



May 3, 2004

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## INFORMATIONAL NOTICE 04 – 02

### WELLS WITH CASING LEAKS

The following guidelines have been developed in consultation with the Casing Leak Subcommittee of the Joint Industry Government Drilling, Servicing and Production Operations Committee. The purpose of the Notice is to provide operators with clear guidelines for operating, repairing and abandoning wells with casing leaks. The Notice also provides guidelines for conducting annual annulus pressure tests on injection and disposal wells required under Section 50 of the Drilling and Production Regulation (“the regulation”).

#### 1. Casing Leak Prone Areas

A review of the Branch’s records indicates casing leaks have occurred in almost every field in the province. Figure 1 is a map showing areas of the province where companies have experienced a high incidence of casing leaks. A high incidence rate is currently defined as greater than a 10% rate of occurrence.

Casing leaks are normally associated with external corrosion from the water-bearing Upper Jurassic Melita Formation and Lower Cretaceous Swan River (Blairmore) and Ashville (Viking) formations in older wells not cemented above these zones. However, other factors including tubing landed high in the wellbore, high producing fluid levels and poor corrosion control programs have caused casing leaks.

#### 2. Reporting Casing Leaks

In accordance with Section 51 of the regulation the District Office is to be notified within 24 hours when a licensee determines or suspects a well has developed a casing leak. When a casing leak is reported the licensee must take the steps necessary to determine at what depth the casing leak has occurred. Knowledge of the top depth and extent of the leak will assist the licensee in evaluating options for the well. The licensee has 30 days after discovery of a casing leak to make application under Section 47 of the regulation to either repair the leak, isolate the leak and continue operating the well, or abandon the well.

Operators are encouraged to consult with the District Office to discuss their plans for a well that has developed a casing leak. The District Office can provide operators with comments on the various options that they are reviewing. This consultation should assist the operator with making a decision on the plan for the well.

### **3. Casing Repairs Options**

Operators are encouraged to investigate casing repair options when a casing leak is discovered. Casing repair options depend on the size and condition of the casing, the depth and extent of the leak, and the productivity of the well. Operators have used a number of different casing repair techniques in Manitoba with varying degrees of success. These include cement squeezing (typically more than one squeeze is required to achieve shut-off), running a casing liner or patch, polymer water shut-off jobs, and for holes in the casing above the surface casing shoe, removal and replacement of the casing. The Branch recognizes that economics will dictate whether an operator chooses to repair a casing leak or runs a packer to isolate the leak and returns the well to production. However, operators should factor into their economics the added repair and maintenance costs for tubing repair and replacement and other extra costs associated with operating a well with a casing leak.

The Marginal Well Major Workover Incentive Program provides for a Holiday Oil Volume (HOV) of 500 m<sup>3</sup> to be earned by a well where a major workover is completed. Casing repair qualifies as a major workover. A marginal well for the purposes of the incentive program is defined as a well producing less than 1 m<sup>3</sup>/d (average over the previous 12 months). Effective January 1, 2005, the production rate to qualify for a major workover involving casing repair will increase to 3 m<sup>3</sup>/day. The HOV earned by a major workover can be increased to a maximum of 750 m<sup>3</sup> using credits from an operator's HOV Account. In addition, production from a marginal well on which a major workover has been done is reclassified as third tier oil for royalty/ tax purposes. For more details on the incentive program refer to the Branch publication entitled Manitoba Petroleum Fiscal Regime available on our website [www.gov.mb.ca/itm/petroleum/](http://www.gov.mb.ca/itm/petroleum/).

### **4. Producing Wells with Casing Leaks**

The Branch will continue to allow operators to produce wells with casing leaks using a packer under the conditions outlined in this section. An application under clause 47(1)(h) of the regulation for approval to isolate a casing leak and continue operating the well must be accompanied by a plan for continued operation. The plan must minimize the possibility of a packer becoming stuck in the wellbore or other downhole problems affecting the licensee's ability to abandon the well in accordance with the requirements of Section 56 of the regulation. In addition, the plan must include a description of the downhole equipment, the packer setting depth, procedures to be followed when the packer is to be removed from the well, the proposed method of controlling corrosion in the wellbore, and a program for monitoring the condition of the casing.

The arrangement of downhole equipment in a well can reduce the probability of casing failure. Section 48 of the regulation requires that tubing be landed within 15 m of the completed interval. Tubing landed higher in the wellbore is a recognized cause of casing leaks. The Branch will be checking service tour reports to ensure that tubing is landed at the prescribed depth. If there are special circumstances that require tubing be landed higher than the prescribed depth; the operator should contact the District Office to discuss the special circumstances. Failure to land tubing at the prescribed depth will result in the issuance of a Notice of Non-Compliance.

Where a packer is used to isolate the producing formation, the packer must be set at a depth that will allow for proper abandonment of the well in the event the packer cannot be pulled out of the hole. Operators are to ensure that packers are set just above the base of the Upper (Evaporite Member) of the Amaranth Formation in wells with casing leaks. Table 1 shows the average depth of the base of the Upper (Evaporite Member) of the Amaranth Formation in each field in Manitoba.

Consideration should be given to the type and configuration of downhole equipment run in the well with a packer. Using a circulating device above the packer or a back-off sub will decrease the likelihood of the packer getting stuck in the hole as a result of formation sloughing through holes in the casing. The use of tail pipe below the packer is not recommended.

Operators are also required to develop procedures for removing downhole equipment from wells with casing leaks. The procedures should be designed to reduce the probability of the packer getting stuck in the hole. Procedures that have worked for operators in Manitoba include, after the packer is unset, circulating the well or lowering the packer before starting to pull tubing out of the hole, and avoiding pulling excess weight on the tubing. The tubing should be pressure tested using the downhole pump, as continued production with a tubing leak can exacerbate downhole problems caused by sloughing.

Further deterioration of the casing with continued operation of a well with a casing leak is a major concern of the Branch. Without repairing the casing there is little an operator can do to minimize external casing corrosion, however there are a number of methods to minimize internal casing corrosion. The Branch recommends that the packer be unset once a year and the wellbore circulated to a non-corrosive inhibited fluid. Other innovative techniques for the delivery of corrosion inhibitor with a packer in the hole should be examined. Checking the feed rate into the casing leak annually will assist in determining if the casing is deteriorating further.

For wells that develop a casing leak for the first time, the Branch will, in most cases, grant a one-year approval to isolate the leak and continue operating the well. Prior to the expiry of the approval the operator is expected to review the economics of repairing the casing and reapply to the Branch to repair the leak, continue operating the well with a packer, or abandon the well. The Branch has the discretion to extend the approval for continued operation of the well if the operator can demonstrate that it has complied with the plan for continued operation of the well approved by the Branch.

Starting in 2004 and extending over a two-year period, the Branch will be auditing the operations of wells currently producing with packers in the hole. The Branch expects operators to have developed a plan for continued operation of all wells with casing leaks that meet the requirements set out in this notice by the end of 2006.

## **5. Injection and Disposal Wells**

The annulus in all injection (WIW) & disposal (SWD) wells must be pressure tested annually to 3500 kPa before September 1 of each year. The Branch has identified cases in the past where the testing procedures were not adequate, the interpretations of the tests were difficult and submitted data displayed a wide range of pressure recording scales. To achieve an effective regulatory solution and ensure annulus isolation the Branch has developed guidelines listed in Appendix 1 to assist industry in the testing, recording and submitting of the annual annulus pressure tests for WIW and SWD wells. These guidelines do not deviate from past policy. Their purpose is to ensure consistency in testing and recording of test results.

If a WIW or SWD well fails an annulus pressure test the licensee must advise the District Office within 7 days of its plan to repair the well. When the well is repaired the licensee must fill the annulus with non-corrosive inhibited fluid, re-pressure test the annulus to 3500 kPa and submit the test results to the District Office. A Petroleum Inspector must witness all annulus pressure re-tests.

Where the operator of a WIW or SWD well that failed an annulus pressure test has determined to the satisfaction of the Branch that the casing leak is from old squeezed perforations within or directly above the injection or disposal zone and the pressure bleed-off is very slow, temporary approval to continue injection or disposal operations may be granted. The approval will be limited to a one-year period and the operator will be required to check the well daily, monitor the annulus pressure, and check the surface casing vent for flow. If the well is not on vacuum, the operator will be required to equip the casing with a high pressure switch that will shut down injection in the event of annulus pressure build-up. The high pressure shut down is to be tested monthly.

The approval may be renewed if the operator can demonstrate that the pressure bleed-off or feed rate has not increased substantially since the last annulus pressure test. If the feed rate is high enough to achieve a successful cement squeeze (40 l/min at 3500 kPa), the Branch may require the well be repaired.

## **6. Abandonment Requirements**

There are frequent problems abandoning wells with casing leaks. The Branch expects operators of wells with casing leaks to abandon the wells in accordance with the requirements of Section 56 of the regulations. Efforts must be made to recover any fish stuck in the hole more than 15 m above of the base of the Upper (Evaporite member) of the Amaranth Formation to ensure the bottom abandonment plug can effectively isolate the producing formation from the remainder of the wellbore. The placement of the bottom plug is important because damaged casing is often too risky to attempt to run in

with a packer to test the plug for shut-off. Where the bottom plug will not be tested for shut-off, the operator is to set a cement plug that extends across the completed interval to the top of the Jurassic. The cement plug is to be probed and if the top of the plug is below the required setting depth, an additional plug must be run.

The Branch has been involved with many different types of abandonments. The abandonment reports from these problem wells are available in our District offices for review in order to assist operators with planning for the abandonment of a well with a casing leak.

## **7. Enforcement**

The Branch will be increasing surveillance on wells with casing leaks. The Branch will also be escalating enforcement action on non-compliance matters that contribute to casing leaks such as tubing landed depths.

A well with a casing leak should not be shut-in for an extended period of time unless the well is properly suspended. Operators are to apply to the Branch for approval to suspend a well with a casing leak when the decision is made to shut-in the well, rather than waiting until the well has been shut-in for six months as required under Section 53 of the regulation.

Wells with casing leaks can be suspended with or without the downhole equipment being left in the hole. The Branch would prefer that the downhole equipment be pulled out of the hole after the well has been circulated to a non-corrosive inhibited fluid. In this case up to a three-year suspension approval will be granted. If the downhole equipment is left in the hole, the operator will be required to pressure test the tubing, unset the packer and circulate the well to a non-corrosive inhibited fluid and a one year suspension approval will be granted. At the expiry of the suspension approval the operator must make a decision to repair the casing, isolate the leak and return the well to production or abandon the well.

The Branch will issue a Notice of Abandonment under Section 123 of The Oil and Gas Act for a shut-in well with a casing leak that does not have a suspension approval or the suspension approval has expired.

If you have any questions regarding the information contained in this notice please contact Kathryn Gompf, Petroleum Engineer at (204) 945-8348 or the Virden or Waskada District Office at (204) 748-4260 and (204) 673-2472, respectively.



**John Fox**  
**A/Director, Petroleum Branch**

## **Appendix 1 - Annual Annulus WIW/SWD Pressure Test Guidelines**

- Wells subject to packer tests are to be pressure tested to a minimum 3500 kPa for a 15-minute period.
- The pressure tests are to be recorded on a 1-hour, 0-7000 kPa (0-1000 psi) scale chart and recorder.
- The pressure source is to be isolated (close valve) during the test measurement.
- All charts are to be submitted on a one-company per chart basis, with pressure lines clearly recorded (no vibration).
- Unacceptable pressure charts will require retest.
- Charts are to include well locations, test dates, company, and signature of the pressure truck operator.
- Section 51(1) requires notification of a possible casing leak within 24 hours of discovery.
- Annual pressure tests are to be conducted prior to September 1 of each year; test results are to be submitted to the appropriate District Office not later than September 15<sup>th</sup>.
- The submissions are to include the following:
  1. The original pressure chart.
  2. The pressure test results for each well (pass or fail).
  3. The licensee's acknowledgement that an application under Section 51(1) of the Regulations will be submitted within 30 days'.
  4. Unique situations such as pressure on the annulus (include pressure), excess fluid to fill annulus (include volume), etc.
- Wells with pressure on the annulus are to be bled to zero and let stand 24 hours. If the annulus pressure has remained at zero the test may proceed. This process is to be documented in the submission.
- The pressure variation (increase or decrease) must not exceed 5% over the fifteen minute duration of the test and the final pressure must be 3500 kPa or greater.

**Table 1 –Subsea Elevation - Base of the Upper (Evaporite Member)  
Of the Amaranth Formation**

<u>Field</u>	<u>Elevation Range (m)</u>
<b>Waskada</b>	<b>-357 to -447</b>
<b>Coulter</b>	<b>-468 to -493</b>
<b>Pierson</b>	<b>-433 to -536</b>
<b>Tilston</b>	<b>-378 to -427</b>
<b>Lulu Lake</b>	<b>-269 to -286</b>
<b>Mountainside</b>	<b>-249 to -310</b>
<b>Whitewater</b>	<b>-240 to -260</b>
<b>Regent</b>	<b>-230 to -250</b>
<b>Souris Hartney</b>	<b>-165 to -199</b>
<b>Virден</b>	<b>-103 to -199</b>
<b>Daly</b>	<b>-198 to -302</b>
<b>Kirkella</b>	<b>-150 to -196</b>
<b>Birdtail*</b>	<b>-4 to -8</b>

\* No wells with Lower Amaranth picks, set plug above the top of the Mississippian

† All elevation ranges based on contouring

**Figure 1 – Manitoba Areas with a High Incidence of Casing Leaks**

