



### \_CHALLENGE

Treating late-stage waters from Northeast Pennsylvania for reuse in hydraulic fracturing can be a difficult proposition. In addition to containing some of the highest TDS content in the Marcellus region, this water also features high levels of cationic scaling agents including calcium, barium and strontium. Reducing these scaling agents to acceptable levels is critical to ensuring the performance and life of future wells as well as lowering chemical makeup costs.

Cost-effectively reducing scaling agents required a carefully designed, optimized process. CRS approached this design need knowing that success would be measured by the following criteria:

- Zero liquid discharge
- Minimize the chemical treatment cost
- Maximize the yield of reuseable water from the process
- Minimize the amount of waste that is produced from the process
- Minimize the capital costs of the equipment

### \_SOLUTION

CRS leveraged 30 years of industrial fluid reprocessing experience to develop an innovative solution to meet the demanding customer specifications for water reuse. For this customer, the specification was to reduce both the barium and calcium to < 1000mg/L, at a competitive price over existing options. The process was tested at the following levels of calcium, barium and strontium for the incoming feed water conditions:

#### **RANGE TESTED (mg/l)**

CONTAMINANT	MINIMUM	MAXIMUM
Calcium (Ca <sub>2+</sub> )	9,770	13,800
Barium (Ba <sub>2+</sub> )	9,230	10,800
Strontium (Sr <sub>2+</sub> )	3,220	4,280
TDS	157,000	172,000

The CRS process reduced the scaling agents by using a combination of filtration, precipitation, clarification, flocculation and waste compression; the solution was scaled to handle tanker-truck deliveries of late-stage, produced water. Adequate storage and handling of the incoming water and additives, as well as the finished product and waste, were key design concerns. The application of on-site laboratory equipment also played an essential role in developing a detailed profile of the incoming water conditions. On-site analysis helped direct proper and cost-effective treatment, as well as compliance to customer specifications and waste by-products.

**CORPORATE HEADQUARTERS**

CRS Reprocessing Services\*  
One Triton Office Park  
13551 Triton Park Blvd.,  
Suite 1200  
Louisville, KY 40223  
Main: +1.502.778.3600  
Fax: +1.502.778.3606

**LEWISBERRY OPERATIONS**

CRS Reprocessing Services\*  
569 Industrial Drive  
Lewisberry, PA 17339  
Main: +1.717.938.1938  
Fax: +1.717.938.2151

**EUROPEAN HEADQUARTERS**

CRS Reprocessing Germany\*  
GmbH & Co. KG  
Zaucheblick 24 a  
04288 Leipzig, Germany  
Main: +49 34297 1408-0  
Fax: +49 34297 1408-10

**CRS CHINA**

Level 29 Shanghai Kerry Centre  
No. 1515 Nanjing West Road  
Jing An, Shanghai China 200040  
Main: +86 021 6103 7585  
Fax: +86 021 6103 7171

**RESULTS**

Production runs indicated significant reductions in the scaling agents in this highly contaminated late-stage water, exceeding the customer’s specification. In addition, the waste compression was exceptional, resulting in 80% solids compression.

**PRODUCT (mg/l)**

WATER QUALITY PROPERTIES	AS RECEIVED	*AFTER PROCESSING
TDS	171,000	82,800
Hardness	31,500	2,830

ELEMENTAL PROPERTIES	AS RECEIVED	*AFTER PROCESSING
Barium Total	10,500	458
Calcium Total	10,500	376
Strontium Total	3,460	285

*Actual data from a production run in the Northeast Marcellus region.*

*\*CRS can customize this process to the customer’s unique water specifications. For this case study, the levels after processing exceeded the customer’s spec.*

CRS’ Optimized Reprocessing Management (ORM) has resulted in meeting the goal of zero liquid discharge and the specifications for reprocessed water to make it available for reuse:

- Exceeded the customer spec for reusable water suitable for hydraulic fracturing of another gas well
- Met the customer’s stated price targets for processing
- Significant reduction in the scaling agents; results have improved by over 90% in some cases
- Substantial reduction in the solid waste load for landfills, and resulting waste cost
- Reduction in freshwater required via reuse of reprocessed water
- Improved quality of waste for hauling
- Reduction of transportation cost
- Reduction in chemical makeup costs
- Tight compliance via on-site lab

CRS can modify the design of the process to meet the most stringent requirements including the recent Pennsylvania DEP changes.



\* QUALITY MANAGEMENT SYSTEM  
CERTIFIED BY DNV  
ISO 9001:2008