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**Subject: WPM/Riteway 2-Stage Resin Plug Pilot Program 2018 & 2019  
Feedback/Performance Report**

In 2018 and 2019, Torxen received AER approval to participate in the 2-Stage Resin Plug Pilot Program to evaluate new technology provided by Rite-Way Abandonment Technology. The 8 wells pilot program would evaluate an innovative dump bailer system that does not require a wireline or slick unit to deploy and would also use a 2m two stage resin cap on top of a modified bridge plug instead of an 8m cement cap on top of a regular bridge plug (modified bridges were used on 4 monitoring wells). Once the resin had set (5-7 days), a CCL/impression block was run to top of plug to confirm the 2 meter resin plug placement. A 7 mPa, 10 minutes stabilized pressure test (digital) performed. Torxen/WPM conducted 2 pressure tests during a 3 month monitoring period to confirm the resin plugs were holding.

Below is the summary/feedback for the 8 (4 monitored & 4 non-monitored) Torxen wells.

**BASIC WELL INFORMATION:**

Candidate wells criteria: Sweet gas vertical, 114.3mm casing, no history of SCVF or gas migration issues, good cement integrity with cement to surface.

- Monitoring Well: 100/11-06-018-16W4/00 (W0270564)
- Monitoring Well: 100/08-09-015-14W4/00 (W0235400)
- Monitoring Well: 100/15-18-019-15W4/00 (W0262077)
- Monitoring Well: 100/13-21-016-15W4/00 (W0247941)
- Non-monitoring Well: 100/07-16-021-13W4/00 (W0275463)
- Non-monitoring Well: 100/13-16-015-14W4/00 (W0270408)
- Non-monitoring Well: 100/16-30-015-15W4/00 (W0267707)
- Non-monitoring Well: 100/09-35-015-15W4/00 (W0291209)

**OPERATIONS SUMMARY**

All of the 8 wells resin plugs pressure tested and the AER was satisfied with the results.



## **MECHANICAL OPERATION**

The 2-stage resin system worked remarkably well – simple, fast, safe, and reliable.

The resin product and additives were delivered to the wellsite in premeasured plastic pails for simple, consistent, and exact mixing proportion/ratio required for proper plug setting.

Mixing was quick (~5 minutes), the mixture was poured into the assembled Rite-way bailer. The floatation device was attached to the bailer and then the bailer was dropped into the wellbore. Torxen's FLS timed the delivery system return to surface under 1.5 hours, consistent - no issues.

In 1 case, there was an early resin deployment issue:

100/16-30-015-15W4/00 - non-monitoring well

The 2mm glass disc shattered on the deployment tool before hitting the bridge plug, the resin deployed early (~200 meters), and the bailer floated to surface.

As per the AER's request; WPM ran a gauge ring and confirmed the depth and that resin plug was on top of the bridge plug. A second 2-stage resin plug was deployed with the Rite-Way dump bailer as per the AER's request. WPM Q&C process analyzed this issue and redesigned the glass disc on the deployment tool to solve future early resin deployment accidents. Torxen was satisfied how WPM's QC handled and resolved this issue/incident.

## **OPERATIONAL EFFICIENCIES**

The WPM worked with safe Standard Operating Practices. Their staff were very knowledgeable, safe, and efficient at deploying the 2-stage resin with Rite-way dump bailer. Efficiencies results:

- Completed 4 (possible up to 6) locations in 1 day utilizing the 2-stage resin/Rite-way bailer vs. 2 locations with the conventional wireline/cement dump bailer. Improved operations by ~50%.
- Elimination of carbon footprint - no extra Torxen FLS personnel/truck
- Minimal equipment – doesn't require wireline/slickline unit
- Easy to use for consistent volumes and plug setting requirements (resin& additives premeasured)

## **FINANCIAL SAVINGS**

The 2-stage resin bailer job costs under \$1,000/well, price decreases with more volume. The conventional 8 linear meters of cement jobs with wireline/slickline is approx. ~\$1,200, not that much of a cost difference but the other added cost savings below shows the resin bailer is more cost effective and efficient:

- Lower costs due to minimal equipment - doesn't require wireline/slick unit (~1,000 - 1,500/day)
- No extra personnel Torxen FLS daily costs (~1200/day) + travel km/time (~300/day) for deploying with the Rite-Way's dump bailer.

Torex can see financial savings and time efficiencies utilizing this new technology for upcoming abandonment projects where we can batch larger well counts in the ABC program.

## **2-STAGE RESIN ADVANTAGES**

Dump bailed class "G" cement is not a superior barrier for permanent zonal and wellbore abandonment as the slight shrinkage of cement during the setting process can allow gas to bypass a cement column. The 2-stage resin exceeds the qualities of dump cement:

- Uniform weighted plugs
- Zero permeability
- Physical properties: stronger compressive & tensile strength and shear bond than cement
- Plug longevity



## **LIMITATIONS**

Ambient temperature ~15 degrees – projects need to be executed in summer to fall for best results with the resin plugs.

## **GENERAL FEEDBACK**

Candidate well restrictions: Sweet gas vertical, 114.3mm casing, no history of SCVF or gas migration issues, good cement integrity with cement to surface. Torxen's well selection process for these criterias required complete well file reviews, DDS verifications for SCVF/GM history, and wells with known casing failure histories recorded in WellView were excluded. This is part of Torxen's standard process for abandonment program reviews. Cement integrity and SCVF/GM issues could be verified prior to abandonment but the casing failures/collar leaks encountered could only be identified and addressed during the abandonment execution.

Other well types inclusion that Torxen would like to apply this technology to:

- Oil and deeper wells
- Casing failures
- SCVF interventions
- Option of capping 2m resin plug on top of a long cement plug in casing integrity repairs

The non-routine application could be simplified/grouped/blanketed for operators to apply for in the ABC program.

## **CONCLUSIONS**

From the results of the pilot program, utilizing the 2-stage resin technology with the Rite-Way Dump Bailer is safe, more operationally efficient, and very cost effective for abandonment executions than the conventional wireline/slickline unit with cement bail system.

Please contact the undersigned if there are any questions or if you require any additional information.

Regards,

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