



For Internal Use Only

Multi-Chem Production Chemical Program

**PRODUCTION ENHANCEMENT PROFESSIONALS
GUIDE TO HELP PREDICT AND MITIGATE
POST-FRACTURING PRODUCTION CHALLENGES**

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MULTI-CHEM SERVICES

We seek to form a collaborative relationship with Production Enhancement professionals and customers, providing access to the following range of Multi-Chem service capabilities:

- » Risk assessment
- » Predicting potential issues and offering proactive solutions to the customer
- » Recommendations for mitigation strategies (temporary or permanent)
- » Monitoring programs for predicted risks, including:
 - Corrosion coupons
 - Chemical residuals
 - Oil emulsion testing
 - Bacteria
 - Water analyses (e.g. chlorides)
 - Production parameters
- » Local lab for timely analytical results
- » Customized monitoring and mitigation programs for expected completion designs

Multi-Chem Production Chemical Program

TO HELP MONITOR/MITIGATE POST-FRACTURING FLOW ASSURANCE AND ASSET INTEGRITY RISKS

This guide outlines the services and solutions that Multi-Chem provides to assist Production Enhancement professionals with understanding common post-fracturing production concerns.

Your customer has successfully completed their production enhancement treatment plan. Now, what's next? This is the ideal time to add more value and make recommendations for monitoring/mitigating flow assurance and asset integrity risks post-fracturing. That's where Halliburton's Multi-Chem product service line can help. Our production chemical program offers complete post-frac asset management. We use our technical expertise to identify potential production issues in advance and implement customized solutions to minimize their impact on the customer's ongoing operations.

Initial Production Challenges

During initial production, be aware of the following challenges to Multi-Chem mitigation strategies:

- » Downhole treating is difficult due to no tubing installed yet; however, flowlines may still benefit from treatments
- » Changing water chemistries and production parameters during flowback and initial production require diligent monitoring in order to ensure the correct solution is being delivered



Issues and Predictors

Certain issues are known to arise post-fracturing, and can lead to damaging effects. Table 1 is meant to assist with identifying these issues, their causes, potential consequences and available Multi-Chem solutions. Use it as a key to contact us for further guidance. To be more proactive in anticipating post-fracturing problems in a given oil or gas field/zone, consider the predictors of various affected parameters shown in Table 2.

Table 1: Flowback and initial production issues

Issue	Cause	Consequence	Solution
Increased downhole or wellhead pressure	Higher pressures that typically occur during initial production	Increased corrosion potential (CO ₂ and H ₂ S partial pressures)	Multi-Chem has an extensive line of corrosion inhibitor products, and can often provide local examples of success.
Higher gas/liquid volumes and velocities	Higher pressures from: <ul style="list-style-type: none"> » Initial production » Water/fluids flowing back 	<ul style="list-style-type: none"> » Increased chance of erosion-corrosion » Increased sand/solids production » Reduced oil separation time in surface equipment » Potential need for demulsifier-assisted phase separation 	Multi-Chem can monitor the system to diagnose these issues and make recommendations accordingly.
Higher wellhead temperature	Increased liquid production during initial production, resulting in a lower differential temperatures between the perforations and surface	<ul style="list-style-type: none"> » Future emulsion and paraffin issues* » Scaling tendencies <p><i>* Note: Higher initial temperatures during initial production may help minimize the formation of emulsion and paraffin deposits.</i></p>	Multi-Chem can monitor oil and water properties to determine if issues exist and recommend location-specific treatment options.
Brine chemistry changes	Presence of flowback fluids, which often affect produced brine composition and properties	<ul style="list-style-type: none"> » Scaling » Corrosion » Emulsions 	Multi-Chem can analyze the risks likely to be present during flowback and may recommend mitigation treatments.
Frac gel flowback	Unbroken/re-crosslinked gels from fracturing	Emulsions and solids carryover to interface pads in surface equipment	Multi-Chem can monitor oil and water quality and select products to mitigate these factors.

Table 2: Predictors

Predictor	Oil or Gas	Affected Parameters
Field history (typical issues in this field/zone)	Both	Corrosion, scaling, paraffin, asphaltenes, H ₂ S, bacteria, emulsions
Known or expected gas composition	Both	Levels of CO ₂ and H ₂ S in gas — can affect partial pressures; thus, affecting corrosion potential or need for H ₂ S scavenger
Known or expected oil properties	Oil (or condensate wells)	Paraffin, asphaltenes, emulsions — analyses can be conducted on the oil to predict paraffin appearance temperatures and help select products
Water analyses	Both	Scaling and corrosion — can be predicted from similar wells in the area
Frac gels in flowback water	Both	Emulsion pads in surface equipment; increased solids carried out of well

To discuss your customer's potential issues and risks, please contact a Multi-Chem representative in your area.

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