



## ***Can E & P Companies Add to the Bottom Line through Standardization?***

***By R.T. Bud Weightman***

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Lost revenues due to downtime has cost the oil and gas industry millions of dollars, but the breadth of the loss is not fully known to the industry itself. Information can be obtained through research; however, much of the information available focuses on specific equipment failures or failures related to drilling. Comprehensive data does not systemically address failures related to other aspects of an E & P Company's business from exploration through production.

Although some E & P Companies may keep databases on such costs, it is doubtful they are willing to share the information due to legalities or other company related policies.

### Sidebar 1

The compilation of information from 13,700 incidents of equipment failures that caused lost rig time from 1985 to 1991 were documented in a Daily Drilling Report System maintained by the Norwegian Petroleum Directorate for companies drilling on the Norwegian Continental Shelf. An analysis of these documents concluded that \$900 Million US Dollars were spent on lost rig time on an operational cost basis of \$200,000 per 24 hours of rig activity<sup>1</sup>.

Sidebar 1 demonstrates costs due to excessive downtime offshore. However, due to the high cost environment for most activities, offshore-related costs\* are most likely to be better documented.

\*Note: Although these downtime costs are associated with offshore activities, the past consolidation of the oil and gas industry has narrowed the supplier base and offshore related experiences are easily translated to onshore experiences.

Industry-wide information for onshore downtime related from exploration through production is somewhat more obscure. Many E & P Companies keep this information close at hand, if they track it at all. One E & P Company, who asked not to be identified, shared some of their problems (See INSERT 1). Although these problems may seem normal or insignificant to some, they resulted in loss of revenue to the E & P Company and its stakeholders and represent only a fraction of all of the problems being encountered.

In total, the losses to the oil and gas industry, due to downtime and related problems is unfathomable. This article focuses on land-based developments and deals with planning issues to help E & P Companies identify potential pitfalls. Although there is an initial cost to develop such plans, reinvestment for new, comparable activities will be minimal.

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## **Is there a saving through standardization?**

Planning, cost reduction and savings are not new concepts. In fact several such concepts have been around for quite some time, for example:

- The United Kingdom's Cost Reduction Initiative for the New Era (CRINE) (see INSERT #2) was formulated in 1992 as a means of reducing the costs for offshore development.
- The International Organization for Standardization (ISO), Technical Committee (TC) 67, Working Group 2 (see INSERT #3) "Certification Principles for the Oil and Natural Gas Industries" has produced a variety of documents. Their work includes three specific concepts for standardization and cost savings (i.e., functional specifications, technical specifications and classification).
- The International Organization for Standardization (ISO) Technical Committee (TC) 176 for the topic of quality management, amongst a variety of other standards and guidelines, has produced ISO 9001 "Quality Systems – Model for Quality Assurance in Design, Development, Production, Installation and Servicing" (see INSERT #4).

All of these principles promote various levels of standardization and each particular concept has its proponents, including documented successes and savings. However, it wasn't until recently monumental savings could be realized on a single project.

British Petroleum's Andrew Project (see INSERT #5) proved that combining innovation with the existing concepts of CRINE (which includes the use of TC 67, WG2 documents and quality management principles) can bring a massive offshore project in six months early and eighty million pounds under budget.

So, if the Andrew Project was successful using these concepts could these ideas be applied to multiple, land based well sites and be successful? Is there a baseline formula, which could promote consistency and thereby reduce risk and create a savings?

### **A new concept for E&P Companies**

ISO 9000 applications could apply to any type of company or activity. CRINE and TC 67, WG 2 principles have usually been applied to offshore-related projects (e.g., British Petroleum's Andrew Project, a single colossal effort); whereas, the following strategy (identified below) can apply to diverse smaller projects (e.g., numerous wells that make up an entire oil or gas field).

Although certain aspects of this strategy may be currently utilized by some organizations, E&P Companies typically develop their fields based upon their vast industry experience, project management skills, hands-on approach and site supervision skills. Traditionally, the information they maintain are operational logs and related results, including those records required by regulatory authorities, (i.e., as is the case for the example shown in insert #1).

However, little or no planning is usually considered for rapid expansion. When a tentatively small field turns into a bonanza, past development plans are usually put aside for the new and improved concept of concurrent development (i.e., several wells being developed simultaneously). Concurrent development presents a whole new set of circumstances by increasing the complexity of the activity. Such increases could include the use of multiple suppliers for the same activity or commodity, adding new personnel (i.e., an E & P Company's, supplier's or third party personnel), or doing the same activities at an accelerated pace, including escalation of

the learning curve – not to mention the presentation of other variables. Where success had been present, the opportunity for mayhem escalates due to the dilution of the attention given to any particular subject or activity.

Therefore, the purpose of implementing such a strategy is to reduce exploration and production costs through planning and standardization; thereby, creating an operational model for consistency which in turn reduces the an E & P Company's liability exposure. Specific benefits would include:

- Minimizing downtime
- Minimizing reworks or rework time
- Minimizing risk due to failure
- Bottom line contribution to development/operating expense through consistency of operations

It is not necessary for an E & P Company to fully subscribe to all aspects of CRINE; TC 67, WG2 principles; and ISO 9001 to realize huge benefits from applying quality principles and standardization. All that is necessary is a willingness to plan and implement that plan following some basic principles.

This concept deals with shifting the emphasis solely from production and moving toward a well's operating and life cycle (i.e., beyond decommissioning through reclamation) to reduce production costs after the production is completed thereby: improving production outputs, reducing operating and service costs and improving reliability. Keep in mind insert #1 as this concept unfolds.

## **Long-Term Well Strategy**

### **I. Typical Project Plan**

A typical project plan is considered to be an overall description of a well design and/or expectations for the environmental and operating conditions encountered for the field being developed. The plan could be based upon historical or forecasted data and upon its completion, the plan would represent each subsequent well with the understanding that specific wells may require special, approved alterations to fit its particular circumstances.

The plan could include an overall description of requirements for some of the following topics:

- Drilling Rig, including its components and related services
- The Well, including its components and related services
- Auxiliary Systems, including related services
- Postproduction service related activities, including preventive maintenance

Think of a well as being a huge box with multiple, smaller boxes making up the whole. The box has a specific function and if any one of the multiple, smaller boxes is removed and a replacement is made, is the replacement of sufficient specification (quality, capacity, pressure, availability, dimension, weight, rating, metallurgy, etc.) to ensure that the entire well operates to desired conditions? If not, potential "opportunities"(risks) will most likely present themselves, the question is WHEN? For example, would you protect a 10 amp wire, in a breaker box, with a 50 amp breaker (i.e., if you did, you increase the probability of a fire)? Can something, which appears so minor, be the catalyst for a catastrophic event? You bet!

This type of planning is an insurance policy for E & P Companies. It can reduce liability; liability being defined as anything that has the potential to cause the loss of revenue (e.g., downtime, catastrophe, accident, etc.) or which creates undue publicity. Therefore, once a project plan is developed, any approved critical piece of equipment, any approved critical service and/or any approved critical activity can be exchanged at will, with an assurance that the well(s) will operate as designed (planned).

The documented project plan could portray select, smaller boxes which represent a single commodity (e.g., equipment, service, etc.), but possibly for more than a single supplier (e.g., cementing activity, approved suppliers: Joe’s Cementing Service or Well Cementing, Inc.). This would allow a flexibility to choose (or exchange) pre-approved suppliers for a specific activity (i.e., depending upon availability) without concern of an unplanned or catastrophic event.

The project plan will be supported by various specification requirements (i.e., functional and technical specifications) for critical equipment, services and/or activities (i.e., they will delineate the specific requirements for “any one of those multiple, smaller boxes” to ensure that an exchange will not present undue risks). The plan should identify what the key risks are, the probability of consequences occurring and the degree of the consequence.

**Criticality**

The key to the project plan is adequately determining the criticality for specific operations and circumstances. Criticality could mean different things to different people. A guide for determining criticality is ISO/PDTR 13881 <sup>7</sup> Technical report type 2 – “Classification of products (e.g., equipment), services and processes (e.g., activities)”. This rating system assists an E & P Company to identify what is actually critical, since all equipment, services and/or activities are most likely not considered to be critical.

Criticality may be best determined upon completion of the functional specifications discussed herein. Further consideration to determining criticality is the identification of the supplier and your level of experience with that supplier. If you have previous, successful experience with a supplier your “risk” may not be as great; however, if you decide to have a back-up supplier for those activities, the risk may increase due to your lack of experience with that supplier. Also, a more critical view may taken with suppliers in the area of emerging technologies, since new applications are being developed and as of yet may be untried.

**Project Plan Kick-off**

To initiate a project plan, the E & P Company will have to come up with the overall requirements (e.g., quality, capacity, pressure, availability, dimension, weight, rating, metallurgy, etc.) for each of the critical commodities of the well. This would require an analysis of the commodity for each box as it relates to the functioning of the well (i.e., in relationship for the specific circumstances of the field being developed). A method of determining applicable criteria to be analyzed could come from a master (i.e., an accumulation of data which represents all commodities interacting for the well to function) Design and Development Input Checklist (Table 1) which represents every potential contingency for exploration and production aspects of any well (i.e., you would want to include conditions which may not be encountered in your field to show due diligence that all factors were considered).

<b>Table 1, Sample Design and Development Input Checklist</b>		
—	<b>A</b>	Functions of each system and performance requirements such as capacity, rating, system output
—	<b>B</b>	Codes, standards and regulatory requirements

___	<b>C</b>	Environmental conditions: risks, impacts, opportunities
___	<b>D</b>	Equipment interface requirements
___	<b>E</b>	Operational requirements under various conditions, including vibration, stress, shock, reaction forces, corrosion, terrain, start-up, normal operation, shutdown, emergency operation, special or infrequent operation, system abnormal or emergency operation, etc.
	<b>F</b>	Conditions and costs: servicing, maintenance and operations
___	<b>G</b>	Ease of Changeability
___	<b>H</b>	Personnel requirements and limitations including the qualification and number of personnel available for equipment operation, maintenance and testing
___	<b>I</b>	Safety risks, impacts and opportunities

Upon analysis of a commodity a Design Review Checklist (Table 2) could be used to ensure that each of the applicable design inputs was considered, documented and acted upon.

<b>Table 2, Sample Design Review Checklist</b>		
___	<b>A</b>	Were the inputs correctly selected and incorporated into the design?
___	<b>B</b>	Are the applicable codes, standards and regulatory requirements including issue and addenda properly identified and are their requirements for design met?
___	<b>C</b>	Are assumptions necessary to perform the design activity adequately described and reasonable?
___	<b>D</b>	Have applicable production and operating experience been considered?
___	<b>E</b>	Are the specified parts, equipment, and processes suitable for the required application? Are spares available?
___	<b>F</b>	Are the specified materials compatible with each other and the design environmental conditions to which the material will be exposed?
___	<b>G</b>	Are accessibility and other design provisions adequate for performance of needed maintenance and repair?
___	<b>H</b>	Have new technologies been considered and tested?
___	<b>I</b>	Have DOE and FMEA's been performed and acted upon?
___	<b>J</b>	Have reviews and/or approvals been obtained?

## **II. Functional Specification**

Upon completion of the analysis phase, functional specifications could be developed. A functional specification is considered to be a document that specifies the totality of needs expressed by features, characteristics, process conditions, boundaries and exclusions defining the performance of the equipment, service and/or activity. A functional specification would also include considerations for: well life cycle, operation, servicing, maintenance, environment and safety.

An E & P Company could develop a functional specification for each critical piece of equipment, service and/or activity to ensure that each of those “multiple, smaller boxes” have defined operating requirements as it relates to the overall well function, including an interface between the E & P Company and its suppliers.

Many feel that existing company and/or industry specifications (e.g., API, ASTM, etc.) suffice for their applications. Such specifications normally address standardization of a product and not it’s full application or interaction with the entire well design and/or environment. However, these do not provide the level of assurance of a well thought-out functional specification.

ISO/CD 13879.3<sup>8</sup> Petroleum and natural gas industries – “Writing and content of a functional specification” provides guidance for functional specifications. Functional specifications should include an analysis of the expected life and de-commissioning requirements for each critical piece of equipment, service and/or activity, including reclamation. The following represents a sample listing of equipment, services and/or activities potentially requiring a functional specification:

- A. Drilling Rig, including critical components
- B. Well, including critical components
- C. Service Related Activities
  - 1. Logging
  - 2. Fraccing
  - 3. Other Critical Service Related Activities
  - 4. Post production servicing, including preventive maintenance
- D. Auxiliary Systems
  - 1. Pipeline
  - 2. Other Critical Auxiliary Systems

### **III. Technical Specification**

Accordingly, for each functional specification, an E & P Company should require each critical commodity supplier to develop technical specifications. A technical specification is considered to be a document that prescribes technical requirements to be fulfilled by the equipment, service and/or activity in order to comply with the functional specification.

Compliance to the technical specification could translate into the need to develop specific operational or testing procedures. This need must be analyzed for each technical specification.

If an E & P Company already has wells in various stages of process, the project engineer could evaluate the supplier’s equipment, service and/or activity and create a report to substantiate that it meets the requirements of the functional specification or use some other logical method to ensure that a level of confidence is present.

ISO/CD 13880.3<sup>9</sup> Petroleum and natural gas industries – “Writing and content of a technical specification” provides guidance for functional specifications.

### **IV. Quality Related Topics**

The following quality related topics address fundamental, baseline issues, which help, ensure consistency of all related site activities.

## **A. Lines of Communication**

Lines of communication represent the E & P Company's scheduling and information exchange with its suppliers and external regulatory sources. Lines of communication should be established and documented to assure that responsibility, authority and interrelation of personnel who make external contacts, schedule, manage, approve purchase orders, perform and verify work affecting quality/criticality have been sanctioned to do so by the E & P Company's management.

This will assure that all communication has been authorized (i.e., for select personnel) and that communication channels are consistent and reliable, especially when a field rapidly expands.

## **B. Training**

Training is an area of utmost importance to ensure safety, reduce the likelihood of environmental impact, ensure that activities are performed as planned and to attain consistency. There are training programs available for various aspects of oil and gas applications through industry organizations, societies and associations not to mention governmental sources (both federal and state).

Sometimes training issues are so fundamental that they are overlooked (e.g., INSERT #1 addresses a variety of problems, some of which may have been averted through proper training which includes training to the appropriate project plan and functional/technical specifications). Training could be included as part of the project plan and implemented through a series of checklists for each specific project phase. The training program must ensure that:

- Personnel\* are initially trained to all aspects of the job
- Newly introduced personnel are brought up to the same level as existing personnel
- Personnel are retrained whenever changes occur in the project plan/specifications (functional/technical)
- Personnel are retrained whenever it is necessary to institute corrective/preventive action

\*Note: Personnel mean all of those who are involved with a specific activity, including personnel from the E & P Company, suppliers or 3<sup>rd</sup> parties.

## **C. Contract Review**

Contract review is considered to be the evaluation of any agreement between the E & P Company and any other parties (e.g., suppliers, processing plants, etc.). A contract review function should be established which includes authorized members of the E & P Company's team. Authorized members include personnel with expenditure authority; authority to sign a legal document and the technical knowledge to assure the contract will produce the desired results (i.e., as specified in the functional specification and technical specifications).

Special considerations should be given to assuring that:

- Appropriate communications between the contracted party (e.g., supplier) and the E & P Company is identified
- The E & P Company's position on subcontracting activities is clear

- Insurance, health and safety, including environmental requirements are apparent
- Responsibility for problem reporting and rework is addressed
- Requirements for processing corrective and preventive actions
- Modifications (through amendment or verbal means) to the contract are agreed upon and documented by authorized personnel

Contract records should be maintained so they are easily retrievable and available for review by the E & P Company and contracted party. Originals should be retained in a safe and secure location.

#### **D. Supplier Approval**

A supplier is considered to be any party who performs work on a project who is not on the E & P Company's payroll. For example, suppliers would include the drilling contractor, pipeline contractor, wellhead equipment supplier, fracing company, logging company, contract geologist or engineers, laboratories, etc. Additionally, suppliers could be internal (sometimes referred to as 2<sup>nd</sup> party suppliers) or external (sometimes referred to as 3<sup>rd</sup> party suppliers), depending upon the organizational structure of the E & P Company.

Criteria for acceptable performance for each specific, critical function should be specified by the E & P Company as part of the functional specifications included in the project plan. Approval of these suppliers constitutes a documented evaluation of their capability to perform each critical activity as specified by the project plan/functional specifications.

Keeping the functional specification in mind, evaluation could include, but not be limited to any one of the following:

- Approval of the technical specification
- An engineering evaluation of specific circumstances
- The witnessing of a supplier performing a specific activity
- The successful, past usage of a specific piece of equipment/service
- Capacity
- Technical personnel capability
- Capability to meet requirements of work to be performed or the specification(s)
- Past experience
- Reliability
- Types of past nonconformances encountered

All approved suppliers should be recorded and should be traceable to the project plan to assure that the appropriate, E & P Company personnel readily know which equipment, service and/or activity may be exchanged, where needed.

A further step to approved suppliers could include strategic alliances. Many strategic alliances focus on reducing the number of suppliers, thereby increasing reliability (i.e., providing that proper project planning is achieved). Additionally, some strategic alliances offer incentives to improve life cycle costs, tying profits to performance (e.g., a supplier may win a bonus if one of their goals is to increase the output of a well and improve operating costs).

#### **E. Problem/Event Reporting**

Problem reporting represents the need to document those events, which potentially jeopardize quality/criticality. Quality and/or criticality could be defined as how much will it cost the E & P Company (e.g., in time, material, resources, etc. – all of this = dollars) to re-perform an activity, to replace/recover parts or components or to reinitiate a specific sequence of events.

The documentation of such problems identifies all of the appropriate circumstances surrounding the problem, the “fix” to the problem and actions taken so the problem will not happen again. In the long-term, this documentation could be tracked to identify any potential trend of events.

#### **F. Functional Verification Planning**

Functional Verification Planning is considered to be the pre-evaluation, (either through inspection, testing or other functional means), of supplier equipment, service and/or activity prior to a critical operation. The purpose of such verification activities is to assure that the equipment, service and/or activity will perform as planned and to assure that no unexpected risks occur (any failure of the equipment, service or activity to operate as required represent additional costs to the E & P Company).

Depending upon the E & P Company’s philosophy and resources, such functional verification planning could be included in the appropriate functional/technical specification and be performed by the supplier prior to the initiation of a specific event.

#### **G. Record Keeping**

Records provide evidence, where required, that specific activities have been accomplished. Records are normally retained to provide:

- Evidence that a contract was satisfactorily completed
- Due diligence that the wells will operate as planned
- Evidence that regulatory requirements were met
- Problems and outstanding issues were resolved

Records establish a history for a specific project, which could be called upon for future applications if the need should exist and should be retained for a predetermined duration in an area where they will be protected and safe. An example of some of the records possibly necessary includes:

- The Project plan, including Functional and Technical Specifications

- Design and Development Input Checklists and Design Review Checklists for each well
- Drilling and Operational records
- Functional Verifications
- Problem/Event Reports
- Maintenance records
- Contracts
- Supplier approvals
- Regulatory required records
- E & P Company required records

#### **H. Opportunities for Improvements**

Throughout the planning process and the implementation of the project plan, many new ideas will arise. Some E & P Companies maintain a collective database for these ideas and address them in the order of significance or impact to the project. Cross-functional Opportunity for Improvement Teams could be established to effect these new ideas.

Considerations should be given to the revision of the project plan, functional and technical specifications and any other documents as necessary, including the retraining of personnel to effect these improvements.

Does your documentation allow you to identify your downtime costs? Do you know your costs or liabilities associated with the lack of planning? Are your stakeholders aware of the potential bottom line profits?

If your answer to any of these questions is “no”, perhaps it is time to invest in your company’s future by instituting comprehensive project planning.

***Downtime Costs & Causes (INSERT #1)***

<b>Problem</b>	<b>Probable Cause</b>	<b>Potential Cost</b>
<p><b>1. Drilling</b> - Water to the centrifuge was shut off, resulting in mud caking-up and drying in the centrifuge. The centrifuge heated-up and its safety system shut it down. Thereafter, the centrifuge could not be turned back on.</p>	<p>Equipment was shut off when not in use, but it should have actually remained on.</p>	<p>Service contractor call to clear centrifuge. Actual downtime was 6 hours, plus loss of actual drilling time and the cost of a service call.</p> <p>If condition were more serious, it could have resulted in the replacement of the centrifuge. This could have caused an approximate 2-day delay in downtime.</p>
<p><b>2. Drilling</b> – Mud pump (1 of 2) down. Company man monitoring mud pump pressure</p> <p>Pressure was ½ of what it should have been (i.e., 500 PSI in lieu of 1,000 PSI).</p>	<p>Out take valve was shut off.</p>	<p>Not maintaining proper mud weight:</p> <ul style="list-style-type: none"> <li>• Drilling was slowed down to maintain the proper mud weight while mud pump was working.</li> <li>• Weight too light – potential blowout.</li> <li>• Weight too heavy – mud goes into formation possibly damaging it. Lose mud, ruin formation.</li> </ul>
<p><b>3. Drilling</b> - Bit change took 12 hours @ ~ 3,800 feet – should have been done in ~ 7 hours.</p>	<p>Drill hands not using an efficient method in nipping-up drill pipe</p>	<p>Wasted time. Concern increases as the well gets deeper.</p> <p>Potential increase of an accident happening (i.e., increased connection time and handling of drill pipe)</p>
<p><b>4. Well Site Preparation</b> - Coliche clay surface had cured and was ready to receive rig. 3 days prior to rig moving in – strong rainstorms hit area. Ground softened, particularly in area where rig was to be located. Rain continued when rig was moving in.</p> <p>Tool pusher forewarned company man of exiting condition that the area had to be dried out before setting the rig (e.g., by a couple days of sunshine or by adding additional clay).</p>	<p>Not having a standby crew available to repair rig site.</p>	<p>2 days of downtime, plus call-out for service company.</p>
<p><b>5. Well Completion</b> - Specialized fracturing situation. Well fracing improperly performed.</p>	<p>Weight, type, size of propan, including delivery pressure – incorrect.</p>	<p>Well zone producing 1/10<sup>th</sup> of what it is designed to produce.</p>

Notes:

1. These examples are only a thumbnail sketch of the actual condition, which existed.
2. Costs could skyrocket depending upon the location of the well site in proximity to the location of service companies and/or replacement parts/equipment.
3. Arguably, these costs could be passed on to the drilling contractor in some circumstances (e.g. a turnkey contract), but the operator's costs include down time, potential liability related to accidents, costs related to non-drilling contractor activities (e.g., day rates, personnel and equipment rentals, the cost of not drilling while maintaining other expenses and not bringing the well on-line in the time frame expected).

## ***CRINE*<sup>2</sup> (INSERT #2)**

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The Cost Reduction Initiative for the New Era (CRINE) was established in the UK in 1992 as a means of developing offshore discoveries, which were small but significant. During the day, such discoveries were not economical to produce due to rising capital and operating costs. CRINE identified significant cost drivers and defined ways to lower costs and to shorten the development life cycle through the following objectives:

- Maximize standardization and repeatability in design, procurement and construction
- Introduce fit-for-purpose, functionality into codes, specification, contracting and procurement documentation aimed at standardization and simplification
- Develop industry standards for efficient, cost-effective and necessary certification aimed at self-certification
- Rationalize the supply of quality, fit-for-purpose equipment so that the procurement time and cost can be reduced while increasing the reliability, safety and operability of equipment
- Introduce philosophies and codes of practice to self-regulate activities in the furtherance of cost-effective safety measures in all aspects of operation

To achieve these objectives the CRINE working groups involved a high level of cross-industry support at executive, management and engineering levels. Working group participants included representatives from design contractors, vendors, fabrication contractors, certifying authorities, and marine contractors, as well as E & P Companies.

The CRINE work resulted in the ultimate objective of achieving a substantial reduction in the cost base of development and production activities through application of the following recommendations:

- Use standard equipment
- Use functional specifications
- Use criticality to determine documentation requirements
- Simplify/clarify contract language and eliminate adversarial clauses
- Rationalize regulations on certification, Production Consents, Pipeline Work Authorizations and Field Development Programs
- Raise the credibility of qualify qualifications

The adoption and implementation of these recommendations was projected to lead to a transformation in the industry by generating at least a 30% reduction in capital costs within 2 – 3 years and by leading to lower operating costs, simplified maintenance and an inherently safer working environment.

Various companies have demonstrated the successful implementation of the CRINE principles in a number of instances:

- Utilizing non-prescriptive standards
- Purchasing of major equipment as standard vendor products
- Employing smaller site teams and partnership/alliance contracts for design and fabrication

The most notable savings are documented by British Petroleum (see INSERT #5 British Petroleum's Andrew Project).

The International Organization for Standardization (ISO)/Technical Committee (TC) 67 (see Sidebar 1)/ Work Group (WG) 2 titled “Certification Principles for the Petroleum & Natural Gas Industry” movement is being driven by:

- Customer requirements (mainly due to safety and reliability);
- Marketplace demand (to improve competitive position);
- As a means of complying with potential European Union (EU) directives; and
- Operational excellence.

<i>Sidebar 1 ISO TC 67</i>
ISO TC 67 is responsible for the development of standards for materials, services, and equipment that are used in drilling production, refining and the transport by pipelines of petroleum and natural gas

WG2 was formed to address the wide array of failures of oil & gas equipment in operation. Statistics show that the failures have caused:

- Loss of life;
- Damage to operating facilities
- Environmental impacts
- Billions of dollars of losses

Subsequently, WG2 activities have resulted in the development of five inter-dependent documents (see Table 1) which may become the basis for worldwide voluntary certification activities in the Oil and Gas Industry. The purpose of these documents is to have a consistent approach towards giving confidence to the end user that products comply with specified requirements. These documents present a new method to the purchaser for conducting business: Limit the purchaser’s involvement in specifying the methods of manufacturing; instead focus on activities that ensure the functionality and fitness for use of the supplied product or service.

The purchaser of the product or service may impose the documents’ requirements on suppliers of Oil and Gas Industry products, equipment and services. The purchaser may specify the certification system and the functional specification for the product or service.

Numerous E & P Companies have adopted these principles internationally as a means of standardizing their project design concepts. The UK’s Cost Reduction Initiative for the New Era (CRINE) has embraced the concept of functional and technical specifications as well as British Petroleum’s Andrew Project (see INSERT #2 and 5 respectively).

*Table 1*

1) **ISO/CD 13879.3 Petroleum and natural gas industries – Writing and content of a functional specification**

**User of the Standard:** The end user of the product or service.

**Description:** This document provides guidance to the purchaser for writing functional specifications for products and services. The functional specification can be an industry standard, a company specification, an industry specification or any combination thereof.

2) **ISO/CD 13880.3 Petroleum and natural gas industries – Writing and content of a technical specification**

**User of the Standard:** The supplier of the product or service.

**Description:** This document provides guidance to the supplier on how to write a technical specification that describes how the requirements of the functional specification will be met.

3) **ISO/PDTR 13881 Technical Report Type 2 - Classification of products, services and processes**

**User of the Standard:** The end user and the supplier.

**Description:** This document describes methods available to the end user for determining the classes of products or services in order to determine the method of certification.

4) **Petroleum and natural gas industries – Definition of certification systems (ISO/PDTR 13882.1).**

**User of the Standard:** The end user and the supplier.

**Description** This document specifies the details of each method of certification

5) **Petroleum and natural gas industries – Requirements applicable to certification bodies (ISO/PDTR 13621.1).**

**User of the Standard:** The entity performing the certification activities

**Description:** This document specifies the requirements (i.e., personnel qualification) for entities providing certification activities.

ISO 9000 quality system certification is a widely publicized movement, which is basically driven by the following forces:

- Required as an option for complying with certain European Directives
- Customer driven (or customer mandated)
- Marketplace driven (due to competition)
- International acceptance (the ISO 9000 series quality system standards have been accepted by at least 80 countries worldwide)
- As a means for improving product quality
- Improve business controls and safety
- Improve productivity

The ISO 9000 series is a group of quality system standards, which identifies 20 quality system elements (ISO 9001, See Table 1) or good business practices that if followed will allow a company to provide consistent and repeatable product. The elements include:

<b>Table 1 ISO 9001 Topics</b>
1. management responsibility
2. quality system (including quality planning)
3. contract review
4. design control
5. document and data control
6. purchasing
7. control of customer supplied product
8. product identification and traceability
9. process control
10. inspection and testing
11. control of inspection, measuring and test equipment
12. inspection and test status
13. control of nonconforming product
14. corrective and preventive action
15. handling, storage, packaging, preservation, and delivery
16. control of quality records
17. internal quality audits
18. training
19. servicing
20. statistical techniques

The process of documenting such a system usually takes anywhere from 6 months to 18 months; however, the duration greatly depends upon each individual supplier (i.e., the amount of quality related expertise and resources to do the work).

Once the quality system is documented, the supplier has two choices: to become certified or not to become certified. The process of quality system certification is performed by a 3rd party known as a certified body or registrar and could cost anywhere from \$15,000 and up for a 3-year period. The cost depends upon the size of facility being certified, number of locations, and a number of other factors. Certification normally builds good will between the supplier and the customer through compliance to an internationally recognized standard, which provides minimum criteria for a quality system.

If a supplier does not feel affected by any of the driving forces of certification, they may forgo certification. However, a documented quality system to the ISO 9000 series has its benefits whether or not certification is chosen.

The benefits of implementing an ISO 9000 quality system are:

- Allows others to understand management's vision
- Demonstrates management's commitment to quality
- Minimizes the risk of poor quality
- Reduce safety incidents
- Creates an opportunity to reduce overall costs through:
  - **Standardization** - product requirements, process parameters, document formats, etc.
  - **Implementation of consistent processes** - throughout all activities, including: the procurement process, production or manufacturing processes, the design process, etc.
  - **Institution of checks and balances** - includes processes, which may not be practiced on a regular basis, such as: corrective and preventive actions, internal audits and management reviews.
  - **Operational excellence** – for all facets of business in lieu of production areas.
- Provides better communications which could lead to a more responsive staff

Certification process provides for a 3<sup>rd</sup> party evaluation of your quality system – an external opinion

- Creates a foundation for continuous improvement - blends with other quality concepts

The Andrew Project field is located offshore 230km northeast of Aberdeen at a depth of 155m. The field was initially discovered in 1974 with recoverable reserves estimated at 112 million barrels of oil and 3.8 billion cubic meters of gas. Not until the early 1990's was a solution available to economically pursue development of this field.

British Petroleum decided to take an unconventional approach to develop this field. Their plan included the adoption of the CRINE initiative (i.e., which includes aspects of the TC 67, WG2 documents) as well as some of the following key factors:

- Formed development partners; facility, well engineering and operations alliances
- Linked profitability to performance through a gainshare agreement
- All companies took part throughout the project as members of a single, fully integrated team
- Implemented, centralized project control functions; cost control, planning and document control
- Continuous monitoring replaced by auditing
- Innovative procurement strategy
- Quality management systems focused on self-regulation
- Opportunity for Improvement scheme

The application of these principles resulted in bringing the project on stream in 1996 more than 6 months early and over 80 million pounds under budget.

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## *Biographical Sketch*

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