Voodoo
INJECTION MANAGEMENT

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Reliable Reduction of Chemical Usage in Field Injection Pumps

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ETC
EXTREME TELEMATICS CORP.

ETC Background

- ETC is a Canadian private corporation located in Calgary, AB
- Formed in 2001
- Electronics R&D company that designs low power, wide temperature range, hazardous locations approved electronics
- Specialized in plunger lift and have created the most reliable and innovative products in the market

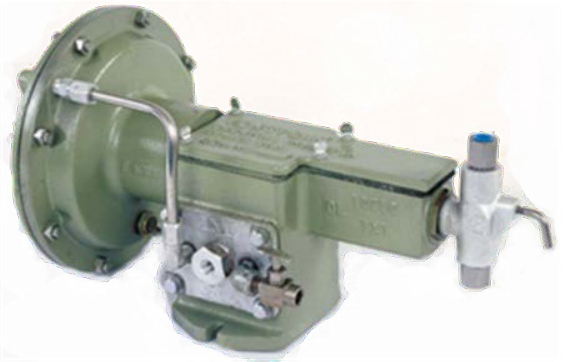
Controller Platform

- Designed for operation in Canada as a plunger lift controller
- Operates from -40ºC to + 70ºC
- CSA Class I Zone 0 Intrinsically Safe (IEC 60079-11)
- < 0.5 mA average current consumption (8 months standby)
- Branded for service companies across North America
- Platform used for Voodoo Injection Management

The Question

- Is over injection costing your company thousands of dollars a year?
- Are you having trouble meeting target injection rates?
- Is your chemical budget on target?
- Are operators having to spend extra time on location repairing pumps?

Problems



- Positive displacement pumps are used throughout the world for chemical injection
- Subject to vapor locking, stalling, and plugged valve seats at lower rates
- Lack of precision
- Lack of remote control
- Chemical starts to set up and plugs off lines
- Low rates are not reliably achieved

Conventional Solutions

- Set the pump at a higher rate, over injecting chemical
- Visit the well site more often
- On/Off Operation
- Move to an electric pump (typically solar)

Electric Pump Solution

- Pros
  - There are many companies offering this
  - Eliminates stalling
  - Lower rates can be achieved
- Cons
  - Injects on a slow duty cycle
  - Still subject to vapor locking
  - Not close enough to continuous injection, can be multiple minutes to hours between injection strokes
  - Leads to long periods of time with no chemical being delivered

Voodoo Solution

- Patent pending process
- Pump is set to an optimal rate
- Designed to inject and recycle excess chemical back to tank
- Controller manages injection and recycle to achieve the target rate

Voodoo Benefits

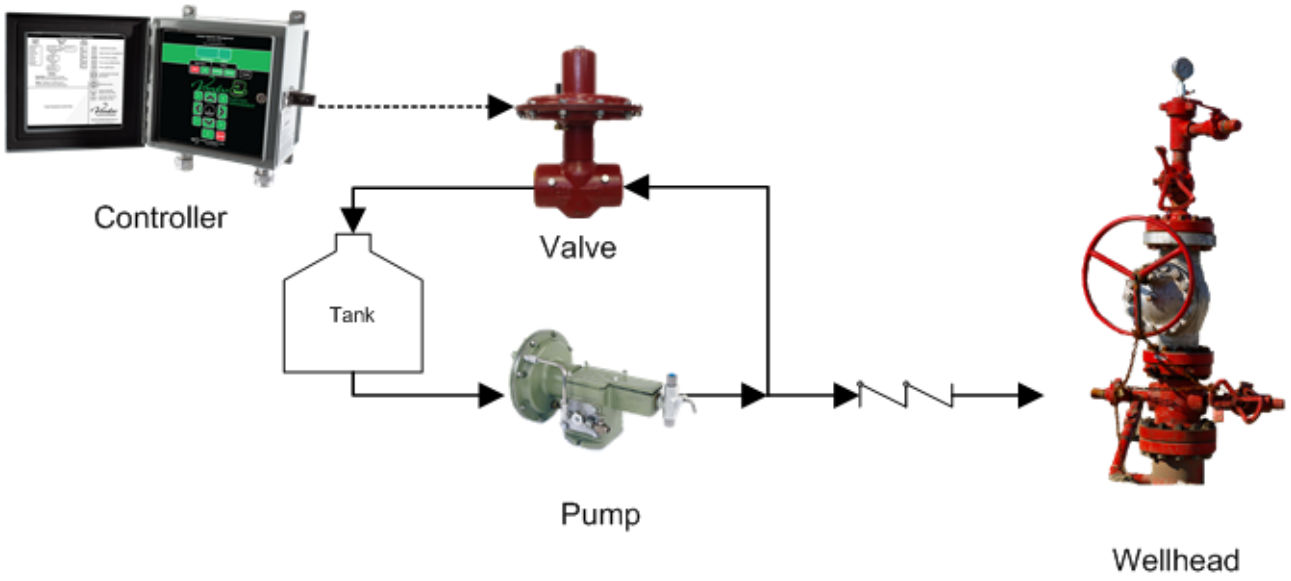
- Make use of existing pump (retrofit)
- Pump is always running at an optimal rate
- Precision control & expanded low-end range of pumps capabilities
- Chemical is always moving
  - Avoids settling in tank
  - Reduces set up in lines
  - Eliminates build up in pump head
- Chemical is recycled or used elsewhere instead of over injected
- Continuous injection
- Remote control capable
- Many other enhancements become possible

Basic Operation

- Set the pump to optimal rate
- Enter the system parameters
  - Pump Rate (L/day)
  - Target Rate (L/day)
  - Injection Point Average Pressure (kPa)
- Press Run
- The controller does the rest

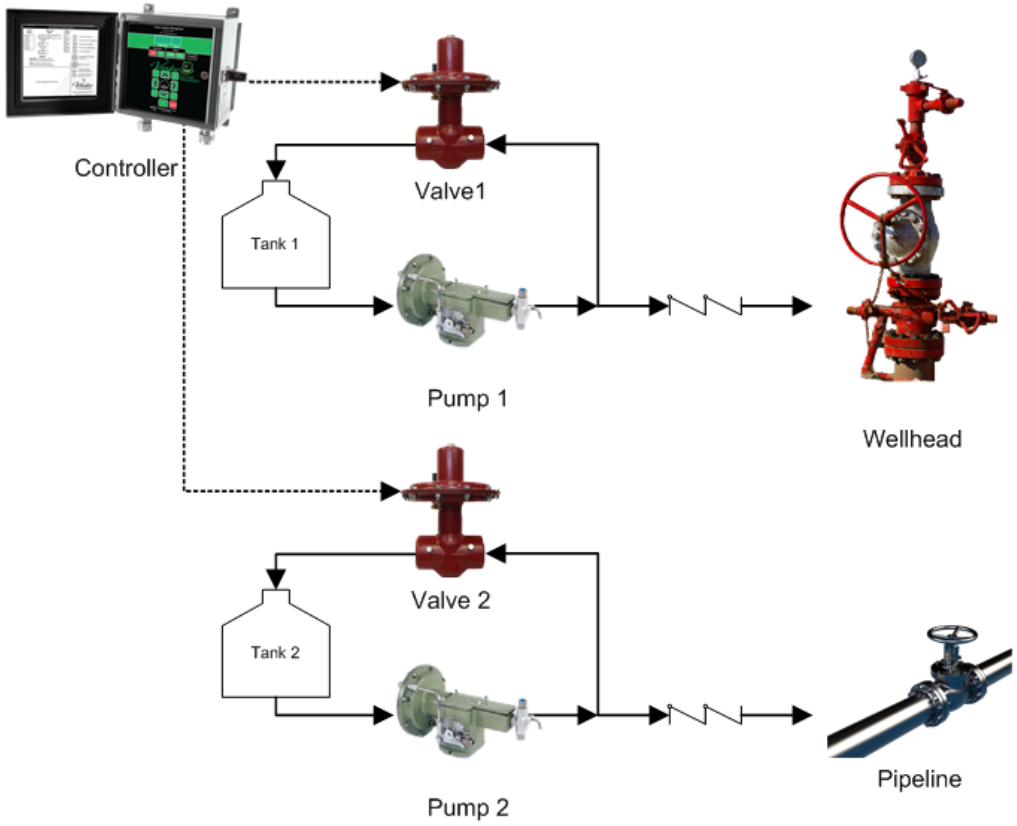
Basic Configuration

- Motor valve is closed to inject and opened to recycle back to tank
- Times are automatically calculated and applied based on parameters



Dual Pump

- Ability to run 2 pumps independently with their own pump rates and target rates

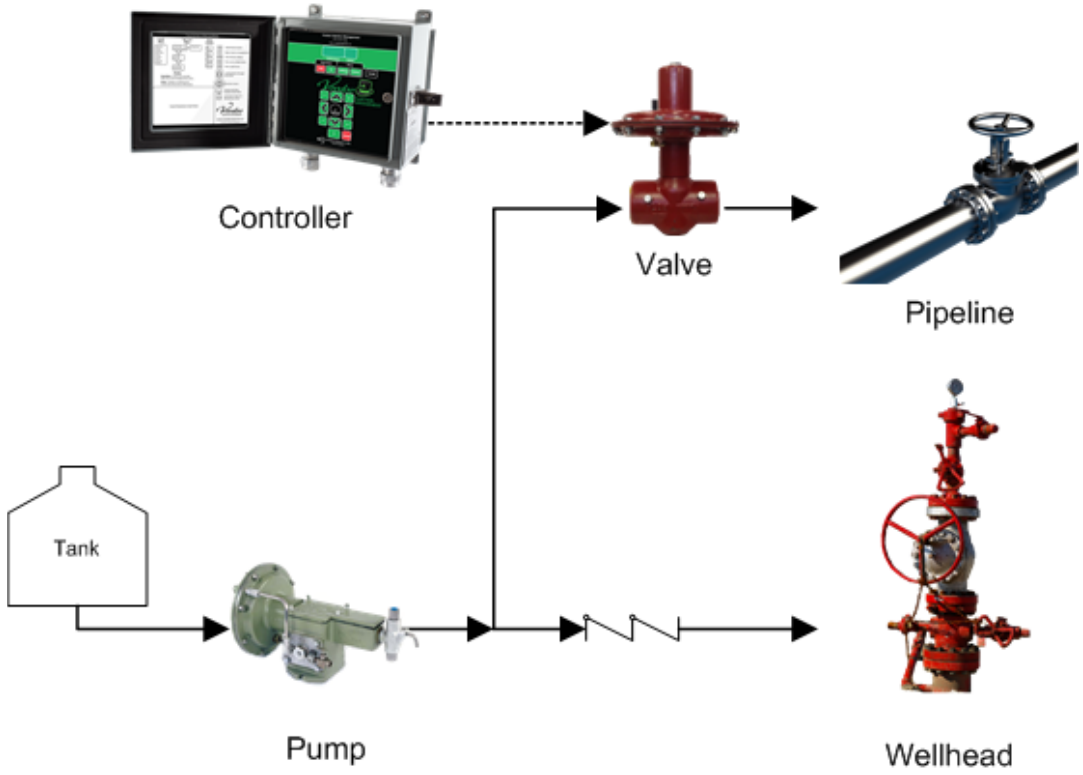


Dual Pump Field Installation

- Pump 1
  - Inject corrosion inhibitor
  - Pump Rate = 7.0 L/day
  - Target Rate = 1.0 L/day
- Pump 2
  - Inject wax inhibitor
  - Pump Rate = 10.0 L/day
  - Target Rate = 2.0 L/day

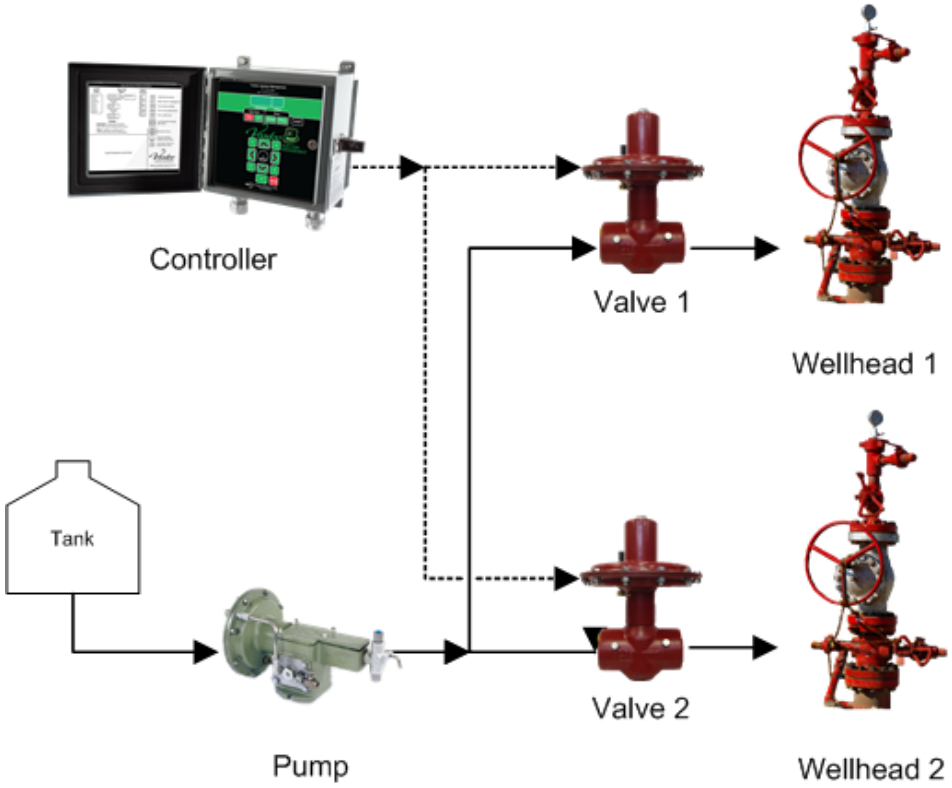
Pump Splitting

- One injection point is lower pressure
- Only one motor valve required



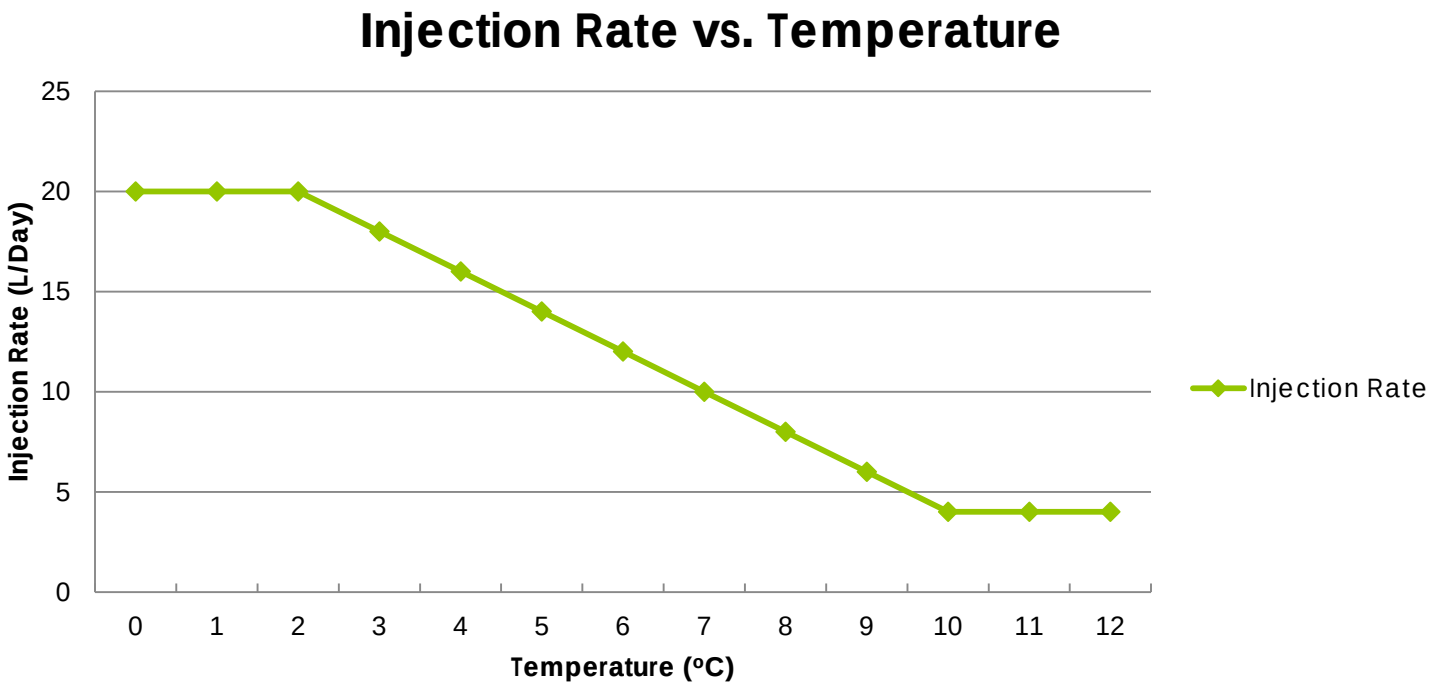
Pump Splitting

- Both injection points are similar pressures
- Use 2 motor valves running opposite



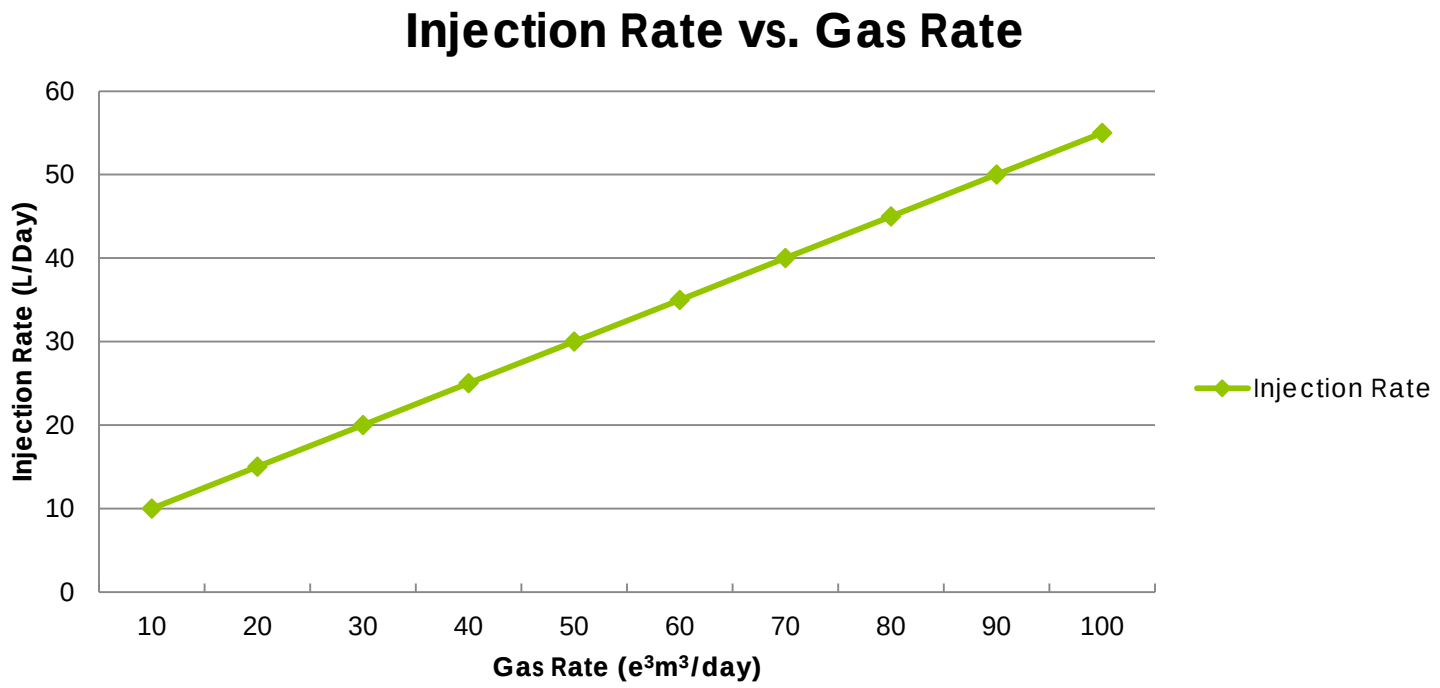
Temperature Compensation

- Set low temperature and rate
- Set high temperature and rate
- Linear interpolation between low and high set points



Remote Control

- Integrate with existing SCADA system
- Set rate from a control room
- Automatically adjust based on other factors



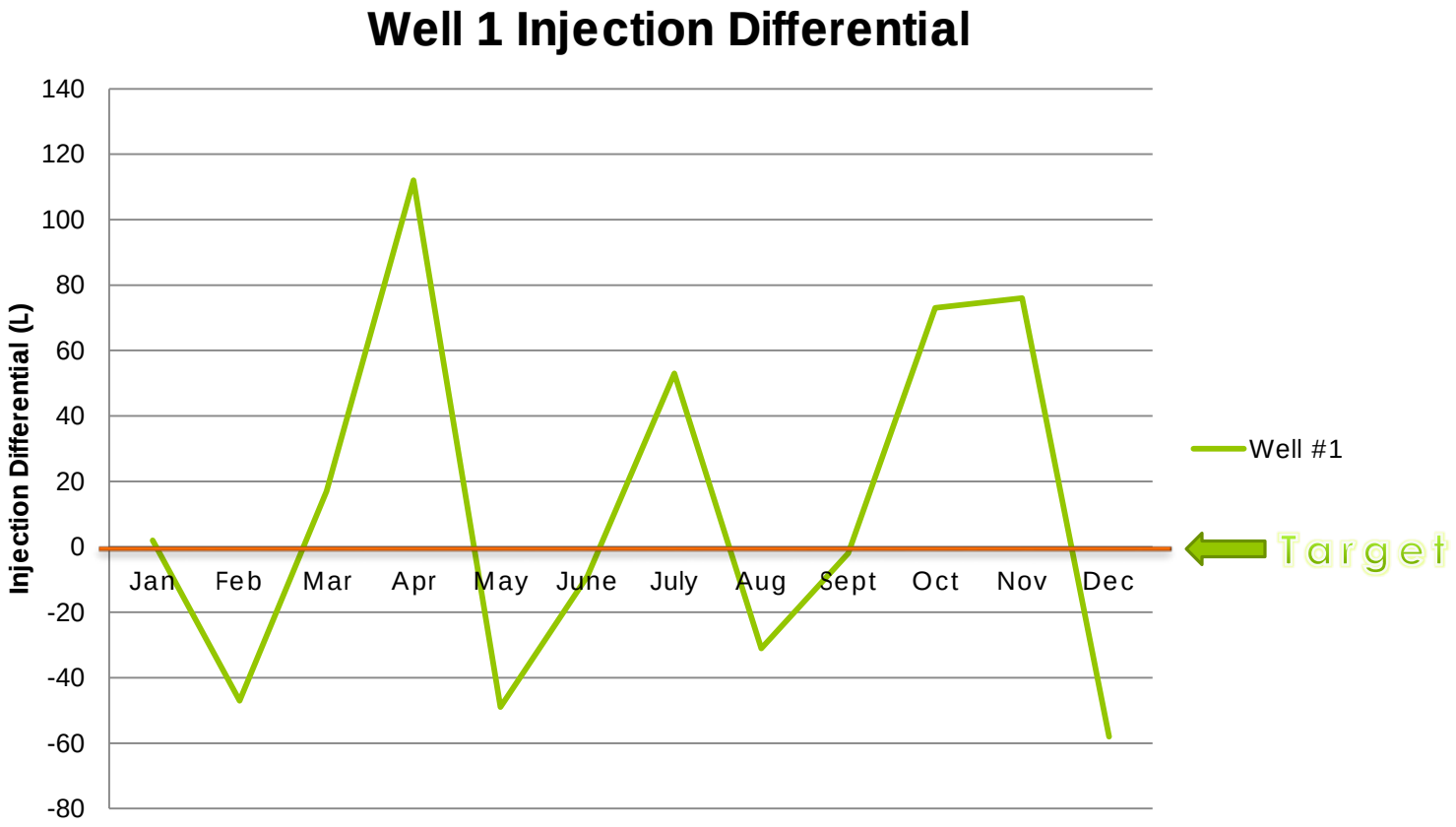
Case Study 1

- Examined16 sites
  - 13 well sites
  - 2 Batteries
  - 1 Pipeline
- Recorded difference between actual and target injection rates

Case Study 1 Data

	Chemical	Target (L/d)	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Net (L)
Well #1	Corrosion	3.0	2	-47	17	112	-49	-9	53	-31	-2	73	76	-58	**137**
Well #2	Corrosion	5.0	100	23	16	12	31	-27	10	-53	68	27	6	68	**281**
Well #3	Corrosion	2.0	203	217			222	64	0	140		0	162	93	**1101**
Well #4	Corrosion	3.0	-32	-43	-43	-36	-47	18	-2	54	7	-17	-34	223	**48**
Well #5	Corrosion	6.0	-21	-48	3	9	1	-2	-2	-36	52	-22	-2	-24	**-92**
Well #6	Corrosion	2.0	-25	-35	-50	-23	37	180	63	196	87	217	0	0	**647**
Well #7	Scale	3.0	-27	-32	-3	-25	70	-47	8	119	-23	48	18	141	**247**
Well #8	Corrosion	3.0	-25	41	16	-3	86	73	18	9	-58	33	26	78	**294**
Well #9	Corrosion	5.0	100	30	48	34	15	4	5	179	-145	150	123	192	**735**
Well #10	Corrosion	2.0	65	89	30	24	57	65	36	124	152	168	180	184	**1174**
Well #11	Corrosion	4.0	15	-17	7	-14	23	16	-22	5	11	54	-18	-31	**29**
Well #12	Scale	4.0	0	210	-30	-46	-111	-108	0	56	-58	155	-54	155	**169**
Well #13	Scale	2.0	84	44	0	-36	46	-7	-2	29	52	73	126	73	**482**
Battery #1	Scale	13.0	50	-10	70	35	95	-15	50	-160	-35	35	95	125	**335**
Battery #2	Parrafin	10.0	39	9	80	98	57	267	47	58	83	82	302	248	**1370**
Inject #1	Scale	9.0	-125	35	-60	74		612	210	756	0	186	216	31	**1935**
														Total	**8892**

Case Study 1 Analysis



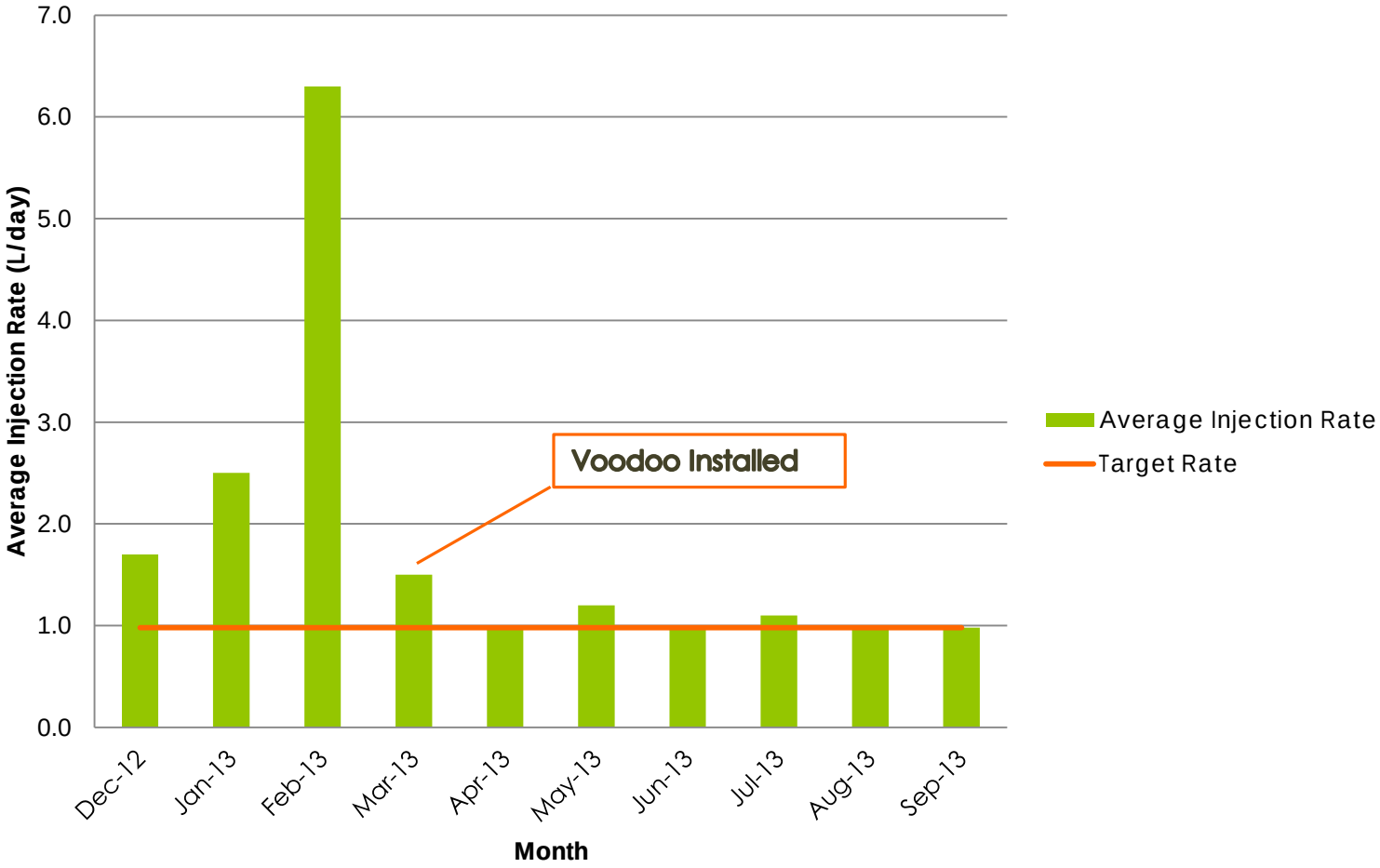
Case 1 Study Findings

- Almost every well over injected for the year
- Most wells experienced several months of under injection
- Even with under injection, a net of 8892 L of chemical was wasted
- $45,000 over injected
- Some wells experienced no injection because the pump was down

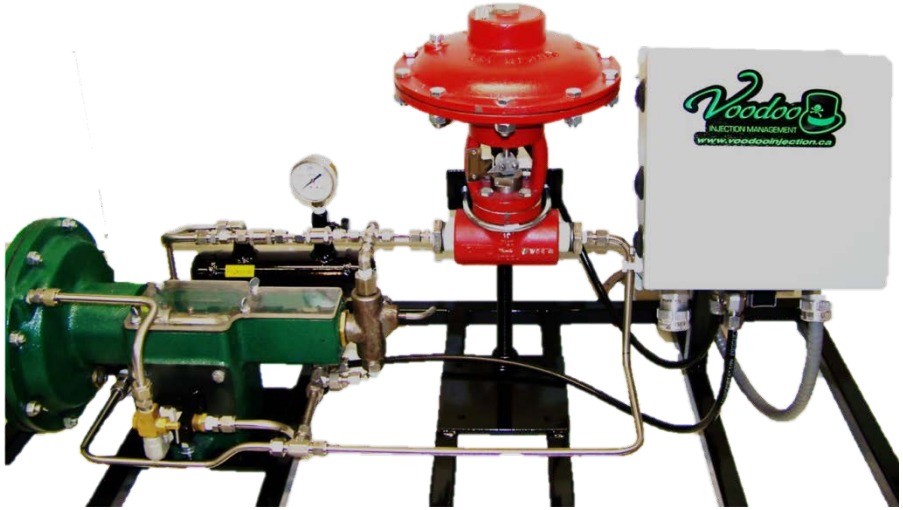
Case Study 2

- Well had a target rate of 1.0 L/day
- Pump had a hard time achieving a low rate consistently
- Monthly average rate as high as 6.3 L/day
- Voodoo installed part way through March and made an immediate impact

Case Study 2 Analysis



Questions



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