Increase your throughput by 5%
with a 20% reduction in cost
without any new capital expenditures.

You will benefit from Novum's Amine Process if you experience:

- corrosion
- stoppages or repairs due to corrosion
- degradation of amine solvents
- oxygen (O_2) contamination
- chemical losses
- foaming

Novum solves the problem of corrosion in hydrocarbon systems. Our new chemical solution fundamentally changes the cost structure and throughput potential of midstream assets.

It takes miles of steel on the ground with continual re-engineering and tweaking of the chemical processes to make oil and gas supplies available to the consumer. Major oil and gas companies rely on major chemical companies to solve the colossal problems of tiny corrosive elements eating away their infrastructure. Each solution seems to cause another problem, which then requires a supplemental solution. The chemical industry's "solution of the month" is, in large part, compounding the basic problems of transmission and processing contaminated oil and gas. This is not a simple business—but there is a simple solution.

SUCCESS STORY

A few years ago, a gas processing plant in Texas was struggling to maintain operations in this manner. Operators, engineers, consultants, and the big chemical companies had given their best shot at solutions, yet the plant was still plagued with shutdowns, adverse incidents, and low, interrupted throughput.

In desperation, the plant allowed a predecessor of Novum's product to be used in the plant to eliminate foaming. Expectations were minimal—but the results were surprising. Over a 12-month period, the number of incidents and shutdowns decreased from an average of 40 per month to an average of 3 per month. During that same period, the corrosion level of the plant decreased significantly. When this product replaced Dow Chemical's product as the sole amine solvent in the plant, there was an even greater decrease in the number of incidents, shutdowns, and the level of corrosion.

THE PLANT TRANSFORMED FROM BEING READY TO BE SHUT DOWN, TO MAKING A PROFIT.

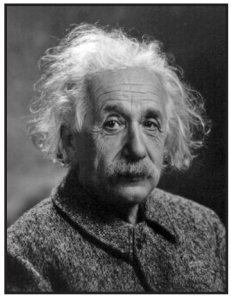
RESULTS

These results got everyone's attention—the product turned out to be a whole lot more than an "anti-foaming" agent. It was obvious to the plant managers that this amine solvent was working. But Novum's predecessor, who supplied the solvent, didn't really know why. The product was not fully developed and was not consistent in its performance. After an extended period of excellent results from the product, the consistency of the product's performance began to degrade and the beneficial effects were reduced. This was due in part from a failure to fully develop the chemistry associated with the product. When the company removed their product from the plant to reassess, the plant reverted back to its previous poor performance.

The results had been startling. The Early Product had:

- optimized an amine treating facility to operate at 98+% "online time."
- achieved a 100% product specification.
- reduced the loss of solvents by 44%.
- reduced filtration cost by 80%.
- eliminated foaming.
- increased solvent life.
- reduced corrosion rates.
- eliminated HHS (Heat Stable Salts) problems.
- lowered energy operating cost by 36%.

It is a great thing to get dramatic positive results for almost a year, but quite another to understand why, and to keep the results consistent without the product's effects diminishing over time. The company needed someone who could bring understanding to the complex chemical relationships at work.



“We can’t solve problems by using the same kind of thinking we used when we created them.”

Albert Einstein

Novum turned to Dr. Marvin Johnson, recipient of the National Medal of Technology (The National Medal of Technology is the highest honor given to any scientist in the U.S.) and creator of over 250 patents, several of which have brought prolific benefits to the petroleum and chemical industries. Half of the gasoline processed in North America uses Johnson's patented methods. Dr. Johnson accepted Novum's challenge to solve the mystery of what caused these dramatic results.

After several years of development and testing, Dr. Johnson developed a completely new, perfected product based on a full understanding of the chemistry involved. This new product has none of the consistency and degradation problems experienced in the early product. Novum Energy Technology is now ready to bring its technology back into the gas-processing environment. Novum understands that independent third party testing is necessary to introduce this product to the industry as a whole. Novum is ready to offer the benefits of their patent pending methods to an oil and gas processing "partner."

Dr. Marvin Johnson receiving the National Medal of Technology from President Ronald Reagan

The potential benefits are enormous. There is very little risk in testing this process. Still, a gas processing company will ask itself: 1) do we need it? 2) is it going to work? and, 3) how much effort is it going to take to implement?

DO WE NEED IT?

Oil and gas midstream companies have millions and even billions of dollars invested in plants, transmission lines, equipment, and other technology, which pay handsomely when working properly. Oil and gas contain high levels of corrosive substances that continually cause havoc with lines, vessels and equipment. A 1999 report mandated by Congress estimated the cost of corrosion in the sub-sector for liquid and natural gas transmission pipelines alone to be approximately $8.6 billion per year. The situation has only gotten worse in subsequent years. Most plant and equipment failure is due to corrosion.

While some plants operate and flow with consistent, predictable throughput, others are beset with problems and interruptions to the regular flow of oil and gas. In the hierarchy of problems, corrosion is king.

There is a multi-billion dollar industry built up just to address the adverse effects of corrosion in oil and gas processing. “Solutions” require countermeasures, retooling, filtration, heat control, equipment, and more equipment. No one would say corrosion is a simple problem, nor say that there may be a single, simple solution. But the very companies addressing these problems are those most attached to the existence of continuing problems.

Unfortunately, the current approach to the corrosion problem is to treat the effects of corrosion rather than prevent corrosion in the first place.

Without taking corrective measures, even the “problem free” plants will fall to corrosion’s harmful effects.

The chemical industry provides a whole shelf of “solutions.” There is a solution for absorption, another to help with circulation, still more to deal with saturation, anti-foaming agents, and on and on. It is complicated. When something goes wrong, the “experts” pull something else off the shelf to solve the problem. Complication works well for them. What they want is to have derivatives of the problem. The more derivatives they have, the more they can throw at it, and the more they sell. Try this, try that.

The key is not just to treat corrosion and the accompanying treatment side effects, but to chemically prevent corrosion. Novum Energy Technology has developed a chemical process to prevent corrosion in midstream assets. Field tests showed that Novum’s new product did not allow an iron redox reaction to take place, eliminating the corrosion problem.

Novum’s technology doesn’t treat corrosion — it prevents it.

Whether the Novum technology is a breakthrough remains to be proven, by independent third party verification. For this purpose Novum is seeking a “partner” company willing to engage in a small scale test on a slip-stream of gas. This test would not interrupt the plant’s current operations, but would provide the means to demonstrate realizable benefits first hand. Even a 2-3 percent increase in throughput, with a decrease in interruptions, would be significant. Preliminary field tests showed much more dramatic results, and chemical science has since supported these results.

The gas processing “partner” company will potentially benefit from lower costs and more reliable output. The level of risk is low and completely manageable. In addition, the testing company will receive a license and discount on future use of the product.

WILL IT WORK?

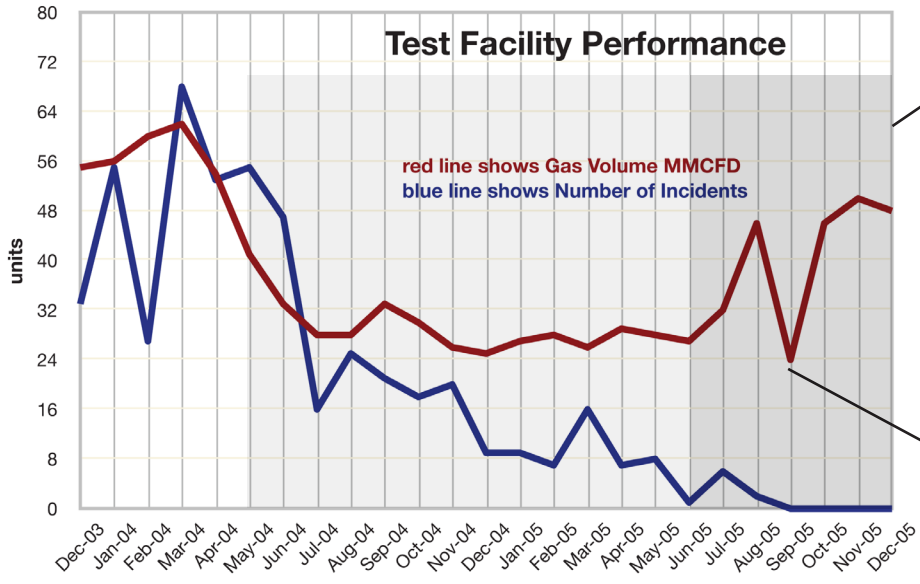
To determine if this process will work, consider two factors: 1) has it worked before and, 2) who is responsible for the science. The early field tests were dramatic. What began as a “pleasant surprise” has led to a distillation of scientific principles at fundamental levels, due to the knowledge and expertise of renowned scientist, Dr. Marvin Johnson.

THE EARLY FIELD TEST

In the spring of 2004, a partially developed predecessor of Novum’s formulated solvent (the “Early Product”) was applied to a Natural Gas Liquids (NGL) extraction processing facility in Texas (the “Test Facility”) for the purpose of eliminating severe foaming. The Test Facility was experiencing significant operational and mechanical problems caused by high levels of acid gases and contaminated amines which were causing extreme foaming and severe corrosion. The Test Facility’s incidents and shutdowns were very high and gas throughput was a fraction of the plant’s capacity.

From May 2004 to June 2005, the Early Product was used exclusively in the plant as an anti-foaming agent along with a high performance amine solvent provided by Dow Chemical to treat the acidic gas. Almost immediately after the Early Product was introduced, the gas processing at the Test Facility experienced a sharp turnaround. Over the 12 months in which the Early Product was used, the number of incidents and shutdowns decreased from an average of 40 per month to an average of 3 per month. During that same period, the corrosion level of the plant decreased significantly. In July 2005, the Early Product replaced Dow Chemical’s UCARSOL products as the sole amine solvent in the plant. After this replacement, the Test Facility experienced an even greater decrease in the number of incidents, shutdowns and overall level of corrosion.

From July 2005 to January, 2006, the Early Product was the primary gas treating solvent in the plant. But the Early Product was a sort of “black box” because it was not clear how or why it worked. For a variety of reasons, the Early Product was removed from the plant in January 2006. Shortly after its removal, the Test Facility reverted back to its previous lower levels of throughput, increased corrosion and higher level of incidents and non-scheduled shutdowns. The following chart illustrates the performance of the plant before and after introduction of the Early Product:



The lighter gray shaded area on graph shows the time frame for the stages of implementation of the Early Product. (May 2004 to June 2005) The darker gray shaded area shows when the Early Product was the sole amine solvent in the plant. (July to December 2005)

The August 2005 drop in gas volume was due to a previously scheduled maintenance shutdown.

A thorough summary of the field test results can be illustrated by comparing the “Before” and “After” averages from the Test Facility shown here.

The field test verifies the efficacy of our corrosion inhibiting technology in an operating gas processing facility. The Early Product demonstrated that it was superior to Dow Chemical’s UCARSOL products, which are currently considered to be the state of the art products in treating acid gases in Amine gas processing systems.

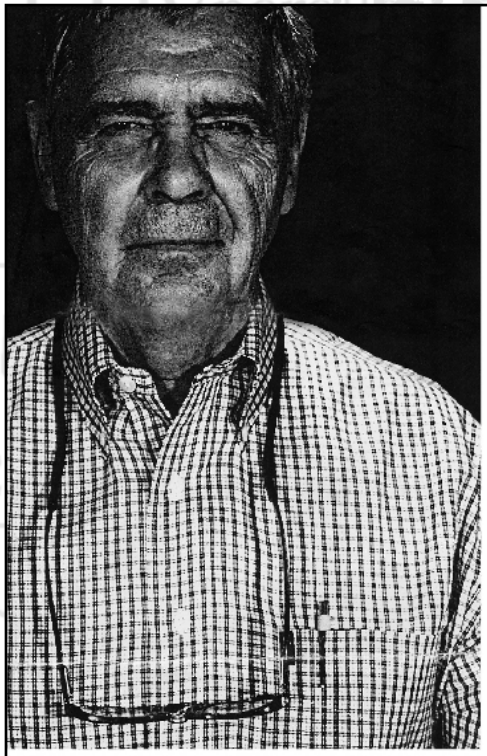
Summary of the Early Field Test results

Before:

- Facility operated at 30 mmcfd (35% capacity) average
- Incidents averaged 40 per month
- Significant mechanical & chemical problems - hydrocarbon absorption, foaming, carryover, pressure differential across the contractor, amine losses due to inadequate $C0_2$ removal
- Frequent charcoal filter changes, increased circulation rates & venting & draining of reflux accumulator
- High solvent failure, excessive corrosion & increased energy consumption

After:

- Increased gas volume to 49 mmcfd (55% capacity) average
- Incidents averaged 3 per month
- Foaming was eliminated
- Reflux gas showed slight to no carryover
- Hydrocarbon saturation was nonexistent (no carbon filtering)
- No HSS creation
- No corrosion
- Significantly eliminated additives
- Significantly increased online time
- Reflux water clear and odor free
- Acid gases were hydrocarbon & amine free (99.358%)



Mr. Patent

Marvin Johnson can't seem to stop innovating. The plainspoken scientist from Phillips Petroleum has 212 patents to his name. Here are the surprising secrets of his creative success. Better copy quickly, before he patents these too. **BY ALISON OVERHOLT**

Marvin Johnson has a distinct twinkle in his blue eyes when he admits, "I really don't remember my first patent. Does that sound funny to you?"

It might sound funny, if Johnson were anyone else. For most researchers and engineers, being granted a patent is on par with winning an Olympic medal: It is a career-defining achievement. But Johnson, a 74-year-old research fellow with Phillips Petroleum, stopped keeping track of his patents a long time ago. That's because he has 212 of them to his name, with at least 8 more on the way.

Do the math: a 46-year career and 220 patents either issued or pending. That's more than one patent every three months for more than four decades. How does Johnson evaluate his remarkable performance? He starts with a wisecrack: "It's the same in patents as it is in having a baby. Conception is the best part of it."

Then he gets serious. "What's really important is finding solutions to problems. If you find a unique solution, then you have a patent," he explains.

Johnson's straightforward approach to innovation is at odds with much new-wave thinking about where great ideas come from. Innovators break the rules, right? Johnson is about as loyal a company man as you'll find. Today, he works part-time in order to accommodate the occasional urge to go off and explore other projects, but for the most part, he can be found right where he's always been -- at the company research lab in Bartlesville, Oklahoma. This is a place that will never be confused with Silicon Valley or Madison Avenue. There are no splashes of multicolored paint on these walls, no scooters waiting to provide "inspiration" to free-spirited thinkers.

PHOTOGRAPHS By BRENT HUMPHREYS

Article in Fast Company Magazine
May 31, 2002

THE INVENTOR

Marvin M. Johnson, Ph.D., P.E. Dr. Johnson is a Senior Fellow Emeritus of Phillips Petroleum Company, a member of the National Academy of Engineering, a recipient of the National Medal of Technology which was presented by President Ronald Reagan, winner of the IRI Achievement Award, American Society of Corporate Investors' Distinguished Inventor Award; the American Chemical Society of Oklahoma Chemist Award; the American Chemical Society Southwest Region Award for Chemical Research; the Oklahoma Bar Association Inventor of the Year Award, the IR 100 Award of PROP oil recycling along with Drs. Norwack and Tabler, and twice awarded with the Outstanding Engineer of the Year Award. He was inducted into the Oklahoma State University Engineering Hall of Fame and given the "Hero" award by the American Chemical Society.

During Dr. Johnson's 46 years with Phillips Petroleum Company he developed many significant catalysts and processes in use by ConocoPhillips and the industry today. He has been the inventor of over 250 U.S. patents, with over half of them related to hydrogenation processes and catalysts. Dr. Johnson's area of expertise includes kinetics and catalysis, reactor design and refining processes and products. Half the gasoline used in the U.S. comes from a process discovered by Dr. Johnson, which allows refineries to squeeze more gallons of gasoline out of each barrel of oil.

Education: Oklahoma State University (Adjunct Professor of Chemical Engineering), University of Utah (Ph.D. and B.S.)

This is the genius behind Novum's corrosion prevention technology.

POST FIELD TEST DEVELOPMENT

The Early Product was removed from the Test Facility in order to protect the technology from competitors and to allow a thorough examination and further refinement of the chemistry. Since January 2006, Novum has been analyzing the field test and developing and refining the corrosion inhibitor. Novum has now designed a superior product, which we have proven through additional testing. Novum has evidence supporting the validity of the chemistry of the current corrosion inhibitor. Additionally, Novum has filed for two patent applications to protect this technology.

Novum's formulated solvent has been verified through field use to increase throughputs at minimal expense with no additional capital cost. It reduces the operational and maintenance costs associated with corrosion and shutdowns. The impact is immediate and it's environmentally friendly.

HOW IT WORKS

Novum's formulated solvent mitigates corrosion and associated problems in three ways:

1. It forms a complex with ferrous and ferric ions that reduces the rate of iron redox reaction that forms corrosive anions.
2. It forms a protective coating on the surface of the iron vessel and piping.
3. It provides a wetting agent for elemental sulfur and metal sulfides and minimizes the formation of foam. The protective coating is significant as it prevents iron from entering the system.

PROPOSAL FOR A TESTING PARTNER

Novum has moved the intellectual property to "proof of concept" and has filed patent applications on its technology. The Company is currently soliciting the participation of a strategic partner to assist them in commercializing this technology. This partner would perform a successful commercial demonstration of the technologies so that it can be sold or licensed to the midstream energy or chemical industry.

Novum believes the whole midstream energy segment may benefit from these discoveries, but the initial testing "partner" will have a unique opportunity to pioneer new methods while experiencing a dramatic increase in its own productivity. Novum is looking for a company that is battling corrosion and its associated problems. The results would be monitored and tested. The gas processing "partner" company will potentially benefit from lower costs and more reliable output. The testing "partner" will get a reduced rate for implementing the Novum technology.

Novum Energy Technology

Novum Energy Technology, LLC was formed to develop and apply new, proprietary technologies to solve economic and environmental problems facing the energy industry. Novum has developed cutting edge technology that dramatically reduces corrosion in hydrocarbon systems. This technology is currently applicable to natural gas processing, natural gas and crude collection and storage and transmission facilities. Novum's corrosion inhibitor technology increases operating efficiencies and asset utilization by reducing operating and maintenance costs, while achieving greater throughput of clean energy product.

Novum President Steve Davis talks with Dr. Marvin Johnson

Novum believes that previous experience with the Early Product in a small processing facility represents the low end of what its current corrosion technology can do. The Early Product was employed in the Field Test Facility in a limited and relatively uncontrolled manner. Novum believes that the potential of its formulated solvent is significantly greater than what was experienced with the Early Product.

Contact:

Steve Davis, President, Novum Energy Technology, LLC

2120 East 3900 South, Suite 300, Salt Lake City, UT 84124
e-mail: steve@novumct.com
(801) 272-1000 office, (801) 541-4383 cell
www.novumct.com

UNDERSTANDING PROBLEMS AND
FINDING SOLUTIONS THROUGH CHEMISTRY

Novum's Corrosion Inhibitor Benefits:

- Proven to increase throughputs in processing
- Low capital expense
- Reduces cost of corrosion (O & M)
- Reduces costly shutdown expenses
- Environmentally friendly
- Impact is immediate

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