Data Acquisition Guideline

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Summary of Changes		
Date Revised	Sections (if applicable)	Description of Change
October 28, 2024		Guideline updated to reflect terminology, phrasing and requirements of the Framework Regulations; duplication with the Framework Guideline removed and contents limited to WDAP and FDAP; made into joint document between both Regulators; changed cutting sample size for exploration and delineation wells; updated submission requirements for cuttings.

Foreword

The Canada-Nova Scotia Offshore Petroleum Board and Canada-Newfoundland and Labrador Offshore Petroleum Board (the *Regulators*) have issued this Guideline to assist operators in the submission of data acquisition plans for which *Regulator* approval is required pursuant to sections 13 and 18 of the *Framework Regulations*. It also includes guidance for the submission of results, data and schematics under section 191 of the *Framework Regulations*.

Guidelines are developed to provide assistance to those with statutory responsibilities (including operators, employers, employees, supervisors, providers of services, suppliers, etc.) under the *Accord Acts* and regulations. Guidelines provide an understanding of how legislative requirements can be met. In certain cases, the goals, objectives and requirements of the legislation are such that no guidance is necessary. In other instances, guidelines will identify a way in which regulatory compliance can be achieved.

The authority to issue Guidelines and Interpretation Notes with respect to legislation is specified by sections 151.1 and 205.067 of the *Canada-Newfoundland and Labrador Atlantic Accord Implementation Act, S.C. 1987, c.3 (C-NLAAIA),* sections 147 and 201.64 of the *Canada-Newfoundland and Labrador Atlantic Accord Implementation Newfoundland and Labrador Act,* RSNL 1990 c. C-2*,* subsection 156(1) and section 210.068 of the *Canada-Nova Scotia Offshore Petroleum Resources Accord Implementation Act, S.C. 1988, c.28 (CNSOPRAIA)* and section 148 and subsection 202BQ(1) of the *Canada-Nova Scotia Offshore Petroleum Resources Accord Implementation (Nova Scotia) Act.* The *Accord Acts* also state that Guidelines and Interpretation Notes are not deemed to be statutory instruments.

For the purposes of this Guideline, these Acts are referred to collectively as the *Accord Acts*. Any references to the C-NLAAIA, the CNSOPRAIA or to the regulations in this Guideline are to the federal versions of the *Accord Acts* and the associated regulations.

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1.0 Acronyms and Abbreviations

ACW	Approval to Alter the Condition of a Well
ADW	Approval to Drill a Well
API	American Petroleum Institute
ASCII	American Standard Code for Information Interchange (a standard data-encoding format)
BOP	Blowout Preventer
C-NLAAIA[1]	*Canada-Newfoundland and Labrador Atlantic Accord Implementation Act*
C-NLOPB	Canada-Newfoundland and Labrador Offshore Petroleum Board
CNSOPB	Canada-Nova Scotia Offshore Petroleum Board
CNSOPRAIA[2]	*Canada-Nova Scotia Offshore Petroleum Resources Accord Implementation Act*
CSRC	C-NLOPB Core Storage Research Centre
FDAP	Field Data Acquisition Program
GSC	Geological Survey of Canada
LAS	Log ASCII Standard (a digital standard for logs developed by the Canadian Well Logging Society)
LWD	Logging While Drilling
MD	Measured Depth
MODU	Mobile Offshore Drilling Unit
NL	Newfoundland and Labrador
NS	Nova Scotia
OBM	Oil-Based Mud

[1] References to the C-NLAAIA in this Guideline are to the federal version of the *Accord Act*
[2] References to the CNSOPRAIA in this Guideline are to the federal version of the *Accord Act*

PDF	Portable Document Format (file format created by Adobe)
SCAL	Special Core Analysis
SBM	Synthetic-Based Mud
SEG-Y	File format developed by Society of Exploration Geophysicists for storing geophysical data
SFTP	Secure File Transfer Protocol
TD	Total Depth
TDG	Transportation of Dangerous Goods
TVD	True Vertical Depth
VSP	Vertical Seismic Profile
WBM	Water-Based Mud
WDAP	Well Data Acquisition Program

2.0 Definitions

In this Guideline, the terms such as “authorization”, “delineation well”, “development well”, “exploratory well”, “field”, “gas”, “oil”, “operator”, “petroleum”, “pool” and “well” referenced herein have the same meaning as in the *Accord Acts*.[3]

Refer also to defined terms such as “installation” and “production installation” in the *Framework Regulations*.

For the purposes of this Guideline, the following terms have been capitalized and italicized when used throughout. The following definitions apply:

Accord Acts	means the *Canada-Nova Scotia Offshore Petroleum Resources Accord Implementation Act* and *Canada-Nova Scotia Offshore Petroleum Resources Accord Implementation (Nova Scotia) Act*, *Canada-Newfoundland Atlantic Accord Implementation Act* and the *Canada-Newfoundland and Labrador Atlantic Accord Implementation (Newfoundland and Labrador) Act*
Development Plan	means a development plan as defined in section 2 of the *Accord Act.* Requirements are provided in section 139 of the *Accord Act*

[3] C-NLAAIA 2, 119, 135 and CNSOPRAIA 2, 122, 138

Framework Regulations	means the *Canada-Newfoundland and Labrador Offshore Area Petroleum Operations Framework Regulations, SOR/2024-25* and the *Canada-Nova Scotia Offshore Area Petroleum Operations Framework Regulations, SOR/2024-26*
Good Oilfield Practices	means those practices, methods, standards and procedures generally accepted and followed by prudent, diligent, skilled and experienced personnel in petroleum exploration, development and production operations
Regulator	means the Canada-Newfoundland and Labrador Offshore Petroleum Board or the Canada-Nova Scotia Offshore Petroleum Board, as the case may be

3.0 Purpose and Scope

The objective of this Guideline is to assist operators in the submission of field data acquisition programs (FDAPs) and well data acquisition programs (WDAPs) for which *Regulator* approval is required pursuant to sections 13 and 18 of the *Framework Regulations*, respectively. It also includes guidance for the submission of results, data and schematics in relation to the above data acquisition programs under section 191 of the *Framework Regulations*.

The *Regulator* recognizes the additional challenges that present when drilling wildcat wells, drilling in rank exploration areas (e.g., new basins) or drilling in deep water environments. The *Regulator* will weigh the well evaluation expectations reflected in this Guideline against reasonable arguments for relaxation supported by operators in their program design. In addition, the suitability of new technology should be demonstrated against established tools.

4.0 Well Data Acquisition Programs

Pursuant to section 18 of the *Framework Regulations*, in the case of a drilling program, the operator must submit a WDAP in support of its application for a well approval (e.g., ADW) under section 17 of the *Framework Regulations*. The WDAP should contain the details of the evaluation program proposed, to the extent that such detail is available prior to commencement of drilling. Issuance of the well approval will be dependent upon whether the proposed program provides for the comprehensive evaluation of the well in accordance with section 62 of the *Framework Regulations*. During the approval process, the *Regulator* may request to meet with the operator to discuss the WDAP. Where the operator is aware of exceptional or special circumstances that would require it to deviate from regulatory expectations, the operator should state its case in writing and discuss in a pre-approval meeting with the *Regulator's* staff.

For wells that are part of a production project (i.e., development wells), the operator is required to submit an FDAP in support of its application for authorization submitted under sections 8 and 13 of the *Framework Regulations*. ADWs for development wells should reference details submitted as part of the FDAP. WDAPs for development wells should include any additions to or specific deviations from the approved FDAP.

WDAPs should provide for comprehensive evaluation of the well, consistent with the class of well being drilled. In general terms, the criteria for assessing the acceptability of a WDAP are linked to the well's classification. In that respect:

- Programs for exploratory wells should:
  - provide basic evaluation of all intervals; and
  - focus evaluation on intervals where hydrocarbons are encountered to ensure that a suitable basis for assessing any potential discovery is established.

- Programs for delineation wells should attempt to resolve uncertainties regarding significant hydrocarbon-bearing and other relevant intervals in order to enable assessment of the development potential of the field.

- Programs for development wells should:
  - attempt to resolve any remaining uncertainties regarding targeted production intervals, and to establish baseline measurements for subsequent production monitoring programs; and
  - provide a level of evaluation outside of targeted production intervals that is commensurate with the development potential of intervals encountered.

Pursuant to subsection 61(1) of the *Framework Regulations,* the operator must implement the WDAP in accordance with *Good Oilfield Practices.*

If part of the WDAP cannot be implemented, refer to Section 6.0 of this Guideline.

The following sections provide guidance on evaluation areas for a WDAP.

4.1 Mud Logging and Drill Cuttings

An operator should provide a high-level summary of the mud logging and drill cuttings program in the WDAP, including:

- continuous monitoring and reporting of surface parameters, as well as the drilling fluid system and its gas content;
- drill cuttings collection frequency if it varies between hole sections; and
- drill cuttings analysis and reporting practices, etc.

Refer to the requirements and associated guidance for drilling fluids provided in section 163 of the *Framework Regulations*. For reporting expectations, refer to

the requirements and associated guidance in section 197 of the *Framework Regulations*.

4.1.1 Sampling of Drill Cuttings

Sampling of cuttings should commence at the base of surface casing with samples to be collected at five metre intervals to the TD of the well. Relaxation of these requirements by the *Regulator* may be given where requested by the operator. Refer to Table 1.

Table 1: Sampling of Drill Cuttings

Purpose	Sample Type/Preparation	Frequency	Destination/ Comments
Lithological analyses	**2 sets washed and dried cuttings** 1 X 25 ml vial 1 x 15 ml vial	5 m	25 ml vials to CSRC or CNSOPB 15 ml vials for the C-NLOPB or CNSOPB c/o GSC
Micropaleontological, palynological and nanno-fossil analyses, or other analyses as required	**1 set unwashed dried cuttings** 1000 g in plastic lined cloth bag (If drilling fluid other than WBM is used ensure samples are completely dry prior to shipping)	5 m	CSRC or CNSOPB
Geochemical analysis	**1 set unwashed cuttings** 500g in 1 L plastic container (e.g., IsoJar bottles) with water, 1 cm air space and 4 drops bactericide	10 m	CSRC or CNSOPB
Fluid analysis	**1 Fluid Sample** 1 L Sample minimum in 1 L plastic container. Only necessary if a drilling fluid other than WBM is used, and must be collected immediately after reaching TD and prior to logging.	1 per hole section	CSRC or CNSOPB

Where the well has been drilled with OBM/SBM, all unwashed drill cuttings should be pre-washed prior to submission to the CNSOPB to remove the majority of the drilling fluid while minimizing any damage to the samples.

The C-NLOPB does not currently require the pre-washing of cuttings prior to submission.

All cutting samples should be dried completely to minimize any potential health risk respecting cuttings from hole sections drilled with OBM/SBM. The samples should be dried at temperatures that will not adversely affect their geoscientific value.

4.1.2 Sampling Relaxation

Where sampling can be shown to be redundant, consideration will be given to relaxation of sampling requirements for drill cuttings. In such instances, the operator is encouraged to discuss and justify its proposal with the *Regulator* prior to submission of the WDAP. Instances where this may be applicable include:

- In development wells where such sampling can be shown to be redundant to samples already taken in adjacent well-bores. In these cases, cuttings may be caught for description purposes only, with no requirement for the submission of physical samples.
- In delineation or exploration wells where overburden samples have been collected in previous penetrations. In these cases, sampling frequency may be reduced but samples are typically still required for submission.

4.2 Conventional and Sidewall Coring

4.2.1 Conventional Cores

- **Exploration Wells**

  An operator should include the criteria (e.g., drilling breaks, shows) to be followed for the cutting of core in the ADW submitted pursuant to section 17 of *the Framework Regulations*.

  An operator should plan to cut core in an exploration well where hydrocarbons are encountered within the reservoir designated as the primary target for the well if coring criteria provided by the operator are met. Where hydrocarbons are encountered within secondary targets, or within other potential reservoir quality horizons, coring is encouraged. but left to the discretion of the operator.

  The *Regulator* recognizes that wildcat wells or wells drilled in rank exploration areas may pose additional challenges to acquiring conventional core. In wells where such challenges are identified,

consideration will be given to waiving conventional coring expectations in favour of a sidewall coring program where the operator makes application providing adequate justification in support of its request for dispensation.

- **Delineation Wells**

  In delineation wells, an operator should plan to obtain core representative of the targeted reservoir interval(s). Coring should attempt to capture reservoir heterogeneity, and where applicable, attempt to cut anticipated fluid contacts. Additionally, an operator is encouraged to cut core from other hydrocarbon-bearing formations encountered outside of the targeted reservoir interval(s) where coring criteria is satisfied.

- **Development Wells**

  An operator should define its coring program strategy as part of the FDAP, as outlined in Section 5.2 of this Guideline. The intent to core a well should be established in the WDAP filed in support of an ADW.

Refer to the requirements of section 64 of the *Framework Regulations* and Section 7.1.3 of this Guideline for guidance on submission of conventional cores.

4.2.2 Sidewall Cores

- **Exploration Wells**

  An operator of an exploration well should plan to obtain sidewall cores from all hydrocarbon-bearing reservoirs where conventional core was not obtained. An operator of a wildcat well, or a well being drilled in a rank exploration area, should also plan to acquire sidewall core over potential source rock intervals. The number of sidewall cores acquired should be sufficient to effectively characterize each petrophysically or geologically distinct zone.

- **Delineation Wells**

  For contingency purposes, the operator of a delineation well should plan to obtain sidewall cores over reservoirs targeted for appraisal where conventional core was either not obtained or does not adequately characterize the reservoir represented by logs. In such cases, sidewall cores should be acquired:

- to reflect the reservoir heterogeneity as evident on logs; and
- over reservoir intervals above and below encountered fluid contacts.

- **Development Wells**

  An operator should discuss its sidewall coring strategy as part of the FDAP as outlined in Section 5.2.2 of this Guideline. The intent to acquire sidewall core should be established in the WDAP filed in support of an ADW.

As a condition of the ADW or in response to viewing logs, the *Regulator* may request that sidewall cores be taken from designated well-bore interval(s) for any class of well.

Refer to the requirements of section 64 of the *Framework Regulations* and Section 7.1.4 of this Guideline for submission of sidewall cores.

4.3 Logs and Surveys

Logs required in support of a WDAP should include:

- those open hole logs necessary to enable a comprehensive evaluation of the well;
- those cased hole logs necessary in support of well evaluation in exploration or delineation wells, or effective reservoir management in development wells; and
- where necessary, cement evaluation logs to ensure zonal isolation where hydrocarbon-bearing or abnormally pressured zones (e.g., overpressured zones) have been encountered in exploration, delineation or development wells.

The WDAP should list the suite of logs proposed for the section of the hole being logged or surveyed. The program should be divided into two parts separating those logs run in open hole from those run in cased hole. Each section of the hole should be identified by indicating whether it is the top, intermediate or bottom-hole section and by stating the corresponding hole diameter and casing size.

The logging program should provide for a comprehensive evaluation consistent with the class of well being drilled. With respect to development wells, the *Regulator* may require that a particular log or survey be taken if it believes that such a log or survey is necessary. Such a requirement will usually be identified during the ADW process and would be included as a condition of the approval.

The following guidance is provided in support of logging operations:

- Every operator should ensure that logs yield data of good quality by being acquired:
  - as soon as possible after penetrating a potential reservoir to avoid hole deterioration and to minimize effects of filtrate invasion;
  - at a logging rate that does not exceed service company or manufacturer-recommended specifications;
  - before altering the nature of drilling fluid in a manner that would affect the quality of logs;
  - before enlarging the diameter of the hole for the purpose of installing casing; and
  - on floating vessels or MODUs employing a motion-compensator device, if the vertical motion of the drilling unit is such that the quality of the data would otherwise be adversely affected.

- All measurements taken while logging a well should be recorded in digital format, preferably in accordance with *API RP 66: Recommended Practices for Exploration and Production Data Digital Log Interchange*.

- A recording increment of approximately every 0.2 m of tool travel should be maintained as the minimum wireline standard for logging a well. Where there is reason to believe that the above recording frequency is insufficient to characterize the complexity of the formation over hydrocarbon-bearing intervals, the operator should take such action as necessary (e.g., reduce logging speed) to contribute to improved characterization of the interval.

- All measurements taken while logging a well should be recorded with respect to MD, representing the distance of tool travel from the point of reference. Refer to the requirements and associated guidance provided in sections 66 and 67 of the *Framework Regulations*.

- LWD should record the frequency of measurement as a function of depth on any log(s) submitted to the *Regulator.*

- When multiple logging runs are carried out on a well, logs must be depth-tied to the primary depth-control log for the well. Logs that have not been depth corrected to the primary depth-control log should be designated and submitted as field logs. Alternatively, a composite log of primary open-hole logs may be subsequently submitted where logs are depth-tied to the primary depth control log for the well. Where a composite log is submitted, as-acquired logs may be submitted as final logs.

- Copies of TVD logs must be submitted in accordance with reporting requirements in section 191 of the *Framework Regulations*.

- To ensure the quality of data, the operator must ensure that each tool run in either open or cased hole has been:

    - calibrated in accordance with *Good Oilfield Practices* to ensure the accuracy of measurements taken;
    - where practicable, checked prior to and following each logging run to verify the validity of the existing calibration; and
    - run to obtain repeat section(s) (> 50 m) over zones where good contrast is present or where hole conditions permit. prior to initiating the main logging pass to verify the repeatability of logging measurements.

- All logs acquired in a well should conform to the format provided in *API RP 31A: Standard Form for Hardcopy Presentation of Downhole Well Log Data.*

- Where conditions in a well are such that the taking of any log would endanger the safety of any person, the well or the installation, the operator should defer the taking of that log until the conditions are such that the taking of the log can be done safely.

- An operator should give due consideration to evaluation objectives when selecting the drilling fluid for the well. Logging tools employed should be compatible with the drilling fluid used in the well. Where an operator plans to modify or replace its drilling fluid system, the operator should first log the hole section if altering the nature of the drilling fluid would affect the quality of data acquired.

- The constituent components of the drilling fluid system used during the drilling of each hole section should be detailed in the Drilling Fluid Report Form.

4.3.1 Pressure-Depth Survey

An operator should plan to conduct a pressure-depth survey as part of the WDAP. In exploration and delineation wells, an operator will be expected to survey those open hole sections of a well in which indications of porous and permeable reservoir rock exist. In development wells, an operator may limit its survey to those intervals targeted for development or that offer potential for development. Refer to additional guidance for development wells as part of the FDAP under Section 5.6 of this Guideline. For development wells, the WDAP should reference the FDAP and include any specific details not covered in the FDAP.

A survey should plan to test all potential reservoir intervals to confirm the existence of porous and permeable reservoir and to record pore

pressure. The operator should take multiple measurements over an interval where sufficient interval thickness permits to:

- verify the existence and quality of permeability over the porosity range evident within the interval for the purpose of establishing an effective porosity cut-off for productive reservoir; and
- establish a pore pressure gradient over the interval for the purpose of:
  - identifying in situ fluid types;
  - verifying the existence of fluid columns;
  - identifying barriers to vertical pressure communication;
  - identifying isolated sands or sand stringers;
  - identifying and estimating fluid contacts; and
  - studying regional pressure regimes;
- in development wells, take sufficient measurements for the purpose of:
  - determining pool or zone pressures prior to completion;
  - verifying inter-well sand continuity;
  - assisting in pool or zone designations; and
  - enabling material balance assessments.

4.3.2 Fluid Sampling

In an exploration or delineation well, an operator should plan to obtain samples of in situ hydrocarbons and formation waters where such opportunities exist and submit results of the analyses conducted on those samples to the *Regulator*. Physical samples are only required to be submitted for formation flow test operations.

As per section 65 of the *Framework Regulations*, an operator should consult with the *Regulator* prior to destroying or discarding residual samples after analyses, and prior to destroying or discarding of additional samples acquired.

The operator of a development well will be expected to collect and analyze fluid samples upon initial completion of the well in a pool and, thereafter, upon recompletion of the well in any new pool as per the approved FDAP. Refer to Section 5.5 of this Guideline for further details.

Refer to Section 7.1.2 of this Guideline for guidance on submission of fluid samples.

4.3.3 Open Hole Logging

The open hole logging program should ensure that sufficient logs necessary to enable a comprehensive evaluation of the well are acquired over all uncased intervals in the well below surface casing. The logging program should be designed to:

- permit an accurate calculation of the porosity, fluid saturation and fluid contacts for all potential reservoirs;
- measure the size of the hole and the natural radioactivity of any formation;
- assist in determining the lithology of any formation; and
- permit the calculation of accurate values of the vertical angle and direction of the hole and of the structural dip of the formations.

In respect of the above:

- a sufficient number of types of porosity-measuring logs should be acquired so that any effect of shaliness, hydrocarbons, lithology and the borehole conditions can be compensated for in determining the porosity of any formation;
- at least two types of porosity-measuring logs should be acquired if reservoir development is indicated in the portion of the hole in which the logs are to be taken; and
- a sufficient number of types of resistivity-measuring logs should be acquired if significant reservoir development is indicated, so that the distortion caused by filtrate invasion, thin beds, drilling fluids and the walls of the hole can be compensated for in calculating formation resistivity.

These guidelines do not limit the types of logs employed by an operator for these determinations and encourage alternatives where equivalency can be supported or demonstrated to exist. The suitability of new technology should be demonstrated against established tools.

The operator may also describe its well logging contingency plans for those intervals in the well where log data was planned but not acquired or where quality was compromised during the initial logging program.

In NS, for each hole section below the surface casing, once drilling and logging has been completed, the operator should submit a quick look log interpretation to the Regulator that includes the following information for the purposes of alignment on the zonal isolation and cementing strategy:

- *log plot of the main raw (e.g., gamma ray, caliper, density, neutron, sonic, resistivity) and interpreted logs (e.g., total and effective porosity, water saturation);*
- *table of any porous hydrocarbon-bearing and overpressured zones capable of flow; and*
- *list of reservoir cut-offs applied in the above calculations.*

4.3.4 Cased Hole Logging

The cased hole logging program submitted in support of the WDAP should consist of logs run to:

- evaluate the quality of casing and liner cementation;
- acquire geophysical measurements;
- evaluate flow contribution;
- support well evaluation; and
- support reservoir management for a development well.

For development wells, refer to the guidance for cased hole logging under an FDAP in Section 5.3.2 of this Guideline.

4.3.4.1. Cement Evaluation Logging

With respect to the requirements and associated guidance under subsection 69(6) and 71(2) of the *Framework Regulations*, an operator will be expected to carry out cement evaluation logging to verify zonal isolation by cement in:

- Exploration/delineation wells where:
  - formation flow testing is planned to assess the in-situ formation properties of distinct zones and isolation of multiple reservoir zones is required;
  - there are indications the cement job was unsuccessful and any of the following conditions apply:
    - hydrocarbon-bearing reservoir zone(s) are present;
    - abnormally pressured (e.g., overpressured) and normally pressured intervals are present; or
    - formation flow testing is planned.
- Development wells where:
  - there are multiple zones or reservoir units and a profile control strategy exists to maximize hydrocarbon recovery;
  - optimizing the perforation interval to avail of hydraulic isolation could improve an operator's ability to isolate high water-cut or gas-cut intervals;

- there are indications the cement job was unsuccessful and any of the following conditions apply:
  - potential adverse effect on production and the recovery of hydrocarbons from the designated production interval(s);
  - hydrocarbon-bearing reservoir zone(s) are present; or
  - abnormally pressured (e.g., overpressured) and normally pressured intervals are present.

In NS, cement evaluation logging is required for all well types where either hydrocarbons have been encountered or overpressured zones are present. Wells that are normally pressured and have all zones wet do not require cement evaluation logging.

Refer to additional guidance for cement evaluation logging in development wells under Section 5.3.2.3 of this Guideline.

The *Regulator* may require an independent assessment of logging of the hydraulic isolation by cement in cased and lined hole sections of a well. In such instances, the logging tool employed should be capable of assessing the integrity of cement bonding to the casing and the formation and if capable, identifying channels behind casing that might provide pathways for reservoir fluids.

The *Regulator* should be notified of any problems or issues arising from an ineffective cement job.

4.3.4.2. Production Logging

An operator should list any production logs planned in support of a formation flow test(s) conducted in an exploration or delineation well. Such logs are typically run at the discretion of the operator to assess flow contribution of zones or intervals being tested. With respect to development wells, refer to the guidance for production logging under Section 5.3.2.1 of this Guideline.

4.3.5 Optional or Contingent Logging

Where any tool or tool combination being proposed is designated as optional, the operator must state the criteria that will determine whether it will be run. In exploration wells, primary open-hole

measurements detailed above should be obtained prior to conducting other surveys (e.g., wireline testing, sidewall coring).

An operator may reduce logging efforts in a particular section of a well where indications from the well justify it. This may apply to formations composed of salt or non-sedimentary rock in an exploration well, or to non-reservoir hole sections in exploration or delineation wells.

4.3.6 Well Geophysical Surveys

Operators should plan to conduct a check shot survey or VSP in all exploration and delineation wells to ensure accurate calibration of the well data with the seismic survey. Operators should consult the *Regulator* early in the planning stages of a well for check shot or VSP requirements. A VSP may be necessary where it would further contribute to resolving geoscientific uncertainty. With respect to development wells, refer to Section 5.3.3 of this Guideline for the level of detail to be submitted in the FDAP.

4.4 Formation Flow Tests

Refer to the requirements and associated guidance on formation flow testing in support of a WDAP provided in section 63 of the *Framework Regulations*.

5.0 Field Data Acquisition Programs

Pursuant to section 13 of the *Framework Regulations*, in the case of a production project, the operator must submit an FDAP in support of its application for authorization submitted under section 8 of the *Framework Regulations*. The FDAP should outline the operator's evaluation strategy for a well, pool or field and satisfy the *Regulator* in respect of evaluation expectations in accordance with section 62 of the *Framework Regulations*. FDAPs should:

- attempt to resolve any remaining uncertainties regarding targeted production intervals;
- establish baseline measurements for subsequent production monitoring programs;
- provide a level of evaluation outside of targeted production intervals that is commensurate with the development potential of intervals encountered; and
- provide sufficient flexibility to respond to changing evaluation needs as the field matures.

The FDAP should provide for data gathering in support of well and pool monitoring and allow for updates in response to changing conditions and performance of wells and pools during the operational life of the field. Development wells drilled during the term of the FDAP may reference in the WDAP, a standard approach to well evaluation where it has been included in the FDAP. Amendments to the FDAP should be provided to the *Regulator*

for approval in response to changing conditions, performance or evaluation as the field matures. The *Regulator* may also request updates to the FDAP. For wells that are not part of the production project (i.e., exploratory or delineation wells), refer to Section 4.0 of this Guideline.

Pursuant to subsection 61(1) of the *Framework Regulations,* the operator must implement the FDAP in accordance with *Good Oilfield Practices.*

If part of the FDAP cannot be implemented, refer to Section 6.0 of this Guideline.

The following sections provide guidance in respect of evaluation areas for an FDAP.

5.1 Mud Logging and Drill Cuttings

An operator should provide a high-level summary of the mud logging and drill cuttings program in the FDAP, including:

- continuous monitoring and reporting of surface parameters, the drilling fluid system and its gas content;
- drill cuttings collection frequency if it varies between hole sections, in particular as the field matures; and
- drill cuttings analysis and reporting practices, etc.

Consideration will be given to relaxing sampling requirements for drill cuttings in any development well where such sampling can be shown to be redundant to samples already taken in adjacent well-bores. In these cases, cuttings may be caught for description purposes only, with the submission of physical samples not required. In such instances, the operator should discuss its proposal for relaxation of drill cuttings with the *Regulator* prior to submission of the FDAP.

Refer to the requirements and associated guidance in section 163 of the *Framework Regulations* for the drilling fluid and the drilling fluid system. Refer also to specific requirements for mud logs and sampling of drill cuttings under Section 4.1 of this Guideline.

5.2 Conventional and Sidewall Cores

For fields under development, an operator should address remaining reservoir uncertainty through the coring program for the field in the FDAP.

Refer to additional guidance on cores under Section 4.2 of this Guideline. Refer to Sections 7.1.3 and 7.1.4 of this Guideline for guidance on the submission of cores.

5.2.1 Conventional Cores

An operator should define its coring strategy as part of the FDAP. The intent to core a well should be executed through the WDAP filed in support of an ADW.

The coring program component of the FDAP should capture the overall strategy with respect to coring needs for a pool or field. It should plan to sample productive reservoir within recognized pools in a manner designed to characterize productive reservoir, and resolve any uncertainty that may exist. A coring program should ensure that:

- Core is acquired from select development wells to ensure spatial representation of all targeted horizons for the purpose of minimizing uncertainty with respect to geologic correlation, reservoir characterization and the proposed depletion scheme. This should include:
    - coring of gas-, oil- or water-bearing intervals from select wells; and
    - coring of reservoir intervals where an opportunity exists to assess the performance of the depletion scheme being employed.
- Special core analysis is directed at resolving the uncertainties identified in the *Development Plan* and at assessing the potential of enhanced recovery schemes.

The coring of hydrocarbon-bearing reservoirs encountered outside of targeted horizons is encouraged where potential for development exists and should be reflected in the coring program, if applicable.

The operator should provide the following information in support of the coring program for a field:

- A summary of coring to date, including the details of core cut and recovered from each well. This should include the interval cored, the formation or pool it represents and the analyses conducted on each core.
- A summary of analyses for cores taken from those reservoirs targeted for development, indicating those areas of uncertainty that need to be addressed in the proposed coring program.
- A list of development wells for which the operator proposes to cut core, noting the interval, pool or formation proposed for coring, the extent of proposed coring and details of proposed analysis for each core. A map(s) should accompany this list showing the location of all

wells proposed to be drilled during the term of the FDAP. As an alternative, a coring strategy for the proposed development wells can be provided, wherein the operator achieves spatial representation of core over targeted horizons for the purpose of mitigating any potential uncertainties.

5.2.2 Sidewall Cores

The operator of a field under development should address the role of sidewall coring in respect of the coring program detailed in the FDAP for the field. The program should address the contingency role, or value of a sidewall-coring program in a well where conventional coring was planned, but not acquired.

The *Regulator* may request for any class of well, either as a condition of well approval or in response to viewing logs, that sidewall cores be taken from designated well-bore interval(s).

5.3 Logs and Surveys

Refer to additional guidance on logs under Section 4.3 of this Guideline. Refer to Section 7.2.1 of this Guideline for guidance on the submission of logs and survey data.

5.3.1 Open Hole Logging

An operator should include a standard open hole logging program for development wells in support of effective reservoir management as part of the FDAP. This program should follow the guidance provided in Section 4.3.2 of this Guideline for WDAP for development wells, except where the operator justifies a deviation from these requirements. As part of an ADW, an operator need only reference this standard logging program from the FDAP with respect to the logging component planned for the well.

5.3.2 Cased Hole Logging

The FDAP should also include those cased hole logs that are planned for development wells during the operational life of a field in support of effective reservoir management. Cased hole logs run after the initial completion date and subsequent well termination date should be detailed and approved through the ACW process.

The following types of cased hole logging are typically recognized for their contribution to the evaluation of a producing pool or field:

- production logging;
- saturation logging; and
- cement evaluation logging.

Such logging may be necessary to satisfy the requirements for evaluation, monitoring and efficient recovery of petroleum from development wells, or to support of workover, suspension or abandonment of wells. The requirement for cased hole logging is not intended to be limited to the above types of logging but may encompass other types of cased hole logging that may be equivalent, or reflect advances in logging technology.

The *Regulator* recognizes the additional challenge associated with the cased hole logging of subsea wells versus platform wells. To this end, in fields developed subsea, the *Regulator* encourages the use of smart well completions and logging during windows of opportunity (e.g., prior to handover to production, during an intervention) in an effort to minimize disruption while the field is producing. The *Regulator* may nevertheless require logging where well performance indicated through routine well monitoring suggests that waste of the resource may be occurring.

5.3.2.1. Production Logging

An operator will be expected to carry out production logging to acquire a flow profile where multiple reservoir zones comprise the completion interval. Such profiling is necessary to assess zonal contribution for production reporting purposes, detect thief zones, identify water breakthrough and assist in planning workover requirements.

Primary measurements of a production logging tool should include pressure and temperature, downhole flow rate either from or into the completion and measurement of the density of fluid flowing from the completed interval. Secondary measurements should include formation natural radioactivity and internal casing/liner diameter.

An operator will be expected to carry out production logging on a development well:

- to provide a baseline log where multiple zones comprise the completion interval; and

- thereafter, as necessary, in response to changes in fluid production or after any well operation that could affect the productivity, deliverability or injectivity of the completed interval where post-job flow performance does not meet pre-job expectations; or
- where there is reason to suspect that thief zones exist that are affecting injectivity.

A baseline log should be acquired within two months of the establishment of stabilized production from or injection into a well.

5.3.2.2. Saturation Logging

An operator may be required to carry out saturation logging either in support of production logging or to provide profiles of fluid saturation in the well. Such profiling may be necessary to provide a basis for tracking flood fronts, identifying reservoir contributing to water influx, and planning and assessing workover strategies.

The logging tool(s) employed should be capable of determining hydrocarbon and water saturation levels behind casing when water salinity is changing, as is typically the case in fields under waterflood.

An operator may be required to carry out saturation logging on any producing development well:

- to provide a baseline log following the initial completion of the well; and
- thereafter, as necessary, during the life of the well to monitor flood front advancement, or to support the design and assessment of workover strategies.

Initial baseline saturation logging should be conducted after well cleanup and prior to water breakthrough in the well. When run to isolate water production, it should be run in association with production logging tools where it could assist in pinpointing water influx.

5.3.2.3. Cement Evaluation Logging

With respect to the requirements and associated guidance under subsection 69(6) and 71 of the *Framework*

Regulations, an operator may be requested to evaluate the quality of cementation of the production casing or liner in a development well during the operational life of the field where indications suggest that the integrity of the liner or casing cementation is compromised and any of the following conditions apply:

- zonal isolation has been lost;
- abnormally pressured (e.g., overpressured) and normally pressured intervals are present; or
- there is potential for adverse effects on production and the recovery of hydrocarbons from the designated production interval(s).

In NS, there is a requirement for cement evaluation logging of all production wells prior to commencing production.

Where a cement evaluation log is run after initial completion of a well, the operator is requested to submit its assessment of the cement log to the *Regulator*. Where a cement evaluation log was also run prior to the initial completion of the well, the assessment of cement integrity by the operator should incorporate both logs. Where the integrity of the cementation is confirmed compromised, the operator will be required to take such remedial action as deemed necessary. Refer to additional guidance for cement evaluation logging under Section 4.3.3 of this Guideline.

5.3.3 Well Geophysical Surveys

Well geophysical surveys may be necessary in fields under development to supplement existing understanding. The *Regulator* expects operators to conduct surveys in areas of the field where deviation from geoscientific expectations is encountered. The operator should define such areas of uncertainty in the FDAP and address the uncertainty through the WDAP for a candidate well(s) under Section 4.3.6 of this Guideline.

5.4 Formation Flow Tests

The FDAP should outline the program for formation flow testing of development wells. Formation flow testing in support of an FDAP is limited to the formation flow testing of approved development horizons as defined in the *Development Plan* and any testing that may be carried out over secondary horizons not currently approved for development.

Testing of secondary horizons would likely occur in the absence of other strategies for reservoir appraisal. It would need to be addressed prior to abandonment or reuse of a well or part of a well in which prospective interval(s) were identified.

For information related to formation flow testing of development wells, refer to the requirements and associated guidance for section 63 of the *Framework Regulations*. Formation flow test reports for development wells should be submitted with the Annual Production Report. Refer to the requirements and associated guidance for sections 195 and 202 of the *Framework Regulations.*

5.5 Fluid Sampling and Analysis

The FDAP should outline plans for fluid sampling of wells and pools in a field during the operational life of the field to ensure that a comprehensive reservoir evaluation can be made, consistent with good resource management practice.

The FDAP should plan for the fluid sampling of a pool at the following intervals:

- upon completion of a well in a pool;
- annually, for the purpose of determining the composition of fluids in the pool;
- where formation flow tests conducted over secondary horizons not approved for development are encountered;
- when new hydrocarbon zones are identified and subsequently flow tested; and
- where water is produced from a well, to determine the composition and source of the produced water.

Fluid sampling and analysis should be conducted in accordance with *Good Oilfield Practices*. The operator should include as part of the FDAP reference to any *Good Oilfield Practices* used.

Refer to Section 7.1.2 of this Guideline for guidance on submission of fluid samples.

5.5.1 Sampling at Well Completion

Fluid samples should be collected and analyzed upon initial completion of a well in a pool and, thereafter, upon recompletion of the well in any additional pool(s).

Samples should be taken during the initial formation flow test by subsurface means where the taking of surface samples would be unsatisfactory for analysis purposes. Samples collected at surface should be recombined to initial reservoir conditions. Samples obtained at well completion will establish the baseline for subsequent monitoring of the well for changing fluid composition.

5.5.2 Annual Sampling

Once production from a pool is initiated, samples of oil, gas and water should be collected at the surface from a sufficient number of wells completed in that pool to determine the composition of fluids. This collection and subsequent analysis should be conducted once every 12 months or more frequently when there is reason to believe that the composition of fluids produced from the pool has changed.

Where a select number of wells in a pool are sampled, the criteria for well selection should ensure that the resulting analyses provide an accurate indication of the composition of fluids in the pool. For this purpose, wells in areas where fluid properties are known to vary or are uncertain should be sampled. Similarly, wells omitted from sampling programs in previous years should be given priority. Generally, the following producing wells are considered good candidates for sampling:

- wells subjected to a formation flow test;
- wells that have experienced a significant change in either the composition of petroleum fluids, or in gas-oil ratio or water cut; and
- wells in which production is not commingled.

An operator should collect samples from producing wells during routine allocation tests for proration purposes and at any time for injection wells by sampling the injection fluid streams.

Sampling of gas injection wells should be conducted where knowledge of injection gas composition is critical to a depletion scheme and in water injection wells where quality control of injection water is required. Fluid injection streams should be sampled at the injection manifolds, or where practicable, at individual wellheads.

An operator should acquire fluid samples and carry out the appropriate analyses whenever there is reason to believe that the composition of a fluid produced from or injected into a pool has changed. Samples should be taken following stabilization of well conditions, but in any event, not later than one month after changing conditions are first observed.

5.5.2.1. Sampling of Group and End Use Streams

The following group and end use fluid streams should be sampled and analyzed as part of the annual sampling program where sampling would either contribute to the evaluation of the pool or field, or assist in environmental monitoring:

- group hydrocarbon production going to storage. (Where storage does not exist on a platform, samples of hydrocarbons exported from a platform should be taken.);
- group produced water discharge; and
- secondary streams (e.g., gas used for fuel, gas lift, gas flared).

The *Regulator* may require increased sampling frequency of any of the above streams should evaluation requirements or environmental monitoring justify increased sampling.

5.5.3 Sampling of Produced Water from a Well

Where water is produced from a well, either upon initial production or during the producing life of the well, the operator will be expected to collect representative water samples to determine its probable source.

For this purpose, equipment should be capable of allowing detection of produced water during formation flow testing or during routine allocation tests, directly as a result of the separation process in place or indirectly through real time monitoring of the outlet stream. Where produced water is detected or suspected, the operator should sample the fluid stream and obtain representative sample of water for analysis.

The following measures should be taken by the operator where appropriate to determine the source of produced water:

- obtain representative samples of formation water from all wells that encounter water-bearing reservoir within the approved development area;
- obtain representative samples of water injected into a pool;
- conduct tracer programs to identify the offending source of produced water; and
- conduct cased hole logging, where practicable, to identify the offending zone or interval contributing to water production.

The operator is encouraged to acquire data early in the life of a pool or a field to provide an effective means to assist in the determination of the source of any produced water.

Where water is produced from a well, the operator will be expected to monitor for increases in water production and where necessary take

remedial action to control the influx of water for the purpose of maximizing hydrocarbon recovery.

The results of any analysis conducted on fluid samples taken from development wells should be submitted with the Annual Production Report as outlined in Section 7.2.3 of this Guideline.

5.6 Pool Pressure Measurements

The FDAP must include sufficient pool pressure measurements for a comprehensive assessment of the performance of development wells, pool depletion schemes and the field.

The guidance in this section was based on *AER Directive 040: Pressure and Deliverability Testing Oil and Gas Wells*.

The operator of a field will be expected to:

- determine for each producing well, the initial pressure of the pool or zone upon completion, prior to commencing production from the interval; and
- carry out an annual pool pressure survey.

5.6.1 Pool Pressure at a Well Upon Completion

This measurement provides the baseline for initial pool pressure. It also enables the identification and delineation of that pool in subsequent development wells. In infill wells it provides a basis for assessing drainage area and recovery efficiency.

The initial pressure of the pool should be based on the pressure-depth survey for the well corrected to datum depth. The operator should address any notable disagreement between this pressure and the pressure reported as part of well backflow or the initial formation flow test conducted for the well.

Where a pressure-depth survey was not conducted, the initial pressure of the pool should be determined:

- following well backflow or cleanup and prior to placing the well into service; or
- as part of the initial formation flow test where this test is conducted prior to placing the well into service.

5.6.2 Annual Pool Pressure Survey

The operator should outline its strategy for the annual pool pressure survey as part of the FDAP.

The *Regulator* acknowledges the operator's need to minimize losses in production when complying with the requirement for an annual survey. Consequently, all wells need not be part of the annual pressure survey. Furthermore, it is expected that the operator execute the survey around both scheduled and unscheduled well downtime.

The following criteria should be considered by an operator when detailing the strategy for conducting annual pool pressure surveys:

- wells surveyed should provide an accurate indication of the pressure distribution within a pool and for the field;
- wells located in high- and low-pressure areas in which a pressure maintenance scheme exists should be surveyed each year;
- pressure sources such as injection wells should be included in the survey;
- wells not surveyed for the past three years should be considered for survey; and
- wells located in areas where pressure levels, pool boundaries and pool continuity are uncertain or where anomalous pressure trends exist should be surveyed.

Wells that are recognized as being good candidates for surveying include:

- wells in which an open-hole pressure-depth survey was conducted;
- wells subject to a formation flow test (i.e., either a producer or injector following initial completion or in response to a workover);
- suspended wells; and
- wells subject to downtime.

Results for the annual pool pressure survey(s) conducted for the field should be submitted to the *Regulator* as part of the Annual Production Report. Refer to the requirements and associated guidance in section 202 of the *Framework Regulations*.

5.6.3 Recommended Practices for Gauges

The following practices are recommended when conducting a pressure survey:

- A minimum of two gauges should be run in tandem as part of every survey as a check on the performance of the gauges and to improve the reliability of pressure measurements taken.
- To minimize the introduction of errors, the same gauges should be used where multiple surveys or tests are to be conducted in a well.
- All pressure measurements should be made to the reference depth as agreed by the *Regulator*.

5.6.4 Initial Completion or Re-Completion of a Well

Where survey data results from initial completion or re-completion of a well either on shut-in of the well following backflow (i.e., cleanup) or as a consequence of formation flow testing conducted in support of the initial production test, or initial injection test or on re-completion of the well, the following criteria should be satisfied:

- In wells undergoing initial completion, the shut-in duration associated with the backflow or cleanup of the well should be adequate to extrapolate reservoir pressure to fall within one percent of wireline pressures at datum depth.
- In wells undergoing initial completion where the initial formation flow test is conducted, the pressure to be used in the survey should be based upon extrapolated pressures from two shut-in periods that fall within one percent of each other.
- In wells undergoing re-completion where the well has been under production or injection for some time, the pressure to be used in the survey should, after extrapolation, fall within five percent of the last pressure survey conducted for that location.

6.0 Deviations from Data Acquisition Programs

If part of the FDAP or WDAP cannot be implemented or if some other amendment must be made, the operator must notify a conservation officer as soon as practicable and submit alternative measures to the *Regulator* for approval pursuant to subsection 61(2) of the *Framework Regulations.*

There are two types of notification recognized:

- Type 1 - Deviation from a WDAP/FDAP prior to spudding the well.
- Type 2 - Deviation from a WDAP/FDAP during the course of drilling a well in response to operational issues or changing reservoir conditions.

Where an operator seeks to make a Type 1 deviation, the request must be submitted in writing to the *Regulator* as an amendment to a WDAP or FDAP. Further clarity may be obtained by contacting the *Regulator* prior to filing an amendment.

Where an operator seeks to make a Type 2 deviation, it will be treated as an operational change and expedited accordingly. The processes for the respective *Regulators* are as follows:

- In NL, the operator should file, as soon as circumstances permit, the *Operational Waiver/Notification from an Approved Well Data Acquisition Program* form found on the C-NLOPB website.
- In NS, the operator must submit a letter to the CNSOPB documenting the requested change and the reason for the request. If the deviation is submitted outside of the *Regulator's* normal business hours, they should contact the designated CNSOPB on-call person to request the change. If the requested deviation is approved, on the next business day, the operator will be required to follow-up with a letter to the *Regulator* documenting the change and the reason for the request. Whenever drilling operations are occurring, the CNSOPB will provide the operator with the after-hours contact information for the designated on-call staff.

7.0 Submission of Samples and Data

7.1 Submission of Physical Samples

Pursuant to section 64 of the *Framework Regulations*, submission of physical samples to the *Regulator* is typically required 60 days after the well termination date, or where analysis of a sample(s) is undertaken, the remaining sample(s) is to be submitted to the *Regulator* within 60 days following completion of the analysis.

Submission of data and analysis to the *Regulator* is typically required 60 days after the day on which the measurement, sample, test or well operation is completed.

An extension to the 60-day requirement stipulated above may be accepted where a written request is filed with the *Regulator* and the delay respecting the submission is justified by the operator and accepted by the *Regulator*.

The operator should contact the *Regulator* for clarification related to the submission of samples or where alternative procedures are to be employed in the preparation of samples for submission to the *Regulator* (e.g., containers used in housing and shipping samples, labeling, cleaning). In NL, contact can be made directly to the CSRC.

Contact information for submission of samples, drill cuttings and cores are provided on the *Regulator*'s websites.

7.1.1 Submission of Drill Cuttings

In preparing samples of drill cuttings, the operator must ensure that:

- containers used for samples are adequate to prevent deterioration or loss of the sample;
- all samples are clearly and indelibly labelled with the well name, location (e.g., field) and sample depth; and
- all samples are carefully packed in labelled cardboard boxes or containers appropriate for shipment.

7.1.2 Submission of Fluid Samples

Atmospheric samples should be transported in suitable containers that prevent loss or deterioration of the sample. All sample containers must be suitably labelled or identified with the well name, field, test number, interval and source as well as the nature of the sample (i.e., oil, gas, gas condensate, water or combination thereof). Any pressurized samples are to be transported in containers in accordance with the TDG Act and associated regulations.

7.1.3 Submission of Conventional Cores

Any cores that have been obtained, including core plugs or samples, should be submitted to the *Regulator*. Core must be placed in containers that prevent loss or deterioration of the sample. Containers must be clearly labelled with the well number and location, core number, depth interval and container number expressed as #__ of __. Any full diameter core selected for special core analysis should be preserved prior to shipment in accordance with *Good Oilfield Practices*.

7.1.3.1. Submission of Core Slab

Following the removal of plug or full diameter core samples necessary for analysis, the remaining core or a longitudinal slab core not less than one half the cross-sectional area of the core should be submitted to the *Regulator* in accordance with the following guidance.

Conventional core should be washed prior to submission to the *Regulator* if it is obtained from a section drilled with oil- or synthetic-based mud. In addition, the residue of any compounds used during the cleaning process (e.g., toluene) must be removed from the core prior to submission. The washing process should be conducted in a manner that minimizes the damage to the core. All samples necessary for analysis should be removed prior to washing the core.

For conventional core that is epoxied into aluminum sleeves, ensure:

- The edges of the aluminum sleeves are sanded down so that they are not a hazard to anyone viewing the core; and
- The face of the core epoxied in the aluminum sleeves is clean for viewing prior to submission.

Conventional core shipped to the *Regulator* should be placed in sturdy cardboard boxes of approximately 80 cm in length and deep enough to ensure that the weight of stacked boxes rests on the box frame and not on the enclosed cores. Where boxes have two or more internal sections, the core should be oriented with its top at the lower left corner and its base at the upper right corner as per the following sketch.

^	base
^	^
^	^
^	^
^	^
^	^
^	^
top	^

The top and base of the core should be clearly marked on the outside of the box. Sample numbers and intervals corresponding to whole diameter segments and plugs that have been removed for analysis should be marked on the inside of the box to assist in correlation of lithologies with reservoir properties. The box and its lid should be labelled in accordance with the above sketch on the end corresponding with the top of the core. Labels must clearly indicate the well name and location (e.g., field), core number, box number expressed as Box __ of __ , the depth of the cored interval and amount of recovery in metres.

7.1.3.2. Submission of Conventional Core Plugs

Each conventional core plug, or part thereof remaining after routine or special core analysis, should be placed in a plastic jar or vial to mitigate the issue of breakage associated with the use of glass containers during shipment. Each jar or vial should be clearly labelled with the well name and plug number noting the depth in relation to the conventional core from which the plug was cut. Samples should be securely packed for shipment in appropriate cardboard or wooden boxes. Each box of samples

should be labelled with the well name and location and box number expressed as Box __ of ___.

7.1.4 Submission of Sidewall Cores

Each sidewall core shipped should be clearly labelled and placed in a plastic jar or vial to mitigate the issue of breakage associated with the use of glass containers during shipment. Each jar or vial must be clearly labelled with the well name, noting the depth at which the sample was obtained. Any sidewall cores cut or selected for special core analysis purposes should be preserved prior to shipment in accordance with *Good Oilfield Practices*.

Samples remaining after routine or special core analysis, or after petrographic, biostratigraphic or other analyses, should be securely packed for shipment in appropriate cardboard or wooden boxes. Each sample should be placed in a plastic jar or vial to mitigate the issue of breakage associated with use of glass containers during shipment. Each jar or vial must be clearly labelled with the well name, noting the depth at which the sample was obtained. Each box of samples should be labelled with the well name and location and box number expressed as Box __ of ___.

Operators are requested to prepare a list to accompany any sidewall cores shipped to the *Regulator* identifying the samples included in the shipment and those sidewall cores destroyed as a result of analyses. The list should include the depth and run numbers associated with all sidewall cores taken from the well and include the type of analyses performed (e.g., routine or special core analysis, petrographic, biostratigraphic, geochemical analysis).

7.2 Submission of Results, Data, Analysis and Schematics

Pursuant to section 191 of the *Framework Regulations*, a copy of final results, data, analyses and schematics obtained during an FDAP or WDAP must be submitted to the *Regulator*.

The international system of units (SI) should be used in the submission of information or data to the *Regulator*. Standard conditions as referenced in this document mean atmospheric pressure of 101.325 kPa (absolute) and ambient temperature of 15°C.

Data in formats other than those prescribed in these guidelines may be acceptable. Persons wishing to submit data in another format should ensure this format is acceptable to the *Regulator*.

7.2.1 Logs and Survey Data

7.2.1.1. Electronic Data

Format:

The *Regulator* requires that the operator submit searchable PDF (electronic) copies of all logs and surveys in accordance with the format defined under *API RP 31A: Standard Form for Hardcopy Presentation of Downhole Well Log Data*, with the following notes:

- Where applicable, each log should consist of two depth scale presentations: the standard correlation log presentation at 1:600 or 1:500 scale and the standard detail log presentation at 1:240 or 1:200 scale.
- The calibration record provided with each log should, where practicable, include the results of calibration checks of the logging tool both before and after the logging run.
- Electronic copies generated must contain the repeat section(s) run prior to conducting the main pass.

TVD logs generated should be distinct and separate from MD logs. In this regard, all logs representing TVD data should be clearly marked with the designation TVD on the log header.

Copies:

One searchable PDF copy of each field and final log should be submitted to the *Regulator*. Where a log requires no further processing, the operator may designate such a log as final. Otherwise, where subsequent processing is required, the operator should submit those electronic copies of field logs with copies of final logs to follow. All logs must be clearly marked on the log header as to whether they are field or final logs. Where logs are not clearly marked as field or final, such logs will be treated as field logs by the *Regulator*.

Delivery:

The operator should submit to the *Regulator* the required electronic copies of logs as soon as possible following the conclusion of logging operations for a given hole section. All logs submitted to the *Regulator* must have an accompaning transmittal slip or email notification when posted to SFTP sites.

Note:

Although not required for submission, the *Regulator* reserves the right to request print copies of both field and final logs and surveys from the operator. If the *Regulator* requests submission of print copies of logs and surveys, the operator should submit print copies of all logs and surveys in accordance with the format defined under *API RP 31A: Standard Form for Hardcopy Presentation of Downhole Well Log Data*.

7.2.1.2. Digital Data

Format:

The *Regulator* requires that the operator submit log data in the following format:

- As a complete data set, submitted in accordance with *API RP 66: Recommended Practices for Exploration and Production Data Digital Log Interchange*.
- As a subset of the complete data set, representing the optical curves presented on final logs. This data should be submitted preferably in LAS 3.0 or LAS 2.0.
- For geophysical surveys, one digital copy of all SEG-Y and ASCII data on USB, SFTP or other medium approved by the *Regulator*, associated with each well geophysical survey.

Copies:

One digital copy of data should be submitted to the *Regulator* in the format prescribed above and on USB, SFTP or other medium approved by the *Regulator*. The operator is responsible for ensuring that all digital data is validated for accuracy and completeness prior to submission.

Delivery:

Unless otherwise agreed upon, the operator is responsible for delivery of digital data to the *Regulator* at the earliest possible time and by appropriate means following completion of logging runs for a specific hole section.

Special:

Where a quick response from the *Regulator* is warranted, the operator may be required to provide digital data by e-mail, SFTP or by other agreed upon means.

7.2.1.3. Pressure Depth Surveys

Where pressure data is acquired, either in association with wireline pressure-depth surveys conducted as part of the open hole logging program, pressure measurements taken upon completion or re-completion of a well, or in association with the annual pool pressure survey, one digital copy of this data should be submitted. It should be submitted as an Excel file or space delimited ASCII file(s) on USB, SFTP or other medium as approved by the *Regulator* in accordance with the requirements of the evaluation program conducted. The format for data submission should be columnar: real time (hh mm ss - 24 hr clock), not elapsed time; pressure (kPa absolute); and temperature (°C).

The results of a pressure-depth survey should be submitted to the *Regulator* in the form of a log or report. The log should include:

- A summary section, or log header, consisting of a table reporting results from survey stations, and a corresponding remarks column. The table should provide a brief summary of all tests conducted, noting the depth, success of test, the result as to reservoir pressure, and whether a fluid sample was captured. All pressures noted in this table should be corrected for temperature and reported in absolute pressure.

  Note: Remarks by service company personnel should include the serial number and make of the gauge employed, and whether pressures reported in the log header were temperature corrected and reported in

absolute pressure. Remarks should also indicate the status of corrections, if any, reflected in individual tests results that follow in the main body of the log.

- The main body of the log should consist of the individual records of tests conducted in this survey. Each test record should capture the initial hydrostatic pressure of the drilling fluid column at test depth, the setting of the tool, the pretest and shut-in periods, as well as the final hydrostatic pressure upon completion of the test. The specifics of any effort to obtain fluid samples should also be noted. Where fluid properties of samples taken by wireline tools have been determined, the operator should provide a description of fluids recovered, noting volumes of recovery and fluid properties (i.e., API gravity of oil and water resistivity at measurement temperature). Pressures recorded during the test should be printed on this record at appropriate increments to adequately characterize the test.

- The trailer section of this log should also contain the recent calibration history of the gauge. This should include the master calibration record for the gauge.

7.2.2 Analysis of Core

The analysis of conventional core, conventional core plugs or sidewall core should be performed in accordance with *Good Oilfield Practices*.

7.2.2.1. Routine Core Analysis

Every conventional core should be analyzed to determine basic reservoir characteristics of all potential reservoir intervals in the core. Plug sampling of conventional core should take into account the lithological distribution, porosity and permeability variations and distribution of hydrocarbons. This should include measurements of at least the following characteristics:

- porosity;
- permeability in the vertical direction, in the direction of maximum horizontal permeability and normal to the direction of maximum horizontal permeability; and
- fluid saturation.

Rotary sidewall cores taken from reservoir intervals are subject to above requirements.

In addition to the analysis of plug samples taken, an operator should ensure that adequate samples of full diameter core are taken and analyzed where there are significant large-scale heterogeneities in the whole core that are different from matrix properties obtained from analysis of plug samples.

Where additional core measurements and analysis are undertaken, the *Regulator* requires this information to be submitted by the operator. This includes the visual description of core for lithology and hydrocarbon shows and readings of a core's natural gamma activity.

7.2.2.2. Special Core Analysis

For a field being considered for development, or a field currently under development, SCAL considerations should include:

- pore volume compressibility;
- overburden porosity and permeability;
- petrographic studies;
- electrical properties;
- capillary pressure;
- for oil-bearing reservoirs:
  - wettability;
  - gas-oil relative permeability;
  - water-oil relative permeability; and
  - water flood tests; and
- for gas-bearing reservoirs:
  - gas-water relative permeability; and
  - residual gas after water encroachment.

7.2.2.3. Digital Data

In addition to the electronic copy requirements, operators should submit on USB, SFTP or other medium approved by the *Regulator,* one digital copy of data for the following data types:

- Routine core analysis as an Excel file or space delimited ASCII file;

- Digital prints of conventional and sidewall core photographs in JPEG, PNG or TIFF formats at a minimum resolution of 300 DPI; and
- Datasets related to reports conducted using conventional and sidewall core in ASCII format (e.g., petrographic, geochemical, XRD).

7.2.3 Fluid Sample Analysis

The analysis of fluid samples should be in accordance with *Good Oilfield Practices*.

Unless otherwise noted in the approval issued for an ADW, formation flow test reports associated with tests conducted on producers and injectors as required under section 195 of the *Framework Regulations* should be consolidated under one submission and submitted once annually as part of the Annual Production Report required under section 202 of the *Framework Regulations*.

The following types of analyses are expected to be conducted on samples obtained from wells completed in an oil pool:

- pressure-volume-temperature analysis;
- oil analysis;
- hydrocarbon liquid compositional analysis; and
- gas compositional analysis.

The following types of analysis are expected to be conducted on samples obtained from wells completed in a gas cap or gas pool:

- pressure-volume-temperature analysis;
- gas compositional analysis;
- condensate compositional analysis; and
- gas and condensate combined analysis.

Other types of analyses that may be carried out include:

- separator flash analysis;
- saturation pressure determination;
- true boiling point distillation; and
- wax analysis.

The results of any analysis conducted on fluid samples taken from development wells should be submitted with the Annual Production Report referred to in section 202 of the *Framework Regulations*.

The following requirements for fluid analyses are based on section 11.070 of the *Oil and Gas Conservation Rules*, Alberta Regulation 151/71**.**

- **Oil:**
    - Density in kilograms per cubic metre at 15°C of the water-free and sediment-free oil.
    - Sulphur content of the water-free and sediment-free oil, weight percent.
    - Saybolt Universal Viscosity in mPa.s of water-free, sediment-free oil at 20°C and 40°C.
    - Mole fraction, mass fraction and liquid volume fraction of nitrogen, carbon dioxide, hydrogen sulphide, methane, ethane, propane, iso-butane, normal butane, iso-pentane, normal pentane and hexanes plus.

- **Gas:**
    - Density in kilograms per cubic metre at standard conditions.
    - Gross heating value for moisture and acid gas free gas at standard conditions.
    - Pseudocritical pressure and temperature, calculated as sampled in kPa and °K.
    - Gas composition in:
        - moles per mole of methane, ethane, propane iso-butane, normal butane iso-pentane, normal pentane, hexanes, heptanes plus, nitrogen, helium, carbon dioxide and hydrogen sulphide; and
        - moles per mole converted to litres per thousand cubic metres of propane, iso-butane, normal butane, iso-pentane, normal pentane, hexanes and heptanes plus.

- **Condensate:**
    - Density in kilograms per cubic metre at standard conditions of the water-free and sediment-free condensate.
    - Mole fraction and liquid composition in moles per mole of nitrogen, carbon dioxide, hydrogen sulphide, methane, ethane, propane, iso-butane, normal butane, iso-pentane, normal pentane, hexanes and heptanes plus.
    - Molecular weight in grams per mole of the heptanes plus fraction.

- **Gas and Condensate Combined:**

    - Density in kilograms per cubic metre, measured or calculated from the recombined analysis.
    - Pseudo-critical pressure and temperature calculated from the recombined analysis.
    - Liquid-to-gas ratio expressed in cubic metres per cubic metre.
    - Mole fraction and gas composition in moles per mole of nitrogen, helium, carbon dioxide, hydrogen sulphide, methane, ethane, propane, iso-butane, normal butane, iso-pentane, normal pentane, hexanes and heptanes plus.
    - Molecular weight and density in kilograms per cubic metre of liquid hydrocarbons.
    - Molecular weight in grams per mole of the heptanes plus fraction.

- **Water:**

    - Solids contents in kilograms per cubic metre, and the calculated percent solids of chloride, bromide, iodide, carbonate, bicarbonate, hydroxide, sulphate, calcium, magnesium, sodium and total solids.
    - Total solid content by evaporation at 110°C, 180°C and at ignition.
    - Density in kilograms per cubic metre at standard conditions.
    - The pH and resistivity in ohm-metres at 25°C.
    - Hydrogen sulphide in grams per cubic metre.
    - Refraction index at 25°C.

Note: The above measurements are presented as a guide. The *Regulator* recognizes that certain labratories may have modified/evolved analysis practices, and may no longer conduct analyses to the extent indicated above. Operators are requested to note in the submission of analysis results where specific analyses were not undertaken. Fluid analysis reports of oil, gas, condensate and water samples should be submitted as an Excel or space delimited ASCII file.

8.0 Disposal of Samples, Cuttings, Cores or Data

Pursuant to section 65 of the *Framework Regulations*, where an operator wishes to dispose of drill cuttings, samples, cores or evaluation data in their possession, the operator must first notify the *Regulator* in writing outlining, as applicable:

- the nature and volume of material to be disposed of; and

- the nature of data to be disposed of citing relevant information such as the title of document(s) and a brief summary of the contents.

Where the *Regulator* requests that the operator submit the material or data to the *Regulator*, the cost of delivery will be borne by the operator.

9.0 Bibliography

1. *AER Directive 040: Pressure and Deliverability Testing Oil and Gas Wells, September 2021.*
2. *API RP 31A: Standard Form for Hardcopy Presentation of Downhole Well Log Data*, *August 1997 (reaffirmed 2012).*
3. *API RP 66: Recommended Practices for Exploration and Production Data Digital Log Interchange, Version 2.00, June 1996.*
4. *Oil and Gas Conservation Rules*, Alberta Regulation 151/71.