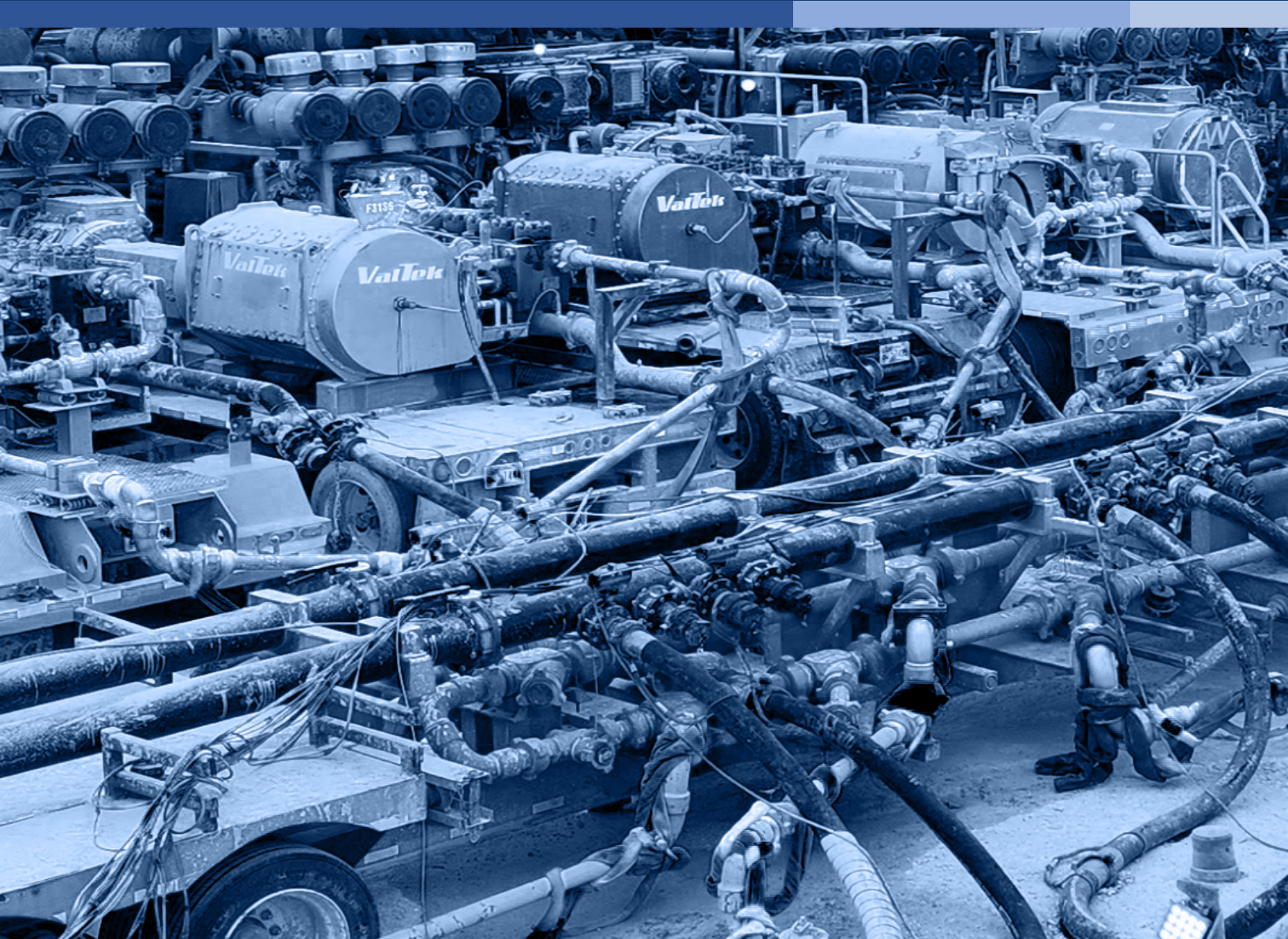




**IRON HORSE  
CHEMICALS**



# HYDRAULIC FRACTURING CATALOG

[www.ironhorsechemicals.com](http://www.ironhorsechemicals.com)



# COMPLETE FRACTURING SOLUTIONS

## IRON HORSE CHEMICALS ADVANTAGES

- ✓ LOGISTICS MANAGEMENT
- ✓ PRODUCT PERFORMANCE TESTING SUPPORT
- ✓ COMPETITIVE ECONOMICS
- ✓ ON-SITE MANAGEMENT



## HYDRAULIC FRACTURING PRODUCT LINE

Our hydraulic fracturing product offering is a complete series of chemistries to enable a variety of primary and re-frac operations.

The following fluid systems are supported:

- Slick Water
- HVFR Slick Water
- Cross Linked Gel Systems – High and Low pH
- CMPG Cross-link
- N<sub>2</sub> assisted slick water
- N<sub>2</sub>/ CO<sub>2</sub> binary foam generating systems
- Foam generated viscosified slick water systems

## RESEARCH AND DEVELOPMENT

Decades of experience are behind all our unique blends of chemistry. IHC is always enhancing our product line and can help our clients design formation specific treatments.

- Apply reservoir characteristics in fluid design
- Ensure fluid compatibility with reservoir and production systems
- Enhance water use and reduction possibilities
- Additional design of chemical packages that can help reduce equipment required

# CONTENTS

---

|                            |    |
|----------------------------|----|
| Polymer Line               | 5  |
| Cross Linked Fluid Systems | 6  |
| Phase Interaction          | 7  |
| Clay Management            | 8  |
| Scale & Iron Control       | 9  |
| Biocides                   | 10 |
| Breakers                   | 11 |
| Fracturing Diverter        | 12 |
| Paraffin Control           | 13 |
| Acids                      | 14 |
| Our Process                | 15 |
| Fluid Testing              | 16 |



# POLYMER PRODUCT LINE

The Iron Horse polymer chemistry product offering comprises of the following:

- Friction reducers, both liquid and dry add based for a variety of water chemistry and temperature conditions.
- High viscosity friction reducers (HVFR) in liquid/ dry and slurry compositions for a variety of water chemistry and temperature conditions. Developed with unique clay free suspension system
- Viscosity Enhancer – additive that can be added to Xanthan and Friction Reducers to increase 10-12 cPS

| Application                       | Range            | IHC Name   |
|-----------------------------------|------------------|------------|
| Fresh Water FR                    | >10,000          | FR-10      |
| Fresh Water High Viscosity        | >50,000          | FR-10 HV   |
| Fresh Water - Mid Brine           | >100,000         | FR-20      |
| Fresh - Mid High Viscosity        | 0 - 170,000      | FR-20 HV   |
| Mid Brine                         | 35,000 - 140,000 | FR-25      |
| High Brine                        | 50,000 - 180,000 | FR-30      |
| Fresh Water - Mid Brine           | 0 - 150,000      | FR-21      |
| Fresh Water - Mid Brine           | 0 - 120,000      | FR-22      |
| High Brine High Viscosity         | 50,000 - 230,000 | FR-30 HV   |
| Cationic Mid-High Brine Viscosity | 50,000 - 260,000 | FR - 31 CV |
| Cationic Mid-High Brine Viscosity | 75,000 - 250,000 | FR-32 CV   |
| Fresh Water - Mid Brine Viscosity | 0-150,000        | FR-101V    |
| Fresh Water - Mid Brine Viscosity | 0-150,000        | FR-102V    |
| Fresh Water                       | 0 - 30,000       | FR-103     |
| Fresh Water                       | 0-30,000         | FR-104     |
| Mid Brine                         | 50,000 - 120,000 | FR-201     |
| Mid Brine                         | 30,000 - 100,000 | FR-202     |

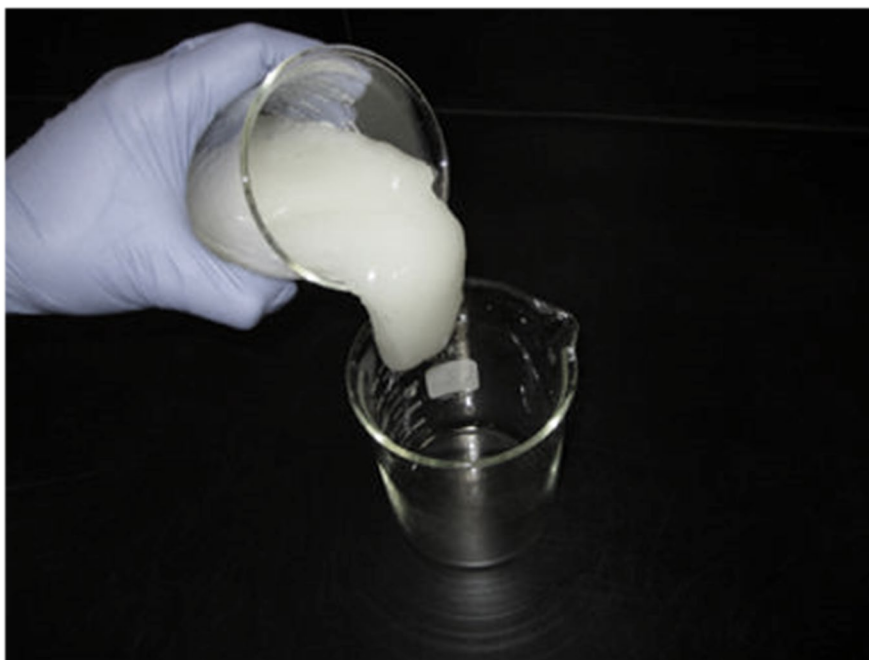


# CROSS LINKED FLUID SYSTEMS

---

The Iron Horse cross-linked fluid systems include options for:

- Borate Cross Link systems – low & high pH – instant or delayed options
- CMHPG Cross Link systems – low and high pH – instant or delayed options
- Titanium Cross Link Systems – Extreme heat





# PHASE INTERACTION

The IHC product offering to manage phase, liquid/liquid, liquid/rock surface interactions is very robust and includes the following categories:

- Non-Emulsifiers - for preventing hydrocarbon/ formation water/ frac water emulsions by surface tension and interfacial tension reduction.
- Flow Back Surfactants to aid in load water and gas/ hydrocarbon liquid recovery tailored to oil/ condensate liquids rich producing reservoirs.
- Flow Back Surfactants that are tailored to load water recovery in dry/ wet gas applications.
- Novel chemistry formulations developed to enhance and improve hydrocarbon production.
- Spear- head and pad breakdown chemistries for cold temperature and paraffinic reservoirs.

| <b>Application</b>           | <b>IHC Name</b> |
|------------------------------|-----------------|
| <b>Non-Emulsifier</b>        | <b>DM-150</b>   |
| <b>Non-Emulsifier</b>        | <b>DM-155</b>   |
| <b>Non-Emulsifier</b>        | <b>DM-160</b>   |
| <b>Non-Emulsifier</b>        | <b>DM-165</b>   |
| <b>Non-Emulsifier</b>        | <b>DM-170</b>   |
| <b>Flow Back Surfactant</b>  | <b>NK-50</b>    |
| <b>Flow Back Surfactant</b>  | <b>NK-75</b>    |
| <b>Flow Back Surfactant</b>  | <b>NK-100</b>   |
| <b>Flow Back Surfactant</b>  | <b>NK-200</b>   |
| <b>Flow Back Aid</b>         | <b>FA-50</b>    |
| <b>Spear Head Surfactant</b> | <b>DET-376</b>  |
| <b>Spear Head Surfactant</b> | <b>DET-377</b>  |
| <b>Spear Head Surfactant</b> | <b>DET-378</b>  |
| <b>Spear Head Surfactant</b> | <b>DET-381</b>  |



# CLAY MANAGEMENT

---

The IHC shale and clay chemistry product offering comprises of the following:

- Temporary and permanent control technologies
- Clay migration technologies – ICC-500
- Combination clay and iron control additives for enhanced flow back that eliminates the iron solids

Chemistry types include:

- Unique polymer/ bio based synthesized materials
- Surfactant based
- Amines, ether amines, imines

| Application         | IHC Name |
|---------------------|----------|
| Clay Control        | CC-10    |
| Clay Control        | CC-20    |
| Clay Control        | CC-30    |
| Clay Control        | CC-40    |
| Clay Control        | CC-50    |
| Clay Control        | CC-60    |
| Clay Control        | CC-70    |
| Clay / Iron Control | ICC-400  |
| Clay / Iron Control | ICC-405  |
| Clay / Iron Control | ICC-410  |





# SCALE AND IRON CONTROL

---

Mixing of incompatible formation and injected waters; changes in temperature and pressure over the producing well; corrosion and issues caused by injection of various chemicals can all contribute to mineral scale buildup in the reservoir, on tubing and equipment.

This results in slowing oil and gas flow and degrading equipment performance, negatively affecting a well's flow rate. Our scale management chemistry performs across a broad range of minerals and offers exceptional results for both topside and downhole scaling.

The Iron Horse Chemicals product offering includes:

- Chelation and sequestration technology
- Dispersant technology
- Threshold style inhibitors

For fracturing and re frac applications, IHC has unique solid formulations for proppant pack treatment

| Application      | IHC Name  |
|------------------|-----------|
| Scale Inhibition | SCALE 802 |
| Scale Inhibition | SCALE 803 |
| Scale Inhibition | SCALE 804 |
| Scale Inhibition | SCALE 814 |
| Scale Inhibition | SCALE 811 |
| Scale Inhibition | SCALE 812 |
| Scale Inhibition | SCALE 813 |
| Scale Inhibition | SCALE 791 |
| Scale Inhibition | SCALE 722 |
| Scale Inhibition | SCALE 784 |
| Scale Inhibition | SCALE 787 |



# BIOCIDES

---

Oilfield bacteria, which includes sulfate-reducing bacteria (SRB), acid-producing bacteria (APB), is found throughout the process from reservoir to sales. During a fracturing operation, unchecked bacteria can cause fouling and sour the formation.

To mitigate these damages, IHC can provide a broad range of registered biocides to handle the problem. Through pre-job planning and testing, we can provide an accurate treat rate to ensure an effective kill on the fluids that are being injected into the formation.

Listed below are the most common, but we have a larger catalog for different applications.

| <b>Application</b>              | <b>IHC Name</b> |
|---------------------------------|-----------------|
| <b>10% DDAC</b>                 | <b>DDQ10</b>    |
| <b>50% DDAC</b>                 | <b>DDQ-50</b>   |
| <b>20% DBNPA</b>                | <b>DB-20</b>    |
| <b>5% Glut 10% Mixed Quats</b>  | <b>BIO-510</b>  |
| <b>12% Glut 3% Mixed Quats</b>  | <b>BIO-1203</b> |
| <b>25% Glut 12% Mixed Quats</b> | <b>BIO-2512</b> |



# BREAKERS

---

Once the proppant is placed in the formation, the viscosity of the fracturing fluid must be 'broken' to flow back to surface during operations. This process ensures that the proppant stays in the formation and the maximum amount of fluid is returned out of the well.

Breakers are used to lower fluid viscosity by 'breaking' the cross-linked fluid or polymers in the fluid system.

Our product line includes:

- Encapsulated
- Non-Encapsulated
- Liquid Breakers
- Powder Breakers
- Enzymes



# FRACTURING DIVERTER

---

Our patent pending PLA diverter for far field diversion applied during fracture stimulations includes a particle blend that bridges at the fracture tip and provides fracture geometry control.

Far Field Diverter minimizes communication to offset wells (parent / child relationship) and fracturing into undesirable (depleted) zones. The Far Field diverter also creates a more complex fracture network, resulting in more stimulated rock and drainage.

Our Far Field diverter is biodegradable and hydrolyzes based upon reservoir temperature, pressure, and water to a clear, non-hazardous liquid.

- PLA – Polylactic acid
- Our liquid suspension package allows for ease of pumping on demand
- Blend of patent pending particle sizes that bridge at the fracture tip
- Minimizes risk of communicating to offset wells (parent/child relationship)
- Minimizes risk of fracturing into undesirable zones; depleted zones
- Degrades by BHST without leaving residue
- Creates complex fracturing network for enhanced drainage



# PARAFFIN CONTROL

---

Changes in temperature and pressure over the producing well; can contribute to paraffin buildup in the reservoir, on tubing and equipment. This can result in slowing oil and gas flow and degrading equipment performance, negatively affecting a well's flow rate.

Our paraffin chemistry is custom designed to the formation being fractured and works across a broad range of hydrocarbons. Utilizing the right chemistry offers exceptional results for both topside and downhole challenges.

The Iron Horse Chemicals product offering includes:

- Solvents
- Dispersants
- Inhibitors

For fracturing and re frac applications, IHC has unique solid formulations for proppant pack treatment



# ACIDS

---

Understanding the type of formation being acidized and details of its composition (mineralogy) is critical to achieving positive results. Downhole temperature, pressure, production type and the acquisition of field samples will enhance the success of a program.

**Hydrochloric Acid (HCl):** This is a highly corrosive and strong acid used in well stimulation and various acidizing processes. It is commonly used to dissolve mineral deposits and stimulate reservoirs by creating or enlarging fractures, thereby improving hydrocarbon flow. Available in any blend up to 36% concentrate.

**Hydrofluoric Acid (HF):** An aqueous solution of hydrogen fluoride

**Organic Acids:** Formic, acetic, and citric acid are other acids commonly employed in acidizing treatments. They are less corrosive than HCl but still effective in dissolving carbonate formations and enhancing production rates.

**SYN / Green Acid:** A safer alternative to HCL and organic acids.

- pH zero
- Non-corrosive
- Non-skin, non-eye irritant, non-fuming
- Not D.O.T. regulated
- No special requirements for disposal

|                          |   |
|--------------------------|---|
| <b>Acetic Acid</b>       | Acetic acid solutions   |
| <b>Citric Acid</b>       | Citric acid (solid and solutions) Formic acid solutions<br>Hydrochloric acid solutions                        |
| <b>Formic Acid</b>       | Safer acid alternative to traditional strong acids, various options are available depending on the acid to be |
| <b>Hydrochloric Acid</b> | replaced and the strength of the acid   |
| <b>SYN ACID</b>          | Acetic acid solutions   |



# OUR PROCESS

---

Primary Frac Fluid Design includes testing every chemistry and modifying the fracturing package to enhance well performance.

## Physical Samples

- Crude Oil or Condensate (Chemical free) 5 gallons
- Formation water (Chemical free) 5 gallons
- Frac Water ( Base fluid for fracing) 5 gallons– 100 gallons – more required dependent upon flow loop testing
- Formation cuttings (not washed) 1 -5 lbs. total is ideal (heel, middle, toe 1-2 lbs. each)

## Data and Information

- Frac Design
- Geology reports (Porosity, Permeability, etc.)
- Formation Type Description
- Water Analyses (Frac Fluid, Produced Water)
- Hydrocarbon Analyses (Oil, Condensates, Gas)
- Testing (Core/Compatibilities etc.)



# FLUID TESTING

---

General testing conducted to select the chemistry includes:

- Low and high shear demulse studies
- Flow loop testing
- Surfactant Testing
- Flow Back Testing
- Bacterial Testing
- Breaker Testing
- Viscosity Testing
- Water analysis and compatibilities for scale control
- XRD of bulk and clay fractions for clay/shale management
- CST/ roller oven for clay/ shale management
- IFT – oil flow/mobility
- Compatibilities of entire fluid system to ensure all additives combined are compatible with one another





**IRON HORSE  
CHEMICALS**