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bp

Exploration and Production

Drilling and Completions

Beyond the Best common process

EXHIBIT # 2681
WIT:

Dear Colleagues

I am delighted to be able to present you with a copy of the third edition of the Beyond the Best Common Process Handbook.

Our mission in Drilling and Completions is to delivery industry leading wells that maximize the recovery of BP's global asset base. Beyond the Best (BtB) remains a key component of the strategy since its development in 2001.

The Common Process element of BtB paved the way for a notable breakthrough in performance for D&C. There are now eight common processes, defining 'the BP way' across the E&P segment, and we must all understand how they can help us to work more effectively across teams. This edition of the Handbook contains a chapter explaining the interfaces between Beyond the Best and the other segment common processes.

Other changes to the Handbook, reflecting our ongoing pursuit of simplification, standardisation and performance include:

- Completions Excellence fully integrated within 'mainstream' BtB.
- Technical Limit refocused on "best of the best" and learning.
- No Drilling Surprises aligned with feedback from recent reviews and with D&C risk management practice.
- Front End Loading assessment tool simplified.
- Well Handover Documentation added to Minimum Conditions of Satisfaction.
- Assurance Requirements simplified.

Our Common Process has passed the test of time. By applying it thoughtfully, and evolving it in response to your feedback, I am confident that it will continue to do so.

Barbara Yilmaz
TVP Drilling & Completions

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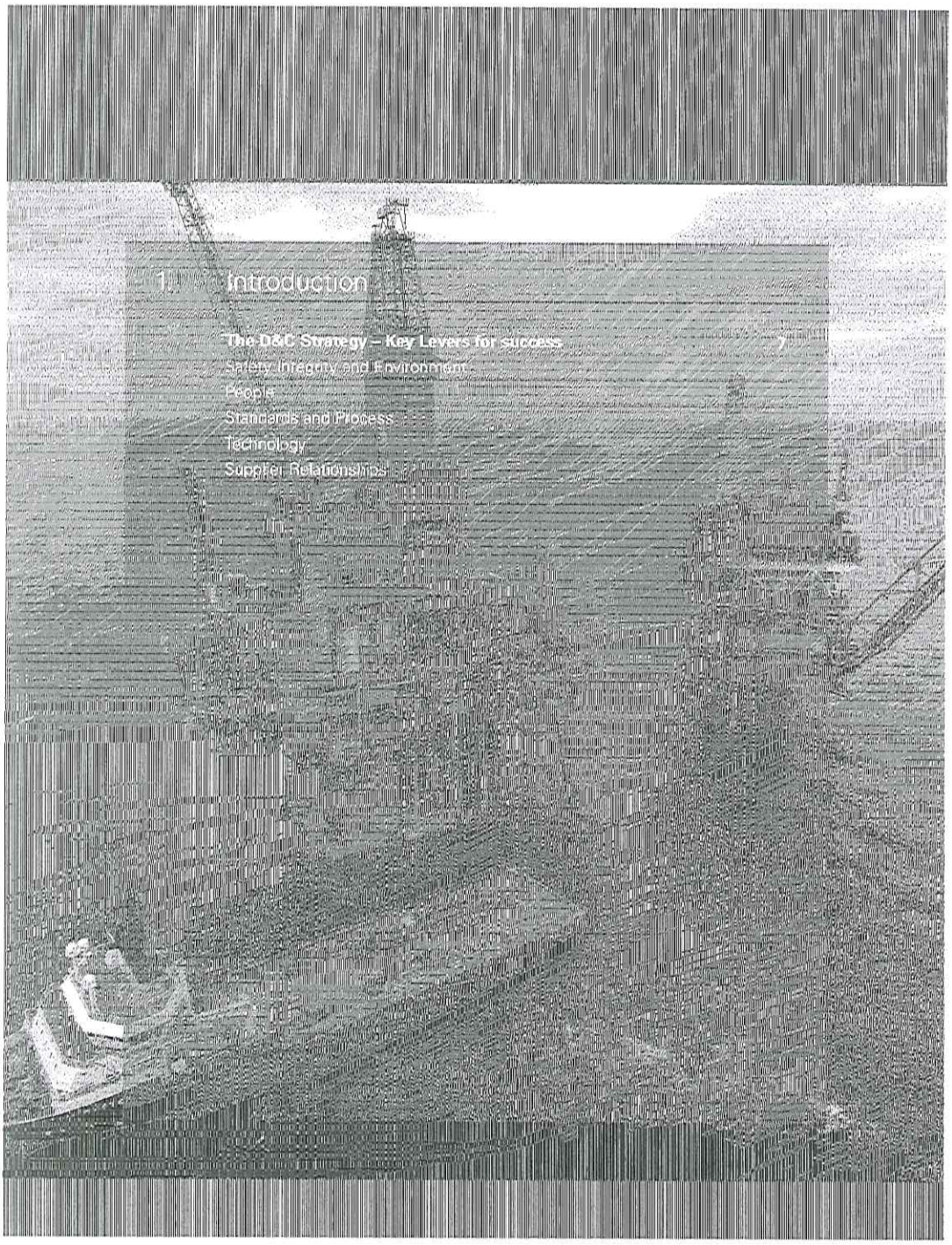

1. Introduction

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Safety, Integrity and Environment

People

Standards and Process

Technology

Supplier Relationships

1. Introduction

The D&C Strategy – Key Levers for Success

"Beyond the Best" is the strategic brand for Drilling & Completions focused on improving performance in drilling and completions efficiency. It targets a prize characterised by improved safety performance, improved capital efficiency and a bigger contribution to production from new wells. Its success is playing a key role in delivering BP's growth agenda.

Safety Integrity and Environment

- Zero is the norm – injuries, incidents, defects and surprises.
- We engineer hazards out.
- Lowest environmental impact.

People

- Attract, inspire and retain a diverse talent pool.
- World class development, deployment and connectivity.
- Value and promote integration.

Standards and Processes

- Common processes and Practices define the way we work.
- Standardization is a core value.
- Every well is better than the previous one.

Technology

- Industry leading solutions to drive business delivery.
- Rapid implementation at scale.
- Continuously extending the limits of what we can do.

Supplier Relationships

- Distinctive relationships based on values, people, and portfolio.
- World class contracting and performance management.
- Our goals are aligned and we reward excellent performance.

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introduction

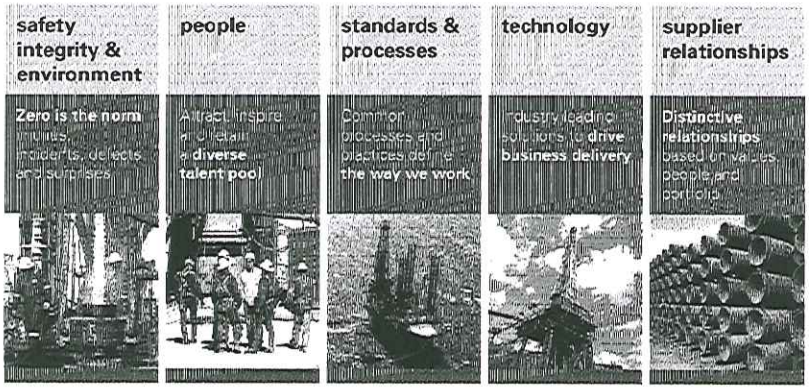

Figure 1-1 The Five Elements of the D&C Strategy.

Beyond the Best common process (BtBcp) is the application of best practices and the building of a common language across the wells community. Its benefits are impressive. Used to its fullest it provides greater clarity and efficiency in how we work and direct our focus to delivering business value. By defining what's core and mandatory in the way we work, it reduces the workload and takes the "noise" out of the system.

Due to its extreme importance, its use is mandatory, stressing rigour and consistency. Common processes address both the design and execution of well programmes through cross-discipline application of four components.

Beyond the Best common process was the first common process in the segment and its successful impact on performance gave impetus to the development of seven additional segment common processes. Since the conception of BtBcp in 2000 we have learned new lessons and identified better practices. This updated publication captures those lessons and best practices. Key changes from the previous publication (Issue 2, 2004) are:

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- Integration of Completions Excellence.
- Focus on "best of the best" and learning in Technical Limit.
- Refreshed NDS aligned with feedback from recent reviews and close alignment with Drilling and Completions Value Assurance risk management practice.
- Simplified Front End Loading Assessment Tool.
- Integration of BtBcp with the other segment common processes.
- Addition of Well Handover Documentation to the Minimum Conditions of Satisfaction.
- Simplification of Assurance requirements.

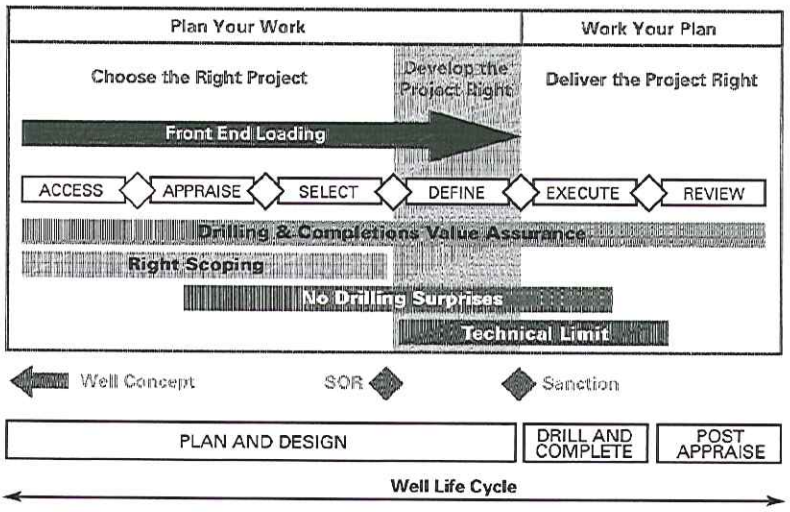

Figure 1-2 "Beyond the Best - Common Process"

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introduction

BtBcp does not define or describe the work we do. It provides a framework and structure to what we do. It should go without saying that focus on BtB CP should not detract from our engineering excellence but augments it.

The first three components: **Right Scoping, No Drilling Surprises and Technical Limit**, address discrete project phases.

The fourth, **Drilling and Completion Value Assurance (D&CVA)**, provides functional assurance throughout the well planning and operations cycle and utilises the existing CVP (Capital Value Process) Frame work. In addition to the core components there are a number of drilling or subsurface best practices, whose use is suggested if they add value.

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Section 1

introduction

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2. d&c value assurance

2.1 Introduction

Drilling & Completion Value Assurance (D&CVA) requires that Drilling and Completion related activity be managed and delivered as projects. Delivering wells as projects will ensure that the necessary high quality detailed planning (front end loading) will be carried out on well projects in a structured and proven manner such that success will be delivered in the operations phase.

D&CVA will provide the framework to focus the multi-discipline work required to deliver the expectations of BP management with respect to drilling and completions in a structured manner. The overall management of wells as projects (D&CVA) will allow the other high value adding common processes of No Drilling Surprises, Technical Limit and Right Scoping to be applied with the maximum efficiency. There is a proven track record of success associated with these processes throughout BP and the industry – to get the maximum benefit we must adopt them all and incorporate them into the way we work.

Learning is a key practice that will be incorporated into the project managed approach to well delivery – it will be integrated into the way the planning and execution are carried out using the full suite of tools and knowledge banks available.

Assurance will be provided in D&CVA by the utilization of the CVP stage gate approach with appointed Gatekeepers (Stage gate reviews supported by Decision Support Packages (DSPs)), peer reviews, the Front End Loading Index (FEL) and Completions Excellence Scorecard. The FEL is a simple system allowing an assessment of the quantity and quality of pre-planning carried out on a well or sequence of wells to be easily assessed at the critical stage reviews.

D&CVA will be used on all wells – the degree of application is dependent upon the size of project. Consideration should be given to batching together small wells into a single project or applying D&CVA and the common processes to a single trial well in a large program of small wells to detirmine to what performance improvements may be obtained. It is down to the PU Leadership to determine its appropriate level of assurance and stage gate reviews apart from those mandated by ESET. The influencing factors will be cost, production, risk, criticality and track record.

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2.2 Overview of the D&CVA Process

D&CVA structure

D&CVA is simply the delivery of a well (or block of wells) as a project in a staged manner. The project management structure as utilised in D&CVA is based around the following simple elements:

- Learning and Knowledge Management.
- Goals.
- Quality and Assurance.
- Scheduling and Planning.
- Risk Management.
- Cost Management.
- Organisation.

If all of these elements are managed and in place and the commitment is made to work in this environment then the team is set up to deliver consistent success.

D&CVA Stages

D&CVA is set up to give wells teams guidance on delivery of wells as projects by using the timeline and stage gate approach of the CVP process. The delivery of the wells project is split into the Access, Appraise, Select, Define, Execute and Review stages as per the CVP process. Decision Support Packages (DSP) based on defined deliverables have to be in place to support movement through these stage gates.

Table 2.2-1 illustrates how the stage gates apply within D&CVA.

The level of mandated external peer review to progress through the D&CVA stages has been determined by ESET in consultation with the D&C discipline. However all other peer reviews will be determined by the SPUs.

Progression from one stage to the next is by way of passing through a gate with a gatekeeper ensuring that the necessary criteria have been satisfied before allowing the project team to move onwards. The selection of gatekeepers will be very much

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asset driven and may not be a single individual. In some cases it can be the Delivery Manager, but may be the Wells Manager. However it will be agreed upfront who will fulfil this role with an appropriate level of distance from the wells project.

D&CVA Stages	What it means to a Well Project
Access	• At the start of a wells project. It involves the evaluation of higher-level project to extract a planned well delivery project. • Input from the multi-disciplined team may be required in certain projects.
Select	• Review all the options and select the right well to drill. The Right Scoping process covers this stage of well delivery.
Define	• Design the selected well option right.
Execute	• Plan and execute the designed well option right.
Review	• Review it right.

Table 2.2-1 D&CVA Stages.

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2.3 The Seven Elements of D&CVA

There are seven elements of the D&CVA process, primarily aligned to project management principles. They are:

Elements 1 – Learning and Knowledge Management

Elements 2 – Goals

Elements 3 – Quality and Assurance

Elements 4 – Scheduling and Planning

Elements 5 – Risk Management

Elements 6 – Cost Management

Elements 7 – Organisation

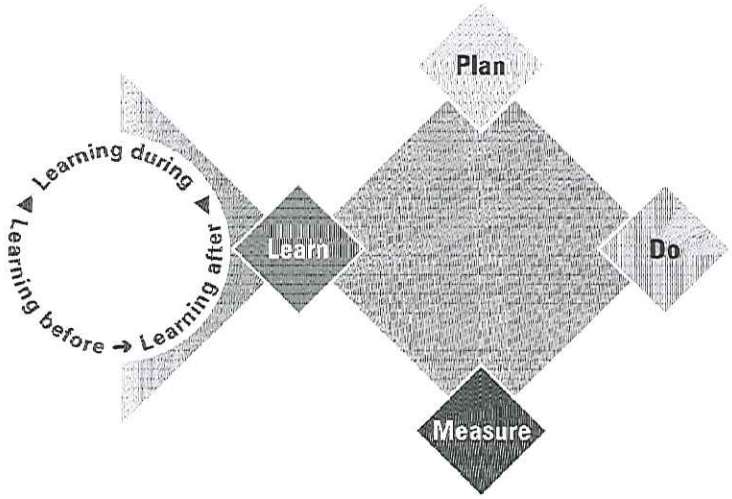

Figure 2E1-1 Learn Before, During and After.

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Element 1 – Learning and Knowledge Management (KM)

"Continuous learning is the lifeblood of the company, it is vital that each of us has access to the most up to date knowledge so that each of us can build on our collective experience."
– Andy Inglis, BP Chief Executive, Exploration & Production

BP's philosophy of continuous learning, expressed in the quote above by Andy Inglis, has driven our focus and commitment to Learning and Knowledge Management (KM) by the D&C community. The results to date are impressive, with sustained improved performance indicated by metrics such as drilling days/10K and cost savings. Our simple yet powerful three-step learning model – Learn Before, During, and After – are shown in *Figure 2E1-1*.

Learn Before Doing – Before becoming activity focused, identify and apply available shared knowledge to improve your plan and maximize the results of your efforts. Chances are, someone has done something very similar before and learned from it. Learning before doing enables you to work smarter and upgrade your planning process. A Peer Assist is the ideal process for this activity.

Learn During – Once you've learned from others, prepare to harvest and benefit from the rich bounty of lessons learned that occur while executing your plan. These lessons reside in the gap between what you thought would happen versus what actually happened: The bigger the gap, the more the potential to learn.

- Identify what went better than expected, as well as those activities that failed to meet expectations.
- Assign and close out action items to quickly apply the lessons learned to benefit your team as well as the global BP community.
- A lesson is only learned when it has been successfully applied to improve performance. An After Action Review (AAR) is an effective process for learning during operations.

Learn After – Conduct a comprehensive look back and collect, distribute, and apply the lessons learned. Identify those who can benefit immediately and invite them to take advantage of your hard won experience. Retrospects and Post Well Reviews are ideal processes for learning after.

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The "Faster" Learning Curve

The learning curves shown in *Figure 2E1-2* illustrates the benefit of learning and KM. Over time, individuals, teams, and entire organizations have an opportunity to learn and improve performance, represented as cost or days to drill or complete a well. This could equally be represented by other value measures such as increased productivity and/or reserves recovery. Our aspiration is to progressively improve and approach the Technical Limit as quickly as possible: By learning from others before taking action, the drive towards Technical Limit is accelerated.

The benefits from learning and KM include:

- Reduced well planning and execution time.
- Elimination of unnecessary work due to "reinventing the wheel".
- Enables operational and functional excellence by sharing "know-how" across the global BP community.
- Quick, effective transition of new team members and thorough knowledge transfer from those leaving.
- Continuous learning and performance improvement as technical and business demands change.
- Sustains application of new technologies and drives innovation.
- Supports risk management through sharing of identified risks and mitigating actions.
- Provides assurance for leadership.

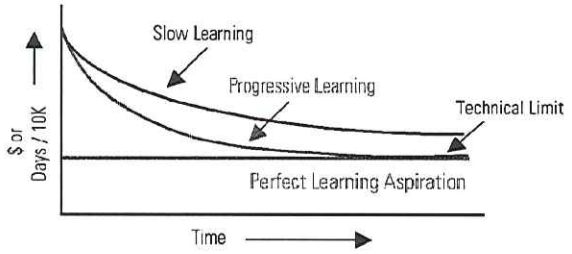

Figure 2E1-2 Learning curve.

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The E&P Knowledge Framework

A common Knowledge Framework has been adopted across all of E&P. The principles underlying this framework include:

- We are a Local Energy Company bound by segment wide Common Processes.
- Knowledge Management underpins every Common Process.

The Knowledge Framework addresses direction, governance, and performance management as well as the people, process, and technology enablers necessary for KM to occur in the organization. This is a systematic approach to Learning & Knowledge Management with five essential components. The content within each component has been reduced to the minimum for success and formulated from the experience of the many years that BP and others have been working organizational knowledge as an asset.

The Knowledge Framework is shown in *Figure 2E1-3*.

This framework includes the **PEOPLE**, **WORKFLOW & TOOLS**, and **TECHNOLOGY** elements that have been used successfully in the D&C Discipline over a number of years.

Each of these elements is described in more detail in the sections below:

People

Knowledge Management Training

This highly praised course helps build learning and KM skills. It is recommended to bring individuals or whole teams up to speed with the learning and knowledge management principles, processes, and tools embedded in the E&P Knowledge Framework. A course description and scheduled offerings can be found on the E&P Portal."

In addition to the training course described above, a series of KM modules have been developed for the online eLearning system, WebLearn. This enables individuals to learn about all the tools and processes within the Knowledge Framework at their own pace.

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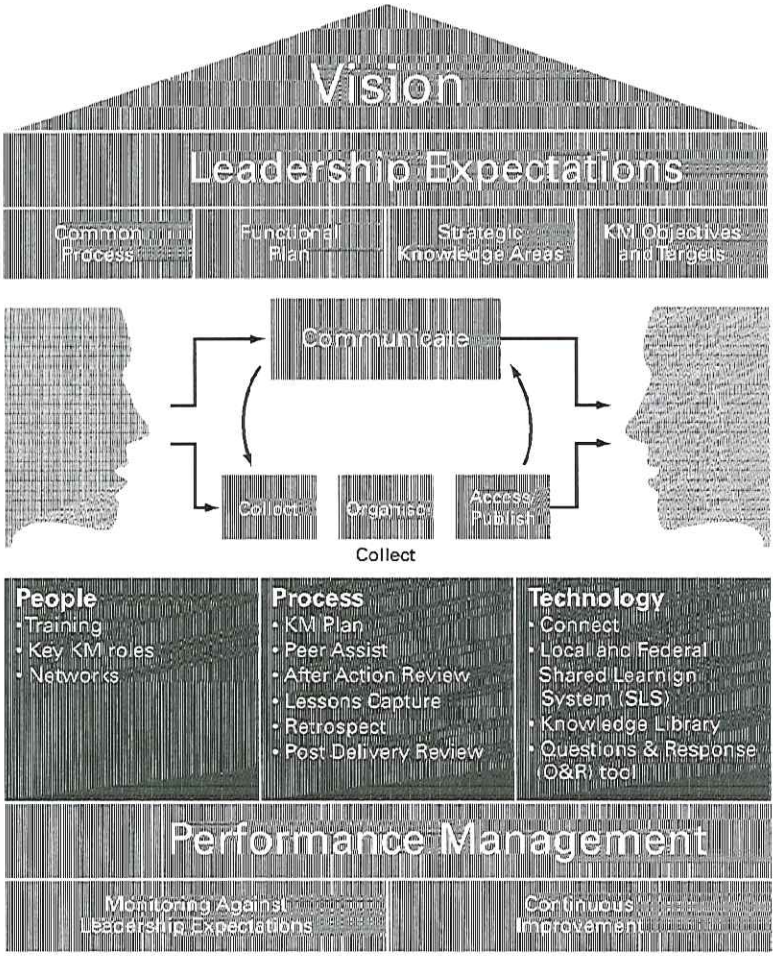

Figure 2E1-3 The E&P Knowledge Framework.

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Key KM Roles

Who will be accountable for each part of the learning process? Typically this might include:

- Wells Manager, Superintendent, or Team Leader. Assuming leadership at this level.
- Provides sponsorship and leadership to coach, facilitate, and promote use of BP's learning tools and processes.
- Encourages a continuous improvement mindset.
- Ensures that measurable learning objectives are represented on team members' performance evaluations.
- Ensures that new team members become familiar with the Knowledge Management Plan as part of their induction process.

KM Champion

- Coach, facilitate, and promote the use of learning tools and processes for the entire Wells Team.
- Perform required administrative tasks for the learning tools and processes (e.g. Teamlink).
- KM Specialist/Coach (can be either part of the team or used on a consultancy basis).
- Assist with the learning induction process as directed by the Learning Champion.

Team members

- Understand and apply basic KM principles as part of the way you work.
- Take the time and make the effort to share your knowledge with others.
- Seek out and apply the knowledge and experience that will help you to be more successful.
- Identify and participate in the networks that most closely link to your area of interest or expertise.

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Networks

Networks are a formal extension of our organisational capability. They are essential to sustaining performance delivery and learning. In line with the segment we have focused the scope of our Networks, aligning their purpose with the business needs and simplifying their remit with a view to further enhancing business performance.

In D&C we have three networks:

- Completions Excellence
- Drilling Engineering Excellence
- D&C Operations Excellence

The Networks will span a number of Communities of Practice to maintain the technical edge of our practitioners. Activities undertaken by these communities will be expressed and funded in line with Network priorities. In D&C we currently have four "communities of practice" that are associated with key operational areas of importance to performance and business delivery:

- Fluids
- Well Placement
- HTHP
- Exploration

As stated above the number and focus of the communities of practice can change depending on business priorities and performance.

Networks have three key objectives *(see Figure 2E1-4)*:

1. Connecting and codifying our capability. This includes acting as a source of expert opinion for the identification and development of technical practices and procedures and accountability for their codification and accessibility to the business.
2. Providing domain expertise for the development of petrotechnical tools and applications.

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3. Providing Solutions to Key Business Problems. Networks may focus on specific cross SPU issues of Segment / Group level significance as requested by the TVP and their extended Functional Leadership Teams. As such each network will have an annual performance contract agreed with the TVP that reflect key areas which will have a significant impact on the business.

Networks' Principles

Specifically our networks will:

- Identify and prioritize performance gaps and issues.
- Develop single solutions to shared problems.
- Codify best practices and processes.
- Engage the D&C community through communication and knowledge sharing.

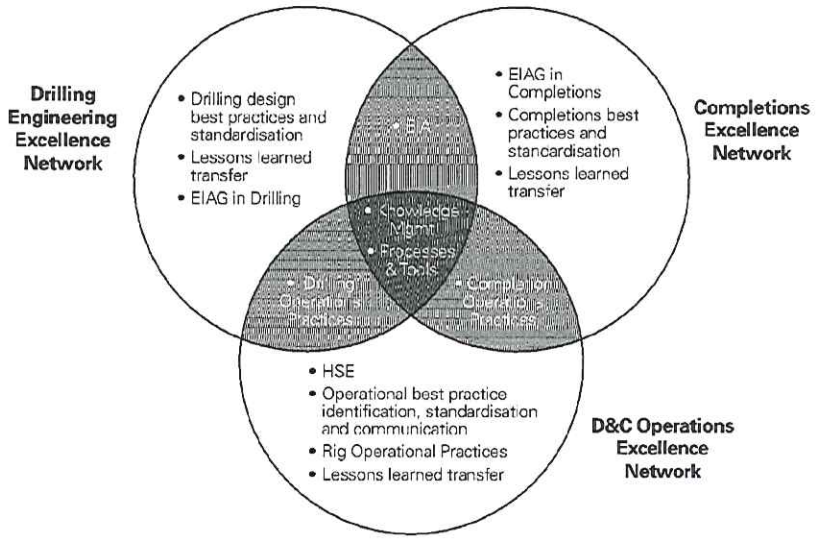

Figure 2E1-4 Network fit.

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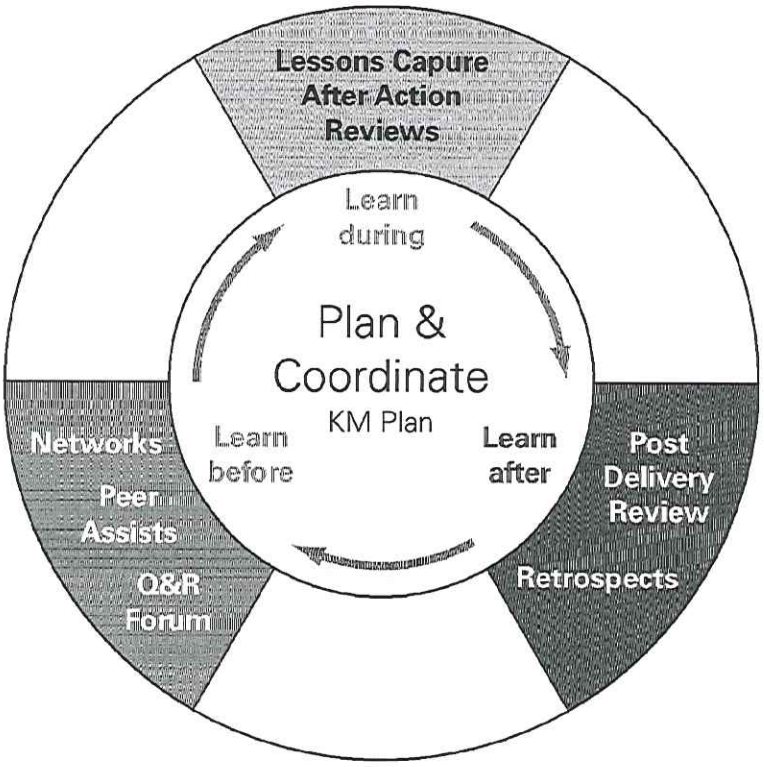

Figure 2E1-5 The Key KM Processes.

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Workflow & Tools

There are several KM tools that have been proven to be highly effective for learning before, during, and after an activity *(see Figure 2E1-5)*.

More detail on each process is provided in the section below.

KM Plan

A Knowledge Management (KM) Plan is an organized, systematic, and focused approach to identifying and implementing the knowledge goals and objectives of a team or project.

These goals and objectives include:

- Identification of the critical knowledge needs; especially those the team or project needs to improve performance, reduce risk, or address business and technical challenges.
- The specific means for accessing and using this knowledge.
- The actions that the project team will undertake to distribute and promote the learning for each particular specific knowledge need and ensure knowledge (lessons and best practices) is returned to the functional body of knowledge.
- The personnel responsible for the resultant KM activities in the project.
- The monitoring of KM Plan components and activity should also be addressed in the KM Plan. The KM elements included in the Plan should be monitored and reviewed with the same diligence as other key business activities in the project.

Additionally an effective KM Plan:

- Feeds into the ongoing business agenda and procedures.
- Defines the overall KM related technology applications and interfaces of the project.
- Details the knowledge processes (e.g. Peer Assists, Retrospects) that are agreed as part of the Project Plan.
- Documents and tracks where the inputs and outputs of the processes reside.

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Evidence from analysis of existing lessons reveals the huge untapped potential for teams and communities across BP to leverage performance through improved sharing. This knowledge sharing would not only help avoid repeated learning of the same lesson but also provide a means to quickly transfer best practice.

Peer Assist

A Peer Assist is a very powerful tool teams can use to assist in the resolution of significant and unusual challenges. A Peer Assist takes the form of a workshop where peers from outside a "host" team offer solutions and provide feedback on a specific technical or commercial challenge. Peer Assist participants apply their experiences, insights, and knowledge to the new context and advise on a future course of action. A Peer Assist is appropriate when the logistical cost of accessing the experience of others is exceeded by the value the additional knowledge brings to the team.

After Action Review (AAR)

An After Action Review (AAR) is a learning tool intended for individuals and teams to learn how to immediately improve their performance. The AAR is used to gather learnings from either the success or failure of a planned activity, one that will be repeated in the very near future by the same team. A planned activity is an event with a beginning and an end. It can be an entire small action or part of a larger action. It must have clear and measurable objectives to support later comparison with the recorded results. Examples of activities that merit an AAR could include the end of a Partner meeting, components of the Front End Load (FEL) process for a well, or drilling a hole section. An effective AAR can often be carried out in 30 minutes to an hour.

Lessons Capture

Lessons capture is the process of recording and synthesizing knowledge and experience in a way that is useful to others. A lesson can be derived by a single person or identified by a group of individuals. A Local Lesson is learning that has relevance only to the individual or team that derived it. A Federal Lesson is one that has relevance to the wider community within a discipline, or beyond. To become a bona fide Federal Lesson, a Local Lesson must be vetted by a designated Subject Matter Expert and assessed as such.

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Lessons can be categorized into high context lessons and low context lessons. Many valuable learnings from a project fall into the high context category. A high context lesson is complex to write down and in many cases will require a face to face follow up discussion. A low context lesson is articulated easily and should be written down.

Other specific attributes of a lesson include:

- It contains new knowledge or experience that is material and relevant to the project team (and in the case of a Federal Lesson others in the community).
- It arises from a positive or negative difference between what was expected and what actually occurred.
- It stands alone in its own context, expressed as a single lesson.
- It is clearly articulated including what was supposed to happen, what really happened and the root cause for the difference between expectations and results.
- It contains a firm recommendation for others which might be in the form of a doable actions, such as changes to a process or procedure.

Retrospect (End of Well Review)

A Retrospect is a team-based workshop designed to capture and share key learnings technical, operations, commercial, common process, project management, etc. for the primary benefit of other teams. For a typical drilling and/or completion project, a Retrospect involving all the members of the D&C team is conducted at the end of the Execute phase and before the team disbands.

A Retrospect allows the team to 'look back' and refine lessons learned as well as 'look forward' and transfer learnings to others on how to improve future performance. These lessons are shared with the participants and guests in the workshop and with those in other teams that may be interested.

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Post Well Review

The Post Well Review (PWR) process is a multi-discipline Retrospect to identify and share the lessons learned around production performance of new wells or completions. The PWR is typically conducted 3-6 months after initial production. The primary goal is to identify lessons and actions to optimise well performance, reserves recovery, and capital efficiency for future well and/or completion delivery via a rigorous performance evaluation *(see Figure 2E1-6)*.

Other goals of the PWR include:

- Allow Base Management and New Well delivery teams to capture key well design and planning learning as it affects longer term performance post well handover.
- Bridging completion and subsurface components to highlight their specific impact on overall productivity.

PWRs can be performed on individual wells or groups of wells. Asset team members and management, team leaders, vendor personnel, Completions Excellence (CEx) Network representatives, and peers should participate in the PWR. It is preferred that a PWR summary document be placed on the Completions Excellence (CEx) website for sharing best practices globally.

For more information about these Learning and KM processes, please access the BtBcp website at:
http://epsegmentcommonprocess.bpweb.bp.com/Default.aspx?tabid=195

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Element 1 Learning & Knowledge Management

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Integrated PWR Process Framework

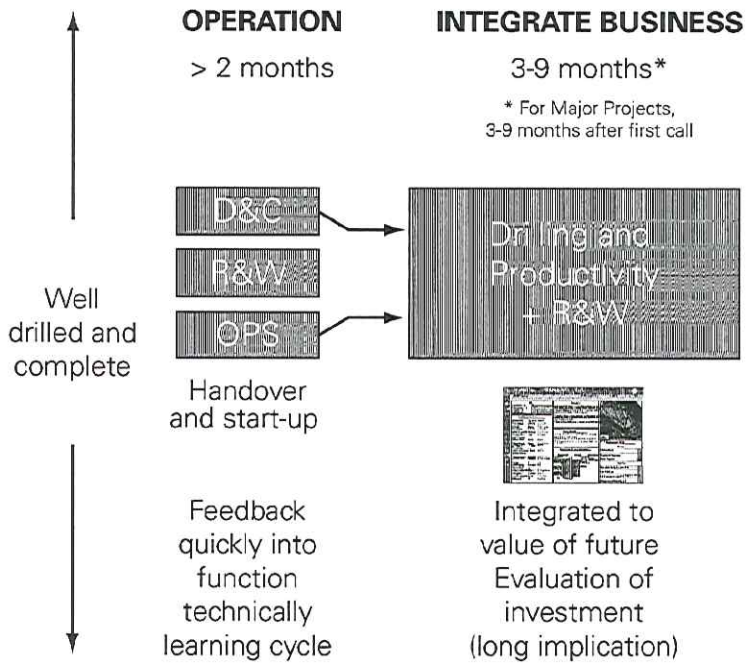

Figure 2E1-6 Integrated PWR Process Framework.

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Technology

Connect

Connect is a personal knowledge sharing technology application. It enables you to find people to help you, and to help people find you. Connect might be used to find someone to help you with a particular business issue, to find out more about people before a meeting, or to find appropriate Communities to join. Use Connect to create your own personal home page on our intranet – it only takes ten minutes – that includes your contact details, expert qualifications and areas of interest. You can also upload your résumé (CV) or picture if you so choose. The best place to find technical instructions on how to edit your entry is on the Connect frequently asked questions (FAQ) page posted at the Connect web site.

For more information about Connect, and to upgrade your personal page, please access the Connect website at:
http://connect.bpweb.bp.com/Index.asp

Teamlink – The D&C Shared Learning System (SLS)

A Shared Learning System is an application in which lessons can be captured and stored, actions assigned, and actions tracked. Teamlink is the D&C technology application for storing and managing Local Lessons.

Teamlink users can search their own installation of Teamlink for Local lessons, but cannot access another team's Local lessons, unless invited as a guest member of that team. Please note that lessons in Teamlink may be not be fully validated. Only those lessons that are validated can be considered to be fully qualified as representing good practice for possible application in other similar situations.

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Knowledge Library

What is the D&C Knowledge Library?

The D&C Global Document Centre contains links to a number of key Drilling and Well Operations documents. Additional guidance, templates, tools, and 'good practice' examples can also be accessed via the website. The library is owned by the D&C Networks.

https://epti.bpglobal.com/C17/C3/Knowledge%20Centre/default.aspx

How is it organized?

Within the D&C Global Document Centre, links to documents are stored in folders and sub-folders which are organized according to whether they are Global Policies, Recommend Practices, or Guidelines.

What documents will I find in the Library?

There are three types of documents in the Global Document Centre that are relevant to D&C users. These are:

- Engineering Technical Practices, which are mandatory for compliance with Integrity Management Standard.
- Recommended Practices, deviations from which should be risk assessed and clearly justified.
- Guidelines, which are optional Best Practices and other Information.

The D&C EPT website contains links to documents and other resources on web sites in a variety of formats.

How do I locate the documents I need?

The D&C Global Document Centre website offers users the ability to browse or search for documents. To browse for documents, select the document type and then select the folder or sub-folder of interest. Searching for information is possible using the standard 'Search' feature within the EPT web site.

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How can I provide comments or examples?

If you have a comment regarding a document, would like to ask for clarification on a point, or if you have an example or related shared learning to contribute, you can e-mail the custodian of the relevant document. The custodians' names are listed on the site.

The Well Engineering and Performance Forum (WEPF)

The WEPF is a Question and Response (Q&R) technology application which allows D&C community members to access others' knowledge and expertise through threaded discussions. This application allows users to post questions and related responses on topics of material interest. All content is archived, thereby providing a searchable corporate memory to leverage learning and prevent "re-inventing the wheel". The WEPF provides a powerful mechanism to proactively seek early input to potential issues or opportunities and to improve planning and execution activities.

To Join the WEPF, please select the 'Subscribe' button at the Forum located at: http://epforums.bpweb.bp.com/wepf

Where To Go For More Information and Help

The BtBcp Learning and KM website below includes overview information, links to the tools and processes, and suggested contacts:
http://epsegmentcommonprocess.bpweb.bp.com/Default.aspx?tabid=195

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Element 2 – Goals

A project must set itself realistic and achievable goals with which the team can align itself. Within D&CVA, the goals include the following:

Well Objectives

These are defined at the start of the project and define what the project is promising to deliver. The objectives should be hierarchical running from the high level strategic objectives through the technical objectives into the specific operational objectives.

There should always be a clear link from the well objectives to whatever is planned to happen or does happen during well operations. Safety and environmental objectives should always be included in the well objectives.

See Section 3: **Right Scoping** for further information on the subject .

Well Productivity Benchmarking

Completion efficiency is a key performance metric which should be considered by a wells team during the Define and Execute stages. It essentially defines the expected productivity achievable for a given well type against the ideal case *(see Figure 2E2-1).*

Completion Efficiency Scorecard

Planned		Actual	
Reservoir		**Reservoir**	
Pr	7,000 psi	Pr	6,600 psi
k	800 mD	k	320 mD
h	108 ft	h	86 ft
μ	0.650 cp	μ	0.690 cp
kh/μ	***130,909*** mDft/μ	kh/μ	***39,884*** mDft/μ
Psurf	800 psi	Psurf	800 psi
Design Targets		**Actuals**	
Target Rate	9,800 bopd	Flowing Rate	8,795 bopd
Test Rate	9,800 bopd	Test Rate	8,000 bopd
Skin	15 Global	Skin	0 Global
Drawdown	456 psi	Drawdown	413 psi
PI	***21*** bopd/psi	PI	***21*** bopd/psi
Technical Limit		**Technical Limit**	
Skin	-1.2 Global	Skin	-1.8 Global
Drawdown	143 psi	Drawdown	321 psi
PI	***69*** bopd/psi	PI	***27*** bopd/psi
Rate Potential	10,800 bopd	Rate Potential	9,070 bopd

Results

	Planned	Actual	
Completions Efficiency *Sandface*	26%	73%	
System Efficiency *Surface (Actual Rate/TechLimit Rate)*	91%	97%	
Excess Potential *Rate Potential - Flowing Rate*	*1,000*	275	boepd

Figure 2E2-1 Completion efficiency scorecard.

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Goals 2 Element

Completion efficiency is defined as a ratio of the post cleanup well performance against the best performance possible from that completion type. It is calculated so that a well's productivity is always compared to the actual obtainable productivity for the applied completion design. This definition avoids dictating some arbitrary level of skin, i.e. skin = 0, as the best possible. Thus, completion efficiency has the quality of normalizing the measure of completion success for different completion designs.

A scorecard was developed to capture expected reservoir pressure, permeability, zone height, target skin, and technical limit skin based on Prosper modelling and benchmarking against technical limit performance for a specific completion/formation type. Once production and pressure transient analysis data is gathered, the actual parameters can be compared to the technical limit, and completion efficiency can be calculated using this skin and PI data. The resulting completion efficiency quantifies the incremental prize a well could produce and can be used to optimise future completions for the team. Training on the use of Prosper to determine technical limit skin and PI for various completion types has been developed.

Investigations as to whether Completions Efficiency could be used for benchmarking of completions performance has concluded that this is not of value or useful. Indeed the data available globally is inconsistent in many aspects (including consistency of data analysis and interpretation) and some work is required to resolve this.

The following recommendations are made for wells teams looking to set well productivity targets:

- Mechanical skin targets should be set for new wells.
- Benchmarking against comparable well types should be considered.
- Completion efficiency calculations should be made during define & Execute to support understanding of the optimum performance of the well system.

The Completions Excellence network Leader should be consulted for latest advice in this area.

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Element 2 Goals

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Performance Management

Performance management should be used to set goals for the project. The type of goals set should link to the asset performance contract.

A key issue is to use performance management in a pro-active manner during the planning of a well. Performance targets should be set in the planning phase and benchmarked against the best performance in similar wells to see if lessons can be learned at a stage when they can be implemented on the planned well.

The visibility of performance measures is critical. Projects should set up a reporting system that allows the team to easily see what project targets have been set, how they link to the performance contract and how the team is performing against these targets.

The Technical Limit Process closely links into performance management by way of the operations crew setting specific well performance targets for the planned operation – see Technical Limit for further details.

Deliverables

As a function of the project staging of D&CVA (CVP alignment) there is a requirement to have a set of deliverables in place at each stage gate for review by the gatekeeper as part of the Decision Support Package *(Figure 2E2-2 D&CVA Deliverables)*.

These deliverables can be considered as goals for that particular phase of the project and will have to be in place to ensure that the project is set up to deliver overall success.

An example of a key deliverable that has to be in place is the Drilling and Completions Uncertainty Statement (compiled as per "Well Cost Estimating Handbook") which is based on the Probabilistic Cost estimate and the risk register. This document may be used as an attachment to the FM (Financial Memorandum). Other key deliverables would include the overall project schedule, the risk management plan, safety and environmental systems and basis of design.

For more information about goal setting and objectives, please access the BtBcp website at:
http://epsegmentcommonprocess.bpweb.bp.com/Default.aspx?tabid=190

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ACCESS	APPRAISE	SELECT	DEFINE	EXECUTE		REVIEW
Select the individual well project	Look at the options available	Select the right well	Design and Engineer it right	Plan to execute it right	Deliver it right	Review it
Evaluate high level projects: • Access acreage – Exploration programme – Appraisal programme – Development programme – Infill drilling programme – EOR programme • Extract smaller level well delivery focussed project	• Project plan – Level 1 • Knowledge management plan • Resource plan • NDS assessment • Risk management plan	• Statement of requirements and WPDP • SMS in place • EMS in place • Performance management plan • Project specific risk assessment • Logistics and procurement strategy	• Detailed well design • Basis of design for key constituents of well • Rig and key service contractors in place • Procurement SOR/QA • Planning schedule – Level 2 • Risked cost estimate • Economic review • Well specific risk assessment • Drilling and completions uncertainty statement • CM plan for project execution • Key decision points identified	• Execution plan – Level 3 • Detailed mud, cement, etc programmes • Tech limit workshop • Risked cost estimate • Operational specific risk assessment • Drilling operations procedures • Logistics support plan • Partner and government approvals	• Daily DIMS reports • Lessons learned captured • Deliver well objectives • Weekly costs estimates • Weekly performance assessment	• Completion report • Lessons learned implemented • Risk management tool updated • Well cost summary • Well performance review • Major incident follow-up • Post project review

Output from Right Scoping

Figure 2E2-2 D&CVA Deliverables.

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Element 3 – Quality and Assurance

A project must have the necessary quality and assurance measures built into the way it delivers its business *(see Figure 2E3-1)*.

These measures cover quality management practices, compliance with policy and regulations and overall assurance that the project is set up for success.

The Quality and Assurance requirements of D&CVA can normally be satisfied in the following manner:

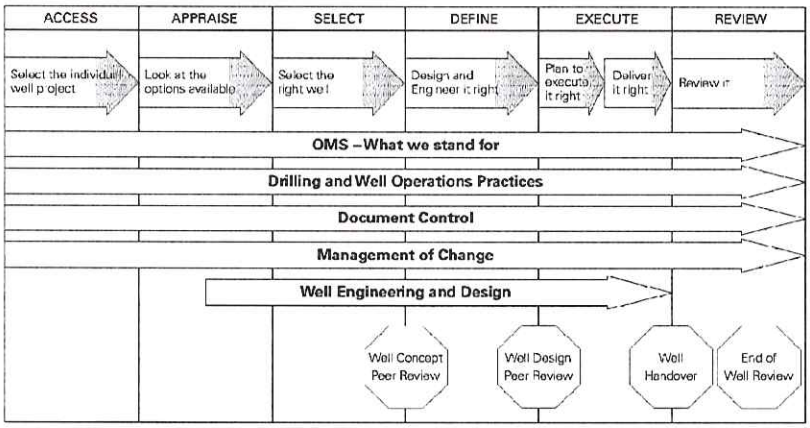

Figure 2E3-1 Quality Assurance.

Operational Management System (OMS)

The project should always be in conformance with company standards and be able to demonstrate compliance.

All project personnel (BP and External) should be aware of and comply with these standards. These are the Driving Standards, the Integrity Management standards, Control of Work and Group Marine Operations

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A Safety Management System (SMS) and an Environmental Management System (EMS) should be in place for all projects. Assistance in the implementation of these policies and systems can be obtained from the appropriate web sites, HSE department and line management.

Drilling and Well Operations Practices

All well projects will adhere to the Drilling and Well Operations Practices (DWOP) and to the new Integrity Management standard and relevant Engineering Technical Practices

Document Management

All projects will have a document management system in place that fulfils the following requirements:

- Identifies all key documents.
- Single system for all disciplines.
- Approval procedure for key documents.
- Filing control system (CPOL).
- Revision control to ensure personnel use the latest approved version.
- Simple instructions for use.
- Accountabilities defined for document management.
- Back up procedures.
- Archiving procedure.

The definition of key documents will include the following:

- Statement of Requirements (SoR).
- Basis of Designs (for key elements of well design).
- Drilling and Completions Uncertainty Statements (DCUS).
- Well Planning Data Package (WPDP).
- Financial Memorandum (FM).

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- GEM (where appropriate).
- Drilling Programme.
- Completions and/or Well testing programme.
- Casing Design.
- Completion Design.
- AFE.
- FEL Index.
- Geohazards Assessment.
- Geological Prognosis.
- Pore / Fracture Pressure.
- Permitting Information.

Management of Change

A clear process must be in place for management of change throughout any project. This management of change process must be auditable and in place during planning as well as operations.

The minimum requirements that a management of change process must address are:

- A clear project statement saying when the Management of Change process will be utilised.
- Incorporate a risk assessment.
- Have a clear approval structure linked to this change process.
- The process itself must be clear and satisfy the following criteria:
  - Be linked to the document management system.
  - Ensure an auditable trail is put in place.
  - Clearly reference the document or procedure which has to be changed.
  - Clearly state what approval is required and log what has been obtained for the change.

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- Have a close out procedure for ensuring the change is distributed and changed.
- Ensure that the impact of this change on the overall project plan is considered.

Well Engineering and Design

It is a BP requirement that approved engineering and design manuals will be utilised in any well project.

These include the following:

- BP Casing Design Manual.
- BP Directional Survey Handbook.
- BP Well Control Manual.
- BP Shallow Hazards.
- BP Completion Design Manual.

There are other best practices related to Drilling Fluids, Cementing, Hole cleaning, Torque and Drag simulations, Sand Control, Well testing etc. which should also be consulted.

It is recommended to utilise subject matter experts in peer assists related to these key deliverables. This involvement will ensure the appropriate learning, technical expertise, assurance and technology are applied to the well engineering and design process.

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Element 3 Quality and Assurance

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Equipment Integrity Assurance (EIA)

The EIA is the evolution of Quality Assurance/Quality Control but includes both engineered equipment (EE) design assurance as well as the traditional quality assurance aspects.

The EIA Guidelines (EIAG) gives recommended practices to the BP Wells Team for assuring the technical integrity of equipment and services in well construction and intervention (Drilling & Completions).

For a team to implement the EIAG the following aspects need to be considered:

- An asset specific Technical Integrity Assurance Plan (TIAP) in compliance with Equipment Integrity Assurance Guidelines (EIAG) specific to the local BU/SPU needs has been developed
- Ownership of equipment integrity assurance within the team is clear.
- Formal equipment design reviews of new and / or critical equipment are conducted by asset personnel supported by EPT or subject matter experts (as appropriate).
- An Equipment SoR process is in use, preferably the global Equipment SoR web based system (www.bpEquipmentSoR.com). Consistent use of this web based system will help drive consistency in the way we communicate our functional specifications, well conditions, integrity assurance specifications, quantities, and delivery requirements to our key equipment suppliers for both manufacturing and shop assembly.
- Drilling and Completion engineers and procurement ensure appropriate QAQC requirements in Purchase Orders.
- Global Quality Control Plans are being used where available.
- Stack up trials of equipment are conducted as appropriate.
- Critical equipment and materials are checked during final manufacture and prior to mobilisation to rig site.

Link to EAIG document:
http://eia.bpweb.bp.com/default.htm

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Stage Gates, Gatekeeper and Decision Support Packages

As previously mentioned, wells projects will have stages aligned to CVP with progression through the stage gates controlled by a Business Unit (BU) appointed gatekeeper(s). The deliverables (Decision Support Package) need to be in place to support this move through the stage gates to determine key steps and deliverables for each gate.

The progression through these gates will be auditable and in certain circumstances the gatekeeper will allocate this responsibility to a network or a peer review. Whatever system is in place it will be documented and understood by all. The BU will determine selection of the gatekeeper(s) at the Appraise stage according to the project type. The gate keeper must agree the content and depth of the decision support package. These will normally be based on the minimum expectations (see roadmap *Figure 2E3-2)*.

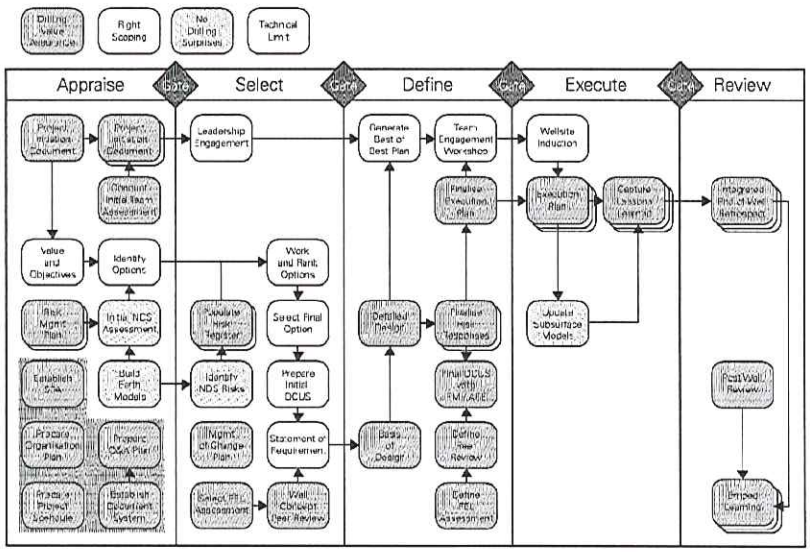

Figure 2E3-2 Road Map.

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Element 3 Quality and Assurance

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Front End Loading (FEL) Assessment

FEL is a quantitative measure to assess the level of front end engineering and planning in a project. It should be completed by teams at the end of the Select and Define stage gates utilising a simple Excel tool with assistance as necessary from an experienced assessor. Wells teams should use the FEL at Select Stage to determine gaps that need to be addressed. Management should use the FEL index at the Define Stage as an indicator or predictor of project success. The time to complete will normally be around two hours, and the output will be in the form of a spider plot based on the D&CVA elements *(see Figure 2E3-3).*

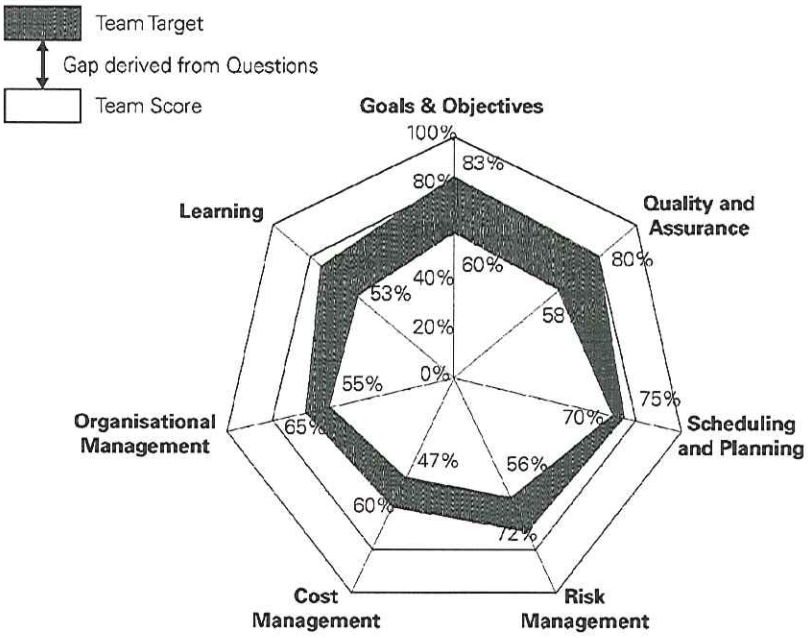

Figure 2E3-3 Scorecard from an FEL Assessment.

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Peer Reviews

Mandated Peer Reviews

The CEO and the Extended Segment Executive Team have determined that certain peer reviews will be mandatory and led by the D&C Function

For Drilling & Completions these fall into the following categories:

- A review will be required for all operated exploration wells.
- A review will be required for critical wells with materiality and/or high risk. A defined list of critical wells will be agreed annually by the TVP D&C with OpCo.

These peer reviews will be led by a member of the Functional Drilling & Completion Excellence team (SPU support as needed) and conducted at the Select to Define and Define to Execute gates, as outlined here in D&CVA. Action closure will be verified.

All other peer reviews fall under the category of Self Verification and will be determined by the SPUs. If they so require, the SPUs can seek assistance from the functional D&C Excellence team for any of these reviews.

Peer Review Process

Dependent upon the size of project there are up to three peer reviews required which will act as stage gate approval processes when utilised. It should be noted that the timing of these reviews may be varied according to BU requirements.

Peer Reviews should not be confused with Peer Assists. A Peer Assist is used by the Wells Team to "sense check" specific plans or address key risks. A Peer Review is a multi-discipline assessment by an external team of how the balance between risk and value is being managed. It will draw on regional, global and specific technical expertise from the key disciplines that represent the risk or value for the project. A Peer Review is required to provide assurance to the BU and HoD that the project team is on track.

The purpose of Peer Reviews is to provide PuLs, BULs and TVPs with an independent assessment of the technical strength of an identified business option. This is achieved both by reviewing the technical evidence provided by the PU in terms of its adequacy, consistency and relevance to the business context, and by testing the technical uncertainties and associated commercial risk.

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Element 3 Quality and Assurance

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The framework for peer reviews does not change from BU to BU but emphasis, timing and participation should be tailored to match the complexity and business impact of a particular well or wells.

Minimum Conditions of Satisfaction

The Peer Review process can be categorized under four main headings – When, Who, What, and How. The following "minimum conditions of satisfaction" for Peer Reviews are based on the CVP process and linked to BtB activities. Clearly, the Wells Teams should exceed these guidelines as they deem appropriate. These conditions apply to BP operated projects, but the principles also apply to non operated wells also.

Who should be in a Peer Review?

The team makeup will vary based on the complexity and value of the project being reviewed and should consist of 4-6 people. A Peer Review Leader will be appointed for all reviews. This person should be an experienced reviewer, will have a QA role in selecting team members and is accountable to ensure the HoD is adequately informed of the outcomes. The team should have the relevant multi-disciplinary expertise, with at least 2-4 people from roles external to the BU. A Drilling and Completion Excellence team member should be invited to all Peer Reviews. Consider including partners if they have specific concerns or experience to share.

How to conduct a Peer Review

At least 2-4 weeks before the Peer Review, the Leader should be agreed and in conjunction with the Wells Manager, should select the Peer Review team. The date for the review should be set as early as possible and the Terms of Reference stating the objectives developed.

Pre-reading of key documents as well as the venue and a cost code should be made available to the Peer Review team as early as practical. Peer Reviews should take from 1–2 days, and the Leader should look for opportunities to utilize net meeting and video conferences as well as face to face attendance to access expertise.

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At the completion of the Peer Review, the Leader should complete a summary document including the view on performance metrics, key risks, the team assessment, and engagement in BtB initiatives (an example is attached). The Leader, working with the Wells Manager, will arrange for the appropriate feedback sessions with BU personnel and the HoD.

Drilling & Completion Peer Review Agenda (Pick List)

To some extent the Peer Review Agenda with vary dependant on particular aspects of the well and SPU/Discipline needs. The following list is a guide for suggested agenda items:

- Introduction.
- Setting the Stage.
- Project overview.
- Project Economics and Value Drivers.
- Organization Charts.
- Subsurface Understanding (by the subsurface team members).
- Reservoir Description.
- Reservoir Uncertainty Statement/Risks to Delivery.
- Reservoir Model and Production Risks.
- Overburden Risks and No Drilling Surprises Review.

Drilling & Completion Focus

- Completion Strategy and Risks.
- Drilling Plan and Risks.
- Performance Benchmarks: Drilling, Completion and Production.
- Risked Cost Model and Sensitivities.
- Breakout time for Peer Review Team (min 1 hour).
- Describe key concerns and associated actions?
- Identify key positive steps or processes the team has done well.

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Element 3 Quality and Assurance

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- Look at PR Summary Document and address each area as appropriate.
- Feedback session to Project Team.
- Discuss issues.
- Agree Actions and process to document and close out in 1-2 weeks.
- PR Leader prepares High Level Summary for PU and Discipline management.

Peer Review High Level Summary

- Purpose of Review.
- Peer Review Team.
- Accountable for Follow Up with Project Team.
- Performance Metrics Summary.
- Risked Costs – P10, P50, P90, Technical Limit, and Best in Class.
- Production – P10, P50, P90 and Reserves P10, P50, P90.
- Well Productivity Expectations.
- Drilling KPI (Days/10K) – P10, P50, P90, Technical Limit, and Best in Class.
- Completion KPI (Days/Completion) – P10, P50, P90, Technical Limit, and Best in Class.
- FEL Assessment.

Key Risks

- Describe project key risks in no more than one line each.
- Peer Review Team Assessment.
- Describe your assessment of the Project in no more than one line each.
- Costs.
- Value.
- Risk Management
- People.

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- Engagement in Beyond the Best Initiatives
  (Describe key positive and negative features as succinctly as possible).
- Common Process.
- Technology.
- People.
- Market.

Note: The intent is a crisp, high level summary. If additional data or information is required it can be attached as necessary.

End of Well Reviews

An end of well retrospect will be carried out with the key product being precise actions, which influence future operations.

The review will cover the following:

- Performance assessment – How the well delivered against its HSE and performance objectives.
- Well performance review – How the well delivered against its technical objectives). For objectives such as Well productivity and completion efficiency refer to Post Well review.
- Post project review – How the organisation worked.
- Major Incident follow-up – After Action Reviews.
- End of well cost reconciliation – This will deliver a project success measure.

Consideration should be given to putting in place a simple project specific Quality Management Manual outlining the required practices that will be adopted by all personnel working on the project and also detailing key assurance procedures that will be in place. These procedures should include the listing of governing documentation, emergency procedures etc. The use of this type of manual is dependent upon the project type and the BU procedures already in place.

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Element 3 Quality and Assurance Goals

d&c value assurance

Well Handover Guidelines

The well handover process facilitates the safe and efficient start up and life cycle operation of a well from the well integrity and deliverability perspective. The well handover is defined as the point at which the ability to influence or control the state of a well or well equipment moves from one party to another. Consequently a formal transfer of accountability is required to ensure the receiving party is able to conduct subsequent operations in a safe and effective manner through their knowledge of the well as built status. This is achieved by transferring well construction information in the form of as-built data sets from the construction team to the production operations team.

The Well Handover document captures the minimum information and data required to safely and efficiently handover a well after the construction phase is complete. The process ensures that the status of the well is known and conforms to the SOR (Statement of Requirements). Any deviations from the SORs are identified and the impact to well integrity can be assessed.

Well Handover Document contents are shown in *Table 2E3-4*.

For more information about quality management and assurance, please access the BtBcp website at:
http://epsegmentcommonprocess.bpweb.bp.com/Default.aspx?tabid=191

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1. General Well Information	e.g. datum points, pressures, depths, fluid types etc.
2. Wells Team Contacts	Key personnel involved in design and construction.
3. As-Built Well Construction	Details on tree, wellhead and completion.
4. As Built Surface Wellhead and Production Tree	Schematics and specifications of the as built wellhead and tree (including valves) (Not just default photocopied supplier drawings).
5. As-Built Subsea Systems	Sub sea layouts and equipment specifications.
6. As-Built Completion	Detailed drawing of completion with depths, specification etc of equipment.
7. As-Built Casing Scheme	Detailed drawing of as built casing scheme, depth and specifications and logs (e.g. USIT and calliper).
8. Well-bore Trajectory	Final well-bore trajectory drawings and details.
9. Pressure Containment and Barriers	Details of all "As Built" barriers in well and their integrity tests.
10. Well Commissioning	Details of tests for all critical well components, including LOTs and FITs.
11. Controls	Details of commissioning tests on control systems.
12. Inventories	Details of control fluids, well fluids and any junk.
13. Well Clean Up	Rates, pressures, temperatures and duration.
14. Wellsite Clearance Certificate	Topside, site or seabed survey.
15. Intervention / Remediation	Hold ups, callipers, bond logs or repairs.
16. Flow Assurance	Potential for scale, wax, hydrates, corrosion etc.
17. Well Design Envelope	Design and operations limits for well equipment.
18. SOR Conformance	Any variations to SoR in "As Built" well.
19. Well Construction certificate	Formal sign off of well Handover.

Table 2E3-4 Well Handover contents.

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Element 4 – Scheduling and Planning

A single schedule / plan should be in place covering all phases of the well from planning to final delivery and execution. This plan should be linked to other functional schedules and the higher level BU schedules.

The Integrated Field Planning common process (IFPcp) has been developed to efficiently maximize the planning and execution of all field-related activities. It is a very extensive process which will naturally reach maturity in some assets faster than in others. Drilling, completions and well interventions teams should be aware of the progress of IFPcp implementation in their asset, and should ensure that their schedule/plan is appropriately linked to it *(see Figure 2E4-1)*.

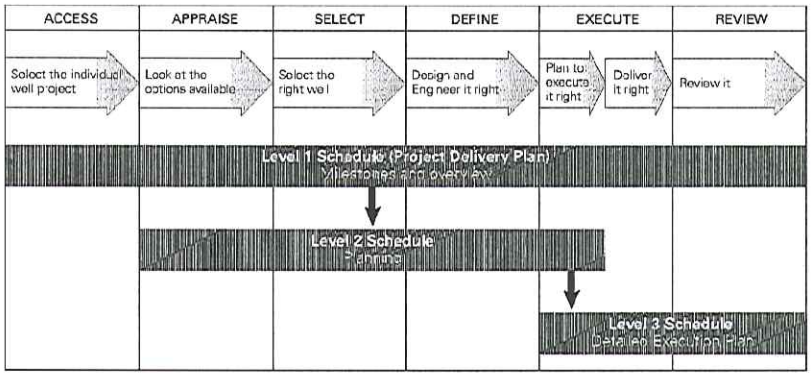

Figure 2E4-1 Scheduling.

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Scheduling

This schedule should be run by a professional scheduler who can ensure (with consultation with Wells team) that it is structured and administered correctly and contains all the critical links and dependencies. The suggested structure of the schedule / plan is that it is set up at three levels:

Level 1 – High-level project delivery plan outlining key milestones for delivery.

Level 2 – Details the planning phase of the well. Who will deliver data to whom by when, who will produce documentation, when it will be circulated and approved etc.

Level 3 – The detailed execution plan for the well. The detail of this execution plan should be such that it links directly to the Drilling & Completion Operations Procedures. Contingency plans should be included. Morning reports should be monitored against this plan. Logistics, personnel movements etc, should be included in this plan too. The risk register should be linked to this execution plan to ensure that planned mitigation measures are incorporated into daily operations.

A good project schedule is critical to consistent project delivery and offers the following obvious advantages:

- Forces team to set out planned activities in a logical sequence.
- Sets up dependencies between activities and highlights full impact of delays or accelerated progress.
- Provides a visual picture of the project.
- Activity timings allow project targets to be set up.
- Actual progress can be compared with planned.
- Look-ahead timings assist with:
  - Manpower planning.
  - Materials planning.
  - Detail planning.
  - Scheduling for maintenance and repetitive tasks.
  - Scheduling for safety timeouts.
  - Contingency planning.

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Element 4 Scheduling and Planning

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- Delivers one clear answer to all project team and management on when things will happen.
- Allows what if scenarios to be run.
- Provides a record of what actually happened.
- Links into logistics and manpower planning.
- Once a good schedule is in place it can be used as a model for future projects.

For more information about Scheduling, please access the BtBcp website at: http://epsegmentcommonprocess.bpweb.bp.com/Default.aspx?tabid=192

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Element 5 – Risk Management

The principle of D&CVA is "Drilling and Completing Wells as Projects", so it makes perfect sense to use the same risk management language, tools and processes for well construction as we use for projects. These are fully described in the Risk Management Guidelines for Major Projects booklet which supports the Major Projects Common Process. You can download a copy at:
http://epsegmentcommonprocess.bpweb.bp.com/Default.aspx?tabid=331

This section summarises the guidelines, and briefly describes a number of techniques which support the central project risk management process. Where necessary, application of both the process and the supporting techniques to single well projects is discussed.

Guidance specific to the management of risk in D&C, including decision analysis, is available on the D&C Risk Management website:
http://epsegmentcommonprocess.bpweb.bp.com/Default.aspx?tabid=193

Definitions

"Risk" in the sense used here, means uncertain future events which, were they to occur, would have an impact on delivery of well objectives. Risk events with a positive impact are "opportunities" and those with a negative impact are "threats". "Risk Management" is what we do to enhance the likelihood or impact of opportunities and reduce the likelihood or impact of threats.

Risk Management Process

The Risk Management Process has four main, cyclical steps (identify, assess, respond, control) the outputs of which are recorded in a database known as a Risk Register. This cycle is not a once-per-well or even a once-per-stage-gate process. It is a continuous loop by which risks are captured and worked throughout the well life-cycle *(see Figure 2E5-1)*. To make the process efficient and value-adding, attention must also be paid to the separate start and end steps (initiate, learn).

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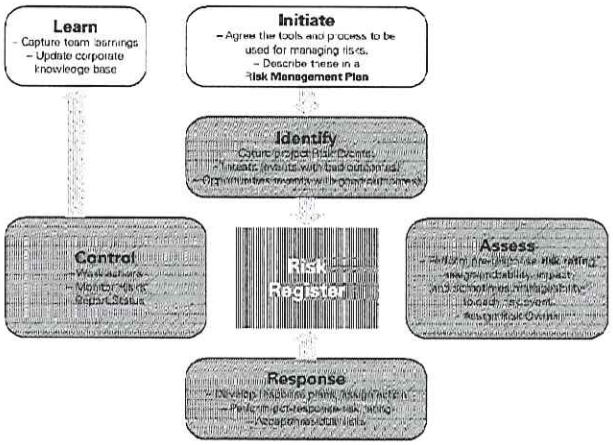

Figure 2E5-1 Risk Management Process.

Risk Management Roles and Responsibilities

It is important that the Project Manager sets his/her expectations around risk management early, clearly and concisely. This is the primary purpose of the Risk Management Plan. Day-to-day responsibility (not accountability) for running the risk process may be delegated to a Risk Champion.

The Risk Champion (typically an office-based member of the engineering team) energises the process while the team members work the risks. Risk identification is the shared responsibility of all team members.

In the guidelines, the last three tasks of the Project Manager are assigned to the (Project) Management Team. This is certainly appropriate to major projects, and may be so for big complex wells, where this team might include the leads for engineering, completions, operations, logistics etc.

These are illustrated in *Figure 2E5-2*.

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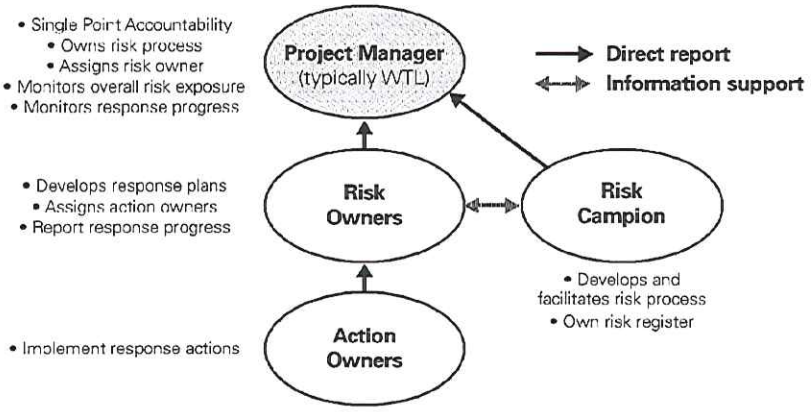

Figure 2E5-2 Risk Management Roles and Responsibilities

Risk Status

The status of a risk changes through its life cycle, and is recorded in the risk register. There are only four possibilities for the status of any risk *(see Figure 2E5-3)*:

- **Active** – Risk live, response planning required.
- **Accepted** – Risk live, adequate response plan in place.
- **Dormant** – No work currently required, review periodically.
- **Closed** – Risk no longer considered capable of further impact.

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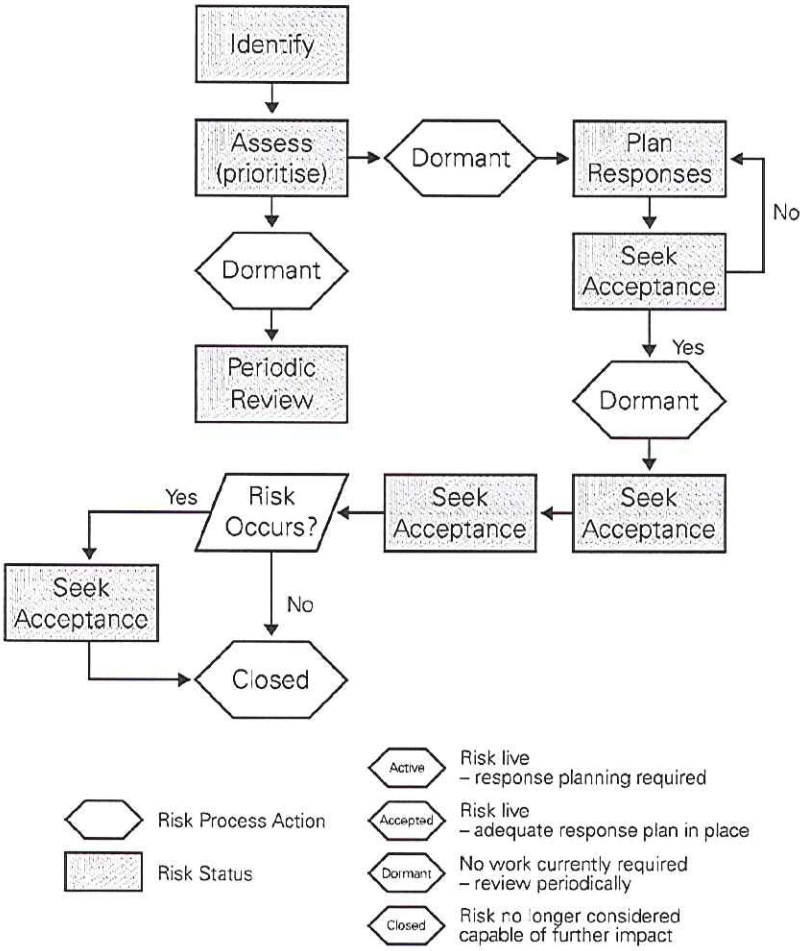

Figure 2.E5-3 Life cycle of a risk.

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Risk Register

The risk register captures all the outputs of the identify and assess steps. The response and control steps may be recorded in the register, or in a separate action tracking system (which becomes, in effect, an extension of the register).

The guidelines specify the following minimum recommended level of detail for a risk register (and action tracking system, if separate) *(see Table 2E5-4)*:

To get full value from the learn step, information on the outcome of the risk and efficacy of any actions taken should also be recorded.

Two Risk Register tools in particular are recommended for use in support of D&CVA:

1 **Common Process Risk Register** – An Excel workbook downloadable from the D&C Risk Management web page. Produces Probability-Impact Grid or PIG (see Figure 2E5-7) and Boston Squares automatically.

2. **BP RAT** – An intranet-based tool designed to meet the needs of BP's Major Projects. Find out more at: http://projects.bpweb.bp.com/bprat/

Excel-based registers have the advantage of portability. Network-based registers are better suited to collaboration – provided communication links are adequate – and the only viable solution for really big projects (the Common Process Risk Register is limited to 200 risks).

General Information	Assessment Information	Risk Response Information	Acceptance
• Risk ID • Risk Name • Risk Event Description • Risk Status • Risk Owner • Project Area / WBS Reference	• Pre-response Probability • Impact Type • Pre-response Impact Level	• Actions – Description • Actions – Owner • Actions – Status (closed, ongoing, not started)	• Risk (Response Plan) Accepted by Appropriate Management

Table 2E5-4. Minimum risk register requirements.

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Risk Assessment Scales

Four-point scales are generally used for both Probability and Impact, as shown in *Table 2E5-5* and *Table 2E5-6*. The combination of Probability and Impact gives the risk rating – a measure of risk importance useful in prioritizing actions.

Where each risk is rated for manageability, a three-point scale is used *(see Table 2E5-7)*.

Scale	Probability	Frequency
High	>25%	More than 1 in 4 wells/projects experience this.
Medium	5 – 25%	About 1 in 10 wells/projects will experience this.
Low	1 – 5%	About 1 in 10 wells/projects will experience this.
Very Low	<1%	Less than 1 in 100 wells/projects will experience this.

Table 2E5-5 Probability.

Scale	Impact – Well NPV*	Impact – non-monetary
High	>50%	More than 1 in 4 wells/projects experience this.
Medium	10 – 50%	
Low	2 – 10%	
Very Low	<2%	

* Net Present Value (NPV) is the best quantity against which to assess risk impact. If it is not known, or difficult to estimate, total well cost may be used instead.

Table 2E5-6 Impact

Scale	Manageability
High	Within control of the project team. Can control probability and/or impact
Medium	Within influence of the project team. Can influence probability and/or impact
Low	Outside the influence of the project team. Can only influence impact

Table 2E5-7 Manageability.

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Reporting and Visualising Risks

The best means of communicating well risk is via the detail available in the Risk Register itself. When a graphic representation is required, the most commonly used format is the Probability-Impact Grid or PIG *(see Figure 2E5-8)*. These can be drawn in two ways:

- **A pre-response PIG –** shows the size of risks as they currently are (and as they will continue to be if no actions are taken to manage them).

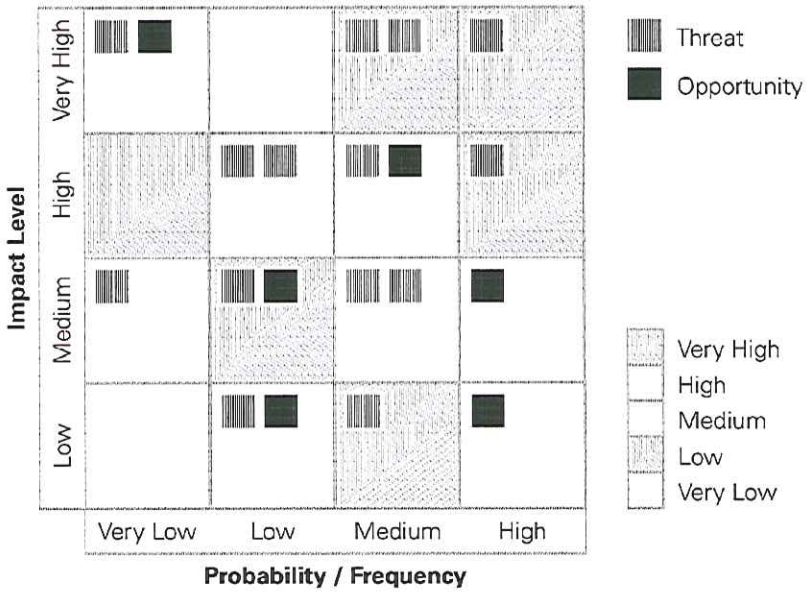

Table 2E5.8 Probability-Impact Grid.

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- **A post-response PIG** – shows the size of risks as they will be, once all planned actions to manage them are complete. It can thus help determine whether existing action plans are adequate, or need to be enhanced.

An alternative graphic is the Boston Grid. It includes manageability, which indicates the extent to which threats may be reduced (or opportunities enhanced). In doing so, it loses the distinction between probability and impact and tends to hide low probability, high impact risks (eg Major Accident Risks). This can be misleading.

Running a Risk Management Meeting

Risk management can add real value to a well or project – or it can be a "tick-the-box" exercise. The difference is in the quality of the meetings where risks are discussed. Some guidance is give below:

Initiate

- Get familiar with the risk register which you are going to use to record the session.
- Establish risk assessment scales for cost, schedule and HSSE impact.
- Plan the session by dividing it into distinct sections (Identification; Assessment; Response Planning).
- Consider adding a section on Opportunities.
- At the start of the session, explain to the team:
  - The deliverable (e.g. a register populated with identified and assessed risks, each with an owner).
  - The scope of the risks (e.g. drilling, D&C, wells, project, technical, HSE etc.).
  - How much time you've got, and how it will be sub-divided.

Identify

- Use data-driven methods (lessons learned, previous risk registers, execution plans) and people-driven methods (brainstorming, expert interviews).
- Choose your moment for introducing written inputs (e.g. a risk register from a similar project) carefully – you want to stimulate, not stifle, the discussion.
- Help the team to identify each risk event. This is best done by clarifying the cause,

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event and consequence of each risk (the event is the bit in the middle!).

- Don't let the team get sidetracked into assessment

Assess

- Have the scales for probability / impact definitions on a hand out and explain them
- Stress that this phase is a means to an end – prioritisation. Don't overwork it.
- Clarify that "pre-response" assessment should take credit (only) for actions which are already planned.
- Agree impact level before probability. It is easier to assess the probability of the risk event which results in a given impact

Respond

- Work the most highly rated risks first.
- Don't expect to discuss every risk
- On a first pass, assign each risk an owner. On a second pass, define actions.
- For highly rated risks, don't be satisfied with a single action – define a variety of actions which reduce the risk in different ways (probability, impact, contingency etc)
- Set meaningful due dates for actions – by when are they really required ?
- The post-response analysis and rating is really only to close the process, so don't sweat it.

Control

- Agree how the team will keep the risk register up-to-date between meetings.
- Agree the date, subject and attendance for your next meeting.
- Make the risks visible – put the pre-response PIG on a poster and put it on the wall.

Learn

- If the focus of the risk meeting is learning:

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- Put yourself in the position of an engineer 1, 2 or 5 years in the future, faced with a similar well. What would you want to know? Where would you look to find this information?
- Store the information where it will be easy to find.
- Don't hesitate to state the obvious.
- Include references to more detailed analyses and reports.

Supporting Risk Management Tools and Techniques

Early Warning Indicators

The EWI tool was one output of a global review of D&C "wrecks" undertaken in 2002. The review found that failure to deliver on well objectives was to an extent predictable in advance from a consideration of nine key attributes of the well, the team and their environment.

The tool itself *(see Figure 2E5-9)* is an Excel spreadsheet containing three alternative descriptors of each attribute. These are colour-coded, with green meaning "no issue", yellow meaning "some cause for concern" and red representing a definite challenge. The team chooses which descriptor it thinks best describes their well for each attribute (much of the value of the tool is in the conversation which this process stimulates). Red or yellow attributes are the source of threats which will require special attention to mitigate. Where these outnumber green attributes, especially if three or more are red, experience shows the probability of a "wreck" is significantly elevated. The wisdom of proceeding with the well as-is should be critically questioned.

Decision Analysis

Business decisions are always, and should always, be made after a consideration of all the costs and consequences, not all which will be quantifiable. Decision analysis – typically using a decision tree – is a means of illuminating difficult decisions by examining those aspects which are quantifiable.

Skilful decision analysis benefits a team in three ways:

1. The process of drawing the decision tree provides clarity on what the choices are, when they have to be made, and what are the possible consequences of each

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	Well Project			
	Green	Yellow	Red	
New Rocks	Known formations with good sub-surface definition. Good offset well data	Unfamiliar formation with reasonable sub-surface definition. Limited offset well data	Unexplored formations without sufficient sub-surface definition. No relevent offset well data	Green
New Rig / Key Contractor	Key contractor(s) and/or Rig that have worked with BP within the last two years on similar projects	Key contractor(s) and/or Rig that have worked with BP within the last two years but not on similar projects	Key contractor(s) and/or Rig that have not worked with BP with in the last two years	Yellow
New Technology	Existing and proven drilling and completions technology. Appropriate local support available	New drilling and completions technology with previous relevent operations experience. Local support available	Complex project from external perspective. Team not familiar with the principal challenge	Red
External Factors (Partners, Regulations etc.)	Straight forward project from external perspective. External factors not onerous	Complex project from external perspective. Team are familiar with the changes	Complex project from external perspective. Team not familiar with the principal challenge	Green
Multiple Objectives	Well project involves one primary objective with compromise	Multiple targets which carry some level of compromise but without adding risk to the primary objective	Multiple targets which cannot be met without compromise or additional risk to primary objective	Yellow
Change of Scope Likely	No significant scope change likely after sign of of Wells SoR. Effective and well understood MoC process	Some project changes likely (reflected in late delivery and sign off od SoR or changes to SoR). MoC in place	Significant project changes likely which will impact design, cost and/or schedule. No effective MoC process	Red
New Team	The well team have worked together on a previous wells project involving similar well types	Either the well team have worked together before or they are very familiar with the well type	None of the wells teams have worked together before and they are unfamiliar with the well type	Green
Space (Time / People)	Time and resources allocated are appropriate for project scope	Time and resources are insufficient. Targets are in line with expectations. Increased risk is well understood	Time and resources are clearly insufficient and are not reflected in scope, targets or risk profile	Yellow
Delivery Promise	Delivery promise reflects application benchmarks for performance, opportunities and risk	Delivery promise represents top quartile performance which is not supported by the appropriate work	Delivery promise is aspirational and not supported by benchmarking or by teams view of what is possible	Red

Table 2E5-9 Early Warning Indicator.

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2. The finished tree gives the team a picture – a shared understanding of the issue. Without this, misunderstandings may go unrecognized.
3. Calculations with the tree (cost-benefit analysis and sensitivity analysis) may provide new insights on which is the best option, and under which circumstances.

The top tip for developing decision trees is to do it before the decision is taken. This may seem obvious, but trying to justify a sketchy decision with a hastily constructed decision tree is unfortunately an all too common, if fruitless, activity.

Other tips are:

- Develop the tree in a small group of people.
- Use BP's preferred software, TreeAge Pro. At most BP sites, you can download this from: http://epapps.bpweb.bp.com (in 'Cross-Domain Utilities', page 2).
- Make sure at least one member of your team is confident to use the software (hint: many junior engineers pick it up very quickly). Have them create the tree on a screen while others describe the options and outcomes.
- Use names ("variables") in place of numbers. This enables you to check the sensitivity of the decision to changes in the data, and also makes the tree much easier to understand.
- A decision tree is a model of the decision to be made. As with all models, it should be simple enough to be understood by its audience, while sufficiently true-to-life to provide new insights and information. To achieve this balance, start simple and add detail a piece at a time until the team is satisfied.

When you have completed the decision tree and run some analyses, talk the decision maker through it (if they are not already in the room).

If you are the decision maker, remember that your reaction will determine the future of decision analysis in your team. Be supportive. Ask questions. Then make the decision.

Contingency Planning and Decision Flowcharts

When the post-response rating of a risk is such that it remains a threat to the well, a contingency plan to control its effects should be developed. Ideally, such plans should be developed jointly by the engineering and operations teams. Where they

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are developed by the engineering team alone, they must be discussed in detail, in advance, with the operations team.

Straightforward contingencies may be written into the execution plan: "If X happens (as indicated by Y), operation Z should be performed. If this is unsuccessful, the situation must be discussed with the engineering team".

More complex situations, for example where the first response may itself have several possible outcomes, are best described with the aid of a "decision flowchart". *Figure 2.E5-10* shows schematics of a decision flowchart and a decision tree, and highlights the differences:

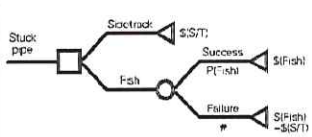
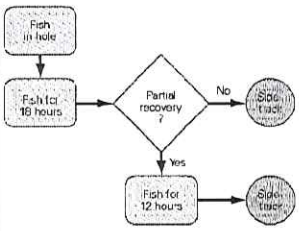
	Decision Tree	Decision Flowchart
Example (simplified!)		
Purpose	To help select the best option from a range of possibilities	To communicate a contingency plan where different scenarios require different actions.
When developed	Usually during planning, to determine best design. Sometimes during execution, to determine best response to a change or surprise.	During planning, to illustrate required sequence or responses to a possible risk event.
When used	Immediately after development, to make decision and determine design/plan	By wellsite team, after occurrence of risk event, if it occurs.

Figure 2E5.10 Decision flowchart and decision tree.

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Element 6 – Cost Management

The term "Cost Management" covers the life-cycle of cost activities *(see Figure 2E6-1)*:

- **Estimation** – predicting the total cost of a well or project.
- **Tracking and Forecasting** – monitoring the spend of wells projects against the plan.
- **Reconciliation and Close-out** – allocation of all actual costs to their correct budget.

Cost Estimation is generally the direct responsibility of D&C engineers. The other two activities, which may be termed "Cost Control", are generally performed by or with the help of FC&A (Financial Control & Accounting) personnel, sometimes within a Wells Project Services team. Minimum requirements are summarized at the end of this section.

Cost Estimation

This section describes the role which cost estimation and the Drilling & Completion Uncertainty Statement (DCUS) play in the BtB Common Process. For a detailed description of the well cost estimation process and tools, for single wells and multi-well projects, see the Well Cost Estimating Handbook. Contact Hugh Williamson for a copy.

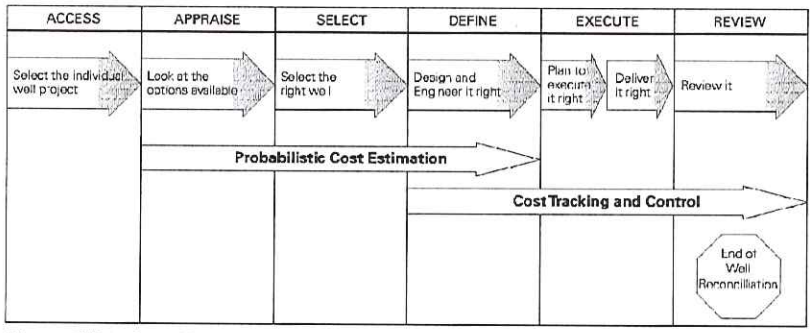

Figure 2E6-1 Cost Management.

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Cost Estimates and the Planning Cycle

As a well plan matures from a concept to an executable program, a number of cost estimates may be required, each capturing the projected range of likely costs based on the understanding of the well scope at that time. *Figure 2E6-2* illustrates this schematically for an exploration well. To achieve the progressive narrowing of the uncertainty range within the range predicted by the previous estimate requires wide enquiry, foresight and even imagination. Without these, the danger is that the estimated cost will increase, sometimes dramatically, between successive estimates.

The number of cost estimates required while planning a well will depend on its scope and importance. Where a well is deferred or delayed, updates to existing estimates – to account for changing market rates and recent engineering work – may be required. *Figure 2E6-3* shows how single well cost estimates may be timed in relation to the estimates for a multi-well major project.

Where a single well constitutes a major project, the MPcp stage-gates effectively define the required cost estimates.

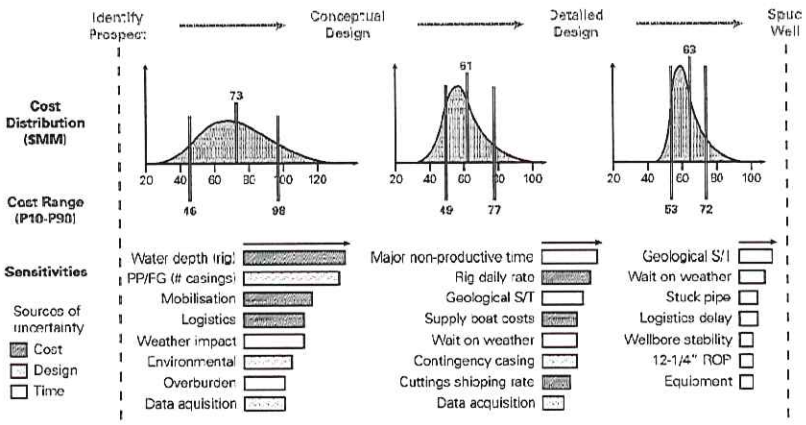

Figure 2E6-2 Evolution of cost estimate for a single well.

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Element 6 Cost Management

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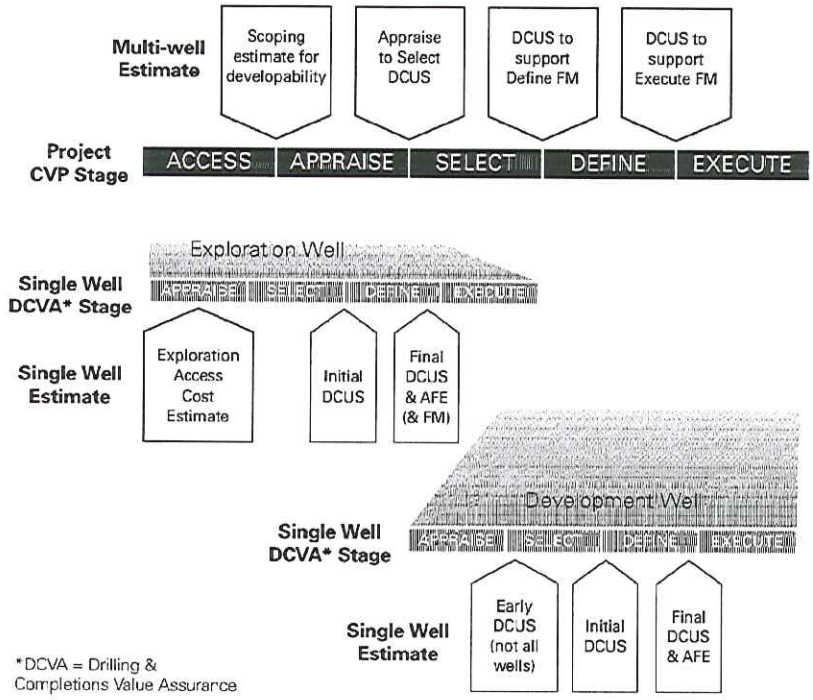

Figure 2E6-3 Typical well cost estimates for a multi-well major project.

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"Headline" Values

There is a strong preference to set AFE (times and) costs at the mean. This is the only value for which a corresponding deterministic cost breakdown – used for cost control and tracking – can be easily provided. Mean times are also the only sound basis for realistic schedules, for example those needed for the development of production forecasts.

Some project or commercial teams may request costs at the P90 or another upside scenario. A probabilistic estimate can provide these directly, although it is very difficult, while planning a well, to anticipate all possible causes of cost growth. In these cases it may be necessary to consider cost increases beyond the typical inputs to the standard cost estimating templates. Examples would include scope changes, major problems or delays, or a change of rig contract.

The Drilling & Completions Uncertainty Statement

A spreadsheet which just contains numbers and calculations does not constitute a DCUS. All estimates require some level of description and context to be properly understood.

For simple wells – or early estimates – the one page template provided with all standard cost estimating tools *(Figure 2E6-4)* may enable sufficient context, particularly assumptions inherent n the estimate, to be captured.

Multi-well projects, and complex or challenging single wells require a separate written DCUS to accompany the estimating spreadsheet. The context, assumptions, subsidiary results and discussion which it provides play a central role in the wells assurance process.

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Element 6 Cost Management

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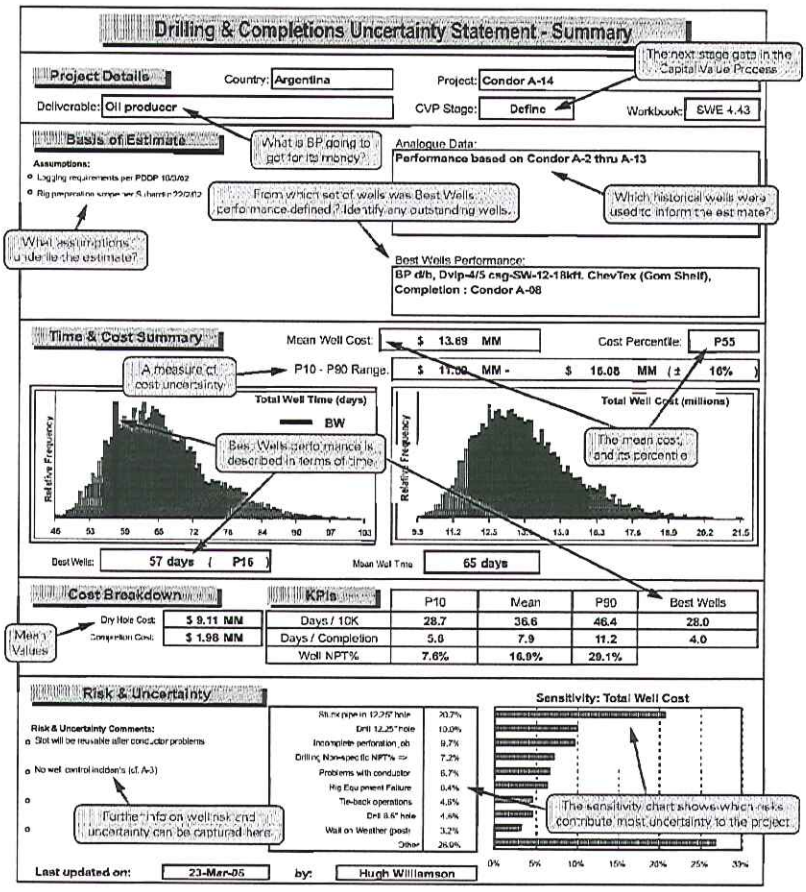

Figure 2E6-4 One-page DCUS summary.

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Cost Estimating and Risk Management

There is an intimate and value-adding relationship between cost estimating and risk management *(see Figure 2E6-5)*. Since the DCUS must reflect all known, quantifiable well risks, the well risk register is an important input to the estimate. Conversely, the sensitivity chart generated with the estimate shows the major contributors to uncertainty in final well cost. As such, it forms a list of potential "points of access", where planning, engineering or contracting effort can potentially yield the greatest benefit.

When leading or participating in the well planning assurance process, probing the links between the planning team's cost estimate and their understanding of the wells risks and challenges can be particularly useful in assessing the quality of the work done.

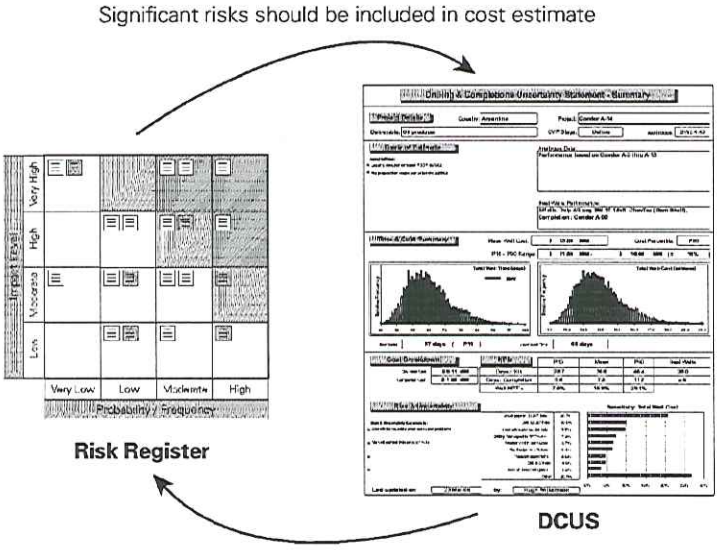

Figure 2E6-5 The link between risk management and the DCUS.

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Cost Control (Tracking, Forecasting, Reconciliation and Close-out)

Efficient and robust cost control processes are a part of good corporate governance. But they also contribute directly to the bottom line, by:

- Revealing the cost detail necessary to identify, plan and secure the elimination of waste and other cost reductions.
- Highlighting unplanned or unapproved charges, which can be investigated / challenged.
- Providing learnings to improve future forecasts, and hence capital productivity

To secure these benefits requires the close collaboration of the D&C Discipline and the FC&A (financial control and accounting) function. Cost analysts working within wells teams have proven themselves a valuable resource, capable of recovering their own costs many times over.

Given the multi-database, cross-functional nature of cost control, it is vital that processes and data flows, once established, are documented. Such documentation should include the specific roles and responsibilities of each party involved (analysts are not engineers, and vice versa).

E&P Purchase to Pay (P2P) is a global program to implement a common process and standard technology for purchasing goods and services from our suppliers. P2P is being rolled out in waves throughout the segment, with completion due in 2010. It will undoubtedly impact the way every wells team buys services and controls cost.

Measuring Cost Control Performance

Performance measurement is an important aspect of cost management. Useful measures, which your team ought to be able to provide, include:

- AFE cost vs. Final General Ledger (GL) cost (±%).
- Final tracked (eg DIMS) cost vs. Final General Ledger (GL) cost (±%).
- Invoices paid within 30 days (%).
- Final AFE close-out time (days).
- Cost Control Expectations.

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The following is a general statement of the company's cost control expectations:

- All well/project costs shall be tracked at an appropriate level agreed with the Project SPA and aggregated to the Project AFE/FM level.
- Costs shall be reconciled between drilling tracking systems and BP's financial and accounting systems.
- More specifically, expectations of both the FC&A and D&C functions with regard to well costs are detailed below. Measuring your existing processes against these expectations would be a valuable health check.

Minimum Expectations for Cost Control in Wells

Financial Control and Accounting

- All Capital Expenditures shall be covered by an appropriate FM.
- Projects shall carry proper Management Information (MI) categorization (GFO linkage).
- A Single Point of Accountability (SPA) shall have direct accountability for the project and it's associated costs. (The SPA may or may not sit within the D&C function).
- All capital projects shall carry a budget in the financial system.
- Accruals shall be recorded on a monthly basis per project.
- Capital Overhead is included in the project budget.
- The project SPA shall understand when a project is deemed to be "Ready for Service" and be aware of the process to transfer the project costs to Fixed Assets from Assets Under Construction (AUC). (The Project Close Process)

Drilling & Completions

- Capital expenditure vs. sanctioned and supplemented amounts (AFE to FM link) shall be tracked and reconciled.
- For multi-well projects in Execute, the Forecast Final Cost (FFC) must be regularly calculated and communicated. The FFC should incorporate actual costs to date and the likely impact on future wells of new performance data and all engineering, operational and contractual changes. Changes should be reflected in the FFC as soon as they become likely – don't wait until they

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become certain. Regular FFC updates from D&C are essential for the project controls required by the Major Project common process (MPcp).

- Projects AFEs will be supplemented when the latest estimate, not the actual costs, breach the approved AFE threshold.
- Invoices shall be reviewed and recorded to the appropriate project in a timely and verifiable manner (SPA accountability).
- Costs tracked through systems such as DIMS shall be reconciled against actual costs in financial and accounting systems on an agreed schedule and at the appropriate level.
- SPAs and delegates who make Work in Progress (accrual) estimates shall have had appropriate training (to include familiarity with the accrual purpose and process)
- The Project SPA/Delegate should be aware of costs that are not tracked in DIMS but which are associated with the AFE, i.e. Pre-spud costs, Location Expenses, Overhead, etc.

For more information about cost management, please access the BtBcp website at: http://epsegmentcommonprocess.bpweb.bp.com/Default.aspx?tabid=194

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Element 7 – Organization

D&CVA requires that every project has a defined organization *(see Figure 2E7-1)*, which satisfies the following criteria:

- Single Point Accountability for delivery of the total well project should be put in place by the appointment of a Project Manager.
- The Project Manager should have the following roles and responsibilities:
  - Have a clear understanding and accountability for the delivery of the well throughout the well from appraise to review.
  - Ensure that the organisation in place to manage delivery of the well meets the expectations of D&CVA as detailed in *Figure 2E7-2*.
- Where appropriate a larger BU with multiple wells teams or several strings running may decide to put in place appropriate resources and processes across the BU which ensure compliance with D&CVA. These could include:
  - A cross BU risk management process and risk register.
  - A common cost management and tracking process.
  - Common document management and tracking systems.
  - Common management of change processes.
- It is the responsibility of the Project Manager to ensure the wells project that he/she is accountable for is utilising these common systems.

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Element 7 Organisation d&c value assurance

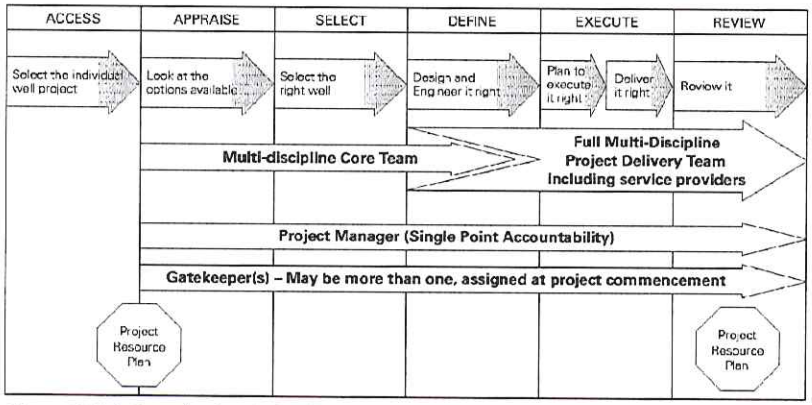

Figure 2E7-1 Organisational timeline.

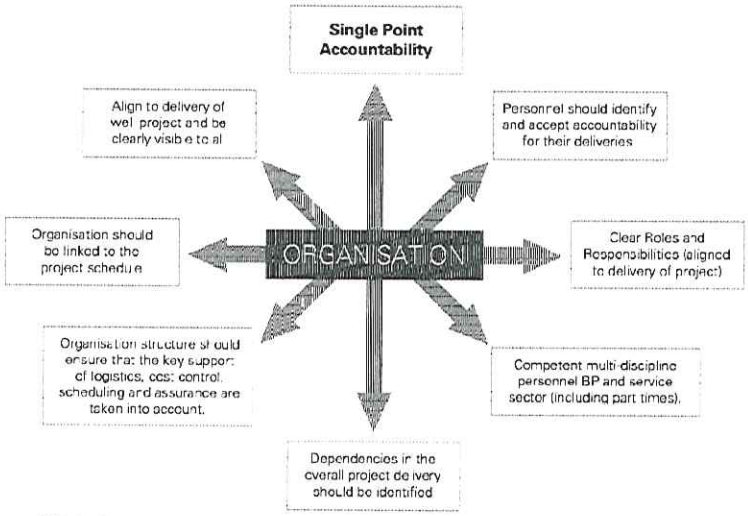

Figure 2E7-2 Orgainisational attributes.

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Selection of Project Manager

Someone who has the appropriate skills, business awareness, understanding of risk and time to assume accountability for delivering the complete wells project from start to finish, e.g. Subsurface Team Leader or Wells Team Leader.

Note: Responsibility for various phases of the well may be assigned to appropriate personnel as the project dictates – it is the Project Managers Accountability to ensure that all the individual phase responsibilities are aligned to delivery of the complete well project.

Complete D&C Organizational guidelines can be found through this link: http://dcsddn.bpweb.bp.com/ (see 'Terms Unique to D&C').

In order to understand how to appropriately resource activities across the Discipline, it is important to recognize the different demands in the activities as they progress through the D&CVA stages. Each specific activity is defined as a "work front."

Definition: "Work front" is an activity that occurs within one of the five D&CVA stages and requires specific D&C resources to complete. In Appraise, Execute, and Operate, activities are (usually) associated with a rig. In Select and Define, mainly planning activities occur. Each of these "work fronts" requires a different level of D&C resources, and typical organizational structures for each are documented in the D&C Organisational guidelines.

In some SPUs there is a pre-CVP stage called Access, which looks at strategic issues around licensing and country entry options and also may include some early exploration work. This work, while predominantly Geology and Geophysics (G&G) and commercially driven, may require support from a skilled D&C resource.

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Work Fronts

Table 2E7-3 shows some of the D&C work fronts than can be found within the framework of the segment common processes.

Other work fronts within an SPU that would draw on D&C resources are SPU Central Support Teams, Functional Excellence Teams, and Central Engineering, and may include Planning, Technology Development, and Special Studies. These teams are responsible for driving the functional excellence agenda and may manage scarce skills, which, in turn, are shared across the various PU wells teams.

Refer to Section 6: BtB Within the E&P CP Framework, for more detailed description of links with other segent common proceeses.

For more information about Organisational Capability, please access the BtBcp website at:
http://epsegmentcommonprocess.bpweb.bp.com/Default.aspx?tabid=189

Appraise	Select	Define	Execute	Operate
Major project Appraise Planning activity – appraisal plan Exploration and/or appraisal well(s)	Major project Select planning activity Define FM Pre-drilled development well(s) or further appraisal well(s)	Major Project Define planning activity Execute FM Pre-drilled development well(s)	Major project Execute activities Development well(s)	Operate activities. Infill wells, interventions, workovers, Abandonment/ Decomm-issioning

Table 2E7-3 Work Fronts.

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3. Right Scoping

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3. right scoping

3.1 Introduction

Drilling and completions activity only makes sense when it is in the context of an integrated technical, functional and business strategy designed to deliver short and longer term asset performance. The process which creates and sustains this strategy is Depletion Planning. For wells teams, knowledge of the asset Depletion Plan is not enough, the team must be closely involved in its creation, providing guidance on the well activity options available. In this way, all well activities implicitly or explicitly defined in the Depletion Plan will be, feasible, practical, cost-effective and adequately resourced.

"Right Scoping" is the process which ensures that individual wells are designed to meet the needs of the asset Depletion Plan. It aligns with the "Appraise"[1] and "Select"[2] stages of Drilling & Completions Value Assurance (D&CVA) and BP's Capital Value Process (CVP). It covers the critical elements of Front End Loading (FEL) leading up to detailed design, to identify (up front) the optimum well concept for delivery of value to the business. "Right Scoping" involves close cooperation of all disciplines with a key interest or stake in well delivery: Geologists, Petrophysicists, Geophysicists, Reservoir Engineers, Petroleum Engineers, Completion Engineers, Facilities Engineers, Drilling Engineers, Wellsite Leaders, and Commercial Analysts to name a few.

"Right Scoping" involves a disciplined approach to delivery of the optimum well concept. Clear deliverables are required leading to a concept freeze where all stakeholders are fully aligned with the objectives, risks, costs and means to deliver value to the business. Its main aim is to create the space and opportunity to achieve engineering excellence in drilling and completions as a forefront to establishing the basis from which to move to flawless execution. The Right Scoping Process can and should be scaled based on the criticality of the well.

It is our intention to provide a framework to help the team get the right scope defined the first time thus delivering value, avoiding unnecessary duplication of work and the need to re-define or re-work well designs. We have aimed at setting "Right Scoping" at a level that identifies value adding components of the process, to provide guidance in its execution, but allows application and moulding to different business circumstances without being overly prescriptive.

1 Appraise – Determine project feasibility and alignment with business strategy – Understand project drivers, identify viable opportunities to pursue, with an emphasis on business goals and the probability of success

2 Select – Select preferred project option(s) – Select, develop and compare project option(s) and appropriate technologies by focusing on the uncertainties, risks and other economic factors associated.

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right scoping

The "Right Scoping" framework is intended to provide flexibility to develop and explore ideas and options to deliver value to the business. It also sets the framework for reducing uncertainty, a crucial step in understanding and managing risk. Once "Right Scoping" has been completed with the delivery of the "Statement of Requirements" (SoR) for the well project, any further changes to the well concept must be managed through a rigorous Management of Change (MoC) process. This is critical to allow engineers to undertake focused detailed design work without having to repeat steps and undertake detailed engineering on numerous different concepts. This will have a major impact on improving engineered solutions, reducing workload on our staff and will allow time for better planning to deliver "Best in Class" performance.

For clarity, and to guide users of the process, "Right Scoping" has been broken down into seven key phases: Value, Objectives, Data, Options, Analysis, Ranking and Statement of Requirements (SoR) *(see Figure 3I-1)*.

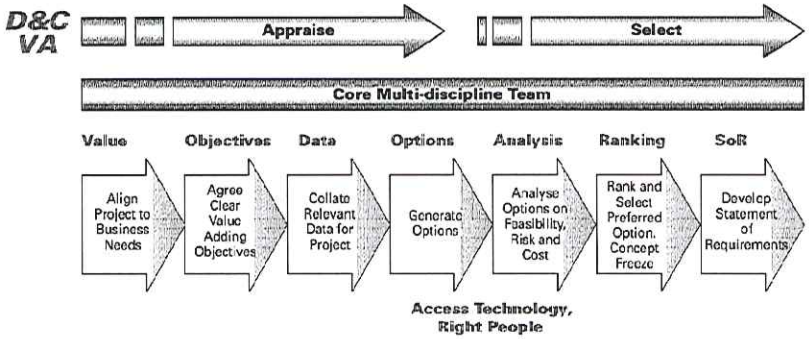

Figure 3I-1 Seven Key Phases

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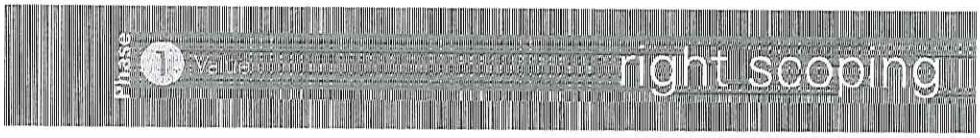

3.2 Detailed Description

There are seven phases of the Right Scoping process. They are:

Phase 1 – Value

Phase 2 – Objectives

Phase 3 – Data

Phase 4 – Options

Phase 5 – Analysis

Phase 6 – Ranking

Phase 7 – Statement of Requirements

Phase 1 – Value

Business needs and strategy will define project and well deliverables. It is therefore critical to have a full understanding of how projects should align with the business and how they will deliver value. Business strategy is normally captured in both the Strategic Performance Unit (SPU) and individual Performance Unit (PU) performance contracts. Ultimately business strategy will be driven from the very top of the company and will be expressed in terms of Brand, business drivers and expectations.

The SPU and PU performance contracts will capture targets against which all options need to be measured. What defines the value for a project or a well? Is it sustained Production or Growth? The key value adding criteria for the project must be defined and is what eventual performance will be measured against. These criteria are important when it comes to assessing and ranking options generated. To assist the ranking process, the criteria also need to be ranked (i.e. what is more important: drilling and completion performance, cost, well productivity, schedule, life of well integrity or environment?).

The value drivers for the project need to be defined and agreed with the whole team and any uncertainties resolved prior to moving ahead. This should be achieved through a meeting of the key stakeholders and decision makers for the project, and should include all representatives of the different disciplines involved. Such a

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meeting will also set up the framework of the core team and act as a means to bring the team together and ensure alignment.

Alignment will:

- Reduce assumptions across disciplines.
- Challenge paradigms.
- Provide a common and clear understanding of risks and targets.

Value Checklist

- Operating Management System (OMS).
- SPU Performance Contract.
- License / Block Commitments.
- PSA/Economic Model.
- Production Requirement.
- Data Requirements.
- Depletion Plan.
- Capex Constraints.
- D&C performance goals/objectives.
- Pace/Schedule.
- Integrated Field Planning (IFP).
- Prioritisation of people and equipment.
- Big Well risk (our critcal wells? / largest production performers?).
- Life of Field.

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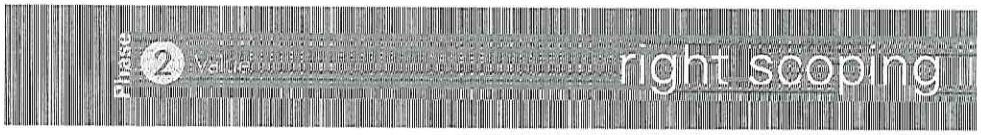

Phase 2 – Objectives

Having now a good understanding of the value drivers for the project and buy in from the team, clear objectives must be set. The purpose of having clear objectives is to capture the value adding components of the project as clear deliverables that will keep the team on course to deliver value to the business.

Objectives need to be focused and crystal clear. They need to be defined in business alignment and then functional terms and not be described in such a way that may stifle creative thinking as a means to achieve them when considering different options or concepts.

For example "to take core" is really a means of gathering data such as porosity or permeability. A functional objective would be to "gather reservoir data" or "determine reservoir properties". When considering options there will be many different ways of determining reservoir properties other than taking core.

Objective setting must avoid conflict and avoid any likelihood of compromise. Secondary objectives should be avoided, if at all possible, as they tend to distract efforts to achieve the main purpose for the project and usually result in significant additional costs. (If secondary objectives are considered important enough to retain they must be clearly ranked with a cost limit).

Objectives can be defined in terms of Strategic and Technical. Strategic Objectives capture the high level "must haves" for the project and if correctly defined will steer the project in the right direction and will provide the skeleton around which the project *(see Figure 3P1-1)*.

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	Strategic Objectives	Technical Objectives
Exploration Well	• Discovery • Dry Hole Scenario • Appraise/Development issues • License and Federal Issues • Planning/Performance Success case	• Success Case • Understand Rock Properties • Verify Seismic • Acquire data to understand reservoir • Identify Fluid Properties • Determine Compartmentalisation • Delineate contacts • Biostrat information • Failure Case • Explain Failure
Appraisal Wells	• Gather necessary data to allow optimum development strategy • License and Federal issue • Discovery • Dry Hole Scenario • Development issues • Planning/Performance	• Acquire further data to understand reservoir • Further understand the fluids • Identify flow issue • Identify Compartmentalisation • Determine Completion needs • Understand the overburden • Further define rock properties • Determine Temperature and Pressure
Development Wells	• Access Reserve • Access Production • Gain Reservoir Information • Gain Overburden Information • Access Injection • License and Federal issues • Planning / Performance	• Position within reservoir • Length of pay accessed and available for production • Zonal isolation • Diameter requirement of penetration • Minimal formation damage • Ability to stimulate • Well integrity (barriers, thermal effects, pressure etc) • Special completion requirements (sand face, artificial lift etc) • Life expectance • Intervention capabilities

Figure 3P2-1 Objectives checklist.

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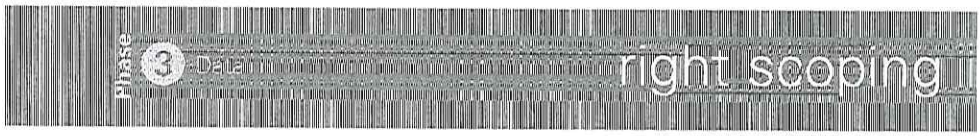

Phase 3 – Data

Prior to exploring project options to capture value it is imperative that all relevant data is identified and collated. Without sufficient data, value will be lost through misinterpretation of facts, uncertainty and the need to base decisions on assumptions. The data needs to be of sufficient quality, and be provided in a sufficient time frame to allow judgements to be made on feasibility, risk, cost and probability of success.

A significant proportion of "Right Scoping" revolves around having a clear understanding of the facts and identifying key areas of uncertainty that need to be managed in terms of risk. Clearly the most significant area of data is in the sub surface on which the future success of wells will depend; from a viable exploration prospect, a productive area of a reservoir to a broad understanding of the overburden and identification of drilling hazards. Other critical areas of data include previous lessons learned for similar areas of activity, offset well data (drilling performance, costs, well performance, geological data etc), PSA requirements, available technologies to be considered, commercial constraints/environment, facility limitations, schedule constraints and environmental criteria (HSE and climatic).

Once the data needs are identified, clear accountability to core team members needs to be given to deliver the data within the required time frame. This is possibly the greatest area of challenge, especially in the sub surface, where data is complex and takes significant time and resources to deliver to the required quality and resolution.

Also, certain data requirements will be dependent on others; for example pore pressure interpretation will be dependent on seismic and basin modelling. Thus a rigorous project schedule should be drawn up to link the data needs, how they interface with each other and when they need to be delivered.

Bottom line – prospect options need to be identified and worked prior to the Select phase to be able to capture the best value for the project.

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The following is a list of data needs which is by no means exhaustive:

- HSE expectations and requirements.
- Offset Wells data (sub surface, production, drilling and completion performance and costs).
- No Drilling Surprises (seismic interpretation of faults, drilling hazards, pore/frac pressure determination, 3D visualisation of reservoir and overburden).
- Lessons Learned for similar areas of activity/wells.
- Licence and PSA details.
- Project constraints.
- Reservoir issues – ranked list of prospects.
- Fluids issues.
- Completion issues.
- Technology needs/Available Technologies.
- Rig requirements and availability.
- Commercial issues and constraints.
- Benchmarks for performance.

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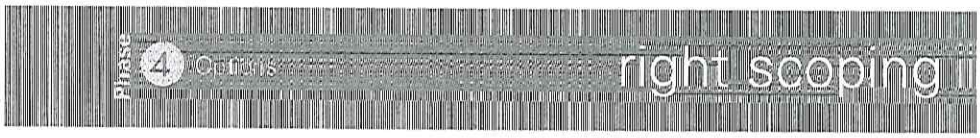

Phase 4 – Options

Having established the value adding criteria for the business, the objectives for the project and having the right data, the team are now well positioned to consider options and concepts to realise the value identified.

One means to come up with ideas is to conduct one or several facilitated brainstorming sessions where anything goes. No idea should be considered stupid or unsuitable at this stage and this is where the team can be at its most creative. It is crucial to widen the sphere of experience as much as possible, therefore inviting in peers from Technology (EPT) and other Performance Units for peer assist is key to success and to ensure that all options have been aired.

Remember Key people and Technology – People being the core multi-disciplined team, people who might have done it before and technical experts who understand the technologies involved.

It is important here not to make snap judgements on ideas to avoid stifling what should be a highly creative process. Having a reasonable understanding of each others business often allows us to see things differently and bring a new perspective. Use of visualisation tools such as the HIVE have proved to be invaluable in helping us see each other's perspective; i.e. Geologists can see what Drillers are attempting and understand the technical challenges, Drillers can see the complexity of the sub surface and understand the reasons for uncertainty, and Wellsite Leaders can add their operational experience. Once ideas have been captured they need to be worked further to achieve definition and reality. This is now the time for challenge and further exploration into possibilities, opportunities and pitfalls.

Ideas that survive this stage should then be screened for viability. One tested way to achieve this is by team vote and then by assigning champions. Firstly screen by voting for each idea:

- Does it have merit in meeting the objectives and achieving the value for the business?
- Does it appear to be feasible?
- Does it deliver the objectives in an economical / cost effective manner?
- Does it meet the requirements for integrity and life of well needs?

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- Does it carry unacceptable risk?
- Can it be delivered in the required timeframe?

Once screened, team members should be asked to champion what should now be viable options. In this context a team member could be one of the peers or technologists you invited to the brainstorming session(s). All options with a champion and all those with a higher score than the lowest championed option should be taken forward into "Analysis" together with a clear understanding of ownership within the core team.

In CVP terms, this is the end of the Appraise stage and the team should document their recommendation and supporting rationale for Option generation in a Drilling and Completions Uncertainty Statement (DCUS). The DCUS will identify the background to the project, the data considered, benchmarking details, a risk and uncertainty summary and the methodology applied to identify the different options to be taken forward. Applicable technologies and best practices should be documented at this stage as should a prognosis of high level costs and forward schedule. The DCUS will be a key component of the Decision Support Package (DSP). The DSP is a compilation of key project information and is used to plan project activities as well as document project considerations and decisions against which the decision makers (or Gatekeepers) will sanction the project to proceed to the next phase.

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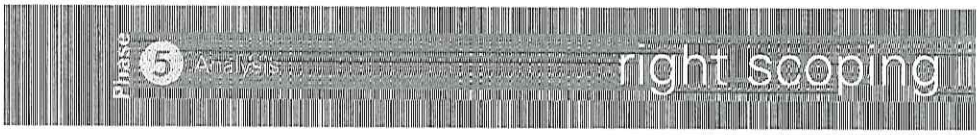

Phase 5 – Analysis

The "Analysis" stage of Right Scoping involves working the options to gain a high degree of understanding of feasibility, risk and cost and determining appropriateness in terms of delivering value and meeting objectives. Use of appropriate engineering tools, risk, cost and economic models is essential. The number of options taken forward into this stage will dictate the complexity of the work-scope, however a high degree of project management discipline and assignment of specific team member accountabilities is required with clear milestones set for delivery.

Technical well objectives aligned to the strategic objectives should be defined at this stage (see objectives table under "Objectives") to provide further focus on the analysis of the different options.

Each option needs to be examined/analysed to determine its appropriateness for the project and how it affects other project components (if applicable). Overcoming drilling hazards, casing design, directional constraints, torque/drag, hydraulics, completion, stimulation and intervention requirements etc. all need to be taken into account.

Probabilistic cost models (e.g. multi-well and single well estimator tools) should address assumptions made and identify key areas of sensitivity and uncertainty. HSSE and well integrity issues must be addressed.

At the end of this stage all of the options/concepts should be documented in a manner that captures the key components described above to allow them to be ranked in a consistent manner. All risks should be addressed in terms of appropriate requirements for mitigation and possible outcomes for uncertainty included in the cost estimates.

One means of examining the appropriateness for options is to test them with the simple statement:

> "Everything you do and design for on a well project must be linked to the well project objectives".

If there are aspects of the design or concept that do not meet this sense check then they need to be re-worked or dropped.

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Phase 6 – Ranking

Having worked up the options in terms of feasibility, cost, risk, deliverability of objectives and generation of value to the business, they need to be ranked to identify the most appropriate concept(s) to take forward for detailed engineering. Decision making tools may be required to resolve possible conflicting information. This may well require the support of appropriate professionals skilled in this area.

Economic models will help in ranking worked options as there is always an uncertain trade off between value and cost. At this stage it is important to maximise on value providing the prognosed costs do not override the economics and value delivery.

A great tool to rank options is "Paired Analysis". This provides a weighting for the project value criteria which can then be used to rank identified options. The Value criteria will normally be those identified in the first step of "Right Scoping" – Value. A simple example of a decision using paired analysis is explained in the following figures. Often with many criteria it is difficult to determine their priorities for given projects. By comparing cash value criteria versus another (i.e. pairing them) allows the team to make a clear judgement of their importance and weighting compared to each other. Once you have the value criteria weighted you can rank options against them. The example given *(see Figures 3P6-1 and 3P6-2)*. is for a simple decision to be made on selection of a mode of transport for a given trip, but the message on how the tool can be used is clear. From the analysis the best way to travel will be by plane.

Step 1: Weighting the critieria

	B	C	D	E	F		Ranking Criteria	Score	%
	B3	C2	A1	E3		A	Low Cost	1	4.3%
	B	[illegible]	B3	[illegible]		B	Safety	12	52.2%
		C	D1	E2		C	Short Time	2	8.7%
			D	E2		D	High Comfort	1	4.3%
				E		E	Good Reliability	7	30.4%
								23	100%
			1					2	3

Guide

1. Compare each criteria against each other and give relative points to the more important criteria
   eg: In the cell A/B Safety (B) is much more imortant than cost (A) thus entry = B3
   eg: In the cellC/D My comfort (D) is a little more important than time (C) thus entry = D1
   eg: In the cell D/E reliability (E) is reasonably more important than my comfort (D) thus entry = E2
2. Now add up all the points attached to the As, Bs, Cs etc and put the total in the appropriate score cell
   eg: adding up all the A points = 1, so put 1 in the A score cell
   eg: adding up all the B points = 12, so put 12 in the B score cell
3. Calculate the percentage score for each of the criteria which gives the relative weighting

Figure 3P6-1 Paired Analysis – Weighting the Value Criteria

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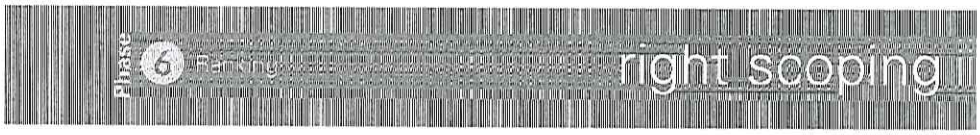

Step 2: Applying the weighted criteria to each of the options

Criteria Applicability

Low Cost	Safest	Short Time	High Comfort	Good Reliability
1	1	1	2	0
1	0	1	2	1
0	2	2	1	2
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

← 1 →

Criteria Weighting x Applicability

From Step 1

Option	Low Cost 0.04	Safest 0.52	Short Time 0.09	High Comfort 0.04	Good Reliability 0.30	Value	Ranking
Train	0.043	0.522	0.087	0.086	0	0.74	2
Car	0.043	0	0.087	0.086	0.304	0.52	3
Plane	0	1.044	0.174	0.043	0.608	1.87	1
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.39	4
	← 2 →					3	4

Guide

1. Apply the criteria applicability to each of the options and complete the matrix (left)
   eg: Train satisfies low cost criteria to a medium extent therefore scores 1
   eg: Trains in UK do not satisfy the good reliability criteria therefore scores 0
2. Multiply the criteria applicability ~~scores by the weight~~ing for each criteria and complete the matrix (right)
   eg: Train cost score 1 x cost weighting 4.3% = 0.043
   eg: Plane reliability score 2 x Good reliability weighting 30% = 0.608
3. Add the total score for each option (rows)
4. Rank the Options according to the scores.

Applicability of Critera
Low = 0
Med = 1
High = 2

Figure 3P6-2 Option ranking using weighted value criteria

Details of the ranking process / system employed demonstrating alignment to value drivers and objectives must be documented to provide an auditable trail of how the decisions were made.

Again a Drilling and Completions Uncertainty Statement (DCUS) should be prepared for the selected concept(s) covering the same areas identified in the Appraise stage DCUS but in more refined detail. This will form the basis for recommendation to the decision maker(s) to agree to proceed into "Define"[3] with the preferred concept. Once the preferred concept has been approved the "Concept Freeze" should be implemented.

The freeze dictates that no further changes to the concept taken forward to "Define" are allowed, providing the space and freedom for engineers to further develop the concept(s) and ensure fit for purpose design to capture value and allow effective and efficient execution.

3 Define – Finalise project scope, cost and schedule and get project funding – Develop and define the selected option(s) and provide the appropriate level of detailed planning and design needed to determine the scope of the project and to develop Class 1 cost and schedule estimates.- deliverable – Sanction/ AFE/ funding and resources for project.

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Phase 7 – Statement of Requirements

The most important deliverable of "Right Scoping" is the Statement of Requirements (SoR). The SoR is the basis on which all future decisions are made with regards to well design and execution. It must capture the value adding decisions made during the process and cover all aspects of concept design that address risk and are crucial to successful and safe execution and operation. It must be signed off and agreed by the multidisciplinary team and communicated to all team members before detailed engineering work commences.

An SoR should NOT:

- Be so detailed that it is impossible to complete in sufficient time to allow detailed engineering.
- Be so long that you cannot find or remember anything.
- Be so detailed such that Management of Change (MoC) becomes totally impractical.
- Be so vague such that it cannot be used as a clear guide for well purpose.

Figure 3P7-1 details the required contents of the Statement of Requirements (SoR) for a Well.

Often, the amount of data in a given SoR can be substantial – especially for a large well projects. In such cases it is recommended to capture the salient points in the form of a one pager or poster to keep the team focused on the key aspects of the well.

Figure 3P7-2 shows an example given for the Central Azeri project.

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Phase 7 Statement of Requirement

right scoping

- Justification: generation of value to the Business.
- Key value decisions made.
- Aspects of design which address risk and are crucial to successful and safe execution and operation.
- Well history (if applicable).
- Risk Management plan: The process by which project risks will be managed.
- Provisional costs and economics Including costs for detailed design and project planning costs.
- Well Planning Data Package.

WPDP

- General Data – Location, Licence, Well designation, Classification, Prospect details.
- Well Objectives: Strategic: Drilling and completion performance, HSE, Licence Commitments. Technical: TD criteria, Data, production, reserves accessed.
- Sub surface prognosis and uncertainties: Overburden and reservoir. Drilling Hazards: summary of key drilling hazards to be managed avoided or mitigated. Pressure and Temperature, Fluids description (prognosis).
- Well Location and Targets: Surface and bottom hole.
- Site Survey details.
- Outline well design: Casing design, completion design, trajectory. Data Acquisition Plan, suspension/ abandonment plan (if applicable).
- Constraints and Tolerances.

Figure 3P7-1 The Required Contents of a Wells SoR

Value Drivers – Accelerated production 23mmbbl year 1, 34mmbbls year 2. Enhanced RROR increase from 26.4% to 27.8%. Addxing $85 million NPV10. Value derived from accelerated first oil rate enhanced by keeping suspention and completion design simple to mimimise tieback and completion time on platform installation.

Primary Objectives – Pre-install high angle wells such that they are tied back and completion installed shortly after platform installation for immediate production.

Concept – High angle well through reservoir to maximise production. Type I wells: 1st six wells – 12" hole through reservoir, step out <2500m (inc 800m through reservoir), casing hole. On tie back, run basic completion with TCPs and perforate. Type II wells: 2nd six wells – 12" to top reservoir, run 9 5/8" casing and suspend. Tie back after Type I wells on production, drill reservoir, install open hole gravel pack and completion. No testing of pre-drill wells prior to platform installation. Targets: Must be adequately spaced to limit production interference (pressure support 18 months post platform installation).

Risks to delivery – Schedlue: Need to deliver minimum 8 wells (incl 6x Type wells) prior to pipeline installation.
Wells: Geohazards, wellbore stability, high torque and drag, cuttings disposal.

Costs and Days – Inclusive of tie-backs and completion:
Mean: Type I wells – 39 days, £12.2 million, Type II wells – 45 days, £13.2 million.

Figure 3P7-2 An example of an SoR one pager.

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3.3 Scaling

With the different scales of wells projects around the world we cannot expect the Right Scoping process to be implemented in the same manner across the board. For large projects the expectation will be that Right Scoping is employed in its entirety to its broadest possible scope whereas for sidetracks or re-entries the expectation is that the minimum elements of Right Scoping will be covered meeting the main expectations.

The tree in *Figure 3.3-1* identifies how Right Scoping will be used for 6 different wells project areas and the expectations in terms of timing for the delivery of the SoR and thus concept freeze.

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right scoping

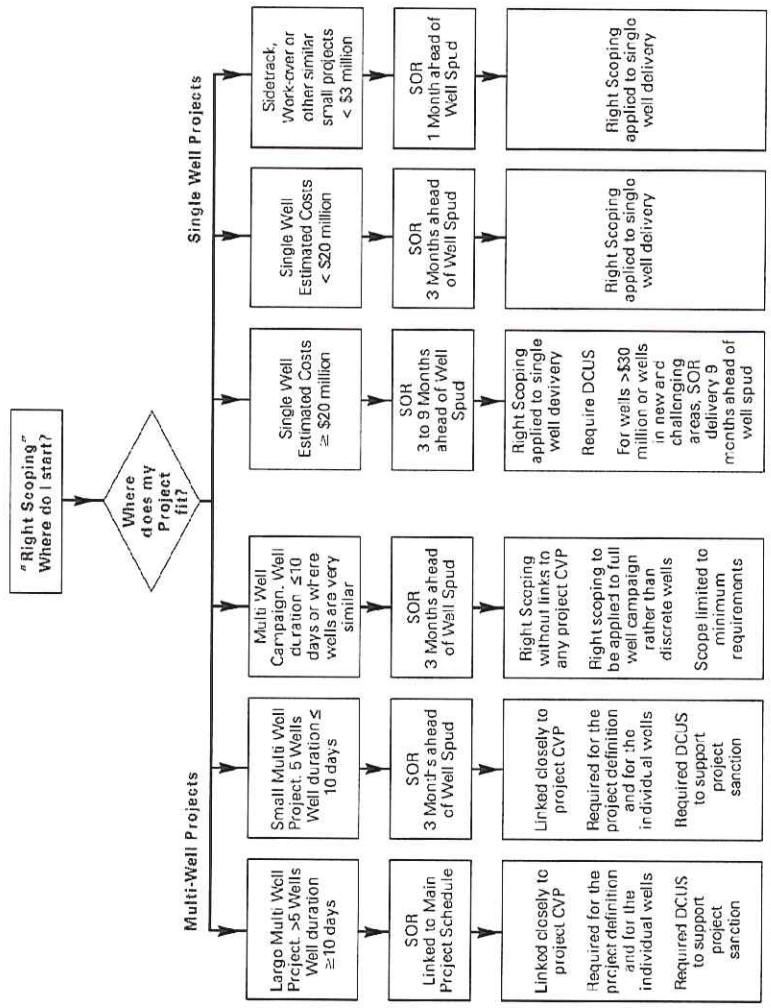

Figure 3.3-1 Right Scoping Scaling.

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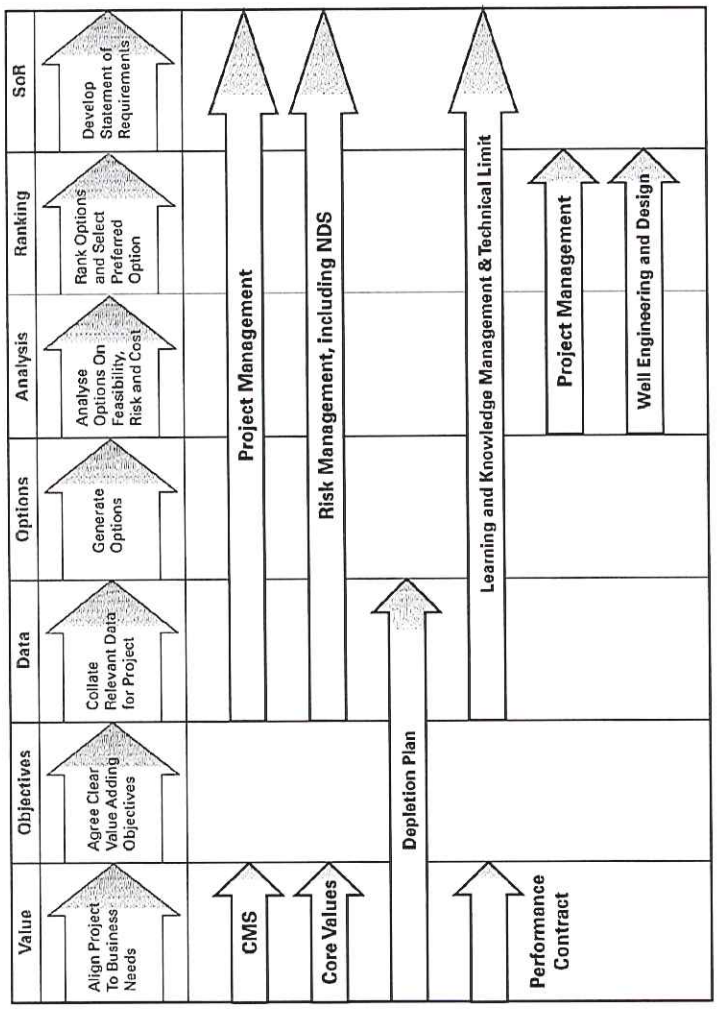

Figure 3.3.2 Generic Inputs and Tools.

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Value	Objectives	Data	Options	Analysis	Ranking	SoR
Align Project To Business Needs	Agree Clear Value Adding Objectives	Collate Relevant Data for Project	Generate Options	Analyse Options On Feasibility, Risk and Cost	Rank Options and Select Preferred Option	Develop Statement of Requirements
Prioritised list of value drivers for the project. Performance indicators to measure delivery. Linked to Life of Well, NPV, Drilling Performance, Completion performance, EOE accessed etc. Agreed by all Project Team.	Prioritised list of clear objectives for the project. Strategic Well Objectives agreed to by all Project Team. **Check List** • What we stand for • Discovery • Dry hole scenario • Appraisal /development issues • Licence and federal issues • Planning / performance • Agreed by all key Project Team	Collated information and data required to make value judgements and identify suitable concept options for the project. Set timeframe for Option Generation session to provide milestones for delivery of data.	A list of screened ideas/ options to be carried forward into analysis stage. Screened at high level and owned by Project Team. A forward plan for methodology to be applied for Concept selection. A Drilling and Completions Uncertainty Statement (DCUS) identifying: • Project scope • Data considered • Benchmarks • Sub surface, Drilling & Completions risk and uncertainty • Methodology applied to identify and screen concepts • Applicable technology and best practices. • High level prognosis of costs vs value of the different options.	Evaluated concepts covering technology, probabilistic cost, risk, value drivers, and applicability to objectives. HSE issues and mitigation should be addressed. Key areas of sensitivity identified and any assumptions made. Agreed Technical Well Objectives. (see objectives guide)	Details of the ranking process/system employed demonstrating alignment to the value drivers and well objectives. Recommendation of concept(s) to take forward to Define stage. Prepare a more detailed DCUS than for Appraise plus details of selected and rejected options. Contracting strategy, and HSE strategy. **Design Freeze** typically 60 days for conventional wells, 90 to 120 days or more complex wells projects and new areas. Big projects 6 months. (see scaling)	A prepared Statement of Requirements (SoR) which will include a WPDP and a Class III Cost estimate (+/- 30%) See attached guide for SoR and WPDP. Following the preparation of the SoR a Well Concept Peer Review will be conducted by suitably qualified peers to provide assurance to Management for approval to move to Define. SoR will be the basis for Management of Change.

Figure 3.3-3 Generic Deliverables (Outputs).

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right scoping

Value	Objectives	Data	Options	Analysis	Ranking	SoR
Align Project to Business Needs	Agree Clear Value Adding Objectives	Collate Relevant Data for Project	Generate Options	Analyse Options on Feasibility, Risk and Cost	Rank Options and Select Preferred Option	Develop Statement of Requirements
Meeting with Project Team. • Sub Surface • Commercial • Drilling / Comp • Facilities • HSE • Partners Identify key value adding criteria for the well(s). Identify key value adding criteria upon which performance shall be measured. **Check List** • PU Performance Contract • What we Stand for • Licence /Block commitments • Reservoir management/performance • Production requirements • Data requirements • Capex constraints • Performance drivers • Economic Sensitivity analysis	Meeting with Project Team. • Sub Surface • Commercial • Drilling / Comp • Facilities • HSE • Partners Agree Strategic well objectives. (See objectives guide) Core Team must be fully bought in and agree to final objectives. Objectives must be crystal clear with no ambiguity or nice to haves. Once objectives defined agree data needs for concept selection phase.	Meeting with Project Team. • Sub Surface • Commercial • Drilling / Comp • Facilities • HSE • Partners Data needs to be of sufficient quality to judge on risk, cost and feasibility. Core team assigned work to obtain the data required. **Check List** • Offset data (Sub surface, Production and Drilling) • No Drilling Surprises • Lessons Learned • Licence details • PSA details • Project constraints • Reservoir issues • Fluids issues • Completion issues • Technology needs • Commercial issues • Benchmarks for performance	Facilitated session(s) to review the data and brainstorm possibilities, Capture innovation and creative energy. Right People. Peers, technologists, Subsurface, Drilling, Completions, Facilities, Production. High level screen ideas and assign concept champions /owners. Undertake high level risk assessment. Assign work to team to analyse the screened options. Prepare Drilling & Completions Uncertainty Statement (DCUS) – see outputs.	Detailed analysis of the options using sub surface, engineering and commercial tools. Assigned tasks to core team members with clear accountabilities and milestones for delivery. Consider feasibility, technology needs, cost / risk, alignment to value drivers and well objectives. Identify and agree Technical Well Objectives. (see Objectives guide) **Check List** • Technology • Feasibility • Probabilistic Cost • Risk • Value • Applicability to Objectives • Sensitivity • Assumptions • HSE issues and Mitigation	Sessions(s) to rank the analysed options. Ranking process should take risk, uncertainty, costs, business value, schedule and HSE into account. Select option(s) which meet(s) the requirements of the project in terms of business needs. Prepare Drilling and Completions Uncertainty Statement (DCUS) for gatekeeper to approve and proceed to Define stage (detailed engineering) **Design freeze** on the preferred concept(s) should be agreed at this point and endorsed by Management.	Team to prepare for the well(s). SoR will be the basis on which all future decisions are made with regards to design and execution. SoR must capture the value adding decisions made. **Sense Check** Everything you do and design for on a well must be linked to the well objectives. **Check List** • Justification • Key value decisions • Aspects of design which are crucial to successful and safe execution and operation • Risk Management plan • Provisional costs and economics • WPDP

Figure 3.3-4 Right Scoping Guidleines.

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right scoping II

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4. No Drilling Surprises

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4. no drilling surprises

4.1 Introduction

No Drilling Surprises (NDS) is an integrated process involving Sub Surface (Geologists and Geoscientists) and Drilling and Completions (Engineering and Operations). The single largest contributor to Non-Productive Time (NPT) in D&C operations is downhole problems and stuck pipe. No Drilling Surprises (NDS) is the primary Beyond the Best (BtB) weapon to enable us to systematically address this performance challenge.

From reviews conducted in late 2007 and early 2008 it has been shown that the front end planning is frequently very good. However the quality of monitoring, detection and reaction to downhole hazards during drilling operations was shown to be much more variable. Also few areas demonstrated effective learning from operations back into the well planning cycle. Emphasis also needs to be placed on cross discipline working and communication.

The following areas were identified during the reviews highlighting where improvements could be made to the NDS process and associated tools to deliver more effective and sustained performance.

1. NDS must encompass spud to TD activity i.e. it will now include shallow hazards, and reservoir in addition to the overburden.
2. Cross discipline pre-drill analysis and scenario planning should be conducted using a hole section by hole section approach. Clear communication of the hazards with details on how they may be manifested and on how to overcome them should be made from the planning to the operations team.
3. It has been recognised that NDS risks should be clearly identified and actively managed through inclusion in the wells risk register rather than separately. This should be accomplished with the new NDS assessment tool.
4. More focus is required on execution through delivery of the NDS plan. The plan should address the potential hazards, how key information should be monitored, hazards detected and how the team should react to their occurrence.
5. Greater rigour is required to ensure that lessons learned during the operation phase of the well are transferred back to the planning cycle for the next well or are captured for future operations

All of the above improvements will be facilitated by the new NDS assessment tool that accesses global, regional and local subsurface problems. These guidelines will provide the reader with an overview of the new NDS approach.

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no drilling surprises

4.2 Overview

No Drilling Surprises is an essential component of well planning and delivery that aligns with the "Appraise", "Select", "Define" and "Execute" and "Review" stages of BtB Drilling and Completions Value Assurance (D&CVA). The aim is to identify the optimum well location and trajectory to minimise and manage subsurface hazards from spud to TD. Those hazards that cannot be managed out through design will still need to be managed through effective real time prediction and reaction to minimise non productive time. To ensure the continued effectiveness of the process, key learnings from NDS experience gained from operations need to be fed back to improve on front end planning and future operations. Subsurface models should also be updated while the well is being drilled to communicate understanding and interpretation of formations still to be penetrated. Successful "NDS" requires close cooperation of, and communication between, all disciplines with a stake in well planning and delivery. This is especially important between the office and the rig to ensure that the execution plan to minimise "No Drilling Surprises" is clearly understood and manageable.

Successful "NDS" requires the use of supporting technologies to enable effective team work and communication of the subsurface hazards and uncertainties. Good examples of these are HIVE (Highly Immersive Visualization Environment) and ACE (Advanced Collaborative Environment) that allow visualisation and transfer of real time data in a format that can be understood by all.

"NDS" provides a framework that allows optimisation of well planning, execution and learning. For well planning a successful outcome will be an executable and cost effective well trajectory that avoids major subsurface hazards while still hitting the downhole reservoir targets. For execution a successful outcome will be a workable plan that ensures the effective identification and communication of potential subsurface hazards and allows the rig operation team to detect and react to them appropriately.

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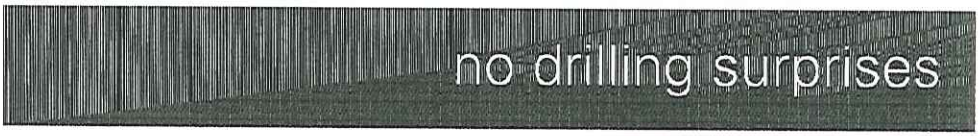

4.3 The "NDS" Process

For clarity, and to guide users of the process, "NDS" is broken down into five key steps that align with the five stages of Drilling and Completions Value Assurance (D&CVA) *(See Figure 4.3-1)*:

1. **Overview and Data Gathering** – Mapping of geology from surface or sea bed to TD using conventional studies, and interrogation of offset data, lessons learned etc, to identify potential risk.
2. **Interpretation** – Interpretation of geology and geological risk within a HIVE, ACE or other visualization system.
3. **Planning** – Evaluation and mitigation of sub-surface risk using the NDS assessment toolkit. The construction of an execution plan that communicates the risks and nature of the hazards, explores possible scenarios, their indicators and how to react.
4. **Real Time Focus** – Clearly communicating the nature of the sub surface risks and hazards to the Well Operations team on the rig. Real time analysis and interpretation of data during execution that allows effective prediction, reaction and avoidance of subsurface hazards.
5. **Learning and Feedback** – Post drill interpretation and analysis of geological NPT, capture of learning into a local and Global library of subsurface risk.

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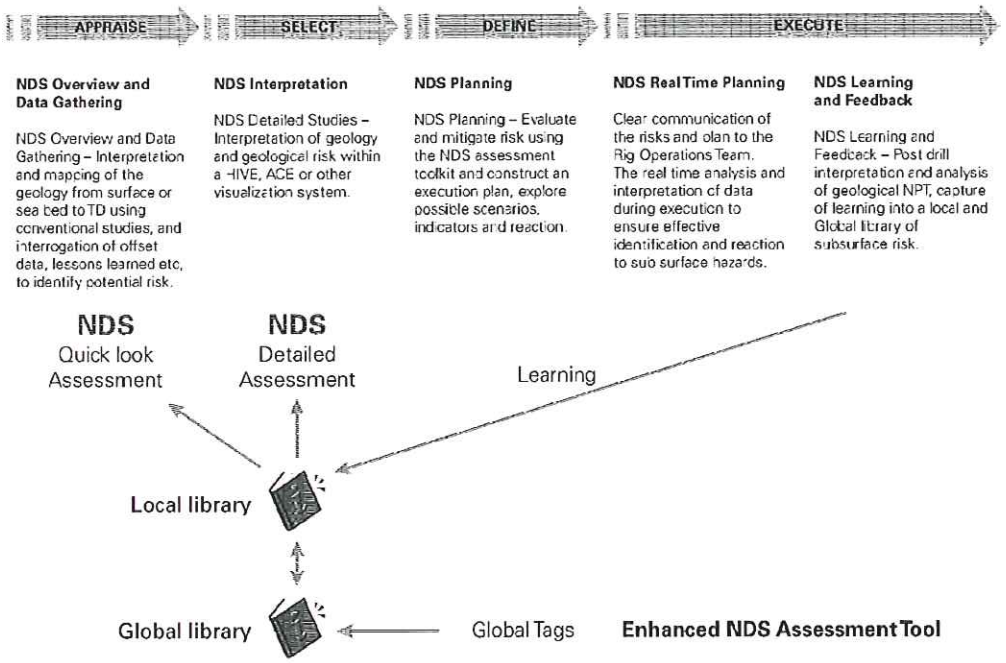

Figure 4.3-1 The No Drilling Surprises Process.

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4.4 Detailed NDS Process

There are five phases of the NDS process. They are:

Phase 1 – Overview and Data Gathering

Phase 2 – Interpretation

Phase 3 – Planning

Phase 4 – Real Time Focus

Phase 5 – Learning and Feedback

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Phase 1 – Overview and Data Gathering

During the Appraise phase all relevant data that could have an impact on well construction must be gathered. This will include subsurface and historical offset operational data – the objective being to identify potential hazards and understand their impact during the execution phase.

The scale of the well or project will determine what level of interpretation will be required. An idea of the level of application of the process is provided with each set of expectations for each stage of NDS. These should serve as guidelines only. A conscious decision needs to be taken with regards to the appropriate application of the process for a given situation or well type.

Although the NDS process is owned by both Drilling and Completions and Sub Surface, the Subsurface Team Leader is accountable for ensuring that the Overview and Data Gathering stage of the NDS process is followed by the multi-disciplinary team in a manner appropriate to the potential risks and the criticality of the well to the business. The Operations Geologist is responsible for ensuring that this work is undertaken, alongside the conventional prospect generation and target selection tasks.

At this stage a high level generic NDS evaluation must be conducted using the Quick Look Section of the NDS Assessment Tool. (REF: Section 5). Major risks to the well project will be identified through this assessment.

Expected Requirements to pass through "Overview & Data Gathering" stage gate

Note: Scaling examples should serve as guidelines only. A conscious decision needs to be taken with regards to the appropriate application of the process for a given situation or well type.

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Phase 1 Overview and Data Gathering

no drilling surprises

		Scaling		
	Expectation	Offshore Exploration well or well in a hazardous location or with potential surprises	Development Well where hazards exist but are known and understood	20th onshore well on same prospect or no hazards expected
1	A completed Quick Look NDS Assessment conducted by the multi-diciplinary team.	Required		
2	An understanding of the Site Selection and Survey implications (potential for shallow hazards).	Required		
3	Establish the requirement for supplimentary studies such as Shallow Hazard, PPFG (Pore Prtesure and Fracture Gradient), WBS (Well-bore Stability), Drilling & Completions Fluids	Required	Sense check	Light touch
4	A forward plan for Selection activities including the use of the NDS Toolkit (Ref: Section 6)	Required	Required	Required
5	A compendium of all relevant subsurface and drilling offset data.	Required	Required	Required
6	A preliminary Operations Forecast based on offset wells for preliminary PPDFG evaluation using offset LOT (Leak-Off Test), FIT (Formation Integrity Test), well control data and significant NDS related NPT events.	Required	Required	Required
7	A feasibility assessment that establishes that all proposed well design concepts are possible within geological and geophysical and drilling uncertainty	Required	Sense check	
8	An initial well specific Risk Register populated with theNDS risks identified.	Required	Required	Field only
9	a RACI chart for the NDS workflow.	Required	Required	Development only

Figure 4.3P1-1 Minimum expectations for NDS Phase 1.

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Phase 2 – Interpretation

Having common tools for interpretation of the subsurface environment which combines drilling information (offset and analogue lost circulation, well control, and well-bore instability events) and subsurface information (stratigraphic surfaces, faults, pore pressure, fracture gradient, well-bore stresses) is essential for mutual multi-disciplinary understanding of the risks that could affect successful well delivery.

The Subsurface Team Leader is accountable for ensuring that the Interpretation stage of the NDS process is followed by the multi-disciplinary team in a manner appropriate to the potential risks and the criticality of the well to the business

This phase involves using all the available prediction tools to ensure that the major hazards are identified and communicated to the wells team and that effective well planning is undertaken to avoid or mitigate against identified hazards whilst still maintaining an economically drillable well. At this stage it is envisioned that several well trajectory options will be under consideration. These will need to be assessed against the following categories:

- Reserves accessed.
- Production delivered.
- Ease of well construction.
- Drilling and completion cost.
- Facilities related costs (flow lines and production surface location).
- Intervention cost.

For example, to deliver the most effective business outcome it may be better to drill an easier well that delivers lower production than to drill a difficult but more productive well that is delivered later or not at all. Alternatively, it may be wiser to drill easier wells early in a campaign to permit maximum learning.

This stage is focused upon detailed offset well analysis from both a wells and subsurface perspective. This work should culminate in a detailed well specific NDS assessment sufficient to allow confident selection of the appropriate well concept. The need for supplementary studies in the Define stage should be agreed at the end of Select.

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Phase 2 Interpretation — no drilling surprises

		Scaling		
	Expectation	Offshore Exploration well or well in a hazardous location or with potential surprises	Development Well where hazards exist but are known and understood	20th onshore well on same prospect or no hazards expected
1	Offset well review conducted by Operations Geologist and Drilling Engineer encompassing well construction and field operations (e.g. production and injection history)	Required	Required	Light touch
2	A statement on the robustness of the selected well concept in adcressing the seismic and geological uncertainty from surface to TD (including well placement, TD criteria, shallow hazards and casing setting depths)	Required		
3	An optimised well trajectory within geological space critically examined by the multi-disciplinary team using a visualisation facility	Required	Light touch	
4	A detailed well specific NDS assessment using the updated NDS Assessment Tool (Ref: Section 5)	Required	Required	Light touch
5	A report on the findings from the NDS toolkit work programme to incluce WBS, drilling and completion fluids, shallow hazards and other studies.	Required	Required	
6	Robust subsurface criteria for casing setting depths.	Required	Required	Light touch
7	A summary of the impact of drilling fluid selection on WBS and formation damage.	Required	Required	Light touch
8	An updated risk register populated with risks and mitigations identified from the detailed NDS assessment and ongoing work. Risks must include Life of Field considerations due to injection and depletion.	Required	Required	
9	Data Acquisition requirements for both success and failure cases as determined from the Data Acquisition Workshop (to include overburden and reservoir needs)	Required	Required	Field only

Figure 4.3P2-1 Minimum expectations for NDS Phase 2.

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		Scaling		
	Expectation	Offshore Exploration well or well in a hazardous location or with potential surprises	Development Well where hazards exist but are known and understood	20th onshore well on same prospect or no hazards expected
10	A detailed Operations Forecast based upon findings and refinements from work conducted using the NDS toolkit.	Required	Required	Field only
11	A forward plan for Define activities including casing pick programme, WBS management programme, decision trees and monitoring requirements.	Required	Light touch	
12	A statement that there is no conflict between the Well objectives and NDS findings.	Required	Required	
13	An NDS section in the Wells SoR (see Right Scoping) clearly communicating the sub surface hazards and how they have been addressed in the well design	Required	Required	Field only

Figure 4.3P2-1 Minimum expectations for NDS Phase 2 (continued).

Should the least risk trajectory not be selected for strategic reasons (e.g. secondary targets above or below the primary target) then this should be communicated to the Gate Keeper and an appropriate mitigation plan should be developed. This also requires that more effort should be placed in the Execution phase to ensure that this incremental risk is mitigated effectively. It could be that some Execution activities that are not mandatory for this class of well are utilised.

Data Acquisition on early wells should account for the full development drilling envelope (e.g. future ERD wells). In the event that circumstances change these must be addressed in terms of data acquisition and predictive modelling.

Expected Requirements to pass through "Interpretation" stage gate

Note: Scaling examples should serve as guidelines only. A conscious decision needs to be taken with regards to the appropriate application of the process for a given situation or well type.

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Phase 3 – Planning

Having established the preferred well design at the end of select, this phase requires that the detailed plan be generated using all the appropriate subsurface and drilling engineering modelling tools. (Outline details of the NDS toolkit can be found in Section 6 and in detail on the identified web sites).

The define phase is all about generating an operationally deliverable plan based on what has been learned in the course of our NDS workflow for Appraise and Select.

It is at this stage that the final well-bore stability predictions for the well should be created and operations practices and procedures developed to mitigate associated problems.

It is the accountability of the Wells Team Leader to ensure that all of the identified NDS risks and hazards are clearly articulated, understood and addressed in the well design prior to the final operations plan being drawn up. It is the responsibility of the Operations Geologist and Drilling Engineer to ensure that effective integration of geological and engineering information and know how are combined to achieve an effective plan.

It is the rigsite operations team that will have to manage the plan at the rigsite and communicating the risks to this team is crucial to achieving successful execution. This has been a key finding of the reviews, and is an area that demands particular effort.

At the end of this phase all the risks should have been clearly documented and a plan put in place to remove or manage them and address the remaining uncertainties.

Expected Requirements to pass through "Planning and Mitigation" stage gate

Note: Scaling examples should serve as guidelines only. A conscious decision needs to be taken with regards to the appropriate application of the process for a given situation or well type.

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		Scaling		
	Expectation	Offshore Exploration well or well in a hazardous location or with potential purprises	Development Well where hazards exist but are known and understood	20th onshore well on same prospect or no hazards expected
1	A risk register with all risks mitigated and actions addressed	Required	Required	Field only
2	A final Operations Forecats with WBS, MW and NDS risks	Required	Required	Field only
3	Decision Trees in place for main NDS uncertainties and risks that identify appropriate contingencies and decision criteria and decision accountabilities	Required	Light touch	
4	Detailed NDS data monitoring programme	Required	Light touch	
5	Confirm RACI chart for delivery learn roles and responsibilities during the execute phase	Required	Required	Field only
6	Demonstration that specialised NDS support personnel (PPFG/WBS or other monitoring specialists) are identified and available	Required		
7	A programme for monitoring and interpreting drilling parameters that indicate potential NDS problems (e.g. hydraulic, torque and drag(	Required	Required	

Figure 4.3P3-1 Minimum expectations for NDS Phase 3.

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Phase 4 – Real Time Focus

The "Execution" stage of No Drilling Surprises involves:

- Communicating the plan so that all are aware and fully understand.
- Ensuring that all personnel involved with the operation are suitably trained to implement the plan.
- Implementing the plan:
  - Ensuring that the NDS hazard identifiers are being monitored.
  - Ensuring that effective hazard prediction practices are implemented.
  - Interpreting relevant data gathered real time to minimise the impact of unseen sub surface hazards.
  - Ensuring that agreed practices are followed to manage/overcome sub surface hazards.

It is the accountability of the Wells Team Leader to ensure that the NDS plan is communicated, understood implemented efficiently and effectively. It is the responsibility of the Wellsite Leader and Operations Geologist to ensure that the elements of the plan are effectively carried out.

Risks that were identified and planned for should be carefully monitored using real-time data. Risks that were not predicted during Appraise to Define may still be picked up, and mitigated through real time data interpretation, before it becomes a problem. Remember that post train wreck investigation often yields missed warning signs!

NDS must be a key area of focus for operations staff throughout the execution phase. As such NDS must feature in the following which should be attended by all key operations personnel:

- Pre-spud meetings.
- Pre-section meetings.
- Pre-tour meetings.
- Daily operations meetings.

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For the above four meetings use "what if" scenarios to emphasise the plan. Share examples and understand how to read the warning signs.

- After action reviews after each well section.

Expected Requirements to pass through "Real Time Focus" stage gate

Note: Scaling examples should serve as guidelines only. A conscious decision needs to be taken with regards to the appropriate application of the process for a given situation or well type.

		Scaling		
	Expectation	Offshore Exploration well or well in a hazardous location or with potential purprises	Development Well where hazards exist but are known and understood	20th onshore well on same prospect or no hazards expected
1	Specific training on identified hazards and their mitigation for key operations personnel	Required	Light touch	
2	"What if" scenario planning for each section of the well	Required	Light touch	
3	Daily communication to Operations personnel of NDS hazards and risks	Required	Light touch	
4	24/7 Real Time monitoring, evaluation and interpretation of drilling and subsurface data by component personnel from spud to TD	Required	Required	As appropriate to hazards
5	Real Time updating of geological prognoses and models based on actual data obtained while drilling	Required	Required	
6	Ensuring that drilling and NDS data are effectively reconciled to avaoid drilling problems (e.g. torque and drag, cuttings volume analysis, mud condition each associated to partcular sub-surface phenomena	Required	Required	Light touch
7	Effective use of the NDS toolkit	Required	Required	Light touch

Figure 4.3P4-1 Minimum expectations for NDS Phase 4.

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Phase 5 – Learning and Feedback

Having delivered the well it is essential that an NDS Evaluation Meeting (retrospect) takes place to capture lessons learned. This has been shown to be a weakness in the NDS workflow leading to repeated and avoidable NDS related incidents. These lessons must be applied on the planning and execution of future wells on the field and where appropriate disseminated globally. It is recommended that this review take place as soon as practical after the well is completed but not later than one month after completion.

It is the accountability of the Sub Surface Team Leader to ensure that all of the identified NDS lessons are captured and addressed for future well planning and execution. It is the responsibility of the Well Site Leader to ensure that after action reviews are held, the Operations Geologist to capture lessons learned and the Wells Team Leaders to ensure that a multidisciplinary end of well review is held.

Interpretation and predictive models should be updated as a result of information gained while drilling the well. This is important for improvements to be made while planning subsequent wells but also to ensure that as staff change over the life of a field. (the models need to remain current, valid and accessible).

A key component of the enhanced NDS assessment Tool is the Risk Library or template. This comprises the learning archive for local and global NDS risk elements. This library should be updated at the end of each NDS assessment and retrospect. Risks of federal significance should be communicated to the NDS Library Custodian (refer to Subsurface and Wells well planning community of practice. The aim here is to be able to access historic risk elements for past wells within the NDS assessment tool.

Expected Requirements to pass through "Learning & feedback" stage gate

Note: Scaling examples should serve as guidelines only. A conscious decision needs to be taken with regards to the appropriate application of the process for a given situation or well type.

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		Scaling		
	Expectation	Offshore Exploration well or well in a hazardous location or with potential purprises	Development Well where hazards exist but are known and understood	20th onshore well on same prospect or no hazards expected
1	End of Well (or Well programme) Review (Retrospect)	Required	Required	Required
2	Drilling Engineer to capture key operational NDS lessons learned and update operational practices	Required	Required	Required
3	Operations Geologist to update local NDS risk library with new learnings/issues	Required	Required	Light touch
4	If significant, forward NDS learnings to Global Library/Network	Required	Required	
5	Interpretation and predictive models updated	Required	Required	

Figure 4.3P5-1 Minimum expectations for NDS Phase 5.

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4.5 Enhanced NDS Assessment Tool

Overview

No Drilling Surprises (NDS) means the management well construction risks which arise from the subsurface environment. It is based on some simple principles:

- Risk identification – "no surprises" – is not enough. NDS risks require positive action.
- NDS risks are managed in the same way and held in the same place as other well risks.
- Continuous improvement is achieved by closing the learning cycle. This must be done locally and globally.

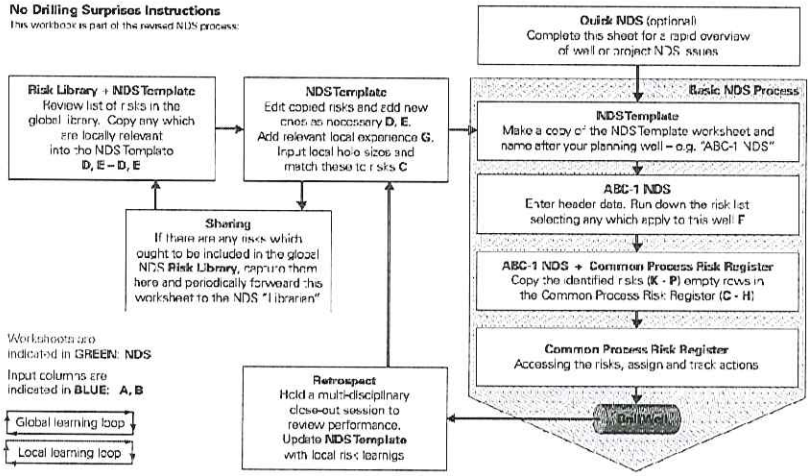

Figure 4.5-1 The No Drilling Surprises Process.

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The NDS process relies upon the exchange of risk data between three tools:

- The Shared NDS Risk Library. A compilation of known NDS risks from around the world. The Library is maintained by the PPP-WBS Network.
- The Risk Register for the well or project (see D&CVA – Risk Management).
- The NDS Workbook. This is an Excel workbook used primarily for identification of NDS risks and capture of local knowledge.

Step-by-Step Process

This section describes the process shown in figure ??. The Instructions worksheet in the NDS workbook has a little more detail.

1. NDS Template Set-up

This is a once-only activity for your team – although you will need to add to the template as you learn.

i. Copy risks from the shared library into the NDS Template worksheet. Risks which you are certain will never impact any of your wells need not be copied across.

ii. Where you have local experience of a risk, summarise this, along with any lessons learned, in the space provided.

iii. If you know of (or suspect) risks which aren't in the shared library, add them to your Template.

iv. Fill in whatever other header information is common to all your wells. If your casing program is the same in every well, you can enter a hole size against each risk too (if a risk may appear in two or more hole sections, make copies of it).

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Classification of NDS Risks

Dividing a long list of risks into groups and sub-groups makes managing them much easier.

The Well Risk Register provides two levels of classification – "category" and "subcategory". It is recommended that "NDS" be defined as a category, with the subcategory being the separate hole sections. This is how the NDS Workbook is set up.

In the Shared NDS Risk Library, it would make no sense to classify risks by hole section, since geology and well designs differ around the world. Instead, each risk is given two separate classifications: "Geological", e.g. salt and "Operational", e.g. ROP. This makes it easy to select risks from the Library for inclusion in local NDS Templates.

When a risk is transferred from the Library to the NDS Template, it loses its geological and operational classifications, and the user assigns it a hole section (subcategory) instead. The category name ("NDS") is automatically assigned by the Template worksheet. Even without the Library classification, the risk name and description should make the source and impact of the risk event abundantly clear.

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2. NDS Risk Identification

i. Early in the planning of a well or project, it is sometimes useful to get an overall view of NDS risk. To do this, fill in a copy of the "Quick NDS" worksheet .This is very similar in style to the Early Warning Indicators tool (p. ??).

ii. To start the NDS assessment proper, make a copy of the NDS Template worksheet, rename it (after the planned well) and fill in the remaining header data.

ii. Go down the list of risks, and flag each risk which might possibly impact the well. Make sure the hole section is entered for each flagged risk.

iv. The NDS Template automatically sorts and summarizes the risk data. Copy this block of data directly into empty rows in your well Risk Register.

3. NDS Risk Management

Follow the assess, respond and control steps of risk management for NDS risks just as you do for other well risks (see D&CVA). This ensures the risks are visible, prioritized correctly and acted upon.

4. NDS Learning

i. When the well is finished, hold a retrospect meeting to discuss NDS lessons learned. Capture them in your Template by adding comments to risks, or by adding new risks.

ii. If you identify a risk which is not in the Shared Library, describe it in the Sharing worksheet in the NDS Workbook and send a copy of this sheet to the library custodian.

iii. When you receive a update to the Shared Library, check to see if anyone else has added risks which may affect your wells. If in doubt – give them a call.

For more information about NDS Learning, please access the BtBcp website at: http://epsegmentcommonprocess.bpweb.bp.com/Default.aspx?tabid=173

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4.6 The NDS Toolkit

Integrated Pressure Prediction

Pore pressure related events still incur significant NPT in BP operations globally. We should view the prediction of pore pressure as a well design exercise. The goal is to determine the degree of uncertainty in pore pressure so that a well design can be made to address that uncertainty. Obviously, the more we reduce uncertainty, the less flexibility (cost) required in the well design. However, not understanding the uncertainty associated with the pore pressure prediction at the time the well is designed will increase the risk of having an inadequate well design.

Integrated pressure prediction involves three areas:

- Basin modeling.
- Pore pressure prediction from seismic.
- Pore pressure prediction from analogues.

Basin modeling

Basin modeling at the exploration prospect and field appraisal / early development stage. Basin modeling can be run for pressure prediction in 2D (Temispack) or 3D (3D Temis). The best solution is to apply a three dimensional basin model (via 3D Temis) as used in Thunder Horse – DW GoM, Andrew field – North Sea and Shah Deniz – Azerbaijan. 3D Temis reconstructs the burial history, thermal and oil and gas generation history, along with the development of pore pressure, effective stress and vertical stress. Calibration of the model with pressure and temperature data from wells in the study area or offset wells is a critical part of the process. It thus provides a 3D pressure volume across the study area that can be used to cross check the pressure prediction from other techniques (see below).

Good websites for more information are:
http://www.beicip.com/html/software-products/temis3d.htm

http://upstream.bpweb.bp.com/ut/default.asp?id=87 (Petroleum Systems website)

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3D Temis is seen as one of the building blocks for the Stress Cube (a three dimensional model of pore and fracture pressure and the insitu stresses within the earth that will allow three dimensional casing seat selection and well-bore stability modelling).

Pore pressure prediction from seismic

This involves using seismic stacking velocities to predict pressure using one of the published algorithms. Presgraf software is the in house tool used to take seismic data and produce a well specific pressure prediction. There are many methods published for this. The PPFG website contains a great summary of those approved for use within BP and their limitations.

The best website for information on people, best practice and Presgraf software downloads is:
http://ppfg.bpweb.bp.com

Pore pressure prediction from analogues

This involves using offset well data predict pressure by shifting the depths up or down dependent on the relative movement between the planned well and offset data. The PPFG website contains a great summary of those approved for use within BP and their limitations.

The best website for information on people, best practice and Presgraf software downloads is:
http://ppfg.bpweb.bp.com

Best pressure prediction results will occur when the seismic velocity, Basin Modelling, and analog methods are all employed (assuming the methods are appropriate for the planned well) and the results integrated to provide a uniform, reinforced conclusion. Differences in answers can be used to characterize uncertainty. However, the inappropriate application of a method can produce uncertainties that are unjustified and costly. Consult with the experts to determine which method (if any) is justified. There is a Pore Pressure Assessment Tool that can be used to help the NDS team to determine the best approach (see PPFG website).

See Figure 4.6-1 for the Well Planning Toolkit.

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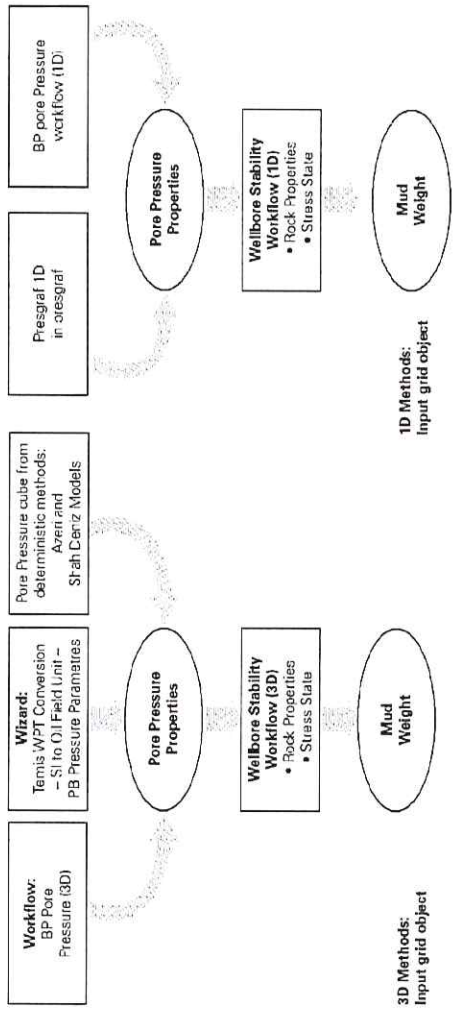

Figure 4.6-1 The Well Planning Toolkit Workflow.

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Faults and Fractures or Structural Geology

Loss circulation via faults and fractures is another major cause of drilling NPT. The key action here is mapping the faults in three dimensions in the overburden around the well-bore. The Shah Deniz and the Valhall Subsurface teams have the largest database of integrated Subsurface/Geology alongside drilling NPT events (losses, well-bore instability) in the Landmark environment (The software to use is 3D Drillview Knowledge Management – DIMS and Openworks are Integrated).

Most of the value comes from merely understanding the intersection between faults relative to the well-bore and understanding its impact on geomechanics. The well trajectory should be adjusted to miss fault zones or the mud weight needs to be optimised to deal with weak rocks and/or prevent losses. The next level of sophistication is understanding the stress fields around the faults.

Within the contracting industry there are several companies with this type of fault interpretation and mapping expertise. Contact the Structural geology and Geomechanics network for more information (G STRUCTURAL GEOLOGY in the GAL or via the EPT website
http://upstream.bpweb.bp.com/EPT/home.asp

The issues concerning fault drilling have been summarised in the Fault Drilling Guidelines which can be found at the WBS website:
http://wbs1.bpweb.bp.com/

Well-bore Instability Modelling

Failure of the well-bore due to well-bore instability is another major cause of NPT, especially on development drilling, where well inclinations are typically much higher than in exploration and appraisal wells. A geomechanics prediction should be made for where any of the following conditions apply:

- Prior to commencing appraisal or development drilling on new fields.
- For wells passing through or within 2000 feet of salt.
- For specific wells where the well deviation is in excess of 50°.
- For specific wells where the well deviation is within 30° of the bedding plane (this may occur in modestly-deviated wells in areas of complex geology).
- In areas where 'abnormal' tectonically stressed conditions may occur.

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- In locations where off-set well experience has indicated significant NPT.

The Well-bore Stability Assessment Tool has been developed to assist the NDS team to determine the level of WBS analysis required and can be found at the WBS website.

The recommended in-house software tools for assessing borehole stability are those developed by GeoMechanics International Inc. (www.geomi.com). These include the software packages GMI•SFIB™ (Stress and Failure in Inclined Boreholes) and GMI•WellCheck™.

The BP Well-bore Stability website may be found at:
http://wbs1.bpweb.bp.com/

On this website BP's "Best Practices and Workflow for Well-bore Stability Prediction" document can be found. This document provides guidance on the necessary BP-approved' steps to be followed when conducting a well-bore stability assessment analysis. This document may also be provided to third-party contracting organizations who undertake well-bore stability analyses on BP's behalf, subject to suitable confidentiality agreements being in place. The purpose of this document is to ensure uniformity of a delivered analysis, free of author or company bias, which incorporates BP's best practices and knowledge. This downloadable document is periodically updated to reflect current evolving understanding.

Shallow Hazards

Please refer to Standard Survey Specifications – Site Investigation Guidelines within the following website:
http://ut.bpweb.bp.com/survey_network/

The two primary shallow hazards are shallow gas and shallow water flows.

Shallow water website is:
http://ut.bpweb.bp.com/swf/

Previous experience has shown that 3D interpretation of the seismic and use of that data in a visualization environment with the wells team has lead to a greater understanding of the uncertainties surrounding the shallow hazards. This practice should be followed in all cases (even if only using a desktop machine to view this data set).

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Well-bore Pressure Management at the Rigsite

Well-bore pressure management at the wellsite involves having a dedicated person at the wellsite who integrates all the data around the rig to manage the window between pore pressure and fracture pressure. It involves analysing data from the mud loggers, Annulus Pressure While Drilling MWD, and the cuttings being generated, and where applicable Seismic MWD sensors. This data set is then compared with the plan for the well and deviations from plan are fed to the BP well site Leader as required. The engineer can be focused on a variety of problems: pore pressure, well-bore instability or general drilling optimization. BP have normally used this service for pore pressure and well-bore instability management.

This service is available from all the main suppliers.
http://upstream.bpweb.bp.com/ut/home.asp?id=99

Real Time Transfer of Data from the Well-bore to Onshore Models

This involves linking the wellsite MWD/LWD & mudlogging data with the onshore planning models. This available technology allows data to be pushed straight into Openworks. Openworks is the 'hub' that all the subsurface interpretation tools hang off, thus allowing resistivity, GR and sonic LWD data to be placed against depth converted seismic. This allows the subsurface specialist to assess whether the formations are coming higher or lower than planned and make quicker recommendations to the drilling team on what mitigation needs to be put in place.

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NDS Minimum Expectations.

APPRAISE	SELECT	DEFINE	EXECUTE	
Overview & Data Gathering	Interpretation	Planning	Real Time Focus	Learning & Feedback
Gather all relevant Subsurface data	Analyse, Predict and Visualise major NPT events	Prepare plan based on all known hazards in overburden	Monitor well to manage perceived risks	Capture lessons learnt in LINK, NDS Community of Practice
• A completed Quick Look NDS Assessment conducted by the multi-disciplinary team. • An understanding of the Site Selection and Survey implications Establish the requirement for supplementary studies such as Shallow Hazard, PPFG), WBS Drilling & Completion Fluids. • A forward plan for Select activities including the use of the NDS toolkit • A compendium of all relevant subsurface and drilling offset data. • A preliminary Operations Forecast based upon offset wells for preliminary PPFG evaluation using offset LOT FIT, well control data and significant NDS related NPT events. • A feasibility assessment that establishes that all proposed well design concepts are possible within geological and geophysical and drilling uncertainty. • An initial well specific Risk Register populated with the NDS risks identified. • A RACI chart for the NDS workflow	• Offset well review conducted by Operations Geologist and Drilling Engineer • A statement on the robustness of the selected well concept in addressing the seismic and geological uncertainty • An optimised well trajectory within geological space critically examined by the multi-disciplinary team • A detailed well specific NDS assessment using the new NDS Assessment Tool • A report on the findings from the NDS toolkit work programme • Robust subsurface criteria for casing setting depths • A summary of the impact of drilling fluid selection on WBS and formation damage. • An updated risk register populated with risks and mitigations identified from the detailed NDS assessment and ongoing work. • Data Acquisition requirements for both success and failure cases as determined from the Data Acquisition Workshop • A detailed Operations Forecast • A forward plan for Define activities • A statement that there is no conflict between the Well objectives and NDS findings.	• A risk register with all risks mitigated and actions addressed • A final Operations Forecast with WBS, MW and NDS risks • Decision Trees in place for main NDS uncertainties and risks that identify appropriate contingencies and decision criteria and decision accountabilities. • Detailed NDS data monitoring programme • Confirm RACI chart for delivery team roles and responsibilities during the execute phase. • Demonstration that specialised NDS support personnel (PPFG / WBS or other monitoring specialists) are identified and available. • A programme for monitoring and interpreting drilling parameters that indicate potential NDS problems (eg hydraulics, torque and drag)	• Where appropriate, 24/7 Real Time monitoring, evaluation and interpretation of drilling and subsurface data by competent personnel from spud to TD. • Real Time updating of geological prognoses and models based on actual data obtained while drilling. • Ensuring that drilling and NDS data are effectively reconciled to avoid drilling problems (eg trip sheets, cuttings volume analysis, mud condition etc) • Implement the NDS plan. • Effective use of the NDS toolkit.	• Hold End of Well Retrospect with NDS as a key component of Agenda • NDS Tag to update local NDS risk Library with any new learnings / issues • If significant, forward NDS learnings to Global Library/ Network

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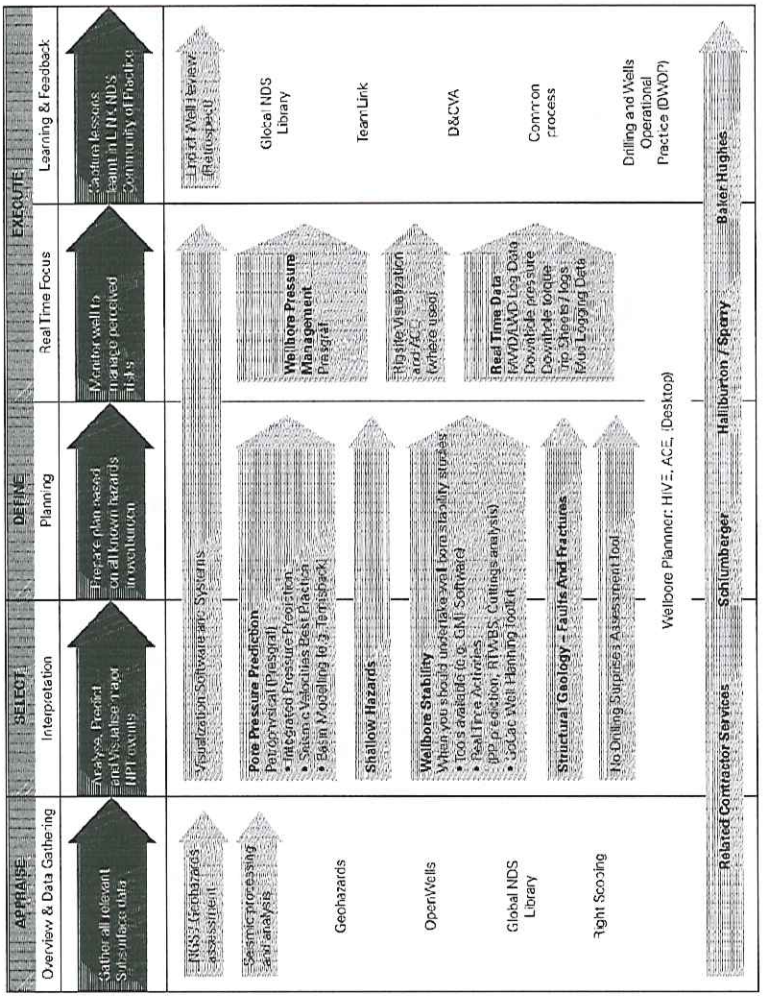
NDS Input Tools



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Section 4

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5 Technical Limit

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5 technical limit

5.1 Introduction

Within Drilling and Completions, the chosen process for continuous performance improvement is Technical Limit.

This is a method to support our aspiration to achieve the ultimate in terms of performance – to be the best. We all recognise that there is always an opportunity to improve, a gap in performance to be identified and closed.

This chapter will help you achieve the goal of continuous improvement.

Although we name this process "Technical Limit", it essentially does not matter what you call it. There are numerous alternative titles, but the principles and the processes are broadly the same. The important thing is that you have a process which addresses the requirements of performance improvement without compromise to HSE.

"Technical Limit" is not just a process for BP personnel. It needs to involve the whole team from planning through to execution. Contractors and BP staff alike regardless of discipline and seniority must be fully engaged and aligned to achieve the goals of performance improvement.

The process is used through all the phases of Drilling & Completions Value Assurance (D&CVA) to ensure the engineering and planning reflect latest lessons learned and design principles, and to ensure flawless execution of the plan and to learn for the next time.

In the following text we identify the key levers for continuous improvement, principles and practices and the tools to help you undertake the process and improve performance. It's about efficiency and organisation, not speed. Not all our teams and operations are the same, so we will show you how to scale your process accordingly. But however you approach it the principles are simple:

- Identify the performance gap.
- Engage the team.
- Figure out how to close the gap.
- Learn how to do it better next time.

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technical limit

This document is intended as a high level summary of steps necessary to plan, implement and monitor a Technical Limit process. More detail is available on the Beyond the Best website and on the supporting CD. Under Common Process, Technical Limit, there are a number of supporting documents and examples that will enable you to build a solid process.

http://upstream.bpweb.bp.com/EPT/home.asp?id=3581

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5.2 Basic First Principles

The principles for the "Technical Limit" process are similar to those that apply to successful management of any project. These are:

- Leadership.
- Engagement and Alignment.
- Effective use of Data.
- Planning.
- Learning.

Leadership

The single most valuable aspect of any performance improvement initiative or process is that leadership engages with their teams and provides motivation to stick with it.

The fundamental elements or the "four E's" of leadership are:

1. Envision

You need a vision, then you need a plan to achieve it.

What is your vision for the team – where do you want to be in one year's time with regard to NPT, days per 10,000 feet and days per completion, cost per foot or other performance metric? Share the vision, help your team icentify where they could be, involve them, coach them to recognise the gap and show them how "Technical Limit" can help them reach their goal.

2. Enable

Leaders need to create an enabling environment to encourage the right kind of actions (and reactions). Choose the right people to get the job done, and recognise and reward them for it. Identify and pursue the means of getting the job done – through influencing, persuading, encouraging and coaching. This is not a one off job but needs to be continuous and visible.

Be prepared to help them out, hold hands and guide.

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3. Empower

If your team develops a new way of doing things that meets the expectations of the "Technical Limit" process then you must encourage it. Encourage them to pass on to others what they are doing – best practices are to be shared. This also builds a sense of pride and achievement.

4. Energize

To realise goals, leaders need to provide the right help, resources and space to get the job done. More than anything else they need to inspire respect from those in their teams through visible and active contribution in their pursuit of performance improvement – a relentless catalyst for change. If team member's perceive any reluctance or hesitation on the leader's part this will result in lack of belief and trust – and the inevitable failing of the process. The successful outcome of the "Technical Limit" process is reliant on leadership.

One of the minimum expectations of the process is to hold a Leadership Engagement session at the outset to ensure that all the leaders "get it", own it, are aligned and committed.

Who are the leaders we are talking about?

- The Performance Unit Leader should be the Sponsor of the goal of continuous improvement.
- The Wells Programme Manager provides direction, context, appropriate resources and space.
- The Well Team Leader /Drilling Superintendent and the Drilling Contractor Rig Manager are collectively accountable to make the process happen.
- The Sub Surface Team Leader ensuring engagement of the sub surface team in their contribution and ownership during the appraise, select and review stages.
- The SDE/SCE and Service Company Representatives own and deliver the process in the planning and learning phases.
- The Wellsite Leader and Senior Toolpusher/OIM own and deliver the process on the rig.

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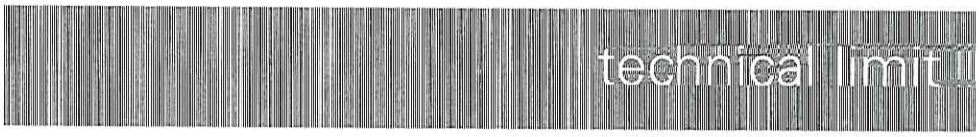

Engagement and Alignment

One of the most challenging roles of the leader is to engage and align all those involved in the "Technical Limit" performance management process. Breakdown will occur or the process will be less effective unless there is common ground and ownership of agreed goals between all the stakeholders.

Alignment is a foundational but frequently overlooked first step to develop the desired performance improvement work culture. Leaders need to "get everybody on the same page" with regards to what the team is trying to accomplish regarding Performance Improvement and how it will be implemented.

Unless we and our contractors are aligned in service of a common performance goal we will struggle to achieve improvement. There are many such goals that are mutually beneficial to all - what is good for us needs to be good for our contractors and suppliers too. This needs to be agreed at the highest level prior to tackling aspects that will ensure engagement of all the team.

Key factors for achieving alignment include:

- Identifying and agreeing common goals and outcomes – including KPIs.
- Identifying barriers or gaps that prevent us achieving those goals together.
- Developing Action Plans to overcome barriers and close gaps.
- Agreeing on the methodology for the process – the inputs.
- Developing a communication plan to inform and engage the team.

With Engagement we need to ensure that there is a clear understanding and buy-in for the performance improvement plan within the team. A clear vision of the performance improvement culture that we want to create must be effectively communicated and explained to all involved. The process thorough which we aim to achieve performance improvement must also be fully established and understood.

Engagement comes through shared ownership of the goal and commitment from all to achieve it and being valued and involved.

Factors that impact engagement of the team are:

- **Involvement in decision making** – the extent to which team members feel able to voice their ideas, leaders listen to these views and value such contributions.

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- **Trust and integrity** – how well managers communicate and 'walk the talk'.
- **The Team** – Individuals need to see how their contribution impacts the success of the operation and feel part of the team.

Data – Measurement and Analysis

A fundamental principle of performance management and the "Technical Limits" process is the capture, analysis and use of previous operational performance data. Such data tells us how we have been doing and where we can improve. It is important to note that Technical Limit is NOT just about gathering data, it is primarily about performance improvement through learning. Be cautious that the team does not get bogged down with non value adding number crunching.

The DIMS and Openwells applications capture performance data from our drilling and completion operations on a daily basis which allow us to determine the time taken for specific operational tasks and whether any "lost time" was incurred. This tells us three things;

- It provides a historical record of how we have performed, thus we can determine our" best performance" for specific analogues as a time to improve on in the future. We call this "best of the best".
- It provides us with an understanding of where time was lost, or "Non Productive Time" (NPT). In Openwells this is normally coded to tell us in what area or for what reason problems occurred so we can focus on managing the problem in the future.
- The third aspect concerns "waste/inefficiency". This is sometimes known as Invisible Lost Time or ILT. Although we identify NPT, this is not the whole story with regards to performance improvement opportunities. By becoming more prepared and efficient for the tasks in hand it has been demonstrated that similar percentage improvements can be achieved as those through elimination of NPT.

The original Technical Limit concept was to determine what drilling times might be possible if everything works perfectly, i.e. what is the "Technical Limit"? This is normally determined by engineers who have analyzed what could be possible given specific technologies and flawless operational performance, the result of which being tested by operational teams. "Invisible Lost time" is calculated by subtracting the "Technical Limit" time from the actual time less NPT.

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technical limit

To avoid disenfranchising teams with purely theoretical targets, we now prefer to focus on the "best of the best" method for data analysis. This is simply setting a realistic target based on what has previously been achieved by a specific rig and team in the past. This approach is scalable. Start with your own historic achievements and progress to a more global benchmarking data set using appropriate analogues. This will ensure continuous improvement.

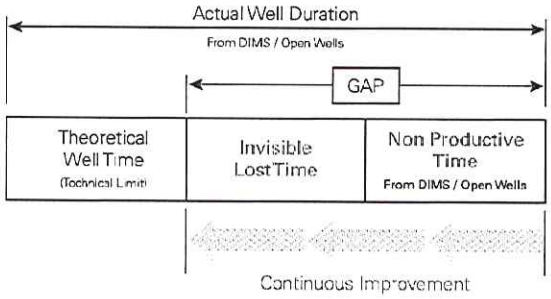

Figure 5.2-1 The three elements of well duration.

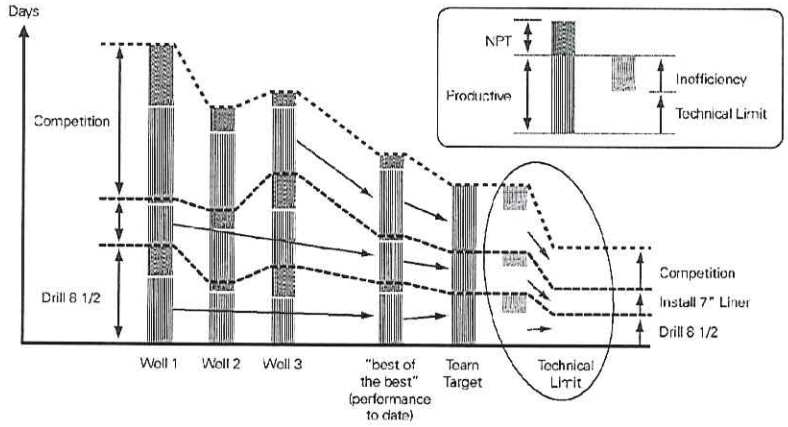

Figure 5.2-2 Defining "best of the best".

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Planning

Previous applications of the "Technical Limits" process have focused on identifying the "Technical Limit" based on an already designed well, and taking that as the potential target for performance. Recent assessment has highlighted two things:

- Opportunities for improvement were being missed through addressing performance improvement on an already designed product. "Right Scoping" now ensures that lessons learned are fed right back to the well concept and design stages. This gives us a better chance of achieving excellent performance through different equipment specification, procedures or even contracts.
- Aiming for a theoretical target such as the "Technical Limit" often disengages teams rather than engages them. Aspirations for performance improvement vary significantly depending on the experience and position of specific teams. In some cases just identifying that there is performance gap is the key step that can lead to performance improvement. In other cases, a full time resource may be employed. We have therefore "scaled" expectations depending on where teams are.

The minimum expectation is that teams will try and repeat the best that they have previously achieved (the "best of the best") as determined from their own data. Once this is done they can begin to look outside their own operations. Can they now challenge the best offset performance? Then the best regional performance and ultimately the "Technical Limit"?

The appropriate well concepts as identified through right scoping and performance improvement targets will form the basis of "Technical Limits" planning.

Engineering the Technical Limit – Right Scoping

Strategy

As stated above, one missed opportunity from previous applications of the "Technical Limit" process has been consideration of optimization of wells concepts and designs based on a clear understanding of previous performance data and lessons learned. In the future we need to ensure that application of the "Right Scoping" process addresses performance improvement and that lessons learned are fed from previous analogues and offsets. Study of data from wells such as these will advise the Right Scoping process in the area of value creation through performance improvement.

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technical limit

Make sure you close the learning loop. Technical Limit is not just about rigsite operations.

Data

Appropriation and analysis of data is one of the fundamental elements of "Right Scoping". It is important to ensure that all appropriate analogues and offset wells are identified for the new wells project to be right scoped and that the data from DIMS/Openwells is analyzed to determine where wells designs and equipment selection have impacted on performance. The analysis should also include an assessment of the impact on any performance improvement opportunities on the primary value drivers for the well project to manage compromise. As the operation begins to consistently deliver "best of the best" times, the targets should be reset using broader benchmarking tools such as Rushmore.

Design

Aspects of design that focus on well construction performance improvement should be addressed during right scoping. Insights into where design aspects have impacted performance improvement should be determined from data from DIMS/Openwells for offset wells and appropriate analogues. Seek to answer the questions:

- Could the well be constructed more efficiently?
- Will any changes add value?

The impact of placement of casing shoes, casing sizes, wellhead types and other aspects of well construction all impact performance.

Equipment

Bearing in mind long lead times for much of our drilling equipment and consumables, early in the well construction process consideration needs to be given to the equipment that will be used to construct the well. For example rotary steerable equipment could have a significant impact on directional design in areas where problems are encountered with motors, or power/logistical requirements may impact rig capability.

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Delivering the Technical Limit during Operations

Once the well concept is agreed and signed off, the operational procedures for drilling and completing the well are developed. The detailed time estimate and cost estimates for the well will be based on these. Under normal circumstances these procedures will be prepared by the engineering planning team with input from Well Site Leaders and approved by the Wells Team leader.

The Technical Limit Workshop

The principle of re-visiting the plan and procedures is to test it with the broader team – BP wellsite staff, Drilling Contractor personnel and key Service company staff. Does the plan really represent continuous improvement or are there opportunities for improvement that the team believe can be achieved? Often referred to as the "Technical Limit Workshop" this is where real engagement and alignment occur and leaders need to be conscious of their role to make it happen. It is of paramount importance that all the ideas are addressed and appropriate feedback given. The output from the workshop will form the basis of the "Team Target" for the well duration and cost and be broken down into sufficient detail so as to allow effective measurement against the plan. This is often to the same level of detail as that recorded on the DIMS/Openwells or IADC reports. However this need not be the case depending on the detail required to understand performance and address improvement. These plans will also form the basis of pre-job meetings where the operations teams will review the jobs to be done and understand the needs for their successful delivery.

Measurement

Performance measurement to the same detail as that formulated in the agreed plan is required. From this measurement the actual performance can be compared to the predicted or expected performance, appropriate conclusions made and lessons captured. To ascertain performance improvement opportunities or lessons learned, rigour is required in terms of data capture, documentation and validation.

Learning and Codification

Learning and the codification of lessons learned in the form of updated equipment, procedures or codes of practice is fundamental to achievement of continuous improvement. As such a core principle of the "Technical Limit" process is the learn before, during and after cycle as prescribed in the "Learning and Knowledge

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Management" principle in "Drilling & Completion Value Assurance". Learning is the engine room of performance improvement. Learning occurs on the rig where operations are conducted and in the office where procedures and designs are updated. Lessons learned reviews should be conducted immediately following tasks or at the end of each shift or hole section as appropriate. The lessons should be captured and documented immediately while the relevant personnel are still on board and memories clear using After Action Reviews. This information should be shared with the team, reviewed on a weekly basis and screened. Actions based on lessons regarded as value adding are allocated, tracked and closed out accordingly. Lessons of particular significance to a broad range of operations or to teams conducting similar tasks should be shared more broadly.

Learning

Under normal circumstances all "Technical Limit" lessons learned will be compiled during well construction operations. However, after the well, in accordance with Drilling and Completions Value Assurance an End of Well Review will be held in the form of a retrospect. A formal assessment of the "Technical Limit" process should be conducted at the time together with a review of the effectiveness of closure of lessons learned and any outstanding actions that need to be taken to achieve closure. Recommendations for how to do things better on the next well or project should be made and a plan agreed to ensure that the actions are addressed.

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5.3. Expectations

Scaling – Where are you and your team?

As stated in the introduction, "Technical Limit" is an aspiration to achieve the ultimate in terms of performance. To get there is a journey with a starting point and an end – the ultimate objective to be the best. We will not all be starting from the same point on the journey, but we all have an obligation to engage in some form of "Technical Limit" continuous improvement process. To help design a suitable process, we have established Minimum Expectations for "Technical Limit" Implementation *(see Figure 5.3-1)*.

Your target for performance improvement and the degree of implementation of "Technical Limit" over and above the minimum expectations will be dependent on the following factors:

- Current HSE Performance.
- Maturity of the team's performance management process.
- Whether the Team as a whole are up for it.
- The degree of resource constraint.
- The ability of the Team to work across disciplines.
- The criticality, duration and cost of the wells.
- The number of wells in the programme.

Scalability Chart

This helps describes where the team currently are. It also describes the expectations for full implementation of the process. We need to recognize that there is an opportunity to improve, a gap in performance to embrace and a plan needed to close it. There is no right answer, but the solution that works is very much dependent on the experience of the team, where they are on the journey of performance improvement and what they are jointly "up for" *(see Figure 5.3-2)*.

The "theoretical" nature of "Technical Limit" is often off-putting for many teams where true engagement is difficult to achieve. It is not uncommon for a team to be distracted with what Technical Limit means or represents. The long and short of it is

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technical limit

Minimum		The Works
HSE Challenged	→	Good HSE
No Perf Process	→	Mature Perf Process
Not up for it	→	Up for it
Understaffed	→	Well staffed
MDT Silo's	→	Integrated MDT
Short Duration Wells	→	Longer Wells
Single Wells	→	Programme

Figure 5.3-1 Scalability: What are you up for?

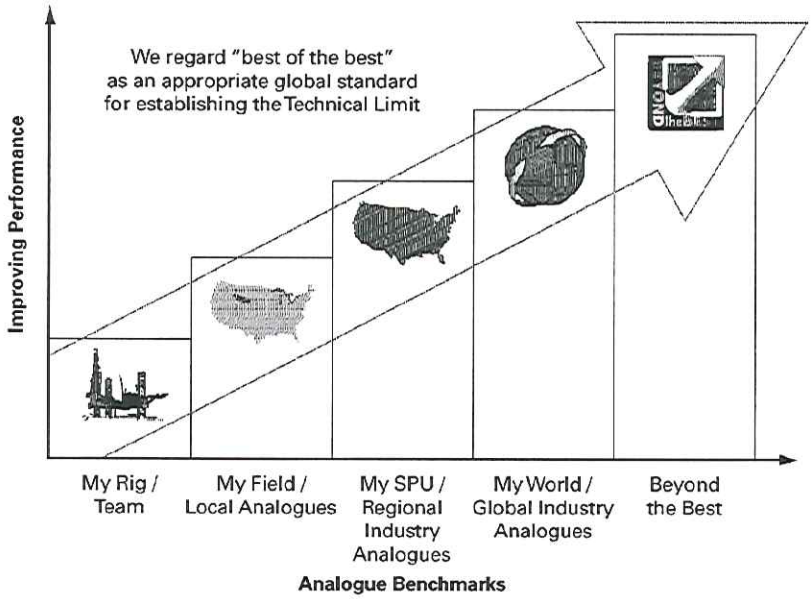

Figure 5.3-2 Scalability: Where do you start?

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that each team needs a Continuous Improvement process - we just happen to call it "Technical Limit". Performance benchmarks are considered more effective in getting agreement from the team that the target is achievable. These again are scalable, from the Team's own experience up to Best in Class, and should be dependent on the team's achievements to date. We have referred to these targets as the "best of the best" as a well target would normally be the compilation of the best times achieved by a team for the specific tasks that make up the full well project.

Minimum Expectations Road Map

Our minimum expectations are primarily for teams who are starting out on the journey - those on the left hand side of the scalability chart. The three most basic levers for performance improvement are:

- Leadership.
- Engagement.
- Learning and Knowledge Management.

Figure 5.3-3 shows how these expectations fit together. As you can see emphasis is placed on the learning loop on the rig as this is the real engine room for performance improvement. The keys are to understand what is planned to be done, discussing how the team will undertake the plan, capturing how it was done and then comparing the actual to the plan and identify causes and thus lessons learned from the performance seen. Further follow up of the lessons and transference to operational practice (through instructions and guidelines) is of paramount importance.

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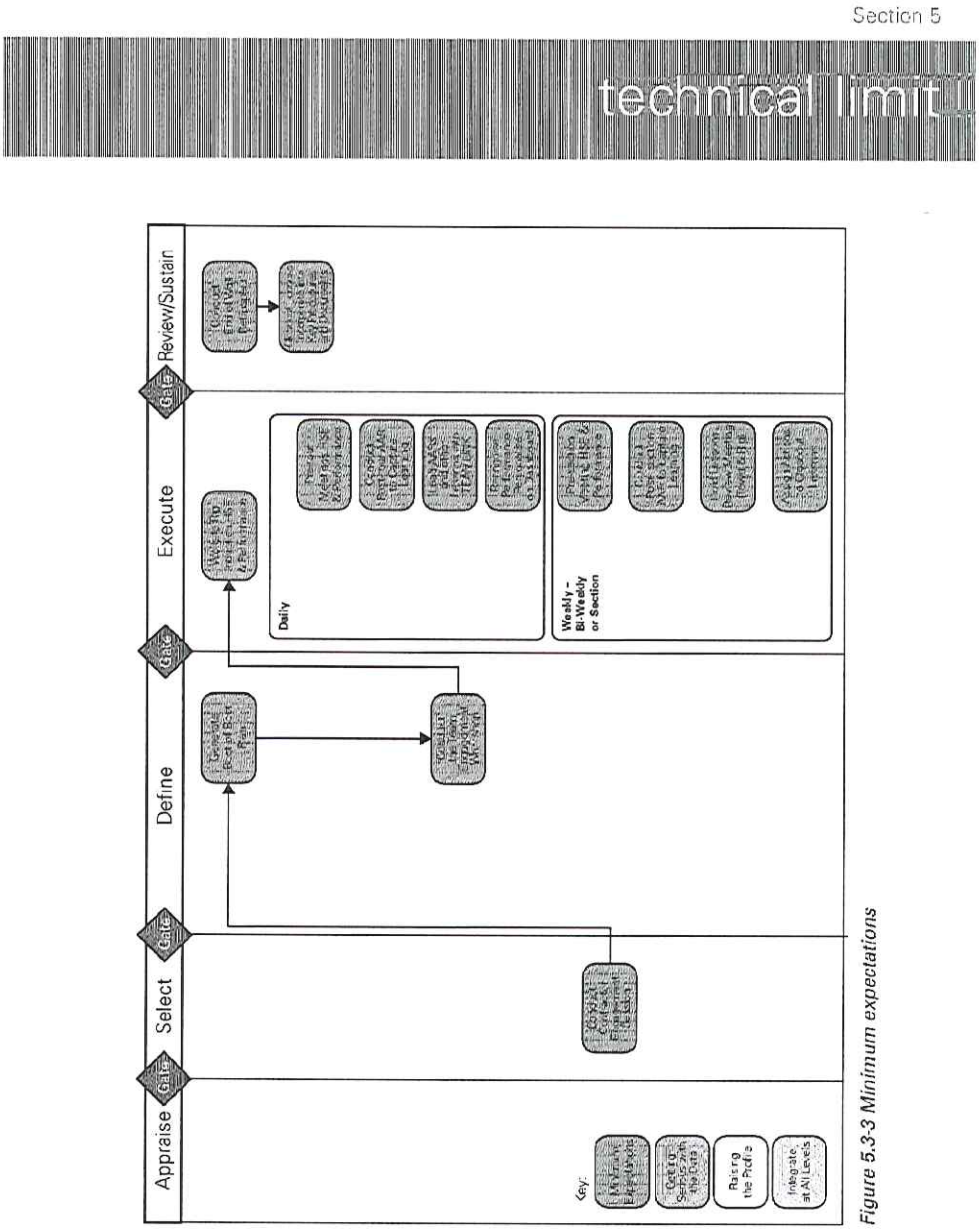

Figure 5.3-3 Minimum expectations

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Full Model

A team responsible for a multi-well high cost project should ensure that the appropriate resources are in place such that they can undertake the full "Technical Limits" process from the outset. This may seem rather daunting at first, but every step described in the Practices section makes perfect sense and dovetails in to the other areas of common process such as Right Scoping, No Drilling Surprises and Learning/Knowledge Management. The key is in the preparation, consideration of the well design and setting up with the right data to understand and determine performance improvements and opportunities.

The colours within the full model demonstrate possible levels of implementation.

Figure 5.3-4 shows the full integrated Technical Limit road map.

The *Tables 5.3-5 to 5.3-10* give a basic explanation of the intent behind each of the suggested steps in the Full Model road map.

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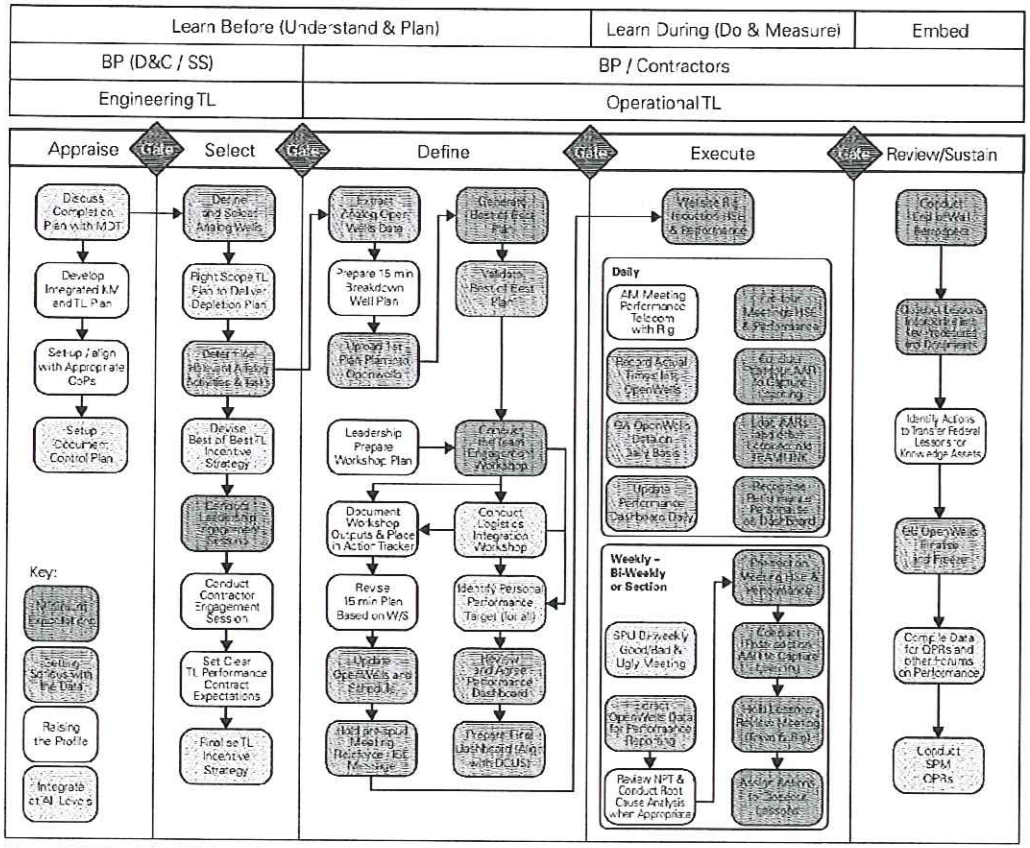

Figure 5.3-4 Technical Limit road map.

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technical limit

Minimum expectations are highlighted in yellow.

	Technical Limit Full Model – Appraise	
Appraise (Learn Before)	Discuss depletion plan with MDT	Establish the field development options with the Multi Discipline Team (MDT) and strategy for development. Highlight the knowledge gaps (Technology, People and experience) Identify the knowledge sources internal and external.
	Develop Integrated KM and TL plan	Create a single integrated Knowledge Management and TL plan that encompasses all planning, measuring and learning activities that will be undertaken by the MDT over the course of the project. The Technical Limit and Knowledge and Learning activities significantly overlap requiring one plan in accordance with the size, value, complexity of the project. This plan needs to represent the key project stakeholders (HSE, Sub Surface, Drilling, Completions, Sub Sea, Production, SCM, Logistics). The plan needs to identify the people, the process, procedures and the technology (tools and equipment). The plan needs to be fit for purpose and can be escalated over time (MDT to check against the scaling model and select the appropriate starting point)
	Set and align to appropriate communities of practice.	The Learn Before phase of the plan should identify all the knowledge gaps, MDT owners, and potential knowledge sources, e.g. Communities of Practice, Technology Networks, Subject Matter Experts. The team members are accountable to establish communication and working relationship with the relevant knowledge sources
	Set up Document control plan	The team needs to identify the project governing documentation, the party accountable for compilation, the process by which the documents will be generated, reviewed, edited, finalised and controlled. The plan should map the approval process aligned to the project stage gates, the distribution list and the storage location (electronic and hard copy). The document control plan needs to identify the Management of Change process for all controlled documentation.

Table 5.3-5 Technical Limit Full Model – Appraise.

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Minimum expectations are highlighted in yellow.

	Technical Limit Full Model – Select	
Appraise (Learn Before)	Define and select analogue wells	MDT needs to identify the relevant wells and activity sets that are analogous to those planned.
	Right scope TL plan to ensure delivery of depletion plan	The TL and KM plan needs to be compatible with and in accordance to the field depletion plan project delivery schedule, key stage gates and deliverables. Note this plan needs to be fit for purpose and can be escalated in rigour over time (MDT to check against the scaling model and select the appropriate starting point)
	Determine relevant analogue activities and tasks	Define the project well construction activities and gather the performance related data set. (Min, Max, Mean) Identify the NPT, inefficiencies, risks and lessons learned.
	Devise the "best of the best" TL Incentive Strategy	Compile the "best of the best" times achieved. Understand where NPT and inefficiency remains in the composite time. Define a technical limit incentive strategy that recognises and rewards excellent performance. The incentive plan must consult with all stakeholders and be endorsed and supported by senior management. Consider boundary conditions to qualify: No LTIs or Spills, Well Objectives met technically. There may be legal issues to consider too.
	Conduct Leadership Engagement session	BP Leadership / Senior management to communicate the big picture – context, objectives and KPIs. The Leadership engagement session should outline tactics for delivery inclusive of the integrated KM and TL plan, resource plan, the "best of the best" data and the incentive plan. The MDT leadership need to commit to the plan and define their expectations of the BP team, the drilling contractor and service partners. Concerns and risks to be addressed.
	Conduct Contractor engagement session	BP senior management and project leadership to engage and enrol the Drilling Contractor and service partners to the project KM and TL plan. This should communicate the people, processes and technologies that will be used in delivery of the plan. The engagement session needs to include the defined "best of the best" data and the incentive plan. Concerns and risks to be addressed.
	Set clear TL Performance Contract expectations	The TL performance targets need to be included as a "stretch" / upside in the performance contract. Does everybody understand what the team is up for?
	Finalise TL incentive Strategy	The incentive plan needs to be agreed and finalised between BP, Drilling contractor and the service partners. At what level are incentive payments reached? Is it properly understood and endorsed?

Table 5.3-6 Technical Limit Full Model – Select.

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technical limit

Minimum expectations are highlighted in yellow.

	Technical Limit Full Model – Define	
Appraise (Learn Before)	Extract Analogue Openwells Activities	MDT needs to identify the relevant wells, activity sets that are analogous to the planned wells activity sets. Where available this needs to be extracted from Openwells / DIMS data. External sources include Rushmore, scouting reports, partner data
	Prepare Well breakdown, Phase, Task Activity	The well needs to be broken down at the phase, task and activity levels. It is recommended that the Objectives / Key performance indicators are defined for each phase as these will be the foundation for pre-section planning and After Action Reviews. Some teams break the activity down into 15 min slices.
	Upload 1st pass well into Openwells	The well breakdown needs to be loaded into the Openwells Technical Limit area (or excel spreadsheet if Openwells not available)
	Leadership prepare workshop plan	The BP Operational Leadership, DS, SDE and Wellsite Leaders need to prepare TL, DWOP, CWOP workshop plan. Agree content, and what is expected of the leadership team. Involve key offshore leaders and communicate the expectations. Ideally meet before hand and agree the scope and process for the workshop.
	Conduct Team Engagement workshop	This workshop has many different banners – Operations Excellence, Technical Limit, Drill Well On Paper (DWOP) and Complete Well On Paper (CWOP). It should include representation from the multi disciplined onshore team and representation from the key offshore positions including technical service partners. The objective is to handover the office based plan to the execution team such that they can understand the purpose of the well, the rationale for the design, the risks and the how to assemble the well. This is their opportunity to ensure that the plan is aligned to their rig. It creates a sense of ownersh p and commitment to the detailed well plan.
	Conduct logistics integration Workshop	A logistics workshop can be conducted to align the logistics plan to the well execute cycle generated at the DWOP / CWOP.
	Agree personal performance contracts	Ensure well performance targets are agreed with the team and establish performance targets that outline the personal activities that will be undertaken to contribute to the well performance targets. This should include activities identified in the KM and TL plan.
	Document Workshop outputs and action tracker	All workshop outputs including opportunities and risks need to be recorded in a risk register/action tracker and actively worked on by the right owners across the extended team.

Table 5.3-7a Technical Limit Full Model – Define.

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Minimum expectations are highlighted in yellow.

	Technical Limit Full Model – Define (cont)	
Appraise (Learn Before)	Revise the well time breakdown post workshop	Update the plan post the workshop. Record all output and embed into activity plan. Ensure the workshop set performance times are validated against "best of the best" time
	Update Openwells project execute and logistics schedule	Load post workshop plan into Openwells.
	Conduct Pre-spud meeting	Use the workshop output as the basis for the pre-spud meeting. The Pre-spud should be conducted at the wellsite and should be fit for purpose as a communication and sharing medium. The Pre-spud meeting can be conducted by the Wellsite Leadership supported by MDT planning personnel and should include the drilling contractor and key service suppliers.
	Agree Performance Dashboard	Communicate the output measures that will define well delivery success and agree the personal input activities of key importance that will contribute to the overall success. Design suitable poster to be updated regularly that aids communication of progress vs. targets.
	Define the rig HSE, Performance and Learning charter	The input activities mapped in the integrated KM and TL plan should form the basis of the rig based performance and learning charter. Most rigs will have a HSE charter, and this is similar in intent but the scope covers, planning, learning and continuous improvement. It should make reference to the type of rig culture that the rig team will strive to achieve.

Table 5.3-7b Technical Limit Full Model – Define (cont).

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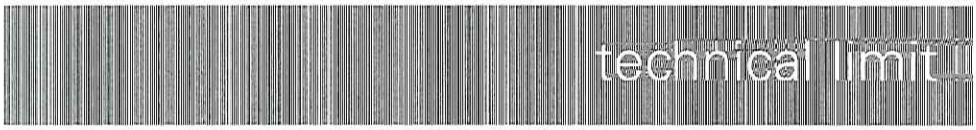

Minimum expectations are highlighted in yellow.

	Technical Limit Full Model – Execute Daily	
Appraise (Learn Before)	Wellsite induction to HSE and Performance Charter	All rigs have a formal process of inducting new personnel, temporary service personnel to the BP HSE expectations and emergency response and evacuation plans. This mandatory communication session can also be used to convey the way the team plans, executes, measures and learns at the wellsite and the expectation for all people to participate and contribute. The daily and weekly schedule can be communicated at this time
	Morning meeting between Rig and Office	All rigs have a scheduled teleconference with the office team to discuss HSE, operations, progress against the plan, forward schedule, personnel and logistics requirements. Use this meeting to discuss TL issues too actual performance relative to expected outcomes and to understand the causes of the differential. The objective should be to identify the improvement opportunities and the operational learning.
	Record the actual times into Openwells	The Actual time of all task's at the activity level should be recorded in Openwells and NPT / inefficiency should be codified. Coding of the activities needs to be agreed and endorsed between the on and offshore team.
	Quality assure the Openwells data	Openwells data needs to be quality assured regularly by an appointed champion to ensure that the data is valid and coded correctly.
	Update the performance dashboard	The performance dashboard KPIs must be updated regularly. Examples are HSE inputs and outputs, Time vs. Depth, Cost vs. Depth, NPT, days per 10,000 feet, days per completion, highlights, learning etc
	Conduct Pre-tour Meeting	The Pre-tour meeting focuses on the next 12 hours, or set of operations. This meeting speaks to the forthcoming HSE and risk exposure and should make reference to learning from previous similar activities and how to most effectively deliver the scope of work to be achieved during the next 12 hour tour.
	Conduct Post Tour AAR to capture Learning	Using a simple AAR process, just prior to handover the Driller, Crane Operator and Toolpusher can conduct an After Action Review on their 12 hour tour while it is still fresh in the supervisors memory. This should include crew and service company participation where operations permit.
	Load AARs and Lessons into LL Tool (TEAMLINK)	All continuous improvement suggestions, learnings and ideas need to be logged and captured at the wellsite and office. These should be evaluated, filtered and logged for future use as appropriate.
	Recognise and personalise great performance	The team needs to go out of its way to recognise and acknowledge contributions from individual or crews. Ideally this could be in combination with an incentive or rewards programme.

Table 5.3-8 Technical Limit Full Model – Execute Daily.

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Minimum expectations are highlighted in yellow.

	Technical Limit Full Model – Execute Weekly	
Appraise (Learn Before)	Conduct Pre-section Meetings	Conduct a pre-section meeting for all logical phases or associated sequence of activities on the rig. This should begin with stating the objectives of the phase and the measures of success. It should include the learning's from previous occasions of the same or similar activity, the risks and the mitigation strategies. Using this information the rig based team needs to fine tune the plan that is right for the circumstances on the rig. This should form the basis of the Driller's instructions for the team. The pre-section meeting and resulting actions should be logged and managed through to effective closure.
	Conduct Post Section Washups/ AARs	The AAR must first consider whether objectives have been met, then the effectiveness of the operation. It should explore whether the instructions and plan was right and opportunities for improvement, and learning recorded, evaluated and validated.
	Hold learning review meetings between rig and office	The rig and office based team must agree a schedule and time to conduct learning reviews. The objective is to hand over and distribute the learning and opportunities for improvement on subsequent wells to the office based support team to evaluate through to effective closure, implementation and embedding. Ideally learning needs to be embedded by continually updating the governing documentation, procedures etc.
	Assign actions to close out lessons	The learning and improvement opportunities need to be assigned to the right team member in accordance with experience and technical expertise, and to distribute the workload across the extended team including where appropriate the drilling contractor and service partners
	Conduct SPU good, bad and ugly meeting	Share and network high value learning – both positive and negative – with all those in the SPU, and more widely if appropriate.
	Review NPT and conduct Root Cause Analysis if appropriate	Define a threshold value of NPT that triggers an investigation of the problem. Where possible use an independent team to focus on identifying the root cause and identifying the best and most cost effective solution.

Table 5.3-9 Technical Limit Full Model – Execute Weekly.

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Minimum expectations are highlighted in yellow.

	Technical Limit Full Model – Sustain	
Appraise (Learn Before)	Conduct End of Well Review	At the end of the well / programme of wells the MDT needs to take the time to review the activity set. This should span the planning and the execute phases of the project and ensure that the learning is captured for future use before key team members depart. Consider the success against the initial objectives – production rate, injection rate etc.
	Close out lessons and incorporate into Procedures and Documents	Manage all lessons, improvement suggestions and embed the learning by updating programmes, BOD's, procedures, contracts risk assessments etc. This ensures that the learning is available in revised documents as opposed to requiring a search of the knowledge database
	Identify key knowledge assets for federal network	Identify what knowledge has significant and repeatable value. Share this externally across all similar BP operations.
	QC Openwells data and freeze	Extract the field based operations data to be used to inform the QPRs. This should highlight both successes and problems of significance. Try to gather data so that similar information can be used for internal BP meetings and with service companies.
	Conduct SPU QPRs	Present the data for all stakeholders and gatekeepers, again both within BP and at service company performance reviews.

Table 5.3-10 Technical Lirnit Full Model – Sustain.

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BtB within E&P CP framework

6.1 Introduction

This chapter describes other E&P Segment Common Processes and how BtB common process sits amongst them.

A Common Process is a process that generates and/ or protects value, sets out base line expectations to materially impact performance, is enduring and globally consistent, and helps advance the capability of the global organisation. Common Processes are the codification of our best practices and expectations across the E&P life cycle.

Figure 6.1-1 illustrates how the eight E&P segment common processes fit throughout the life cycle of a field – from prospectives to abandonment.

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BtB within E&P CP framework

6.2 Interfaces with BtB

Well delivery is a fundamental requirement as a means to access and produce hydrocarbons. As such BtBcp lies within the heart of E&P segment common process and needs to effectively integrate within and between the core processes. These involve Exploration, Major Projects, Opportunity Progression, Base Management and Supplier Performance Management common processes. These are the common processes where most of our D&C work links into.

The following sections describe in more detail how BtB integrates with each of the core processes identified.

To some degree each process has links to the others which ensures an effective transition of work and value through the E&P life cycle. Not all processes are connected, however we have identified and streamlined the connections between those common processes mentioned above that will improve efficiency and performance.

The accountability for ensuring linkage between processes for wells related activity will be dependent on SPU management. There is no "one model" fits all. However where BtB is the primary process as it is for well planning, the wells team leader will normally be accountable to ensure that the appropriate processes are being applied to maximize value.

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BtB within E&P CP framework

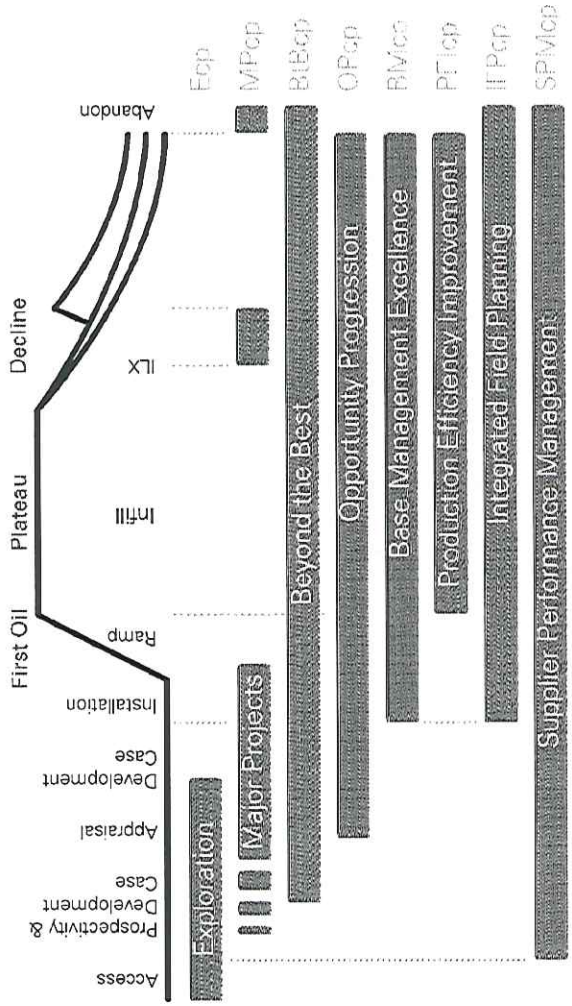

Figure 6.1-1 How the E&P common processes fit with the life of field.

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BtB within E&P CP framework

6.3 Linkages – Inputs, outputs and decision points

Inputs

These are where other processes (disciplines) have deliverables that we require to move forward in the delivery of our work in D&C.

Outputs

These are where we (D&C) undertake a piece of work with a deliverable to another process that will allow that process to move forward.

Decision Points

These are mostly key documents or deliverables that define end points for key stage gates or influence key decisions. Good examples would be Finance memorandums (FMs), Statements of Requirements (SORs) and Technical Assurance Memorandums (TAMs).

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BtB within E&P CP framework

6.4 How BtBcp fits with the **Exploration** common process (Ecp)

Drilling is clearly a core element of the exploration process and as such there is very close alignment between BtBcp and Ecp when it comes to planning and delivering exploration wells.

Figure 6.4-2 shows how BtBcp integrates and aligns with Ecp capturing the main tasks and deliverables to ensure that our exploration wells are effectively planned and delivered to capture maximum value through reserves access.

In practice, Ecp is divided into four stages:

- **Appraise** – Pre-basin access.
- **Select** – Portfolio build prospect selection.
- **Define** – Prospect definition.
- **Execute** – Drill.

Each stage is described by a set of minimum requirements for entry into the following stage. The process delivers the following key documents:

- Technical Decision Memorandum (Appraise to Select).
- Prospect Definition Sheet (Select to Define).
- Technical Assurance Memorandum (Define to Execute).
- Post Well Assurance (Execute to Select return loop).

Details of the Inputs, Outputs for key D&C tasks aligned to Ecp are shown in *Table 6.4-1*. Together they allow the exploration well front end planning process to work effectively towards a successful outcome:

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BtB within E&P CP framework

BtB Stage	Input from Subsurface	Output from D&C	Decision Point
Access	• Screening criteria	• Early warning • Indicators • ExACT cost estimate	• Ecp Technical Decision Memorandum
Appraise	• Value drivers and Objectives • Location options	• Drilling Feasibility • Early Warning Indicator • Early DCUS	• Ecp Prospect Delivery Worksheet
Select	• WPDP	• Updated DCUS BtB SoR	• Technical Assurance Memorandum (decision to drill)
Define		• Basis of Design Drilling programme • Final DCUS	• AFE
Execute		• Well Drilled (and tested)	
Review		• KPIs • Lessons Learned	• Ecp/Post Well Assurance • Update ExACT database

Table 6.4-1 BtB touch points with Ecp.

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BtB within E&P CP framework

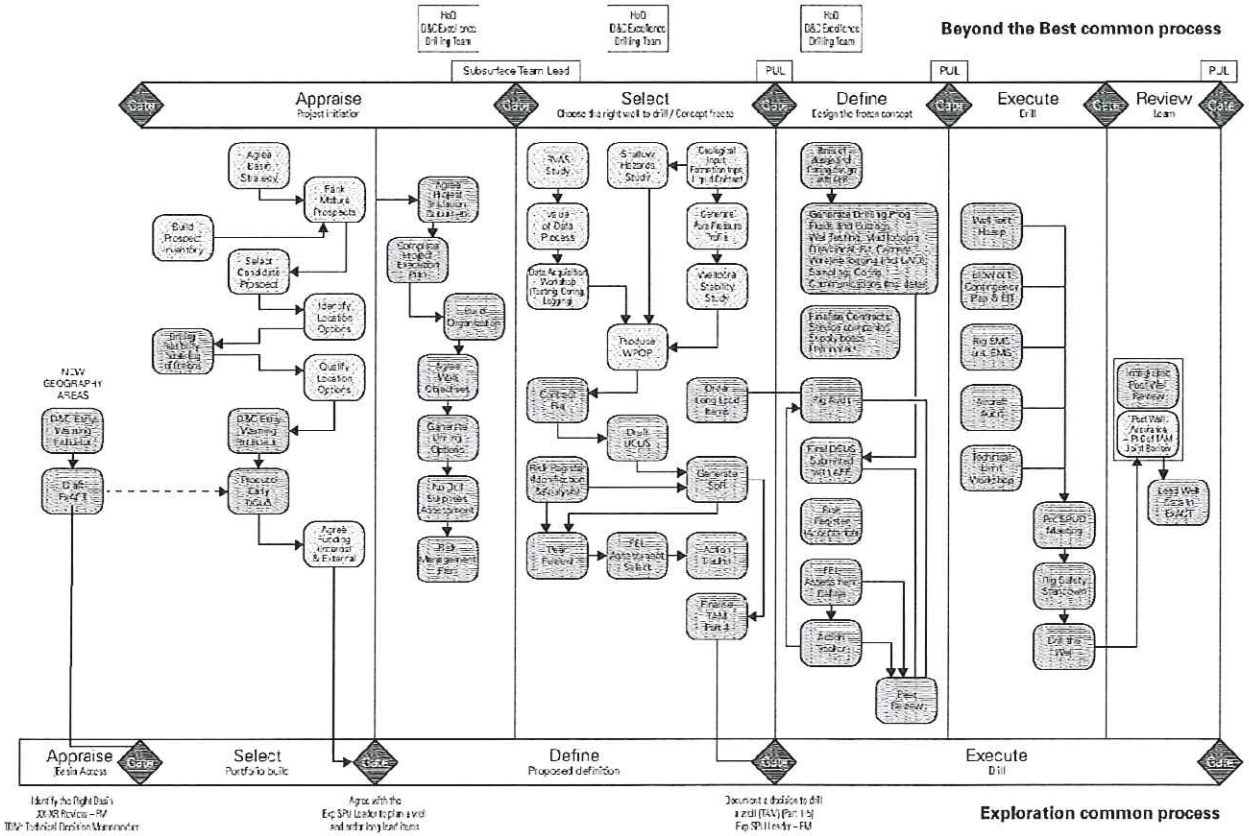

Figure 6.4-2 How BtBcp fits with the Exploration common process.

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BtB within E&P CP framework

6.5 How BtBcp fits with the **Major Projects** common process (MPcp)

MPcp is the process that governs how BP undertakes Major Capital Projects in the Upstream. In most E&P major projects D&C are a key player often impacting costs to 50% or greater degree.

Wells Teams in Major Projects should follow MPcp as the primary common process. Aspects of BtBcp will be clearly evident in the key wells deliverables for major projects front end loading. BtB will be the primary process used for well planning and delivery once the project reaches this stage. It is worth noting that the BtBcp appraise stage for well delivery will be effectively achieved with the front end loading for MPcp. *Table 6.5-1* shows the relationship between BtBcp and MPcp.

The primary D&C task/deliverable in Major Projects is the Wells Basis of Design that needs to be delivered by the end of Select in MPcp once the preferred concept has been selected. This requires that D&C leadership and technical expertise are resourced within the project team at an early stage. Details of the requirements for the Wells Basis of Design are given in *Figure 6.5-2*. Getting the Wells Basis of design right will go a long way to ensure that the facilities are designed and built to meet wells life cycle requirements and ensure that the cost and schedule drivers are clearly understood for the preparation of realistic estimates

Table 6.5-3 provides details of the main inputs and outputs for Key D&C Tasks in the framework of major projects.

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BtB within E&P CP framework

MPcp stage	Input from other disciplines	Output from D&C	Decision Point
Appraise	• Value Drivers and Objectives. • Reservoir Depletion Plan (Links with OP.	• Organisation Plan. • Drilling Options. • Technology Plan. • Preliminary Contract Strategy. • Level 1 Schedule. • Risk Register. • Early DCUS. • L&KM Plan.	• Outline Project Integrated SoR. • Assurance HoD Review/TVP attestation.
Select	• Project Execution Plan.	• Wells Basis of Design • Updated DCUS • BtB FEL Assessment • Update Organisation, risks, contract strategy, Technology Plan and Schedule	• Integrated Project SoR incorporating Facilities BoD and Project Execution Plan. • Define FM. • Assurance HoD Review/TVP attestation.
Define		• Final Wells Basis of Design (not BtB single well BoD). • Final DCUS. • BtB Final FEL Assessment. • Update Organisation, risks, contract strategy, Technology Plan and Schedule.	• Execute FM. • Assurance HoD Review/TVP Attestation.
Execute	• Sanctioned Execution Plan.	• Single Well Delivery with BtB as per development plan.	• Post Project appraisal.

Table 6.5-1 D&C touch points with MPcp.

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BtB within E&P CP framework

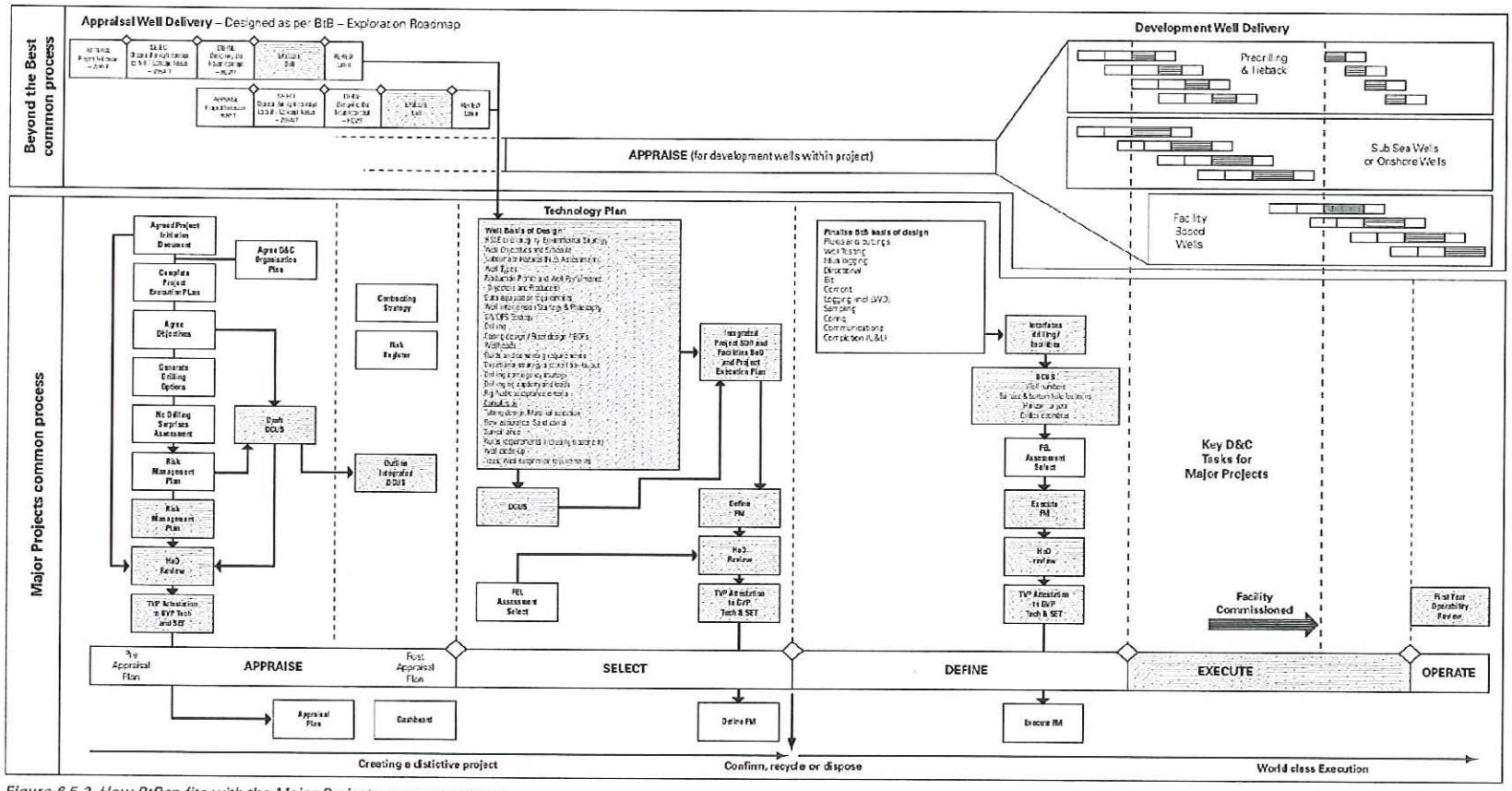

Figure 6.5-2 How BtBcp fits with the Major Projects common process.

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BtB within E&P CP framework

Strategic Background
- HSSE and integrity (environmental strategy
- Drilling and Completions objectives
- Schedule and operational sequence
- Technology overview
- Depletion Plan overview
- Subsurface hazards (NDS assessment)
- Well types (e.g. wet vs. dry)
- Production profile and well performance (injectors and producers)
- Data acquisition requirements
- Well intervention strategy
- SIMOPS strategy

Drilling
- Philosophy
- Casicng design (highlight non-conventional requirements)
- Riser design / BOPs
- Wellheads
- Fluids and cementing reequirements
- Directional strategy and well lay layout
- Drilling contingency strategy
- Drilling rig capability and loads, incl. completions

Completions
- Philosophy
- Upper completion design
- Sand face design, incl. sand control
- Material selection
- Flow assurance
- Surveillance
- Fluids requirements (incl. treatment)
- Clean up
- Trees
- Well suspension requirements

Signed ... ***Gatekeeper***

Figure 6..5-3 D&C BoD for Major Projects.

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6.6 How BtBcp fits with the **Opportunity Progression** common process (OPcp)

OPcp is the process that governs how we deliver business opportunities to convert resources to reserves though effective reservoir management and field depletion planning. Thus the role of D&C within this process is fundamental to ensure that decisions are made in an environment that recognises D&C feasibility and risk.

In essence OPcp addresses: Reserves Pull to progress opportunities in and around existing assets, having a healthy Opportunity Progression Hopper (OPH) to build and provide high-quality choices. To develop robust Depletion Plans involving multidisciplinary input to provide the basis for life-of-field long-term success. Having Reservoir Management as the basic building block for depletion plans and underpinning reserves reporting requirements.

Fundamentally the area where integration occurs between BtBcp and OPcp is during Right Scoping. This also emphasises the need for multidisciplined working throughout well planning and delivery.

Details of the main linkages for the Key D&C Tasks in the framework of Opportunity progression are shown in *Table 6.6-1*.

Figure 6.6-2 shows how OPcp integrates with BtBcp in the BtBcp roadmap.

BtB Stage	Input from Subsurface	Output from D&C	Decision Point
Appraise	1. Assets Screen Opportunities. 3. Detailed scoping studies.	2. High Level Well Value Criteria, Objectives and Feasibility. 4. Right scoping ranking and option selection. 5. Project Initiation Document.	• Prioritisation of Opportunities ranked against value criteria. • Opportunity identified. • Project Initiated.
Select / Define / Execute			
Review		• Post well Review. • Lessons Learned.	• Well performance data capture to inform hopper selection.

Table 6.6-1 BtB touch points with OPcp.

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BtB within E&P CP framework

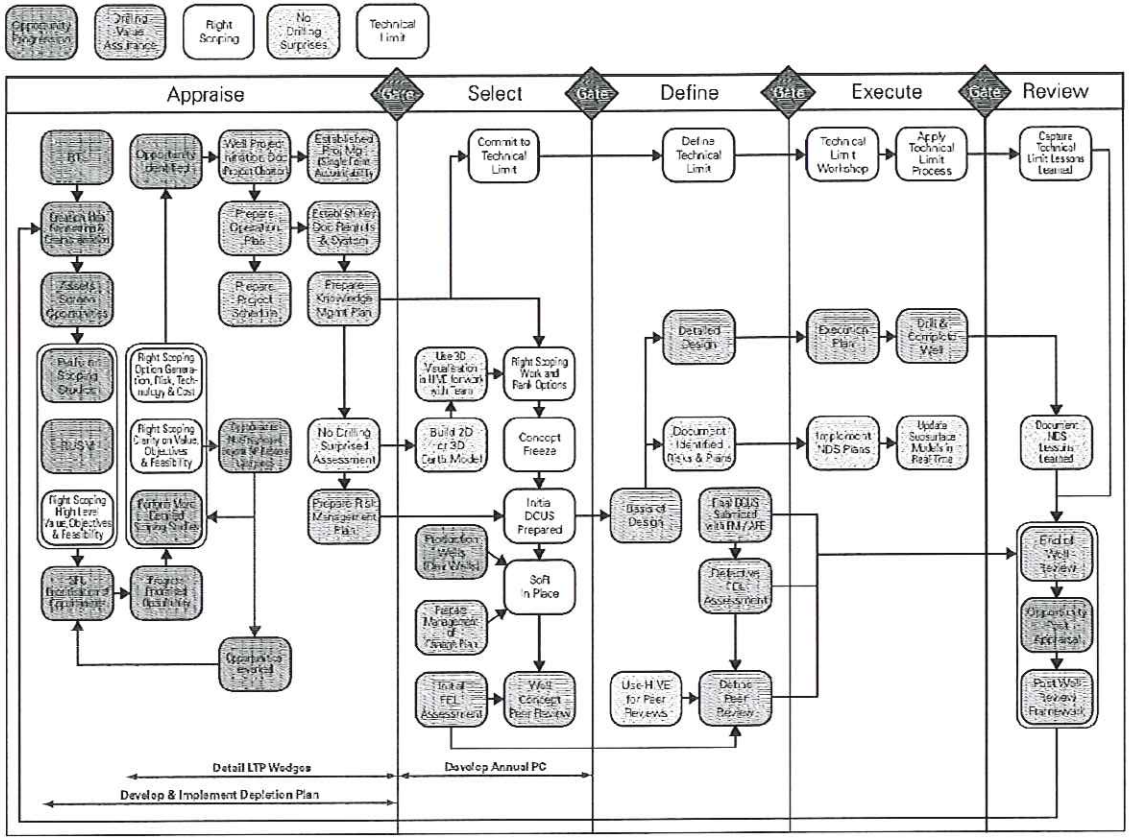

Figure 6.6-2 Integrated OPcp and BtBcp Roadmap.

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BtB within E&P CP framework

6.7 How BtBcp fits with the **Base Management** common process (BMcp)

Fundamentally, BMcp involves the operation of wells to extract maximum value (production and reserves) once the wells are constructed. What we in D&C build is passed to our Base Management colleagues as well owners and we need to ensure that the wells are constructed for their expected service life and specification.

The aim of the BMcp is efficient delivery of Proved Developed (PD) reserves. It is applied throughout most of the life of a field, although focus is on the plateau and decline stages of production, the BMcp must supply input into the pre-start-up design of projects and wells to ensure future BM requirements are met.

Clearly then BtBcp needs to closely align with BMcp not just at the point of well handover, but also at the point of well conception – to identify well design specifications to meet the needs of well life and service and address key risks. A key aspect of Well Management is to maintain well integrity and maximize value from the well stock. Thus a clear well handover process is required to ensure that all aspects of the well that will impact integrity during operation are understood and documented.

Details of the main inputs and outputs for Key D&C Tasks in the framework of Base Management are shown in *Table 6.7-1*.

Figure 6.7-2 illustrates how BMcp integrates with BtBcp.

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BtB within E&P CP framework

BtB Stage	Input from Base Management	Output from D&C	Decision Point
Appraise	• Life of Well Integrity requirements. • Big Wells Risks.	• Big well Risks for register.	• Well integrity criteria acceptance.
Select			
Define	• Well Integrity Criteria.	• Basis of Design	• Accepted Basis of Design.
Execute		• Well Handover	• Well Accepted by Well Operations.
Review	• Post Well Reviews.	• Data to inform future well design and construction process.	• Update Big Well Risks based on findings.

Figure 6.7-1 BtB touch points with BMcp.

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BtB within E&P CP framework

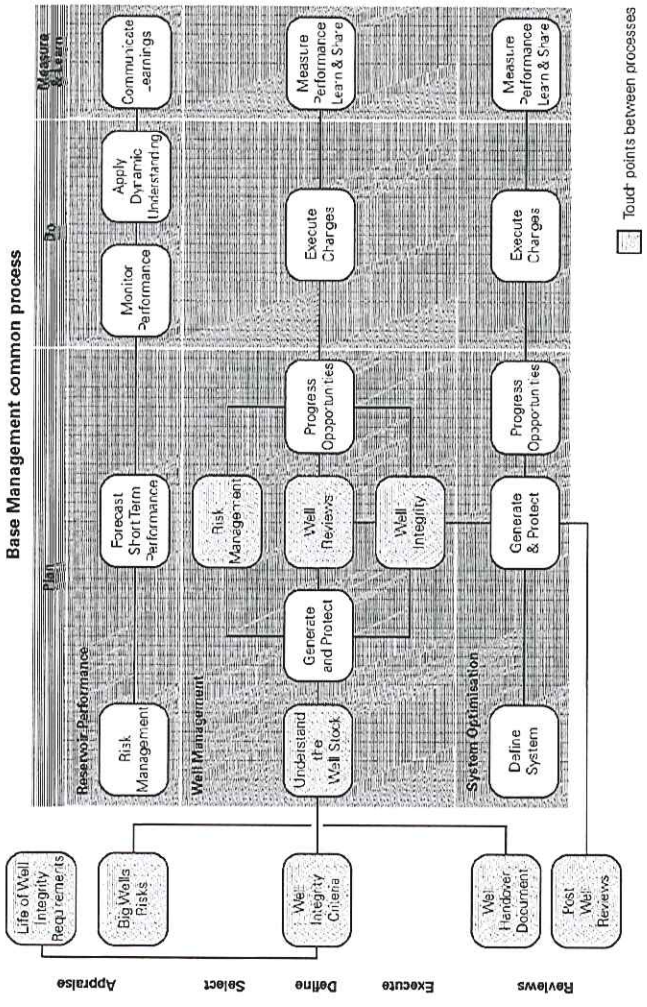

Figure 6.7-2 How BtBcp fits with the Base Management common process.

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BtB within E&P CP framework

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BtB within E&P CP framework

6.8 How BtBcp fits with the **Supplier Performance Management** common process (SPMcp)

SPMcp (formally GWSI) is the process that governs how BP works with its suppliers to achieve optimum alignment and performance delivery. With suppliers undertaking in excess of 80% of our work SMPcp is of fundamental importance to D&C. It is imperative that we understand how to extract maximum value for our supplier relationships through effective integration with BtBcp. The earlier we can involve our suppliers in our well planning the better.

The aim of SPMcp is to deliver incremental value by facilitating the delivery of ongoing performance improvements from BP's suppliers and creating the potential for suppliers to exceed normal performance expectations. At a minimum it aims to provide assurance of expected supplier value delivery and create supplier alignment to BP Objectives.

The principles address: the relationships with suppliers that are founded on performance-based frameworks. Engaging suppliers in BP's performance culture. Focus on the application of resources to the areas of highest risk to BP's business. Multi-discipline involvement with cross functional sector teams. Alignment of KPIs to business objectives and Continuous improvement and reporting and sharing.

Details of the main inputs and outputs for Key D&C Tasks in the framework of Supplier Performance Management are shown in *Table 6.8-1*.

Figure 6.8-2 illustrates how SPMcp integrates with BtBcp.

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BtB within E&P CP framework

BtB Stage	Input from Suppliers	Output from D&C	Decision Point
Appraise		• Well Objectives and Value Drivers. • QA/QC Strategy.	• Agreement on alignment criteria for suppliers.
Select	• Supplier Technologies and costs.	• DCUS (Costs). • BtB SoR.	• Agreed well project scope for suppliers to input for BoD.
Define	• Performance Scorecards with agreed KPIs.	• Basis of Design. • Agreed KPIs. • Detailed execution plan.	• Agreed performance contract with suppliers to meet well objectives.
Execute	• Performance review meetings	• Capture of lessons learned and performance data.	
Review		• End of Well Reviews.	• Agreed performance improvement plan.

Figure 6.8-1 BtB touch points with SMPcp.

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BtB within E&P CP framework

	Appraise	Select	Define	Execute	Review
Major actions involving SPM Objectives	Identify key suppliers able to meet requirements	Work with key suppliers to analyse and select concept options	Work with key suppliers to develop BoDs based on SoR Complete supplier identification and involvement	Monitoring of supplier performance using SPM sheets for tracking against objectives, targets and KPIs	End of Well Review Capture of performance for OPR and GPR feed
SPM Objectives	Early supplier alignment and bring appropriate resources on board	Alignment of supplier and BP to deliver business objectives	Alignment of all supplier objectives to BoD objectives	Delivery and measurement of supplier performance	Determine if suppliers performed against expectation – lessons learned
Inputs	Scope of Project (PID)	Suppliers experience	SoR	Well Execution Plan	Daily reports
		Technology	Suppliers experience	Technical Limit Plan	Well Status (integrity, prod data etc)
	SPM Performance Data	Best practice	Technology Best Practice	Supplier Objectives and Targets	Well Cost and Time
Outputs	Core organisation structure – incorporating key suppliers	SOR: High level well objectives, risks, value drivers, WPDP	BoDs w, design needs	The Well	Well Completion report
			Execution Plan	Supplier evaluation	
			Technical Limit Plan	Daily reports	SPM supplier performance data (overall scorecard)
			Supplier objectives for SPM cards etc.		
Advised supplier involvement	Supplier involvement for complex wells or multi-well projects				
			Supplier involvement for non-complex single wells		

Figure 6.8-2 How BtBcp fits with Supplier Performance Management common process.

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BtB within E&P CP framework

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7 B:B Training and Development

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BtB Training & Development

7.1 Introduction

A number of training courses – both in-house and external – are available to support the use of Beyond the Best common process throughout Drilling and Completions. The ability to apply BtB principles is a core competence for D&C staff, although some of the courses are targetted at the broader multi-disciplinary team as well.

All these courses can be booked via the OneHR - Learning website.

The BtB website is a major resource too, with numerous examples of documentation and best practice from around the world.

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7.2 Knowledge Management for Wells Team

Course Duration – 1½ days

Course Objectives

- To provide drilling/completion/well service teams with the basic understanding of learning concepts and how to apply them.
- To provide hands on training in the use of the core BP wells community learning tools and processes.
- To provide the groundwork for a KM plan

Benefits

- Raises level of learning/KM competency for wells teams
- Makes teams more efficient in their jobs by the application of learning tools and principles.
- Supports the embedding of learning into how teams do their work.
- Builds the groundwork for a KM plan, as required by D&CVA

Course Outline

Day 1 – Knowledge Management/Learning Principles

- Attendees set their own objectives for the course as a group.
- Team PTL assessment
- Introduction to the principles of learning/KM with cross-BP and cross industry examples of what has worked and why.
- Class exercises used to demonstrate principles discussed in informal, non work related scenarios.
  - Exercises start to build input to the KM plan
  - Recognition of core areas of knowledge for the drilling program
- Focus on the People aspect of learning rather than technology

Day 2 – Hands on Training

- Introduction of "Common Working Environment" Tools and Process.
- All attendees have opportunity to gain familiarity with tools online.
- Further presentations interspersed with application of tools
  - Real life examples suggested by attendees.
  - Search of existing corporate knowledge stores to discover the breadth of currently available Knowledge
  - Application to teams real life issues
  - Builds understanding that learning/CWE tools can:
    - Fit into current jobs now.
    - Quickly allow you to access what the organisation already knows – if only you use the tools!
    - Make space for you by reaching solutions quickly.
  - Team collectively reviews gaps identified in earlier analysis (day 1), and builds groundwork for KM plan.

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BtB Training & Development

7.3 Decision Making and Cost Forecasting for Drilling Engineers

Course Duration – 2 days

Course Objectives – The course provides delegates with the skills necessary to apply two complementary risk analysis techniques – decision trees and Monte Carlo simulation – to real-world drilling situations. Delegates will learn how to use software specific to each technique (DATA and Crystal Ball, respectively) to analyse complex decisions and effectively explain the results. In particular, the course covers "best practice" in generating probabilistic well drilling times and costs.

Topics covered include:

- Introduction to decision trees,
- Using DATA to understand and analyse decisions,
- Introduction to Monte Carlo simulation using Crystal Ball to quantify risk and as a tool for generating risked well times and costs,
- Tips for presenting and explaining the results to others.

The course includes an element of instruction and plenty of hands-on practice with the software. Simple everyday examples are used to introduce the techniques. Then, two in-depth examples – a decision on a multilateral development and generation of a risked AFE – are used to illustrate their practical application.

Target Audience – The course examples are aimed primarily at drilling engineers, although other upstream staff have benefited from taking the course.

Prerequisites – Delegates should be sufficiently familiar with drilling planning to appreciate the main course examples – comparison of development options and the generation of well cost estimates.

Course Schedule

Day 1 – Morning
- Introduction
- Fundamentals of Decision Making
- Example: Saturday Afternoon
- Estimating Probabilities
- Ready-made Decision Trees
- Example: Drill String Failures

Day 1 – Afternoon
- Improving the Presentation of Decision Trees
- Example: Single Bores vs. Dual Lateral
- Additional topics in Decision Making
- Introduction to Risk Analysis
- Exercise: Estimating uncertainty
- Introduction to Monte Carlo & Crystal Ball

Day 2 – Morning
- Well Time Forecasting
- Distributions, NPT, Correlation
- The Drilling Uncertainty Statement
- Exercise: Time Forecast for an ERD Well

Day 2 – Afternoon
- Cost Forecasting
- Exercise: Cost Forecast for ERD Well
- Learning Curve
- Multi-Well Time and Cost Forecasting
- Exercise: Multi-Well Time Forecasting
- Forecast Post-Analysis
- Miscellaneous Tools

Instructor/Contact Hugh Williamson. Email: **williahs@bp.com**

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7.4 Introduction to Project Management for Wells Delivery (IPMWD)

Course Duration – 4.5 days

Participants will learn how to:

- Master fundamental project management skills, concepts and techniques
- Link project goals and objectives to clear, compelling stakeholder needs
- Develop work breakdown structures
- Set realistic, measurable objectives and ensure positive results
- Estimate project costs and schedules using simple, proven techniques
- Establish a dependable project control and monitoring system
- Apply the new skills to a D&C case history

Professional Development Units (PDUs) 22.5

PMBOK® knowledge areas:

- Project Integration Management
- Project Scope Management
- Project Quality Management
- Project Time Management
- Project Cost Management
- Project Risk Management
- Project Human Resource Management
- Project Procurement Management
- Project Communications Management

Programme Outline

Participants will get a solid understanding of project management methods with this comprehensive introductory course. They will gain practical experience in proven project management techniques and discover a wealth of valuable, flexible tools that they can use immediately to ensure the success of any project in any type of organisation.

Managing Projects gives participants the foundation, experience, techniques and tools to manage each stage of the project life cycle, work within organisational and cost constraints, set goals tied directly to stakeholder needs, get the most from the project management team, and utilise state-of-the-art project management tools to get the work done on time and within budget.

Covering the entire project life cycle, this course is built around the latest insights from the Project Management Institute's A Guide to the Project Management Body of Knowledge (PMBOK® Guide), which incorporates information critical to project success, are also highlighted.

Participants will learn project management skills through case studies, hands-on exercises and a broad array of practical experiences that can immediately be applied to your job. This approach yields a comprehensive project management experience, including the early stages of defining project requirements, developing work breakdown structures, project change control and closeout.

As the ESI Project Management Professional Development Programme's flagship course, Managing Projects opens the door to more efficient project implementation. The programme's other courses provide opportunities for participants to build on the knowledge they gain during this course to enhance their project management capabilities.

As part of the course materials, participants will also receive a copy of Project Management Terms: A Working Glossary, second edition, by J LeRoy Ward, PMP.

Throughout the course, a BP Common Process Specialist introduces tools and techniques specific to BP wells projects.

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Course Topics

1. Introduction to Project Management
a. What are "projects"?
b. Why project management?
c. The project life cycle
d. Influences on a project
e. Key stakeholders
f. Project management process groups
g. Project manager responsibilities

2. Project Initiation
Understanding the role of senior management
a. Needs Assessment
b. Project selection – Benefit/cost ratio • Present value and net present value
c. Building SMART objectives – Specific • Measurable • Agreed to • Realistic • Time-constrained
d. Developing Requirements
e. Project charters
f. Project Requirements Document

3. Project Planning
Scope planning
a. The work breakdown structure
b. Estimating
c. Schedule Planning
d. Network Diagrams – CPM
e. Speeding up the Schedule
f. Project Management Planning Software
g. Cost Planning
h. Responsibility Matrix
i. Resource Loading and Levelling
j. Risk Planning
k. Procurement Planning
l. Communication and quality planning

4. Project Implementation
Baselines
a. Developing the project team
b. Organisations and team structures
c. Managing change
d. Managing Risk
e. Performance reporting
f. Reserves
g. Assessing and monitoring project performance
h. Earned value
i. Sunk costs

5. Project Closeout
Scope verification and customer acceptance
a. Administrative and contractual closure
b. Transferring lessons learned to future project

6. Case study
Drilling and Completions

continues overleaf ...

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7.5 Managing Risk for Projects

Course Duration – 3 days

Course Description

Managing Risk for Projects is a case based class. Effective management of risk is recognized as a key lever in delivering successful projects. This course will build upon the Project Management Essentials class and the guidelines for Risk Management for Major Projects. It will cover the behaviors, process and tools that are required to create and implement an effective risk management system. A major intent of the course is to make delegates aware of possible risk management gaps on their current projects and how to close them. It will also explore better practice from BP and other industries in managing risk.

Target Audience

The audience consists of BP project management professionals including project engineers, project services staff, project managers, team leaders, cross functional project team members, etc.

Professional Development Units (PDUs) 22.5

PMBOK© knowledge areas:

- Project Time Management
- Project Cost Management
- Project Risk Management
- Project Procurement Management

Course Goal/Objectives

Delegates will understand how to:

- Demonstrate and apply desired behaviors when leading BP project teams through the risk management process.
- Select the appropriate and required activities and processes to effectively identify and manage risks on BP projects.
- Select and use appropriate and effective tools to identify, assess, respond to, and control project risks.
- Capture and use risk management lessons learned.

Course Outline / Key Topics

The course will be organized into three major sections and will consist of the following units:

Section I: Introduction

- Course Introduction – Welcome delegates to the course; discuss course scope and learning objectives.
- Unit 1: Introduction to Risk – Introduce the topic of risk management.

Section II: Risk Management Process

- Unit 2: Risk Management Process – Provide an overview of the step-by-step process for managing project risks.

Section III: Application of the Risk Management Process

- Unit 3: Initiate – Discuss the steps and activities needed to prepare the project to manage risk effectively, including roles and responsibilities and risk acceptance process.
- Unit 4: Identify – Describe techniques and tools for risk identification to minimize the chance of project surprises

continues overleaf ...

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Course Outline / Key Topics (cont)

- Unit 5: Assess – Discuss appropriate risk assessment techniques and prioritization tools to enable teams to focus on the key risk drivers of project value. Describe how the status of a risk changes throughout its lifecycle
- Unit 6: Respond – Describe the different types of risk response strategies, how to determine response effectiveness and the role of contingency planning.
- Unit 7: Risk Control and Reporting – Discuss the monitoring, review, and reporting of risks and their associated action plans and tools. Provides advice on how to make it a living process.
- Unit 8: Risk Learning – Describe the types of risk documentation that must be maintained for a risk lessons learned program, and a practical approach for documenting risk results. Discuss how to turn data capture into a real learning process.
- Unit 9: Course Closeout Prerequisites – BP Project Management Essentials is preferred.

Additional Information

There is an exam to be taken at the end of this course, which on successful completion will entitle you to the course certificate.

22.5 PDUs, 2.25 CEUs, and credits towards a Masters Certificate with George Washington University.

Approximately 40% of the course will consist of lecture; 15% of case study; 15% in use of tools; 10% of exercises; and 20% of small group discussion.

Competencies Addressed

Technical/Professional – Project Performance & Risk Management

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BtB within E&P CP framework

7.6 BtB common process for New Hires

Course Duration – 1 day

Course Description

- To provide new starters and challengers an overview and understanding of BtB Common Process and how it generates value to the Business.
- To provide an introduction to the BtBcp toolkit and demonstrate its use.
- To provide sufficient understanding of BtBcp to be able to use it in the workplace.

Benefits

- Introduces new staff to the standard way of working within D&C.
- Makes new staff more productive at an earlier stage.
- Builds a foundation for further development in the area of common process and wells project management.

Course Goal/Objectives

- Setting Expectations.
- An overview of the origins of Beyond the Best and its fit to current business context and performance.
- Breakout- Why do projects fail? Understanding the drivers for successful wells projects.
- Understanding stage Gate processes demonstrated with simple and business context.
- Drilling & Completions Value Assurance supported with a breakout Case Study to demonstrate the importance of setting projects up successfully.
- Right Scoping (with ranking and decision exercise).
- An introduction to No Drilling Surprises.
- An introduction to Technical Limit.
- Putting it all together through the completion of a wells Case Study.
- A walk through the Common Process Road Map and demonstration of the toolkit.
- An introduction to Learning and Knowledge Management in D&C.

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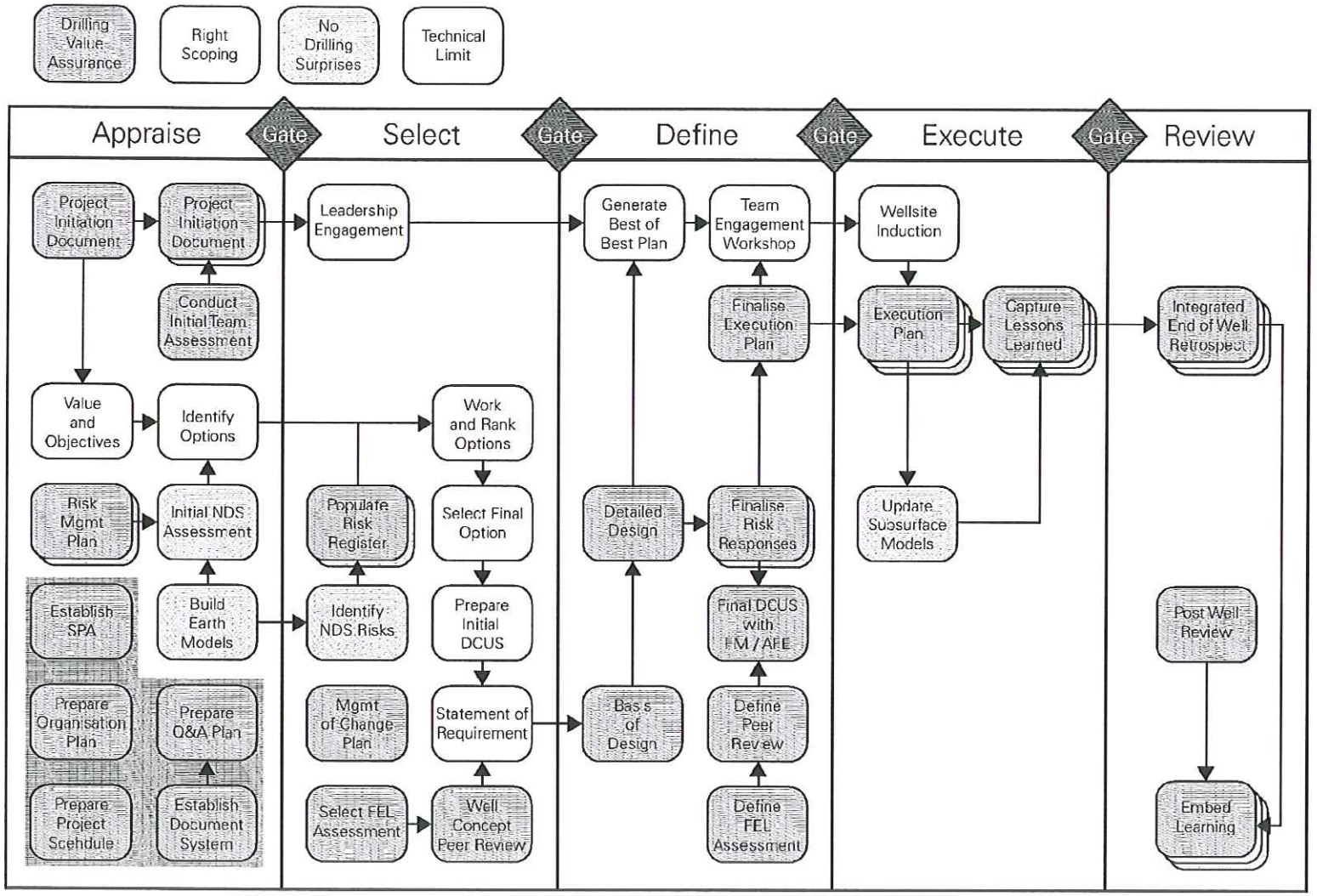

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