

Western Petroleum Management's
Two-Stage Resin Applied as a
Permanent Plug in a Well

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CONFIDENTIAL

Contract No. 33700134

Date January 14, 2020

EXECUTIVE SUMMARY

Western Petroleum Management (WPM) has been developing two-stage resin blends and a unique downhole deployment tool to replace bail dumping of cement as a permanent abandonment plug in Oil & Gas wells under the name of RITE-WAY ABANDONMENT TECHNOLOGY (RITE-WAY). RITE-WAY is a division of WPM.

The purpose of the two-stage resin and the deployment tool are to reduce costs through improved operational efficiency, to improve long term well abandonment outcomes and to reduce the growing inventory of inactive wells.

Testing of RITE-WAY Two-Stage Resins Applied as a Permanent Plug in a cased Wellbore (The Project), was initiated for the following purposes:

- To provide an independent technical assessment of the two-stage resins for use as an abandonment plug in sweet gas wells so that the Alberta Energy Regulator (AER) may accept the use of the two-stage resin with minimal regulatory oversight.
- To conduct an assessment of potential toxicity risks to ground water when using the two-stage resin as described above.
- To conduct laboratory tests of the two-stage resins in a variety of setting conditions and varying temperatures considering the potential risks of the resins not setting or not adhering to different grades of steel casing.
- To conduct leak tests of the two-stage resin plug set in steel casing and determine its effectiveness as a permanent barrier in a wellbore.
- To conduct endurance (longevity) testing of the two-stage resins along with other wellbore materials in simulated corrosive formation brines under accelerated conditions.

After the project commenced, WPM requested additional assessment work on bail dumped cement. A simulated bail dump of cement in PVC casing containing water was conducted and this cement was compared to the two-stage resin using several metrics.

The two-stage resin blends generally consist of a base resin and additional components that function as setting activators, density control additives and additives to control the setting time under design temperatures.

The testing results and conclusions on the RITE-WAY two-stage resins are summarized as follows:

- The RITE-WAY resin blends can be used safely and are not a material risk to ground water when deployed as an abandonment plug contained inside of casing, provided all appropriate procedures are followed.
- Based on the InnoTech testing that was conducted, a two meter long RITE-WAY two stage resin plug may be used as an effective permanent wellbore abandonment plug in sweet gas wells, deviated up to ten degrees of inclination, provided all of the appropriate controls and the RITE-WAY SOP is followed.
- A 1.73 m length of two stage resin plug in 114 mm casing was successfully pressure tested to 14 MPa for over 20 hours while under a constant temperature.

- The resin blends had superior endurance to the simulated corrosive brines than cement or J55 steel. During the endurance testing there was no deterioration of the resin samples.
- The resin blends can be designed to set as planned in a temperature range of 7 to 70 °C.
- The resin blends have very high strength relative to bail dumped cement.
- The two stage resin has extremely low permeability relative to cement.
- The casing corrosion inhibitor used in the laboratory testing did not materially affect the setting of the two-stage blend.
- The thermal coefficient of expansion of the cured two-stage resin is greater than for steel casing.
- When applying the two-stage resin in field operations, the resins should not be subjected to a high pressure differential if the temperature of the cured resin has been cooled lower than the ambient wellbore and or formation temperature that existed when the resin was placed and cured.
- Based on the limited testing of bail dumped cement and the comparison to the two-stage resin, the two-stage resin is superior in strength and endurance to bail dumped cement as an abandonment plug in casing in sweet gas wells.
- The RITE-WAY Standard Operating Procedure (SOP) must be followed along with the SDS sheets and other safe handling procedures to limit potential risks. This includes application of the two-stage resins and all circumstances involving product use, handling, storage, transportation and disposal.
- Further assessment is recommended on the effectiveness of bail dumped cement when used as a wellbore barrier. A PTAC study¹ was released in September 2011 may provide guidance in this regard.

1. PTAC Downhole Well Abandonment Project Objective 1 & 2 Report:

<https://www.ptac.org/12479-2/>

Rite-Way Abandonment Technology innovative dump bailer:

<https://www.youtube.com/watch?v=5F6dk3fNi5s>