

Well Barrier Integrity Validation Reporting

Guideline

Document title	Well Barrier Integrity Validation Reporting
Contact details	Department of Mining and Energy
Approved by	Senior Executive Director, Energy Development
Date approved	11/12/2024
Document review	Biennially
TRM number	58-D24-46962

Version	Date	Author	Changes made
0	11 December 2024	Louis Gomasos	First version

Term	Meaning in this document
AHD	Australian Height Datum
ALARP	As Low as Reasonably Practicable
Code	Code of Practice: Onshore Petroleum Activities in the NT 2019
Decommissioned	Permanent abandonment of a well or a part of a well
DME	Department of Mining and Energy
Drilling Rig	The equipment used in connection with rotary or other drilling, including a workover or well service rig, but does not include a seismic shot hole drilling rig
Inactive well	A well that is not being actively used: <ul style="list-style-type: none"> a) to obtain data b) for the production of petroleum; or c) to maintain the production of petroleum.
Independent competent person	Has the meaning given by regulation 5(2) of the <i>Petroleum Regulations 2020</i>
MD	Measured Depth
Primary barrier	First set of well barrier elements that prevent flow from a source of inflow
Secondary barrier	Second set of well barrier elements that prevent flow from a source of inflow
Shut-in	A shut-in well is an inactive well with one or more valves closed to the direction of flow. Reinstatement of operation of the well is possible at any time by the operation of valves without the requirement for other forms of intervention, reconnection of equipment or control systems

Term	Meaning in this document
Suspended	A suspended well is an inactive well with one or more temporary objects placed in the well to act as part of a well barrier between a reservoir (or petroleum bearing zones) and aquifers (or the surface where aquifers are not present)
RT	Rotary Table
TVD	True Vertical Depth
Validation	Confirmation that the verification activities and the results of those activities are valid based on the requirements of the applicable, regulatory requirements, industry standards and best practices
Verification	Examination, testing, audit or review to confirm that the design, construction, and operation of an activity, product or service meets specified requirements
Well acceptance criteria (WAC)	Specified limits of acceptance used to verify the integrity of a well barrier element
WBIV report	Well Barrier Integrity Validation report
Well barrier	A system of one or several well barrier elements that contain fluids within a well to prevent uncontrolled flow of fluids within, into or out of the well
Well completion (upper)	Section of well that connects the lower completion to surface
Well completion (lower)	Section of the well situated below the production packer or where there is no production packer, the section of the well installed within or penetrates through the reservoir
Well barrier element (WBE)	A verifiable physical element that, in combination with other well barrier elements, form a well barrier
Workover	Intervention of a well with a service rig or coiled tubing unit to repair or replace downhole components such as the production tubing or production packer assembly, or install artificial lift systems

Contents

1. Introduction	5
2. Legislative requirement for a WBIV	5
3. Well integrity	5
3.1. Well Operations Management Plan (WOMP).....	6
3.2. Code/s of Practice	6
3.3. References.....	6
4. When a WBIV report needs to be submitted	7
4.1. New well	7
4.2. Existing wells.....	7
5. When a WBIV report is not required	8
6. WBIV report content	8
7. Well barrier diagram content	9
7.1. Header 9	
7.2. Well schematic.....	9
7.3. Stratigraphy.....	10
7.4. Verification of the well barrier elements.....	10
7.5. Primary and secondary barriers.....	10
7.6. Well integrity classification	10
7.7. Important integrity Information	10
7.8. Revision history	10
8. Independent and competent person	12
9. Publication on department’s website	12
10. Contact for further information	12

1. Introduction

A well barrier integrity validation (**WBIV**) report is a report that details information on a well's well integrity classification and data relating to integrity validation testing that has been carried out on the well. WBIV reports provide an independent verification of well barrier integrity as required by regulation [66AAR](#) of the *Petroleum Regulations 2020 (Regulations)*.

WBIV reports have two components; a report and a fully labelled well barrier diagram that shows the well (as constructed) relative to stratigraphic information. The well barrier diagram, or well schematic, is a publicly facing document that illustrates the current operational status of a well and the status of well barriers.

WBIV reports must be validated by an independent competent person to demonstrate and provide assurance that the processes undertaken to determine the integrity of the barrier are valid and the well barrier diagram is accurate.

A WBIV report must be provided when a petroleum interest holder (**interest holder**) completes a new well; or installs, replaces, modifies, removes or revalidates a sub-surface well barrier in a previously completed well; or acquires or receives evidence that a sub-surface well barrier has been degraded.

2. Legislative requirement for a WBIV

Regulation 66AAR of the Regulations establishes when a WBIV must be submitted to the Minister. A WBIV must:

- be in the approved form;
- include information set out in [Schedule 4H](#) of the Regulations;
- comply with any guidelines; and
- be accompanied by a well barrier diagram that contains relevant well and stratigraphic information.

This Guideline has been issued and published¹ by the Minister for Mining and Energy to inform the requirements relating to well barrier integrity validation reporting. It provides information about how to comply with the Regulations.

3. Well integrity

The NT has a comprehensive and integrated regulatory system governing onshore petroleum activities. This system aims to reduce any risk posed by these activities to as low as reasonably practicable (**ALARP**). Well integrity is one of the key objectives of the regulatory system. Interest holders have a legal obligation to ensure well integrity through a process that emphasises monitoring, maintenance and validation for the entire lifecycle of the well.

¹ Section 117C of the *Petroleum Act 1984* establishes that the Minister can issue and publish guidelines.

3.1. Well Operations Management Plan (WOMP)

[Section 60\(1\)](#) of the *Petroleum Act 1984 (Act)* establishes a Well Operations Management Plan (**WOMP**) as a plan, prepared by a permittee or licensee, that demonstrates to the Minister that well activities will be appropriately managed over the entire life cycle of the well, including in relation to drilling, well construction, operation, re-entry, modification, decommissioning and the post-decommissioning period, to ensure that the risks to the integrity of the well are reduced to ALARP. All wells in the NT must be operated in accordance with an approved WOMP.

WBIV reports must be updated whenever a well's barrier status changes. In this way, a WBIV provides a dynamic interaction with the relevant approved WOMP, showing what operational requirements in the WOMP have, or are being triggered to monitor, maintain and/or manage well integrity across each operational phase of a well's lifecycle.

3.2. Code/s of Practice

The Minister can only approve a WOMP when satisfied that the WOMP has been prepared in accordance with requirements of the Act, including any relevant approved Code of Practice. This direct relationship therefore also extends to a WBIV report. In summary all WBIVs, including the well barrier diagrams, should demonstrate how a particular well is compliant with relevant code or codes of practice.

At the time of writing, compliance with the [Code of Practice: Onshore petroleum activities in the Northern Territory](#), is required to ensure that all petroleum wells in the Northern Territory (**NT**) are constructed, operated, maintained and decommissioned to minimum acceptable standards resulting in long-term well integrity. Compliance requires:

- a) well integrity to be maintained at all times and for barriers to meet requirements of a Code of Practice;
- b) well integrity to be validated through a well integrity testing program;
- c) well barrier status to be known so that technical integrity risks are managed;
- d) that a well operating envelope is not exceeded; and
- e) materials and equipment installed in a well to maintain well integrity for each well's lifespan.

3.3. References

This guideline is subsidiary to the Act and Regulations. It makes reference to the following standards identified in the Code of Practice. For ease of reference and utilisation of this guideline the following documents are referred to in these guidelines in such a way that some or all of their content constitutes a requirement of this document. For dated references, only the edition cited applies. For updated references, the latest edition of the referenced document (including any amendments applies).

- [ISO 16530-1, Petroleum and natural gas industries – Well integrity – Part 1: Life cycle governance](#)
- [NORSOK D-010, Well integrity in drilling and well operations](#)
- [117 – Offshore Norge, Recommended guidelines for well integrity](#)

4. When a WBIV report needs to be submitted

Regulation [66AAR](#) of the Regulations determines when the requirement for a WBIV report applies. A WBIV report must be submitted to the Minister within 30 days of an interest holder:

- completing a new well (R66AAR(1)(a); or
- installing, replacing, modifying, removing or revalidating a sub-surface well barrier in a previously completed well (R66AAR(1)(b); or
- acquiring or receiving evidence that a sub-surface well barrier has been degraded (R66AAR(1)(c).

The Regulations establish the requirement for the submission of WBIV reports at multiple, pivotal times during a well's life cycle. In this way, sequential WBIV reports will effectively track the integrity of well over its life cycle phases enabling a complete revision history to be documented. Only the most recent (current) WBIV will be published on-line as an indicator of the well's current status.

4.1. New well

Well completion steps in a new well can involve removal of the drill string, running casing, cementing, perforating, hydraulically fracturing in the reservoir to stimulate production, expelling drilling and fracturing fluids, and installing the production valve. The sequencing of these completion steps and the duration between them will determine when a WBIV is required as follows:

A WBIV report must be submitted:

1. 30 days after the drilling rig is released; or
2. After rig release:
 - a. where the upper completion is run within 30 days of the drilling rig being released, then 30 days after the upper completion is installed; or
 - b. 30 days after hydraulic fracturing operations have ceased on the well; or
 - c. where the upper completion is run within 30 days of the cessation of hydraulic fracturing operations, then 30 days after the upper completion is installed; or
 - d. 30 days after a upper well completion is installed; or
 - e. where the well head and christmas tree are installed within 30 days of the upper well completion being installed, then 30 days after the wellhead and christmas tree being installed; or
 - f. 30 days after the wellhead and christmas tree being installed.

4.2. Existing wells

A WBIV report must be submitted 30 days after:

1. an intervention in the well where a well barrier is added, replaced, modified (including repair) or removed; or
2. a well barrier is de-rated; or
3. a well barrier fails and is not repaired within 30 days; or
4. re-validation of a WBE in accordance with a WOMP; or

5. a well has been suspended; or
6. a well has been decommissioned.

5. When a WBIV report is not required

For the removal of doubt, a WBIV report is not required when a well's operational status is revised as long as the well's barriers do not need to be revalidated, for example if a well's operational status changes from shut in to producing.

A WBIV report is not required after performing verification activities as part of regular maintenance activities where the criteria for submitting a WBIV report listed in section 4.2 are not met.

6. WBIV report content

A WBIV report must summarise all activities undertaken to verify the status of the barriers, which includes well acceptance criteria specified in the relevant approved WOMP. Contents of the report must include:

- Name of the well
- Permit or licence the well is located within
- Name of the interest holder(s) and, if different, the operator
- Coordinates of the well's surface location
- Date the well was first completed
- Well status i.e. shut-in, suspended, decommissioned or producing/injecting
- Integrity status of the well
- WOMP under which the well is regulated including document number, revision and date
- Document and revision number of the WBIV Report
- Document and revision number of the corresponding well schematic
- Name and signature of the independent competent person (see section 8)
- Date the WBIV report was signed by the independent competent person
- well barrier element description
- well acceptance criteria (WAC) met in accordance with the WOMP
- verification method
- documentation used to information verification process
- confirmation the verification is valid and the WAC has been met
- revision history including reason for the revision.

7. Well barrier diagram content

7.1. Header

- Name of the well
- Permit or licence the well is located within
- Name of the interest holder(s) and if different the operator
- Coordinates of the well surface location
- Date the well was first completed
- Depth reference e.g. AHD, RT etc.
- Well status i.e. shut-in, suspended, decommissioned or producing/injecting
- WOMP under which the well is regulated including document and revision number
- Document and revision number of the well schematic
- Document and revision number of the corresponding WBIV report.

7.2. Well schematic

A diagram of the well as constructed must be included in the WBIV report.

Where applicable, well schematics should correlate to schematics in the relevant approved WOMP. They should provide clear visual representation of how approved well barrier elements have been applied to maintain or achieve well integrity. The diagram must show details of:

- casing strings and primary cement sheaths deployed in the well including:
 - casing size, weight, grade and connection type
 - casing setting depth (TVD and MD)
 - top of cement in each annulus (TVD and MD)
 - ensure the formation in which the casing shoe is set is apparent.
- permanent and temporary barrier elements*, including:
 - type of barrier
 - depth to the top and bottom of a barrier (TVD and MD).

*except if specified for casing strings and primary cement sheaths.

- Temporary equipment installed in the well for a particular operation that are not a barrier e.g. kill or test strings.

Examples of the layout of well barrier schematics can be found in the following guideline and standards:

- [ISO 16530-1, Petroleum and natural gas industries – Well integrity – Part 1: Life cycle governance](#)
- [NORSOK D-010, Well integrity in drilling and well operations](#)
- [117 – Offshore Norge, Recommended guidelines for well integrity](#)

7.3. Stratigraphy

A stratigraphic column diagram extending from surface to total vertical depth of the well naming the different stratigraphic layers in the well, as well as showing the aquifers and hydrocarbon bearing zones present. The stratigraphic column should sit adjacent to the well diagram such that it can be distinguished which formation a casing shoe is set in.

The true vertical depth of the:

- top of the shallowest hydrocarbon bearing zone
- top and bottom of the aquifers identified in the well

Where a formation is a barrier element this should be identified in the diagram.

7.4. Verification of the well barrier elements

The well barrier diagram must include a verification table showing:

- the well barrier elements for the well identified in the relevant WOMP
- the well acceptance criteria for each barrier element as detailed in the WOMP
- the test parameters or results of each barrier element verification including the date of the verification
- where a formation forms part of a barrier include the measured formation strength.

7.5. Primary and secondary barriers

Primary and secondary barrier elements should be highlighted in both the barrier diagram and the verification table. Primary barrier elements should be designated with the colour blue and secondary barrier elements should be designated with the colour red.

7.6. Well integrity classification

The wells integrity classification should be based on the well integrity category system approved in the WOMP. In the absence of this, the well integrity category system in the standard, "117 – Offshore Norge recommended guidelines for Well Integrity" should be used.



7.7. Important integrity Information

The well barrier diagram must list important well integrity information that provides reasons for the well integrity classification e.g. presence of annular pressure, bond log interpretation.

7.8. Revision history

List the revision history of the well barrier diagram along with a summary of the reasons for the revision. Each revision should correspond to a WBIV report revision.

Figure 1: Example of a well barrier diagram format

<p>Logo</p> <p>Well barrier schematic</p>	<p>Well name Petroleum interest (EP, RL or L) Petroleum interest holder Operator Coordinates of well at surface Depth reference Date well first completed</p>	<p>WOMP identifier WOMP Revision No. Schematic identifier Schematic revision No. WBIV Report WBIV Report revision No. Date of independent verification</p>																					
<p>Diagram of well as constructed</p> <p>Stratigraphic column</p>	<p align="center">Operational/well status Include all options e.g. shut in, suspended</p>																						
<p align="center">Primary barrier elements (colour blue)</p>																							
<table border="1"> <thead> <tr> <th data-bbox="448 582 711 629">Well barrier element</th> <th colspan="2" data-bbox="715 582 1034 629">Verification</th> <th data-bbox="1037 582 1243 629">Monitoring</th> <th data-bbox="1246 582 1390 629"></th> </tr> <tr> <td></td> <th data-bbox="715 633 920 680">Test parameters</th> <th data-bbox="924 633 1034 680">Date</th> <td></td> <td></td> </tr> </thead> <tbody> <tr> <td></td> <td></td> <td></td> <td></td> <td align="center" data-bbox="1246 696 1390 743">●</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>	Well barrier element	Verification		Monitoring			Test parameters	Date							●								
Well barrier element	Verification		Monitoring																				
	Test parameters	Date																					
				●																			
<p align="center">Secondary barrier elements (colour red)</p>																							
<table border="1"> <thead> <tr> <th data-bbox="448 873 711 920">Well barrier element</th> <th colspan="2" data-bbox="715 873 1034 920">Verification</th> <th data-bbox="1037 873 1243 920">Monitoring</th> <th data-bbox="1246 873 1390 920"></th> </tr> <tr> <td></td> <th data-bbox="715 925 920 972">Test parameters</th> <th data-bbox="924 925 1034 972">Date</th> <td></td> <td></td> </tr> </thead> <tbody> <tr> <td></td> <td></td> <td></td> <td></td> <td align="center" data-bbox="1246 936 1390 983">●</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>	Well barrier element	Verification		Monitoring			Test parameters	Date							●								
Well barrier element	Verification		Monitoring																				
	Test parameters	Date																					
				●																			
<p>Well integrity classification</p> <p>*Based on well integrity category system in WOMP, or in the absence of this: use 117 – Offshore Norge recommended guidelines for Well Integrity” should be used e.g.</p> <p>Red: One barrier failure and the other is degraded, not verified, or leaking to surface Orange: One barrier failure and other is intact, or a single failure may lead to leak to surface. Yellow: One barrier degraded, other is intact Green: Healthy well – no or minor issue.</p>																							
<p>Important well integrity information</p> <p>e.g presence of annular pressure, bond log interpretation.</p> <p>Surface Casing Pressure = XXX psi Intermediate Casing Pressure = 439psi (I) = Internal, (E) = External A-annulus = 4.5", B-annulus = 7.625" x 4.5", C-annulus = 10.75" x 7.625"</p>																							
<p>Comments/ notes</p>																							
<p>Revision history:</p>																							
<table border="1"> <thead> <tr> <th data-bbox="448 1738 735 1785">Revision date</th> <th data-bbox="738 1738 1390 1785">Reason for revision</th> </tr> </thead> <tbody> <tr> <td></td> <td></td> </tr> <tr> <td></td> <td></td> </tr> </tbody> </table>	Revision date	Reason for revision																					
Revision date	Reason for revision																						

8. Independent and competent person

Regulation 66AAR (3)(e) requires evidence that the person signing the statement of validation meets the definition of an independent competent person in Regulation 3(1) of the Regulations.

The Regulations require that a person who verifies a WBIV to be *independent*, in that they are not employed or contracted by the interest holder and were not involved in the design, construction, operation or management of the subject well. They must also be *suitably qualified* as a result of training and experience.

Evidence could be in a form of a:

1. signed letter confirming they meet the requirements of section (a) of the definition; and
2. resume containing the relevant training and experience demonstrating they are suitably qualified in accordance with section (b) of the definition.

9. Publication on department's website

Pursuant to Regulation 66AAR(4), the Minister is required to publish the well barrier diagram provided under Regulation 66AAR(3). All well barrier diagrams will be published on the [POINT](#) website.

10. Contact for further information

For more information regarding this guideline, please contact the Energy Development Division's Petroleum Operations team by email: petroleum.operations@nt.gov.au.