# MANUAL FOR EXPLORATION OPERATIONS **ONSHORE URUGUAY**

ANCAP

# Manual for Exploration Operations

# Onshore Uruguay

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## Revision History

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## Preparation

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## Revision and Editing

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## CONTENT

# 1. INTRODUCTION

Considering the growing development of exploratory activities in Uruguay, starting in 2012, a collection of information, records and reports was carried out, as well as good practices to carry out exploratory operations, first for offshore areas and then for onshore areas of Uruguay. In particular, this second version of the Manual for Exploration Operations Onshore Uruguay considers exploratory drilling operations only. This document is expected to serve as a reference for ANCAP, Operators and Subcontractors, as well as other institutions or government agencies related to the activity.

The preparation of this manual was carried out through the compilation and revision of standards, guides and procedures that constitute good industry practices as well as ANCAP's experience in coordinating these activities with relevant stakeholders, taking into account the national and contractual regulations.

This manual does not exempt Contractors, Operators and Subcontractors from the obligation to comply with all national and/or international regulations that are applicable to the activity they carry out.

This document will be revised periodically.

## 2. OBJECTIVE

The objective of this document is to provide the guidelines, recommendations and requirements of ANCAP for the design and execution of exploratory operations that are carried out onshore Uruguay, in a safe, environmentally sustainable way, in a climate of good relationship with the relevant actors and in accordance with the best practices of reference applied in the industry at an international level.

## 3. GLOSSARY

AAO: Operations Environmental Authorization

AAP: Prior Environmental Authorization

AFE: Authorization for Expenditures

ANCAP: National Administration of Fuels, Alcohol and Portland

AST: Job Safety Analysis, document in which the analysis prior to the execution of a task on potential risks and control measures is recorded; it is carried out by the executing team itself.

BOP: Blow Out Preventer

CL: Composite Log

Contractor: Exploration and exploitation contract holders and service companies under multi-client contracts with ANCAP.

DAC: Daily Activity Chart

DDR: Daily Drilling Report

DGR: Daily Geological Report

DINAMA: National Directorate for the Environment

DLW: Daily Wellsite Lithology log

DP: Drilling Program

ECD: Equivalent Circulating Density

EOWR: End Of Well Report

ESD: Equivalent Static Density

FHSER: Final HSE Report

G&G: Geology and Geophysics

GEOWR: Geological End Of Well Report

GP: Geological Program

HSE: Safety, Health and Environment

High impact incident: An incident that has or may have in the judgement of the personnel involved in it and as part of a first evaluation, consequences (actual or potential) of severity levels A and B in the risk assessment matrix of ANCAP, which implies as a minimum:

- A death or disabling injury.
- Material damages of U$S 1,000,000.
- Greater or extensive impact on the environment.
- Press coverage at a national level.

LCAP: Loss Circulation Assessment and Planning

MEDEVAC: Medical evacuation

ML: Mudlogging

MOPO: Matrix of Permitted Operations

Operator: initially it means the Contractor and later the company designated by the Contractor to carry out the Petroleum Operations on behalf of the Contractor, and that has the approval of the Management Committee.

Petroleum Operations: they are defined in the Exploration-Exploitation contract as the execution of the Exploration, Exploitation and Supplementary Operations and Ancillary Operations activities. This document deals only with Exploration activities.

PvA: “Prognosis vs Actual” Daily Report

PvF: “Prognosis vs Final” Report

Rex: Return of experience

SEV: Vertical Electrical Sounding

SLDR: Surface Logging Daily Report

WHSER: Weekly HSE Report

WLF: Wellsite Lithology Final

# 4. STANDARDS AND RECOMMENDED PRACTICES

The companies that carry out exploratory operations must follow standards that represent the best practices in the industry.
International standards are those prepared by an international standards development organization. A compilation of these standards has been made in 2012 by the International Association of Oil and Gas Producers (IOGP) in the *Catalog of International Standards used in the Oil & Gas Industry* – Reference [1]. The applicable ISO standards in the oil and gas industry can be found in Reference [2]. Specifically the list of standards and guidelines for drilling, well construction and well operations was published by the IOGP and can be found in Reference [3].

Standards developed by regional or national organizations, as well as by industry groups, are also used internationally. Examples of this are the standards developed by the British Standards Institution (BSI) and the American Petroleum Institute (API). These national or regional standards of wide international use are typically referred to as global standards. The list of API standards for Exploration and Production is presented in [4].

Before the start of operations, the company must notify ANCAP of the standards that will be applied (including exceptions to international standards, such as the application of its own standards with higher requirements than international standards). ANCAP will give the approval to the standards presented by the contracting company. This information must be included in the Safety Management Plan of the corresponding operation.

# 5. DRILLING OPERATIONS

ANCAP guidelines, recommendations and requirements for the design and execution of exploratory drilling operations to be carried out onshore Uruguay are presented as follows

## 5.1 WELL NAMING

The wells will be identified with a systematic naming that includes a code and an extended name, adopting the following structure: (separated by underscore "_"):

- Code of the basin, according to the following:

| Basin | Code |
|---|---|
| Laguna Merín | LM |
| Norte | N |
| Santa Lucía | SL |

**Table 1 - Onshore Basin Code**

- Abbreviation of the well type, according to the following:

| Type | Abbreviation |
|---|---|
| Study | E |
| Exploratory | X |
| Delimitation | D |
| Production | P |
| Injection | I |

**Table 2 - Abbreviation of the type of well**

- Exploratory block code
- Correlative number of well of that type drilled in the prospect
- Lowercase identifying letter of re-drilling from the surface, in cases where the original drilling was abandoned for technical reasons, the objective of the first well is maintained and it is drilled again. In the original well it is not used, in the second well it corresponds to the letter “b”, in the third one to the “c” and so on.

- Correlative number, indicator of sidetrack or deepening (starts at “2” to identify the first sidetrack)

Different examples regarding well codes are presented below:

N_E_PN_1

First study well drilled in Pepe Núñez Block in Norte Basin

N_E_PN_10b

First re-drilling of the tenth study well in Pepe Núñez Block in Norte Basin.

N_X_IN_4_c_3

Sidetrack of the second re-drilling of the fourth exploration well in Isidoro Noblía Block in Norte Basin.

The original code of wells already drilled will never be modified, even in the case of wells that were producers and then used as injectors.

The name of the wells drilled onshore Uruguay will be defined by the operator. For the purposes of the correct identification of reports, it is suggested to use the code described above or the extended name following the criteria presented below:

- Name of the well
- Type of well (according to **Table 2**)
- Correlative number of well of that type drilled in the prospect
- Lowercase identifying letter of re-drilling from surface, for cases in which the original drilling was abandoned for technical reasons and re-drilled. In the original well it is not used, in the second well it corresponds to the letter “b”, in the third one to the “c” and so on.
- Correlative number, indicator of sidetrack or deepening (the latter separated by an underscore "_").

Different examples regarding extended names are presented below:

Quintana E1

First Quintana study well

Tacuarembó Chico E2_3

Sidetrack made in the second Tacuarembó Chico study well

Sopas P4b_2

Sidetrack of the first re-drilling of the fourth Sopas production well

## 5.2 REPORTS AND COMMUNICATIONS

The Operator shall periodically inform ANCAP of the tasks and of any other matter of interest regarding Exploration activities, in accordance with the provisions of the Exploration - Exploitation Contract or the Agreement for the Acquisition of Geological and/or Geophysical Data.

Likewise, due to the specific characteristics of certain activities, communication to other organizations is necessary for the proper coordination of operations as well as for compliance with regulations and obligations for permits issued by them.

Before, during, and after drilling operations, the Operator shall make a series of reports and notices regarding its activity to a variety of recipients, including both government and private agencies. The matrix of recipients and communications is shown in
**Table** 3. ANCAP may request additional information and corrections when it deems appropriate, especially in relation to working procedures.

The start of drilling (spud) is defined as the first removal of rocks, debris and other sedimentary materials with the bit.

The reports to be delivered by the Operator to ANCAP after the activities are completed, must be delivered within 3 months from the date of abandonment of the last drilling of the campaign.

¡Error! No se encuentra el origen de la referencia. presents a checklist regarding the communications to be exchanged in this type of operations.

| Report/Document | Frequency | ANCAP | DINAMA | MTSS | NATIONAL ARMY |
|---|---|---|---|---|---|
| Documents related to the request of Environmental Authorization[1] | Before start | | | | |
| Contingency Plan for Oil spills[2] | Before start | | | | |
| Safety Management Plan | Before start | | | 3 | |
| Drilling Program (DP) | Before start | | | | |
| Geological Program (GP) | Before start | | | | |
| Daily Drilling Reports (DDR) | Daily | | | | |
| Mudlogging | Daily | | | | |
| Incident Report (in case of occurrence) | When it occurs | | 4 | 4 | 4 |
| HSE Performance Reports (WHSER) | Weekly | | | | |
| Documents and reports after the Environmental Authorization[5] | Defined by DINAMA | | | | |
| End Of Well Report (EOWR) | After finishing | | | | |
| Final Geological Report (GEOWR) | After finishing | | | | |
| Final HSE Report (FHSER) | After Finishing | | | | |

**Table 3 - Communications Matrix for drilling operations**

[1] It refers to the Project Communication, Environmental Impact Assessment and Responses to Complementary Information Requests, among others.
[2] When applicable according to the well location
[3] When appropriate depending on the classification of the project in the MTSS
[4] When applicable depending on the incident
[5] Includes environmental performance reports

The types of reports and their minimum content are detailed below, with their format templates for each communication, which will be updated at the corresponding Coordination Meeting.

### 5.2.1 DOCUMENTS RELATED TO THE APPLICATION FOR ENVIRONMENTAL AUTHORIZATION

For drilling operations, according to Law 16466 and Decree 349/005 and amendments (in particular, Decree 72/2016), the contractor must have the required environmental authorizations (Prior Environmental Authorization and Operations Environmental Authorization). In case there is no contrary position by DINAMA, the Operator is responsible for managing the environmental authorizations, periodically informing ANCAP of the progress in its processing. To adequately meet the schedules, it is recommended to make the Project Communication, 18 months before the scheduled start of operations.

The documents related to the request for Environmental Authorization include, in the first instance, the communication of the project to the Municipality of the Department in which the project will be performed; then, with the corresponding receipt, the communication of the project must be presented in DINAMA with the corresponding Environmental Data Sheet.

In the event that the projects were not categorized A, an environmental impact assessment, responses to requests for complementary information, a summary environmental report, a presentation for a Public Hearing (in case the project was categorized C) and the Operations Environmental Management Plan, among others, shall be presented.

Likewise, the submission of documents and reports is required after obtaining the Environmental Authorization. These documents will require the presentation of environmental performance reports with a frequency defined by DINAMA. Additionally, it will be necessary to present a project closure report, which is also part of these documents.

The Operations Environmental Management Plans must contemplate the requirements that DINAMA establishes in the corresponding Prior Environmental Authorizations. As an indication, the plans should contain the following chapters:

1 Minimization/mitigation measures of environmental impacts
2 Compensation/restoration measures
3 Control and monitoring plan
4 Monitoring plan for environmental conditions
5 Risk prevention and contingency responses
6 Community relationship program

### 5.2.2 OIL SPILL CONTINGENCY PLAN

This plan will be prepared by the Operator and delivered to the environmental authorities (DINAMA, corresponding Municipality). The Contingency Plan constitutes one of the documents that must be submitted for the request of environmental authorizations.

### 5.2.3 SAFETY MANAGEMENT PLAN

The Safety Management Plan aims to present the prevention and mitigation measures to be applied to avoid harm to people arising from the project, as well as work programs in the field of safety (training of personnel, inspections and drills). In the case of drilling operations, the contents recommended in ¡Error! No se encuentra el origen de la referencia. must be considered. ANCAP, after endorsing this plan, may participate in the activities it considers appropriate, in the way opportunely agreed (inspections, audits, training, drills, incident investigation, etc.).

### 5.2.4 DRILLING PROGRAM

The Operator must submit, at least two months before the start of operations, a drilling program (DP).

This document presents the characteristics of the equipment to be used, the procedures to be followed and the technical justifications that support the different aspects of drilling design and engineering.

English language is accepted for this document. The minimum contents are presented in ¡Error! No se encuentra el origen de la referencia..

### 5.2.5 GEOLOGICAL PROGRAM

The Operator must submit, at least two months before the start of operations, a geological program (GP).

English language is accepted for this document. The minimum contents are presented in ¡Error! No se encuentra el origen de la referencia..

### 5.2.6 DAILY DRILLING REPORTS

The Daily Drilling Report (DDR) presents the details of the drilling operation. Its content will be agreed at the beginning of operations. An indicative list of minimum content is presented in **ANNEX 4**.

### 5.2.7 MUDLOGGING

The Operator will make available to ANCAP, the daily report of Geological Control (Mudlogging) generated by the corresponding subcontractor for this service, including the daily log of Mudlogging and progress of the Composite Log. The minimum contents of this report are presented in **ANNEX 6**.

### 5.2.8 OTHER GEOLOGICAL REPORTS

In the event that the Operator generates independent geological reports and records such as Daily Geological Reports (DGR) and/or Daily Lithological Logs (WLL), these must be delivered to ANCAP. The minimum recommended contents of such documents are presented in **ANNEX 7** and **ANNEX 8**.

### 5.2.9 HSE PERFORMANCE REPORT

This report must contain detailed information on the management of the environmental and safety aspects identified for the operation, as well as the environmental monitoring that is carried out during such activities.

The minimum content of weekly HSE reports is presented in ¡Error! No se encuentra el origen de la referencia.. Prior to the start of operations, the frequency of submission of this information with ANCAP representatives will be agreed, who may also request the presentation of an updated report when they deem it necessary.

The Prior and Operations Environmental Authorizations establish the content and frequency of presentation of the environmental performance reports that must be submitted to DINAMA.

### 5.2.10 END OF WELL REPORT

Regardless of the reports required in the environmental authorizations, once the campaign is completed, the Operator will deliver to ANCAP the End of Well Report (EOWR), the minimum content of which is indicated in the **ANNEX 10**.

### 5.2.11 GEOLOGICAL END OF WELL REPORT

At the end of the operations, a Geological End of Well Report (GEOWR) will be delivered, the content of which will be agreed in advance of the start of operations. The recommended minimum content is presented in **ANNEX 11**.

### 5.2.12 FINAL HSE REPORT

After completing the activity, the Operator will deliver the final HSE report including the statistics of the data presented in the weekly reports (according to ¡Error! No se encuentra el origen de la referencia.), as well as the lessons learned, conclusions and recommendations.

### 5.2.13 COORDINATION MEETING

In the week prior to the start of operations, a coordination meeting will be held in which representatives of the operating company, service companies and the different national institutions related to the activity will participate, in order to present the project and adjust the contents and list of recipients of the communications to be made during the execution of the project, if applicable.

The meeting is preferably held at a site close to the location of the drilling or at ANCAP headquarters and the list of participants will include representatives from:

- National Naval Prefecture (PNN) when appropriate according to the location of the drilling project
- National Directorate for the Environment (DINAMA)
- Municipality and local authorities
- Operating Company of the Area
- Drilling Contractor Company
- ANCAP
- Other guests deemed relevant for the operation

The Operator will make the corresponding coordinations/invitations to carry out this meeting.

The agenda is as follows:

- Presentation of the project (equipment, schedule, logistics, summary of the HSE management plan including contingency plan and procedure regarding communications in the event of a high impact incident).

The language for this meeting as well as for the information presented will be Spanish.

### 5.2.14 COMMUNICATION IN CASE OF HIGH IMPACT INCIDENTS

A high-impact incident is understood as one that has or may have, in the judgment of the personnel involved and as part of an initial evaluation, consequences (actual or potential) of severity levels A and B in ANCAP's risk assessment matrix, which implies at least:

- A death or disabling injury.
- Property damages of US$ 1.000.000.
- Major or extensive impact on the environment.
- National press coverage.

Before the start of operations, the Operator must provide the name and contact details of the person in charge of communications in the event of a high impact incident. ANCAP will also provide the names and contact details to which the communication must be sent in these cases.

Additionally, in the corresponding Coordination Meeting, the contact list in the event of a high impact incident will be defined, and in this regard it is suggested to consider the following:

- ANCAP: President, General Manager and Exploration and Production Manager
- PNN: National Naval Prefect and HSE Manager (if applicable depending on the location of the drilling operations).
- DINAMA: Director
- Operator: Director/Manager and HSE Manager
- Subcontractor: Director/Manager and HSE Manager

In the event of a high impact incident, the Operator must immediately notify the Maritime Authority (when applicable) and ANCAP within 4 hours of the occurrence. The information provided must contain at least the following:

- Type of incident occurred, place and time
- Person(s) affected (number and names in case they are known at the time)
- Health status of the affected person(s) (if applicable)
- Affected resources and assets and their levels of affectation (if applicable)
- Mitigation tasks performed (if applicable)

Without prejudice to whether or not they represent a High Impact Incident, the following incidents must also be reported:

- Fire on location
- Explosion on location
- Total loss or serious damage to the equipment
- Traffic/transport accident related to the activity
- Criminal act on location
- Action by activists and/or act or threat of terrorism against the operation
- Situation with possible or current attention given by the media
- Complaint by an interest group made directly to the Operator or through a third party (e.g. Uruguayan authorities or the media)
- Events of loss of containment in general (hydrocarbons, mud, cement, as well as any other).
- Partial, severe or total loss of circulation events
- Others identified by the Operator

The Operator will provide ANCAP with daily reports on progress regarding any incident that has occurred. In these reports, ANCAP will be informed of the strategy and the actions taken.

Within three months after the incident closes, a detailed report on the investigation of causes and actions taken will be delivered to ANCAP. ANCAP may, when it deems appropriate, participate in the investigation, as well as request a report on its progress.

## 5.3 MANAGEMENT OF EXPLORATORY INFORMATION

In this chapter, the general concepts that govern the information management by Operators will be defined, in particular:

- Information ownership.
- Information security management, including confidentiality.
- Standards for recording and storing information (geophysical data, geological data, samples).
- Criteria for the delivery of the information to ANCAP and other competent authorities.

The exploration-exploitation contracts signed by ANCAP with oil companies, as well as the multiclient type with services companies, establish, among other aspects, that:

- The ownership of the data and information generated as a result of all the exploratory operations, resides exclusively in ANCAP.
- Eventually and under the agreement of the other party, ANCAP may allow third parties to access such exploratory data.

The minimum requirements regarding the formats and media of the data generated during drilling operations, which must be submitted to ANCAP after the end of the campaign, are presented below.

### 5.3.1 SAMPLES

The Operator must deliver to ANCAP (after coordination with the Exploration and Production Management) the geological samples (including fluid samples) obtained from the drilled wells (previously agreed, for example: cuttings, cores, etc.), properly preserved, in boxes which maximum length will be 110 cm, to the following address:

***Bernabé Caravia y Doroteo Enciso, Capurro, Montevideo, Uruguay, 11700***

***Litoteca de Exploración y Producción – ANCAP***

Each box must have identified the well name, depth and direction, indicating the depth in meters. The well location must also be indicated in X, Y coordinates in UTM22 projection (WGS84) and in geographic coordinates (Latitude and Longitude, WGS84).

In the case of cuttings, two sets of samples will be received (one unwashed and the other washed). The sampling interval for the different drilling phases will be agreed before the start of activities and will be defined in the Geological Program.

The export of cores to carry out specific analyses will be accepted only under duly justified conditions and only as a “half-round” (longitudinal cut, leaving at least 50% of the sample in Uruguay). The cores which analysis is authorized abroad, except in cases of destructive analysis, must return to Uruguay within a maximum term of six months.

Well samples must be photographically recorded. These photos must be delivered to ANCAP in *.jpg format with a minimum of 12 Megapixels.

### 5.3.2 MULTIMEDIA

Any photograph or video taken during operations, for example during key stages of the activity (prespud, inspections, abandonment, restitution, etc.), must be submitted as part of the data package. In the case of videos, it is suggested to use a compressed format in order to reduce the size of the files without reducing the quality.

### 5.3.3 LOGS

The suggested minimum list of logs to be carried out in the area of interest is detailed below (the final list will be agreed before the start of operations and will be defined in the Geological Program):

- Lithologic
- Caliper
- Spectral Gamma Ray (SGR)
- Sonic
- Density
- Neutron
- Resistivity (shallow, medium and deep)
- Litho-Density
- Nuclear magnetic resonance
- Mud
- All profiles generated and formation evaluation carried out

The well logs acquired or generated during these operations will be delivered to ANCAP in *.LAS and *.PDF formats (on a scale to be agreed), stored on a hard disk drive.

Likewise, all the reports generated during these operations will be delivered by the same media in *.PDF format as presented in **Table 4** including operational and formation evaluation reports, for example.

| Type | Format |
|---|---|
| Photography | JPG |
| Videos | AVI, MP4 or other compressed format |
| Logs | LAS and PDF |
| Drilling Reports (DDR, PvA, DAC, EOWR) | PDF |
| Geological Reports (DGR, WLD, GEOWR, CL, Mudlogging) | PDF |
| Drilling Data (FIT/LOT, BOP tests, Cement tests) | PDF, XLS |
| Other data and Geological Control Reports (Final ML Report, Master Log, Drilling Log, Gas Log, Daily Activity Time Logs, Cutting Description, Drilling Depth data, Daily Mudlogging Reports) | PDF and XLS when appropriate |
| HSE reports (WHSER, FHSER, any other HSE report generated by the Operator and subcontractors, presentations made in HSE meetings) | PDF |
| Meteorological Data | PDF and XLS |
| Any other report or data generated during the campaign | PDF |
| Copy of any information delivered to DINAMA regarding environmental authorizations | PDF |

**Table 4 - Format requirements regarding the information acquired in drilling operations. In all cases, the storage medium will be USB Hard Drive.**

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### 5.3.4 SAMPLING OF FORMATION FLUIDS

Before the start of the campaign, the delivery conditions of the fluid samples that will eventually be obtained will be agreed, and included in the Geological Program.

## 6. REFERENCES


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# 7. ANNEXES

## ANNEX 1 SAFETY MANAGEMENT PLAN

The minimum recommended contents for the Safey Management Plan are detailed below:

a. Project description
    i. General Aspects, technologies, equipment, operations
    ii. Areas of operation and acquisition program
    iii. Technical specifications
    iv. Equipment
    v. Logistics
    vi. Detailed procedure of the tasks to be carried out

b. Risk Analysis
    i. Hazard identification
    ii. Risks evaluation

c. Risk management
    i. Minimum certification requirements for participants
    ii. Matrix of Permitted Operations
    iii. Safety Plan with risk control measures
    iv. Contingency plans
    v. MERP (Medical Emergency Response Plan)
    vi. MEDEVAC
    vii. List of high impact incidents
    viii. Applied standards

d. Programs
    i. Safety training program
    ii. Safety inspection program
    iii. Drill program

## ANNEX 2 DRILLING PROGRAM

The minimum recommended contents for the Drilling Program are detailed below:

1. WELL ACTIVITY SUMMARY

1.1. Well summary

1.2. Well trajectory

1.3. Re-spud and relief well locations

1.4. Formation acquisition program

1.5. Casing program

- 1.5.1. Base case sections
- 1.5.2. Contingent sections

1.6 Wellhead specifications

1.7. Bits summary

1.8. Mud and cement program summary

- 1.8.1. Mud program summary
- 1.8.2. Cement program summary

1.9. BOP pressure test program

- 1.9.1. BOP configuration

1.10. BOP test tools to be used for BOP pressure tests

1.11. Casing integrity pressure tests program

1.12. Well design summary

- 1.12.1. Kick margin table
- 1.12.2. Casing design summary

1.13. Drilling rig generalities

1.13.1. Rig tubular list

1.13.2. Mud pump liner set up program

## 2. DRILLING SEQUENCE ABSTRACT

## 3. PLANNED PROGRESSION CHART

## 4. RIG LOCATION/FINAL PREPARATION

### 4.1. Rig and spud location

### 4.2. Well datum and Coordinates

## 5. DRILLING XX" SECTION - RUNNING AND CEMENT XX" CASING

- Section objective
- XX" drilling - section hazards and riscks
- Preparation for XX" drilling section
- Drilling XX" drilling section
- XX" drilling BHA
- XX" drilling mud program
- XX" casing running and cementing section hazards
- Cementing program
- FIT procedure (if corresponds)

## 6. BOP TEST

## 7. PLUG AND ABANDON TENTATIVE PLAN

APPENDICES:

- Service companies list and contact details
- Operator team list and contact details
- Casing Specifications
- Primary Drill bits spec sheets
- Tubular specificities (DP/HWDP/DC performance sheets)
- Location target coordinates
- Technological risk assessment (BLOWOUT CASE)
- Centralizers spec sheets
- Lost Circulation Assessment and Planning (LCAP) documents including losses control method decision tree (see ¡Error! No se encuentra el origen de la referencia.)

## ANNEX 3 GEOLOGICAL PROGRAM

The minimum recommended contents for the Geological Program are detailed below:

1. INTRODUCTION

1.1. Geological overview

1.2. Well preparation historic

2. WELL GENERAL DATA

3. WELL OBJECTIVES

3.1. Primary objectives

3.2. Secondary objectives

4. REFERENCE OFFSET WELLS

4.1. Offset wells in Uruguay

4.2. Offset wells in the Basin

4.3. Additional offset wells

5. RATIONALE FOR WELL LOCATION AND TARGET DEFINITION

5.1. Target definition / Rationale for well location

5.2. Shallow Hazards

5.3. Targets coordinates

5.4. Targets tolerance

6. DEVIATION / TRAJECTORY

7. LITHOLOGY, STRATIGRAPHY, PETROLEUM SYSTEM & DEPTH UNCERTAINTIES

Petroleum system that is going to be tested (Source rock, reservoir, seal)

8. EXPECTED RESERVOIR FLUIDS

8.1. Above objectives

8.2. Well primary objective

9. PRESSURE AND TEMPERATURE PREDICTION

9.1. Pore Pressure – Most likely case

9.2. Pore Pressure – Commitment case

9.3. Fracture Gradient

9.4. Temperatures

10. DRILLING AND GEOLOGICAL HAZARDS ASSESSMENT

11. WELL ARCHITECTURE

11.1. Base case architecture

11.2. Contingencies

11.3. Alternative architectures (lighter)

## 12. PHASE TD CRITERIA

### 12.1. Conductor drilling section – On depth criteria

### 12.2. Surface drilling section – On depth criteria

### 12.3. Intermediate 1 drilling section – On depth criteria

### 12.4. Intermediate 2 drilling section – On depth criteria or geological criteria

### 12.5. Intermediate 3 drilling section – On depth criteria or geological criteria

### 12.6. Final drilling section (WELL TD) – Geological criteria

## 13. DATA ACQUISITION

Defining format, record and storage media for each type of data set, as well as how the access to the data will be assured. Service providers shall be identified, too.

### 13.1. Mudlogging

For each drilling section, it has to be defined:

- Kick detection methodology/ equipment
- Drilling and mud parameters monitoring and recording
- Constant temperature and volume degasser
- Total gas and gas chromatography (out only)
- Cutting sampling, description and interpretation. Including the sampling interval/ rate, and washed/ dryed cuttings set table.
- Mud gas sampling
- Calcimetry analysis
- Drilling gas, H2S and CO2 monitoring

Shall provide a template of the Mudlogging report (daily).

### 13.2. Logging While Drilling (LWD)

### 13.3. Wireline Logging

Tools, intervals, and runs for each drilling section, describing different scenarios if applicable (i.e.: dry case, water bearing reservoir, etc.). For each tool/ interval/ run it shall be explicit if firm or contingent (and the decision criteria).

13.4. Mud strategy

13.5. Conventional Coring

13.6. Well Testing

## 14. END OF WELL STATUS

## 15. RE-SPUD LOCATION & RELIEF WELL

## 16. WELL DURATION

APPENDICES:

- WIRELINE TOOLSTRINGS
- LOGGING WHILE DRILLING BASE CASE CONFIGURATIONS

## ANNEX 4 DAILY DRILLING REPORT

Recommended minimum content:

- Basic project details (Date, well code, Area, Operator)
- Well Information (Area, Supervisor, Engineer)
- Depth and Days (Current depth, average rate of penetration (hereinafter “ROP”), Days of operation, Rotation hours per day, Estimated days, Accumulated rotation hours, Maximum authorized depth)
- Status of the operation (Activities, comments and plan for the next 24 hours)
- Estimated costs (Daily cost, Accumulated cost, Percentage spent)
- Summary of the operation (Time from, time to, duration, measure depth - hereinafter “MD” - from, MD to, Description)
- Well sections (Section name, Hole diameter, internal diameter - hereinafter “ID” - casing, top MD, base MD, section start date, section end date)
- Bit register
- Well Deviation
- Mud (Mud cumulative cost, Description, density, viscosity, hour, MD (m), PV (cp), YP (lbf/100ft2), HCl (ppm), Calcium (ppm), pH, Alkalinity, Pf (mL), Pm (mL)).
- Surveys
- Mud system (Gas, Volumes, Losses)
- Products in the mud (product, unit, daily quantity used, total cost, final quantity)
- Safety, Health and Environment (status, Inspections/drills, BOP pressure tests)
- Personnel (company, number of people, total number)
- Materials (Product, weight/vol x unit, used, final quantity)
- Weather status (time, weather, comments, daily maximum/minimum temperature, visibility, wind speed, wind gust speed)
- Inlet fluid, recovered fluid, fluid still to be recovered (oil, water, other -daily and accumulated-)
- Casing and cementing operations (including details on start, end and any observations on these specific operations)
- Logging operations (including details on start, end and any observations on these specific operations)
- Coring operations (including details about start, end and any observations on these specific operations)

- Formation tests
- Drilling progress compared to planned (PvA)
- Observations

English language is admitted for this report, and it is suggested to present these contents in a report that includes the following structure:

- Daily Summary
- Current Status
- Planned Operation
- Time Log
- Remarks
- BOP Test
- Survey Data
- Expected TD
- Stop Cards
- Safety Incidents
- Casing & Cement
- Casing Summary
- Formations
- Mud Volumes
- Mud Check
- Safety Stocks
- Cost
- Parameters
- Drill String Runs
- Weather Conditions
- Number of People

DDR should include Prognosis vs Actual (PvA) report (¡Error! No se encuentra el origen de la referencia.) as annex or section including:

- Figure showing Prognosed lithology, Age, depth, and prognosed main markers and coring
- Figure showing Actual lithology, shows, actual main markers, mud type and losses/gains

- Figure showing daily progress (Prognosed progress and casing, actual progress and casing)
- Figure showing Logs (Prognosed and actual LWD, Prognosed and actual Wireline)

## ANNEX 5 DAILY REPORT PROGNOSIS VS ACTUAL REPORT (PVA)

The daily report "Prognosis vs Actual" is admitted in English language. The following minimum content is suggested:

- Date
- Report number
- Localization (Country, Basin, Licence)
- Well Name (Operator and ANCAP`s Well name)
- Rig and Coordinates (Rig Name, RT elevation, X(UTM), Y(UTM), Datum, Long, Lat)
- History (on location date, contract date, spud date, Final TD date, Off location date)
- Daily Progress (From, To, Progress, Drill Time, Max. incl.)
- Midnight Depth
- Costs (Planned costs, Planned Days, Cumulated Costs)
- Figure showing Prognosed lithology, Age, depth, and prognosed main markers and coring
- Figure showing Actual lithology, shows, actual main markers, mud type and losses/gains
- Figure showing daily progress (Prognosed progress and casing, actual progress and casing)
- Figure showing Logs (Prognosed and actual LWD, Prognosed and actual Wireline)
- Operation Summary
- Operation from midnight to 06:00h
- Situation at 6:00h
- Program

## ANNEX 6 DAILY REPORT ON GEOLOGICAL CONTROL (MUDLOGGING)

The Daily Geological Control Report is admitted in English. The following minimum contents are suggested:

- Well
- Report Nº
- Date
- RIG
- R.T.
- Measured depth
- Vertical depth
- Drilled interval
- Drilling hours
- R.O.P.
- Last casing
- Phase
- Last survey at:
- Mud
    - Mud type
    - Density
    - FV
    - PV/YP
    - Oil/water Rat.
    - Gel 10s/10/30
    - Cl-
    - Solids (%)
    - Sand (%)
- Drilling parameters
    - WOB avrg
    - TRQ avrg
    - RPM/Total RPM
    - Day Rev
    - Tot. Rev
    - Day Circ. Hour
    - Lower compl. Chrono hours

- Bit chronometers
- Daily Rot. Hour
- Tot Rot hour
- Day Drilling hr
- T-Drilling hr

- Formations:
  - Interval
  - Calcimetry
  - Lithological description
  - ROP
  - Gas (%) min/max
- Gas data
  - Depth
  - Type
  - Volume
  - Density
  - % Tot gas
  - C1 ppm
  - C2 ppm
  - C3 ppm
  - C4 ppm
  - iC4 ppm
  - nC4 ppm
  - iC5 ppm
  - nC5 ppm
  - BGG %
  - Comments
- Fluorescence
  - Depth
  - Direct
  - Cut
  - Show
  - Comments
- Losses
  - Interval
  - Phase

  - Q tot (m3)
  - Rate (m3/h)
  - Total daily (m3)
  - Total phase (m3)
  - Cumulative
  - Operation
- Operations Summary
- From 0:00 to 04:00
- Equipment out of order
  - Calibrations
  - Date
  - Working
  - Failure type
- Operators
  - Day
  - Night
  - Date in
  - Date out

Daily activity chart:

- Column 1: Weight On Hook, Torque, Total RPM, Weight on Bit, ROP, Hook Height
- Column 2: Cement Pressure, Kill Pressure, Choke Pressure, Stand Pipe Pressure, Flow Out Paddle, Flow Pumps
- Column 3: Comments
- Column 4: Time
- Column 5: Temperature Out, Temperature In, Mud Density In, Sm Active Pits, Trip Tanks volume
- Gas chromatography results for each C1-Cn in ppg

Composite Log:

- Log in 1:500 scale including:
  - Dates
  - Mud and drilling data

- Drilling parameters
- Resistivity
- Sonic
- Depth
- Other logs
- Cuttings lithology (%)
- Stratighraphy (Age and Formation)
- Interpreted lithology
- Descriptions
- Calcimetry (%)
- Gas out (ppm) (TG, C1, C2, C3, iC4, nC4, iC5, nC5)
- Shows - qualitative (Oil, Natural fluorescence, Cut fluorescence)
- Remarks
- Geologists

## ANNEX 7 DAILY GEOLOGICAL REPORT

The daily geological report is allowed in English language. The following minimum content is suggested:

- Well name (operator and ANCAP well names)
- Date
- Midnight Depth
- Localization (Country, Basin, License)
- Well type (Class, Environment, Type)
- Report Number
- Last Pressure Test
- Rig and Surface location (Rig name, Rotary table elevation, X(UTM), Y(UTM), Long, Lat, Datum)
- Main Target Coordinates (Main objective, Age, X(UTM), Y(UTM), Depth, Long, Lat, Datum)
- Last casing/liner shoe (Diameter, Depth)
- Costs (Planned cost, cum. Costs)
- Well History (On location date, contract date, spud date, final TD Date, Off location date)
- Contracts (Rig, Positioning, Mud Engineering, Mudlogging, DD/MWD/LWD, Wireline Logging, Testing, Cementing, Coring, Drill Bits, Cutting manag.)
- Start Depth
- Daily Progress
- Geologists
- Operation Summary
- 0:00 to 6:00h operations
- 6:00 status
- Program
- Mud Parameters (Mud Type, MW, ECD, Visc., O/W)
- Fluid Gain/ Loss (From, To, Type, Nature, Volume, Max Rate)
- Survey Summary Table
- Wireline Pressure Test Summary table
- Formation Tops (Actual, Delta, Prognosis)

- Lithology description table (from, to, main lithology, description, shows, ROP, Calci, Formation)
- Gas Peak Summary Table (Depth, Type, TG %, BGG %, C1 ppm, C2 ppm, C3 ppm, iC4 ppm, nC4 ppm, iC5 ppm, nC5 ppm, Oil Shows, Direct Fluo, H2S ppm, Remarks)
- Shows Description (Support, Top Depth, Bottom Depth, Shows, Intensity, Distrib., Colour, Cut Type, Cut Speed, Cut Colour, Description)
- LWD Logs (Bit Nb, Desc., Dates, Log, Interval, Bit Size, Remarks)
- Wireline Logging (Dates, Suite, Interval, Bit size, Comments)
- Mud Analysis (Depth, Purpose, Mud Type, ECD, MW, Visc., PV/YP, Filtrate, O/W ratio, Cl-, HGS Barite, Temp, Comments)
- Comments

## ANNEX 8 WELLSITE LITHOLOGY LOG

The daily lithological record is allowed in English. The following minimum content is suggested:

- Title (Well names, basin/block)
- General Well Data (Projection, Datum, Spheroid, Well head location coordinates, RTE, Drilling Rig, Top level, Final level, final depth driller, final depth logger, date on location, spud date, final depth date, date off location, duration)
- Location map
- Well results (formation, mMD, mTVDSS, fluid, Target X (m), Target Y (m), Deviation (deg), Departure (m), Azi (deg))
- Hole and Casing Data (mMD)
- Contractors (Rig, Mudlogging, Mud Engineering, LWD, Wireline, Coring, Cement, Testing)
- Well Structure (casing schematics)
- Well Profile View
- Well Plan View
- Events and Remarks (Dates, Depths, Events/Remarks)
- Geological Symbols (Shale, fine sand, conglomerate, etc)
- Qualifiers, Accessories and Fossils (Argillaceous, Silty, Sandy, etc)
- Technical Symbols (Top of liner, hard layer, perforations, etc)
- Log in 1:500 scale including:
    - Dates
    - Mud and drilling data
    - Drilling parameters
    - Resistivity
    - Sonic
    - Depth
    - Cuttings lithology (%)
    - Stratighraphy (Age and Formation)
    - Interpreted lithology
    - Descriptions
    - Calcimetry (%)

  - Gas out (ppm) (TG, C1, C2, C3, iC4, nC4, iC5, nC5)
  - Shows - qualitative (Oil, Natural fluorescence, Cut fluorescence)
  - Remarks
  - Geologists
- Bit summary table (BHA No, Bit No, Bit status, Make, Type, Size, TFA in2, Depth, Progress made, Rotating hours, Average ROP, Grading, Remarks)
- LOT / FIT results (Planned MD, Planned TVDSS, Planned EMW, Realized MD, Realized TVDSS, Realized EMW)
- LWD LOGS (Phase No, LWD Pass, Dates, LOG, Interval MD/RT, Bit Size, Remarks)
- Wireline Logging (Dates, Suite, Interval, Bit Size, Max BHT, Comments)
- Wireline Pressures (No, Depth, Hydro Press, Formation Pres, Mobility, Temp, Sample, Quality, Remarks)
- Conventional Core Results (No, Date, Core Top, Core Bottom, Core Barrel Length, Recovery, Efficiency, Remarks)
- Sidewall Core Results (No, Depth, Rec., Shows, Porosity, Calcimetry, Short Description)
- Gas Trap and Line Characteristics (Type, Location, Transit time, Remarks)
- Gas System Characteristics (Total Gas Equipment, Remarks/Status, Chromatograph Equipment, Cycle Time, Remakes/Status)
- Mud Analysis (Depth, Operation, Mud Type, ECD, MW, Viscosity, PV/YP, Filtrate, O/W, Cl-, Barite, Temperature, Comments)

# ANNEX 9 HSE PERFORMANCE REPORT

For the indicated reporting period, the following information must be included as a minimum:

<u>Generalities</u>

Safety Meetings

Toolbox Meetings

Environmental Contingency Response Drills

Emergency Response Drills

Training and coaching in environmental management

Safety Training

Reports/Observation Cards

Safety audits and inspections

Environmental management audits

Report on environmental indicators (water and energy consumption, number of spills, greenhouse gas emissions, volume of waste generated, etc.)

<u>Hours worked</u>

Number of people involved in the operation (distinguishing between the drilling team and the project team)

Hours worked (calculated based on a 12-hour work day)

<u>Incident report</u>

Near Miss, NRM

First Aid Case, FAC

Medical Treatment Case, MTC

Restricted Work Day Case, RWDC

Lost Time Injury, LTI

Fatality, FAT

High Potential event, HPI

Lost Work Day Cases, LWDC Days

Environmental incidents

<u>Others</u>

MEDEVACs

Lifting operations

Permits to Work, PTW

Job Safety Analysis carried out, JSA

Helicopter operations

The definitions are considered according to the IOGP "*Safety data reporting user's guide*" - Reference [5].

Process Safety Incidents:

Among the reported incidents, indicate those related to loss of containment that correspond to TIER 1, 2 and 3 according to API RP 754 (Reference [6]). For TIER 1, indicate the severity rate associated with each incident.

<u>Indicators report:</u>

Frequency of accidents with lost days per million hours worked.

Accident severity with days lost per million hours worked.

Number of Level 1 Process Safety Events (TIER 1) per 200,000 hours worked.

Sum of the severity rate for Level 1 Process Safety Events (TIER 1) per 200,000 hours worked.

Number of Level 2 Process Safety Events (TIER 2) per 200,000 hours worked.

Percentage of compliance with the safety training program.

Percentage of compliance with the safety inspections program.

Percentage of compliance with the emergency response drills program.

## ANNEX 10 END OF WELL REPORT

The End of Well Report is allowed in English. The following minimum content is suggested

- Well summary
  - Well summary page
  - Well summary data
  - Rig data report
  - Service Companies List and Evaluation
- Well Technical Architecture
  - Final Well Architecture
  - Final Well Abandonment Schematic
  - WellHead Drawing / Elevation
- Activity Report Summary & Highlights
  - Endo of Phase Debriefing Per Section
    - Phase Comments (from Wellview)
    - Phase Debriefing (From Rig Engineer)
  - Well Activity History
  - Bit Summary
  - BHA Summary
- Performance, Cost and Timings
  - Progress Curve
  - Well Operation Timing
  - AFE
  - Final Technical Costs
  - Phase Duration & NPT Graph
  - Time Log Summary – Bar Graph
  - Time Analysis Summary per Phase
- Well Position & Trajectory
  - Final Well Positioning Sheet
  - Final Surveys
- Trajectory Plot: Actual vs Plan
- BHA Schematic / Details
- Mud & Cement

  - Mud Properties Graph
  - Mud Phase Reports
  - Cementing Reports
- Casing Tallies
  - Casing Strings
  - Casing Tallies
- Lithology & Acquisition
  - Planned PPP charts
  - FIT/LOT & LOGS Summary
  - FIT/LOT Plots
  - Lithology: Plan vs Actual
    - Prognosed vs Final Chart
    - Wellsite Final Lithology Log
  - Electrical Logging Report
- Wait on Weather
  - WOW Breakdown & Charts
- Daily Drilling Reports

The End of Well Report must include as Annexes the Return of Experience (REX)[6] for each of the operating units, for example including:

- logistic operations
- maritime operations
- aviation operations
- operations of plants and facilities related to the activity
- port operations
- regarding any other operation

Such reports should indicate the activities carried out, the lessons learned as well as the conclusions and recommendations.

Additonally, each subcontractor involved will be indicated, pointing out the positive and negative aspects/to be improved, in the different stages of the operation (before, during and during demobilization), with emphasis on safety aspects, also indicating the

[6] In the case of not having the reports of return of experience within the delivery period of the end of well report, this should not delay the delivery of the end of well report. REX reports may be submitted at a later date.

changes before and after the establishment of the specific procedures of the activity. A model REX report is presented in **ANNEX 12**.

## ANNEX 11 GEOLOGICAL END OF WELL REPORT

Suggested minimum content:

- Statistics
- Location
- Initial targets
- Review of targets after drilling
- Lithological summary
- Correlations
- Hydrocarbons indications
- Cores
- Sidewall cores samples
- Tests
- Mud Profile
- Wireline studies
- Logs
- BHT extrapolations
- Analysis of samples
- Geological data evaluation
- Drilling problems related to geology
- Summary and conclusions

English language is accepted for this report, suggesting the following structure for the mentioned contents:

- General Information
    - Regional & Geological framework
    - Well Objectives
    - Reference Wells
    - Well main results
    - Well general data
- Drilling
    - Drilling summary
    - Well architecture

  - Abandonment summary
  - Deviation data
- Mudlogging
  - Mudlogging service description
  - Cuttings collection at rig site
  - Cutting processig and packaging
  - Mud gas sampling
  - Hydrocarbon shows
  - Mud gas chromatography data
- Mud Analysis
  - Mud summary
  - Mud losses / gain
  - Mud sampling
  - Mud properties
- MWD / LWD
  - Equipment mobilization
  - List of recorded logs
  - LWD failures
  - LWD Quality Control reports
- Wireline Logging
  - Equipment mobilization
  - List of recorded logs
  - Wireline logging failures
  - Wireline supervisión reports
- Formation pressure
  - LWD formation testing
  - Wireline formation testing
  - Fracturing pressures – FIT / LOT
  - Pore pressure: post drill interpretation versus prediction
- Formation fluid sampling
  - Wireline formation fluid sampling summary
  - Fluid sampling results
- Formation Temperature
  - Extrapolated temperatures
  - Calculated geothermal gradient
- Borehole seismic data

- Geological results
  - Litho-stratigraphy summary
  - Prognosis versus actual stratigraphy
  - Conventional cores
  - Sidewall cores
  - Borehole imaginery and dipmeter results
  - Data quality / Petrophysical evaluation
  - Post well analysis
    - Geochemistry
    - Fluid inclusions
- Conclusions and improvement suggestions
  - Well results versus well objectives
  - Positive feed-backs
  - Improvement suggestions
- Annexes
  - LWD quality control reports
  - Wireline log supervision reports
  - Wellsite litholog
  - Composite log (**ANNEX 6** – "Composite log" section)
  - Prognosis vs Final report (see ¡Error! No se encuentra el origen de la referencia.)
  - Any other Mudlogging reports, logs and data:
    - Final Mudlogging report
    - Master Log
    - Drilling Log
    - Gas Log
    - Daily Activity Time Logs
    - Cutting Description
    - Drilling Depth data
    - Daily Mudlogging Reports
  - Others

## ANNEX 12 REX REPORT MODEL

Operation X

- Activities carried out, lessons learned, conclusions and recommendations
- Subcontractors (sub-operators) involved in this operation
    - Before starting operations
        - Operator A
            - Safety (comments regarding safety management by the sub-operator, standards, training, certifications, etc.)
            - Positive
            - Negative / to improve
    - During operations
        - Operator A
            - Safety
            - Positive
            - Negative / to improve
    - During demobilization
        - Operator A
            - Safety
            - Positive
            - Negative / to improve

## ANNEX 13 CHECKLIST FOR DRILLING OPERATIONS COMUNICATIONS

| | | Delivered | Revised | Approved | Point | Comments |
|---|---|---|---|---|---|---|
| | **HSE INFORMATION** | | | | | |
| BEFORE | Documents related to the application for Environmental Authorization | | | | **¡Error! No se encuentra el origen de la referencia.** | |
| BEFORE | Contingency Plan for Hydrocarbon spills | | | | **¡Error! No se encuentra el origen de la referencia.** | |
| BEFORE | Safety Management Plan | | | | **¡Error! No se encuentra el origen de la referencia.** | |
| DURING | Weekly HSE performance report | | | | **¡Error! No se encuentra el origen de la referencia.** | |
| DURING | Post-AAO documents and reports | | | | **¡Error! No se encuentra el origen de la referencia.** | |
| AFTER | Final HSE Performance Report | | | | **¡Error! No se encuentra el origen de la referencia.** | |
| AFTER | Project closure report issued by DINAMA | | | | 5.2.1 | |
| | **ENGINEERING AND GEOLOGY INFORMATION** | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| BEFORE | Drilling Program | | | | **¡Error! No se encuentra el origen de la referencia.** | |
| | Geological Program | | | | 5.2.5 | |
| DURING | Daily Drilling Reports | | | | **¡Error! No se encuentra el origen de la referencia.** | |
| | Daily Geological Control Reports | | | | 5.2.7 | |
| AFTER | Final Drilling Report | | | | **¡Error! No se encuentra el origen de la referencia.** | |
| | Final Geological Report | | | | **¡Error! No se encuentra el origen de la referencia.** | |

## ANNEX 14 LOSS CIRCULATION ASSESSMENT AND PLANNING (LCAP)

Circulation Loss is defined as the reduction or total absence of fluid flow through the annular space when fluid is pumped through the drill string [7]. This reduction in flow can be classified as:

- Minor losses (leaks): from 0 to 1.5 $m^3/h$
- Partial losses: from 1.5 to 10 $m^3/h$
- Severe losses: greater than 10 $m^3/h$
- Total losses: It is not possible to maintain the surface fluid level with the desired mud density

Any loss circulation (partial, severe or total) must be reported as if it were a High Impact Incident (see point 5.2.14).

The Operator shall carry out a Loss Circulation Assessment and Planning (LCAP) Program. In this process, the circulation loss problems that are specific to the drilling project to be carried out will be explored and evaluated, and the link with existing systems, services and products will be made.
The process will focus on the products available and will use the relevant information to create plans and solutions specific to the particular project.
Through this methodology, problems due to loss of circulation are prevented and minimized instead of focusing on remediation after the event has occurred [8].

It is suggested to follow a methodology similar to the one presented in [8] for the preparation of the program, including:

- Collection and processing of all data related to the project and the problem:
  - Patterns of loss of circulation as part of a geological, lithological and stratigraphic analysis.
  - Formation and fracture pressure gradients
  - Well logs
  - Drilling reports
  - Analysis of loss of circulation events in neighboring wells
  - Hydraulic analysis, pressure drop and ECD/ESD simulations
  - Assessment of historical costs associated to loss of circulation

- Identification of potentially problematic formations with respect to circulation losses (type and location) through the available methods. Specifically for wells which surface section is located in basaltic formations, it is recommended to do the following:
    - Detailed structural and stratigraphic geological studies of the area surrounding the well and its influence on possible fault and joint systems in the basalt and the potential presence of intertrap sandstones.
    - Geophysical study from VES (vertical electric sounding) with processing, fracture interpretation and structural geological prognosis in the first 100 meters. This geological and geophysical report will be presented prior to the initial drilling, defining zones and depth of eventual resistive discontinuities, either due to the possible presence of faults with water or disaggregated basaltic layers and facies (breccias, conglomerates, sandy or porous clay materials of different stratigraphic nature).

- Development of prevention measures and specific guides for each problematic formation identified.

- Identification of the best conventional treatments for circulation losses, also recommending specialized contingency treatments including detailed operating procedures. Within this point, the protocols to be followed will be indicated, including the decision trees regarding circulation loss control methods and communications to ANCAP and DINAMA.