting for a platform: 8,000 ft
  - Deepest sub-sea production: 9,000 ft (2,745 m)
  - 15 sub-sea wells with 220 miles (354 km) of sub-sea flow lines
  - Gas travels 134 miles (216 km) through Independence Trail pipeline to platform in West Delta 68, where it divides to separate shore bases

- **Production Start: July 2007**
Complexity of Oil & Gas Projects
Example: The Independence Hub

- **Co-Owners**
  - Enterprise Products Partners LP (80%)
  - Helix Energy Solutions (20%)

- **Producer Group**
  - Anadarko Petroleum Corp. (Leader / Manager)
  - Kerr-McGee Corp. . . . which merged with Anadarko
  - Spinnaker Exploration Co. . . . which was acquired by Norsk Hydro, which later merged into Statoil-Hydro
  - Dominion Exploration and Production Inc. . . . later acquired by ENI Petroleum

- **Constructor Contractors**
  - Atlantia Offshore Limited
  - Heerema Marine Contractors
  - Alliance Engineering
  - Kiewit Offshore Services
  - Allseas USA, Inc.

- **Development Cost:** $693 M
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    - Recent history of QMS standards for the oil & gas industries
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- Summary
Challenges for Unified (Holistic) QMS* Standards in the Oil & Gas Industries

- Long-Standing Historical Segmentation
  - Upstream - Midstream - Downstream
  - Gas Industry related to - but not the same as - Oil Industry

- Uneven Globalization
  - Regional differences exist both in business practices and in preferred standards

- Complexity of Large Projects
  - Many projects (especially Upstream) are joint ventures
  - A single prime contractor usually employs several different sub-contractors – a diverse workforce with various corporate cultures

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  ➔ Recent history of QMS standards for the oil & gas industries
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- Summary
Recent History of QMS* Standards for the Oil & Gas Industries

ISO/TS 29001:2003
Detailed, sector-specific requirements for:
- Design
- Development
- Production
- Installation
- Service
- Emphasis on independent assessments of:
  - Design reviews
  - Product / service acceptance
  - Internal audits

ISO/TS 29001:2007

API Q1 – 7
ISO/TS 29001 plus API admin req’s.

ISO 9001:2000
General requirements with wide applicability

American Petroleum Institute (API)

ISO 9001:1994

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Comparative Review & Approach to an Holistic QMS* Standard for the Oil & Gas Industries

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<td>1. Management Responsibility</td>
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<td>2. Resource Management</td>
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<td>3. Product, Service, Project or Operation Realization</td>
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<td>4. Design and Development (including selection of materials)</td>
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<td>5. Purchasing</td>
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<td>6. Production and Service Provision (including construction and installation)</td>
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<td>7. Measurement, Analysis and Improvement (including Continuous Improvement)</td>
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**ASQ-EED Gas & Oil Committee’s Analysis:**
- Compare & contrast seven (7) existing standards, including special O&G issues
  - Safety & Loss Management
  - Risk Management
  - Producers
  - Suppliers
  - High-pressure equipment
- “Harmonize” comparable elements to approach an “Holistic Standard”

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## Harmonized Elements in a Possible Holistic QMS* Standard for the Oil & Gas Industries

<table>
<thead>
<tr>
<th>QMS Element (Harmonized)</th>
<th>Major Responsibilities</th>
<th>No. Major Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Management Responsibility</td>
<td>• Demonstrate top management commitment and clearly communicate same to employees &amp; contractors</td>
<td>3</td>
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<tr>
<td>2. Resource Management</td>
<td>• Assure that necessary resources are available and that performance standards are clear to employees &amp; contractors</td>
<td>8</td>
</tr>
<tr>
<td>3. Product, Service, Project or Operation Realization</td>
<td>• Develop, document and implement specific plans &amp; procedures for accomplishing work</td>
<td>9</td>
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<tr>
<td>4. Design and Development (including selection of materials)</td>
<td>• Develop and implement specific procedures for design and documentation of design conformance</td>
<td>6</td>
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<tr>
<td>5. Purchasing</td>
<td>• Implement procedures for control of suppliers and all purchased products</td>
<td>1</td>
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<tr>
<td>6. Production and Service Provision (including construction and installation)</td>
<td>• Develop, document and implement specific plans and procedures for delivery of services, including safety &amp; reliability</td>
<td>12</td>
</tr>
<tr>
<td>7. Measurement, Analysis and Improvement (including Continuous Improvement)</td>
<td>• Implement procedures for monitoring, measuring and improving work processes</td>
<td>3</td>
</tr>
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_value of further harmonization of standards_

● Summary
Value of More Harmonized O&G QMS Standards

- Streamline quality assurance during “hand-off” of raw carbon or refined carbon commodities
  - Reduce variance among QMS standards along the Carbon Value Chain
  - Enhance commerce by simplified administration of quality assurance

**Example:** Getting natural gas to the end-user

**Upstream**
- Produce gas
- Perform early metering

**Midstream**
- Remove impurities & split liquids
- Perform final metering
- Ship to wholesale markets

**Downstream**
- Distribute to retail markets

Examples of Dominant Influences Regarding Practices:

- Minerals Management Service (MMS) or Bureau of Land Management (BLM)
- American Petroleum Institute (API)
- Federal Energy Regulatory Commission (FERC)
- Gas Processors Association (GPA)
- State Public Utility Commissions (PUCs)
- North American Energy Standards Board (NAESB)

- - - - - American Gas Association (AGA) - - - - -
Value of More Harmonized O&G QMS Standards

- Facilitate Emerging & Evolving Interfaces with Other Energy Industries . . .
  - Electric-power generation, transmission & distribution
    - Nuclear as well as fossil fuels
  - Coal mining industry
  - Disposal of carbon “waste” (capture & sequestration)
  - Alternative / renewable energy sources (wind, solar, hydro)

- . . . And Their Traditional Sources of Practices . . .

Edison Electric Institute (EEI)  Nuclear Regulatory Commission (NRC)  North American Electric Reliability Corporation (NERC)

Environmental Protection Agency (EPA)  Emerging Standards Organizations for Capture & Sequestration of Carbon Dioxide
Summary

- Oil & Gas Industries Have Made Significant Progress Toward a Unified Quality Management System (QMS)
  - Functional differences between Gas & Oil industries have presented challenges for a single, comprehensive QMS standard
  - ISO/TS 29001 (derived from ISO 9001) initiated in 2003 but not yet universally adopted
- Additional Value and Effort Remain in Further Harmonization of Oil & Gas QMS Standards
  - A uniform standard adopted along all portions of the Carbon Value Chain (Upstream – Midstream – Downstream)
  - Additional progress will require collaborations among professional organizations that traditionally have influenced different portions of the Carbon Value Chain

agogue ASQ-EED Gas & Oil Committee could serve as facilitator / catalyst for the industry-wide campaign
Thank You

- This Presentation Was Brought to You By:
  Gas & Oil Committee
  Energy & Environmental Division
  American Society for Quality

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