Insurance Industry Briefing Document

Well Design and Operations Planning Process

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Prepared for:

Brokers and Insurers

By:

The NRG Group of Companies

1 St. Devenicks Place
Cults
Aberdeen, AB15 9LN

	Name	Signed	Date
Prepared by:	D. Hamer		31/01/31
Reviewed by:	A Mackay		31/01/12

CONTENTS

Introduction

Development of this document has been prompted by persistent difficulties in obtaining the appropriate data in order to conduct insurance risk reviews (IRR) as requested by the insurance industry.

In the majority of cases it appears that the communication is primarily between a representative of one of the brokers and their contact within the Operator's organisation. As neither of these people are likely to be particularly technically aware of the well design and operations planning process it seems probable that some of the difficulty in obtaining the correct information is caused by a lack of appreciation for what is being requested and why.

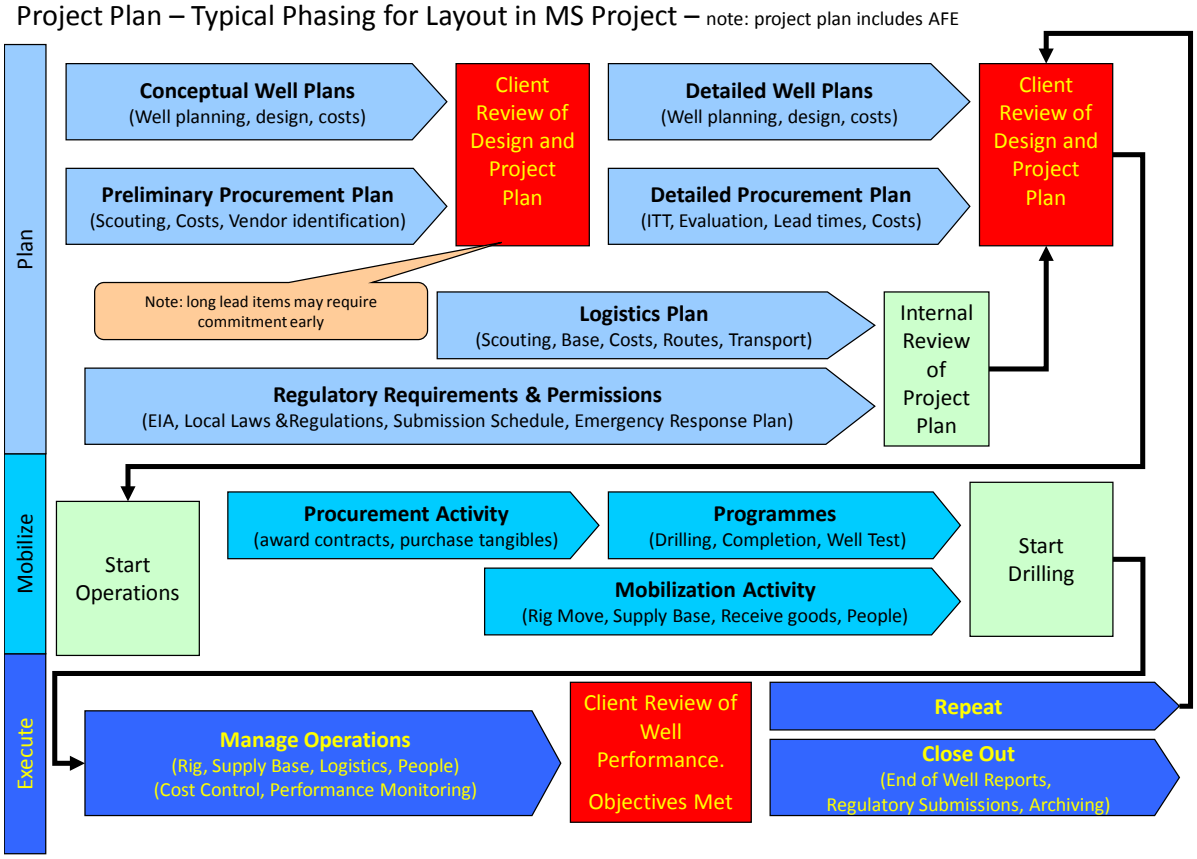
This document sets out to try and summarise in as brief a form as possible what that well design and operations planning process looks like and which key documents are typically generated as the process is followed.

A list of key documents required to perform an IRR is included at the back of this document.

Project Planning

Taking a high level view all well projects have a similar form and while the terminology may vary from company to company the process described here should be recognisable to most.

Project Plan – Typical Phasing for Layout in MS Project – note: project plan includes AFE



Design and Programming

In broad terms once a prospect has been identified and described in the **Geological Prognosis**, a **Basis of Design** document is generated that captures all the information needed to allow a well to be designed.

A Conceptual Design and Plan is generated which, following review, is modified into a Detailed Design and Plan. The output from this **Detailed Design** should be documented in a well design document which shows;

- All the casing stress calculations
- Load cases that underlie them
- Casing specifications which meet these load cases
- Well control considerations
- Tabulated kick tolerance by hole section

It is not until this Detailed Design has been agreed and documented that any **Procurement Process** activity can begin and the drilling programme can start to be drafted.

Understanding the procurement process, and especially how key contractors are selected, is often the only way to make any assessment of the competence of the contractors. The procurement process is normally defined in the operator's management systems policies and standards.

Once key contractors are in place they can contribute to the **Drilling Programme,** and typically this programme will be assembled from multiple sources and not finalised until close to the spud date for the well.

Regulatory Compliance, Consents, Internal Compliance, Planning

One of the most fundamental requirements for any well project is the need to comply with local regulatory requirements. These requirements are likely to include some form of 'consent to drill' as well as associated health, safety and environmental approvals. Some operators use Regulatory Compliance Registers as a way of assuring compliance and thereby mitigating risk.

Operators will also have internal systems and requirements which, although not directly focussed on well management, also help to reduce the risks associated with well operations. Particularly important requirements in relation to pollution risk minimisation are the following:

- Plans to deal with accidental oil spillage. The titles used for these plans may vary depending on national regulation and internal company usage (for example; impact assessment, emergency response plan, oil spill contingency plan, etc). Regardless of title, objective guidance on best-practice scope and content of these plans has been increasingly well-defined within international guidance (International Maritime Organisation (IMO) and various Industry Associations).
- Since the Macondo and Montara incidents, there has been increasing attention paid to contingency planning in relation to well-capping and the drilling of relief wells in the event of a blow-out. Such plans help mitigate consequences in the event of a blow-out.

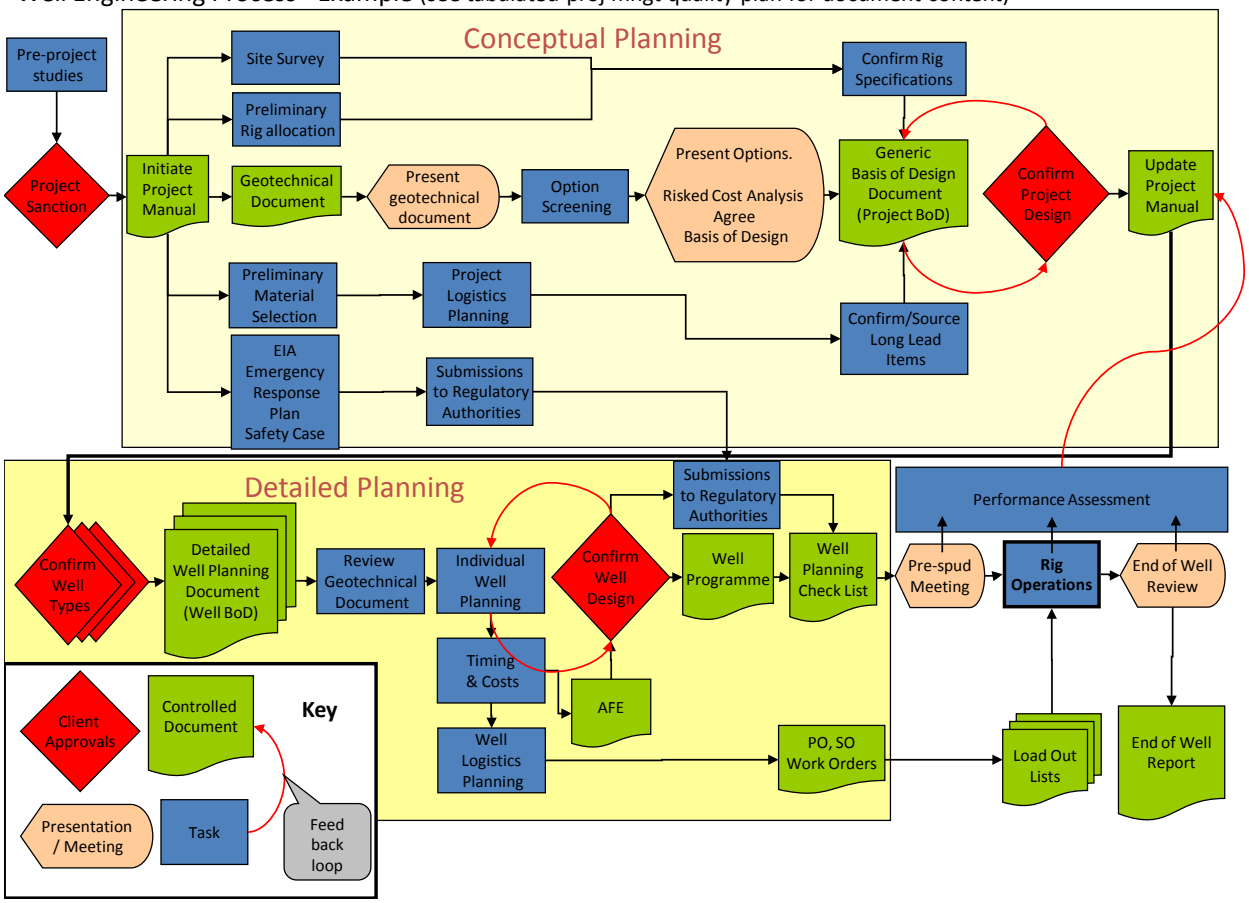
Increasingly both Operators and Governments are requesting some form of independent examination (technical audit) of the whole well design and planning process. In the UK **Independent Well Examination** has been required by the legislation for several years as part of the 1996 DCR Regulations (design and construction regulations). Examination of well programmes is becoming the norm in many other areas of the world, apart from the UK, following the Macondo and Montara incidents.

It is important to recognise that Well Examination is a technical review of well design and programming for planned well operations. As such, it does not replace Insurance Risk Reviews which are quite separate and are intended for insurance assessment and insurance placement purposes only.

Key Documents and what they should contain

Looking at the design and planning requirements in a little more detail it is perhaps useful to have the following process map in place.

Well Engineering Process - Example (see tabulated proj mngt quality plan for document content)



Regulatory Compliance, Consents, Internal Compliance, Planning

Local Legislation / Operator Policies and Standards

Local legislation will vary in scope and detail from country to country and it is difficult to generalise on the requirements. However, most countries with active petroleum industries, even if still at the exploration stage, are becoming increasingly sophisticated in terms of legislation.

It is also true that most competent International Operators and larger Drilling Contractors will have Global Policies and Standards within their management systems. These will generally be written for compliance with the more rigorous legislative environments, such as that in the UK, and may well exceed some local legislation.

It is normal for the Operator to keep a register of legislative compliance and to include the preparation and submission of key documents in their project planning. This is necessary because the lead time for making these submissions in some cases can be 9 to 12 months in advance of any drilling activity.

Sight of such registers of legislative compliance provides the reviewer with an insight into how much the local regulatory regime influences the safety and risk mitigation required.

It is therefore a requirement to see both the operators policies and standards and the regulatory compliance register document.

Spill Response Planning

Oil Spill Contingency Plan (OSCP)

Sometimes addressed within an Environmental Impact Assessment or included as part of an Emergency Response Plan, best-practice guidance requires that the following information be documented:

- A detailed description of the surrounding environment including any economic resources that may be impacted in the event of an oil spillage.
- Modelling work that describes how a potential spillage would be distributed as a result of local tidal, wind and weathering effects.
- Spill response strategies based on the above (e.g. drilling contractor interface, remote surveillance arrangements, use of dispersants, in-situ burning, etc) – these strategies will typically have been subject to advance discussion and, where necessary, approval by local regulators.
- Contractual arrangements with 3rd party spill responders (particularly so-called Tier 2 and 3 capability responders).
- Results of response exercises and other methods of advance assessment of preparedness.

Blow-out Relief Plans (BORP)

The need for more extensive work in relation to BORP is a relatively recent requirement as a result of the Macondo and Montara incidents; the level of detail required will vary according to the circumstances:

- It is generally in the contingency planning documents that reference will be made to arrangements with a well control company (e.g. Boots & Coots, Wild Well Control etc).
- Remoteness of the area, available infrastructure and local regulatory requirements all play a large part in how detailed these plans need to be. For instance drilling offshore Greenland is generally confined to the ice free season and the authorities demand that two rigs be present since the time required to mobilise a rig for relief well drilling from the next nearest source is likely to be several weeks.

Internal Compliance and Planning

Well Operations Management System

An Operations Management System generally sets down the operator's policy statements and standards governing the planning and implementation of all well designs and operations from conception through to final well abandonment, including well intervention operations.

It would be expected to contain policies and associated standards which are to be used when the operator carries out any well operations for governing the management, planning and execution of well designs and operations. Specifically in relation to the safety of well operations on site, including policies on well control, and include policies on the maintenance of well integrity throughout well operations.

The Policy statements are designed to manage the safety critical aspects of well design and operations as well as environmental compliance.

Well Design Standards

Such a document generally describes the policies and standards for achieving fit for purpose well design, including well-related equipment design. Focussing on, well integrity design and the design of well-related equipment necessary to ensure compliance with the regulations.

A well is defined in terms of its pressure containment boundary. Adequate well design construction and operational monitoring and future maintenance of the pressure containment boundary should ensure well integrity through the well life cycle. This would include a statement on the minimum barrier requirements for the design of wells and throughout the life cycle of the well.

Procurement Policy

Sight of the procurement policy and process is helpful to the reviewer to gauge the selection criteria for Third Party and equipment procurement.

Geological Prognosis, Design and Programming

Sometimes referred to as the Drilling Prognosis this document is usually generated by the Geology and Geophysics specialists and essentially describes what will be drilled through and the expected characteristics of the various formations.

Generally may also contain regional geology and geological evaluation, as well as a Lithology Column, other information normally found in this document includes the prediction of pore pressures, fracture gradients, formation temperatures and reservoir fluid properties.

The document provides the Design Engineer with the basic information needed to design the well. It is also likely that the well objectives will be defined in this document.

Offset Well Analysis

The geological prognosis, especially in the case of an exploration well, will be largely a model of expectations based on conversion of a seismic survey into a geological model.

To try and verify these predictions and constrain uncertainties it is normal to draw upon data from relevant offset wells, if any suitable ones are available. This data may be quite local or can be of a more regional nature, but often it is the best information available until the first well has been drilled into a structure.

It is likely that the offset well review will draw upon **hazard identification** and **risk assessment** data which will help the Design Engineer during the well design and planning process.

Basis of Design Document

This document is generated by the Design Engineer and forms an intermediate step between the Geotechnical Document and the Detailed Design document. It is the place where the Design Engineer gathers all of the information he will use to design the well and adds other engineering aspects to the information he extracts from the Geotechnical document.

Access to this document makes it easier to spot any deficiencies or uncertainties in the design.

Detailed Design Document

The detailed design is where the specification of the casing strings will be defined, and should contain the design calculations and the stress load cases that these calculations assume. This is often in the form of output from proprietary well design software such as the Landmark “Stresscheck”, “WellCat” or Schlumberger “TDAS” products.

It is normal for an Operator to have a casing design factor policy document within its well operations management system. This policy defines the minimum design standards for wells and these should be referenced in the detailed design document.

A similar policy should exist that defines minimum kick tolerance requirements for well designs.

The detailed design document should demonstrate that the well has been designed to meet or exceed these minimum standards.

The detailed design document will also define other important aspects of the well design including the cementing programme and the drilling fluids programme in some detail.

If the well is deviated and/or in the vicinity of other wells it should contain the planned well trajectory and anti-collision planning policy should exist.

Site Survey Document(s)

There is a general requirement to perform a site survey. The survey consists of several elements including a “geotechnical survey” a “geophysical survey” and a “sea bed survey”. These may or may not be collected in to one document by the operator.

The geotechnical survey looks at the shallow sediments to determine the hardness of the sea bed down to perhaps 30ft or so and may include sea bed cores and test bore holes. The geophysical survey uses shallow seismic data interpretation to try and identify any shallow hazards such as shallow gas, hydrates and so forth.

The sea bed survey, which may include side scan sonar, examines the topography of the sea bed and any wrecks or other debris that may be present. It would also identify the proximity of other infrastructure.

The site survey is used to define conditions for rig positioning analysis. This is mainly leg penetration in the case of a jack up, and anchoring requirements for a moored semi submersible or drill ship.

The site survey will also provide input to conductor or riser analysis.

For the IRR it is normally sufficient to know that these site survey elements have been performed by competent specialist contractors and the reviewer does not necessarily need to see the report contents.

Conductor / Riser Analysis

It is normal, and in many cases an absolute requirement of the drilling contractor, for there to be a conductor and/or riser analysis. This type of analysis requires inputs on currents and likely sea states from metocean reports, and also uses the shallow sea bed sediment data from the site surveys to determine what stresses the conductor, wellhead and if applicable, riser will be subjected to. They are essentially load and fatigue calculations based on the stresses generated and the vibration induced by the currents and waves.

For the IRR it is normally sufficient to know that this analysis has been performed by a competent specialist contractor and the reviewer does not necessarily need to see the report contents.

Drilling Programme

The drilling programme cannot really be developed until all of the above documents have been produced. It will describe the well architecture and a step-by-step sequence of events that are required to achieve the well objectives.

The drilling programme will also contain details of Kick tolerance data, the cementing requirements, the drilling fluid requirements, and any directional drilling requirements.

The programme should reference identified hazards, risk assessments, and lessons learned from offset wells.

Rig Specification

For offshore rigs this information is generally available over the internet but this is rarely the case for land rigs. This is required so an assessment of rig and associated equipment suitability for the proposed location and well conditions can be judged.

Well Control Equipment and Capability

Typically the type of BOP, its configuration, and wellhead equipment and their respective pressure rating and working pressure are required to ensure they are fit for purpose. Additionally if “shear rams” are included, the shearing capability of these in respect to the drill string components that are to be run in the hole and what measures are in place if components cannot be sheared in a well control situation.

Information that confirms the components are suitable for the expected well fluids and temperatures are also useful to the reviewer.

Bridging Documents

There are typically two primary management systems in force, that of the Operator and that of the Drilling Contractor.

To avoid any conflict between these two systems it is normal for an agreement to be in place which establishes which areas of activity and which circumstances govern which system will take precedence.

This agreement is typically documented in a bridging document which bridges from the Operators system to that of the Drilling Contractor. It will cover several areas but the key one is how well control activity will be managed.

Controlled Documents and Management of Change

There should be evidence that all of these documents are properly controlled and that a formal management of change process is in place.

Competency

This is perhaps one of the most difficult topics to define and even harder to document.

The competency of an organisation or project team is not just the cumulative effect of the competency of the individuals involved.

The Operator

The reviewer is generally looking for named key individuals within the organisation who are managing and supervising the operation to have a demonstrable track record in performing similar tasks in the past. This prior experience need not necessarily be with the current Operator.

In cases where the Operator does not have a drilling department to manage operations and has subcontracted this activity to a Well Management company, then a similar scrutiny of the key individuals would be desirable.

The Rig Contractor

A similar situation prevails. As an organisation the Drilling Contractor and possibly the specific rig crew concerned may have performed similar activity numerous times for the current or other Operators. As the Rig Contractor generally has well developed management systems aimed at protecting their assets and people, then evidence of compliance with their own systems and a track record of performing similar tasks is generally sufficient.

For both the Operator and Drilling Contractor evidence of current IWCF well control certification for key supervisor personnel also provides confidence.

Others

For all of the other suppliers and sub-contractors it is not unusual for the only evidence of competency, other than their general reputation, to be contained in the procurement screening process that the Operator employs when selecting suppliers.

Documents Required for Preparation of an IRR

For the review it is necessary to consider documentation that is compiled and provided for the purposes of well design and compliance with internal and local regulatory requirements, which are encompassed under the following main categories:

- Regulatory Compliance & Consents
- Spill Response Planning
- Internal Compliance & Planning
- Design and Programming
- Competency

A full list of required documentation will be provided with proposals issued for IRR's.