Artificial Lift R&D Council

Autonomous Chemical Optimization and Remote Monitoring: A Case Study

Jeff Clack
Artificial Lift Foreman
ConocoPhillips

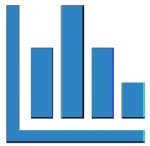
Dylan Bucanek
International Solutions Engineer Manager
CHAMPIONX ARTIFICIAL LIFT

ALRDC Artificial Lift Workshop
February 28th – March 3rd, 2022

Topics

Objective

Procedure



Results

Conclusions

Objectives

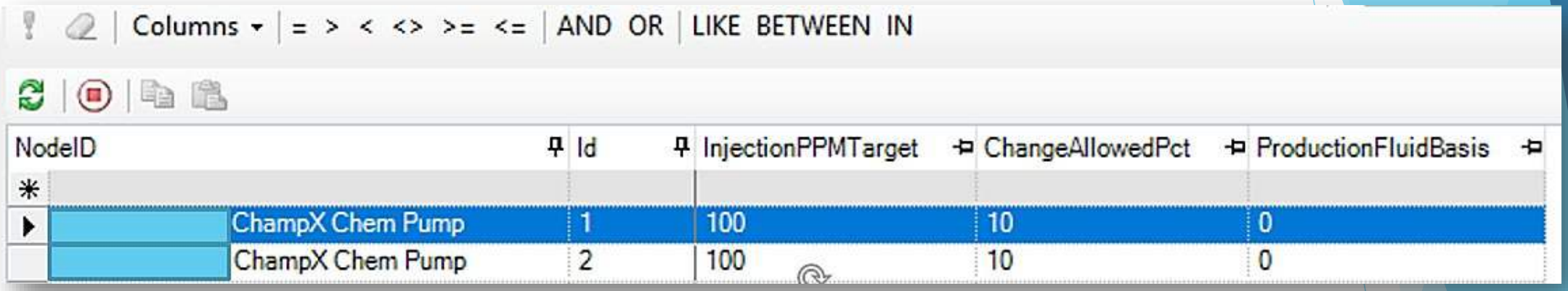
- Seek to identify potential chemical cost savings
- Confirm that chemical dosage is applied at prescribed rates consistently
- Increase operational efficiency and effectiveness of chemical vendor related to checking and monitoring chemical pumps and tanks
- Set up alarm notifications to alert ConocoPhillips and chemical vendor of problems with the system (low tank volume , inadequate pump rate , low voltage, etc.)
- Allow for easier confirmation of chemical invoices by allowing us to see exactly how much chemical was delivered on a specific date and time

Procedure - Hardware

- Install Automated Chemical Controllers
  - Four controllers and chemical pumps on four wells
  - All solar powered with battery storage
- Install and Program Communication Equipment

Procedure – Software Setup

Artificial Lift R&D Council



- Setup parent node designation
- Input prescribed target PPM of chemical
- Input desired change allowed per day
- Define if you want to dose on total liquid volume, water only or oil only
- A prescribed dosage target of chemical in quarts per day (QPD) is calculated daily by the software based on new well test information.

Procedure – Alarm Setup

Low Tank Level

[redacted] Tank Level alarm LO. Value=10 (Tank Level Alarm Low), ServerName:BVLWSCAP0071

XS [redacted] BVLWSCAP0071 <DoNotReply@ConocoPhillips.net>

To Clack, Jeff

Reply | Reply All | Forward | ...

Sun 10/3/2021 9:43 PM

Retention Policy Inbox-1 year (1 year) Expires 10/3/2022

[redacted] Chem Pump, Tank Level alarm LO. Value=10 (Tank Level Alarm Low), ServerName:BVLWSCAP0071

Low Voltage

[redacted] Chem Pump, Voltage alarm LO. Value=1.4 (Supply Voltage Alarm Low), ServerName:BVLWSCAP0071

XS [redacted] BVLWSCAP0071 <DoNotReply@ConocoPhillips.net>

To Clack, Jeff

Reply | Reply All | Forward | ...

Mon 10/18/2021 10:09 AM

Retention Policy Inbox-1 year (1 year) Expires 10/18/2022

[redacted] Chem Pump, Voltage alarm LO. Value=1.4 (Supply Voltage Alarm Low), ServerName:BVLWSCAP0071

Procedure - Testing

Limited to maximum step change to 10%:

11.4 * 10% = 1.14 ⟹ 11.4+1.14= 12.54

```
Friday, October 15, 2021 6:00:06 AM ---> Working on [redacted] ChampX Chem Pump
Friday, October 15, 2021 6:00:06 AM --->    Production Rate: 753
Friday, October 15, 2021 6:00:06 AM --->    Old Injection Rate: 11.4
Friday, October 15, 2021 6:00:06 AM --->    New Injection Rate: 12.7
Friday, October 15, 2021 6:00:06 AM --->    Change too big, clamped to: 12.54
Friday, October 15, 2021 6:00:06 AM --->    Writing Injection Rate: 12.54
Friday, October 15, 2021 6:00:20 AM --->    Write Result:OK
Friday, October 15, 2021 6:00:20 AM --->    Well Status:Running Pump Status:Running, Auto
Sunday, October 17, 2021 6:00:07 AM ---> Working on [redacted] ChampX Chem Pump
Sunday, October 17, 2021 6:00:07 AM --->    Production Rate: 519
Sunday, October 17, 2021 6:00:07 AM --->    Old Injection Rate: 8.7
Sunday, October 17, 2021 6:00:07 AM --->    New Injection Rate: 8.7
Sunday, October 17, 2021 6:00:07 AM --->    No rate changes needed
Sunday, October 17, 2021 6:00:07 AM --->    Well Status:Running Pump Status:Running, Auto
Sunday, October 17, 2021 6:00:07 AM --->    No status changes needed
```

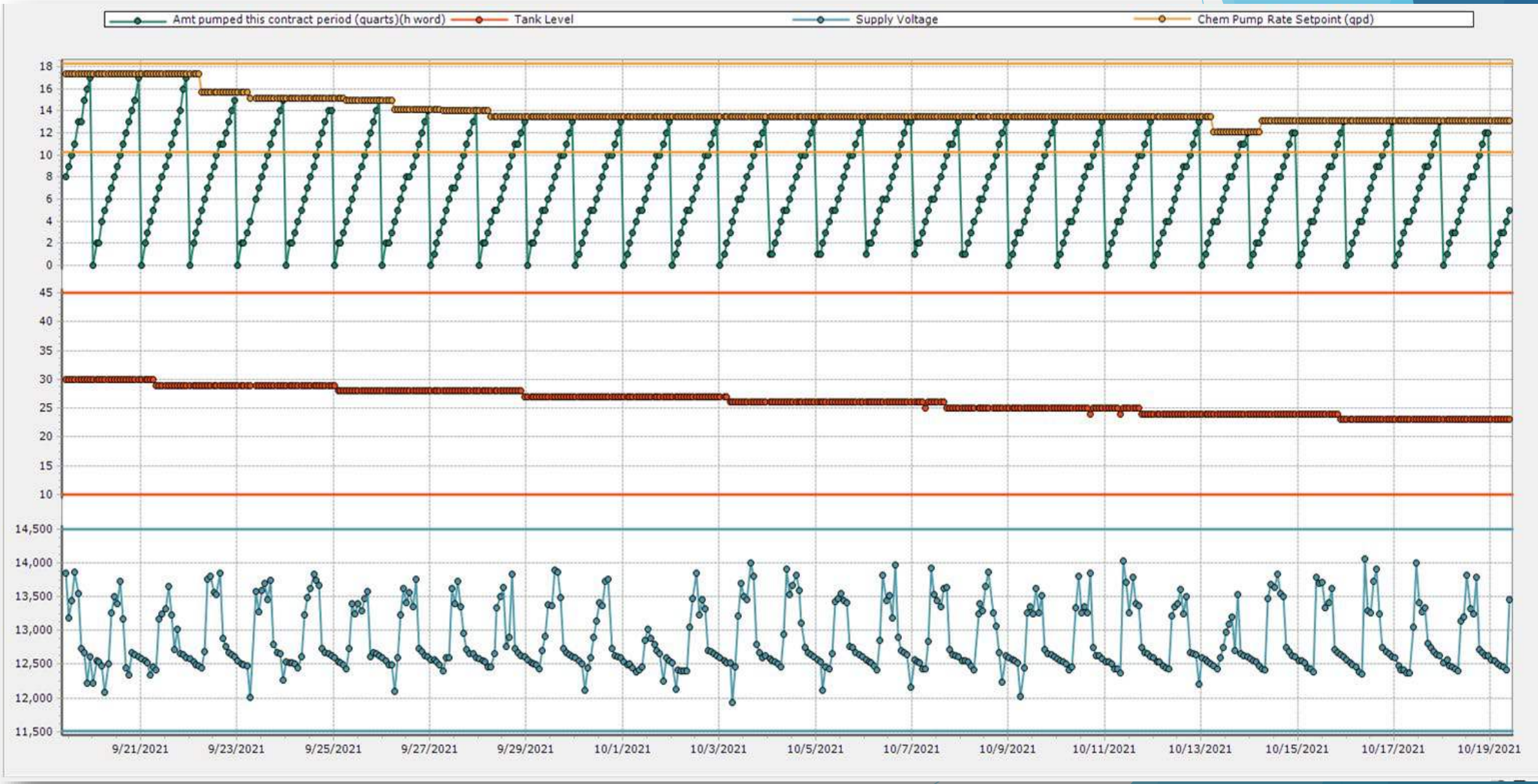
Results

Artificial Lift R&D Council

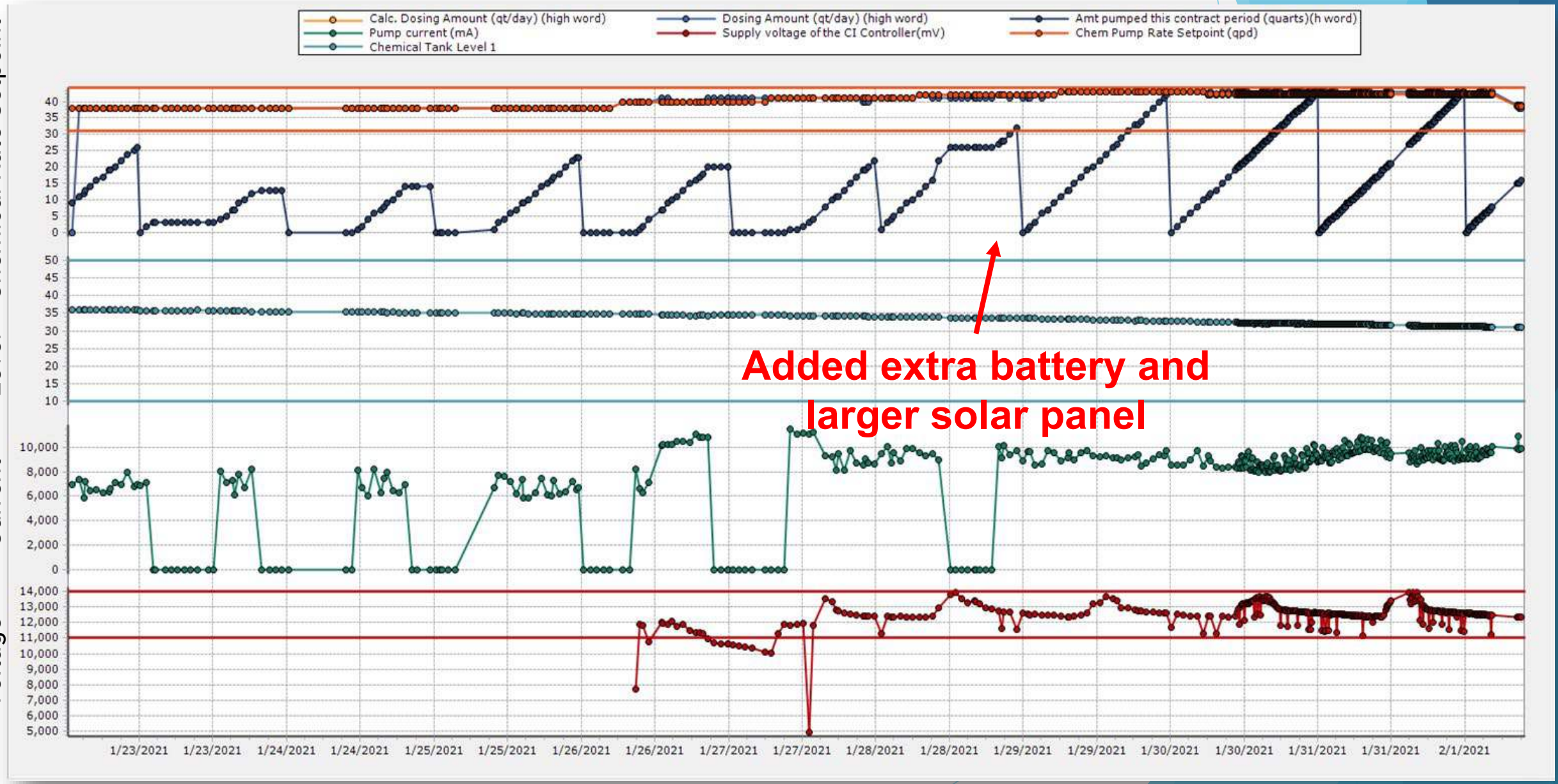
Chemical Pumped vs. Chemical Rate Setpoint

Tank Level

Supply Voltage

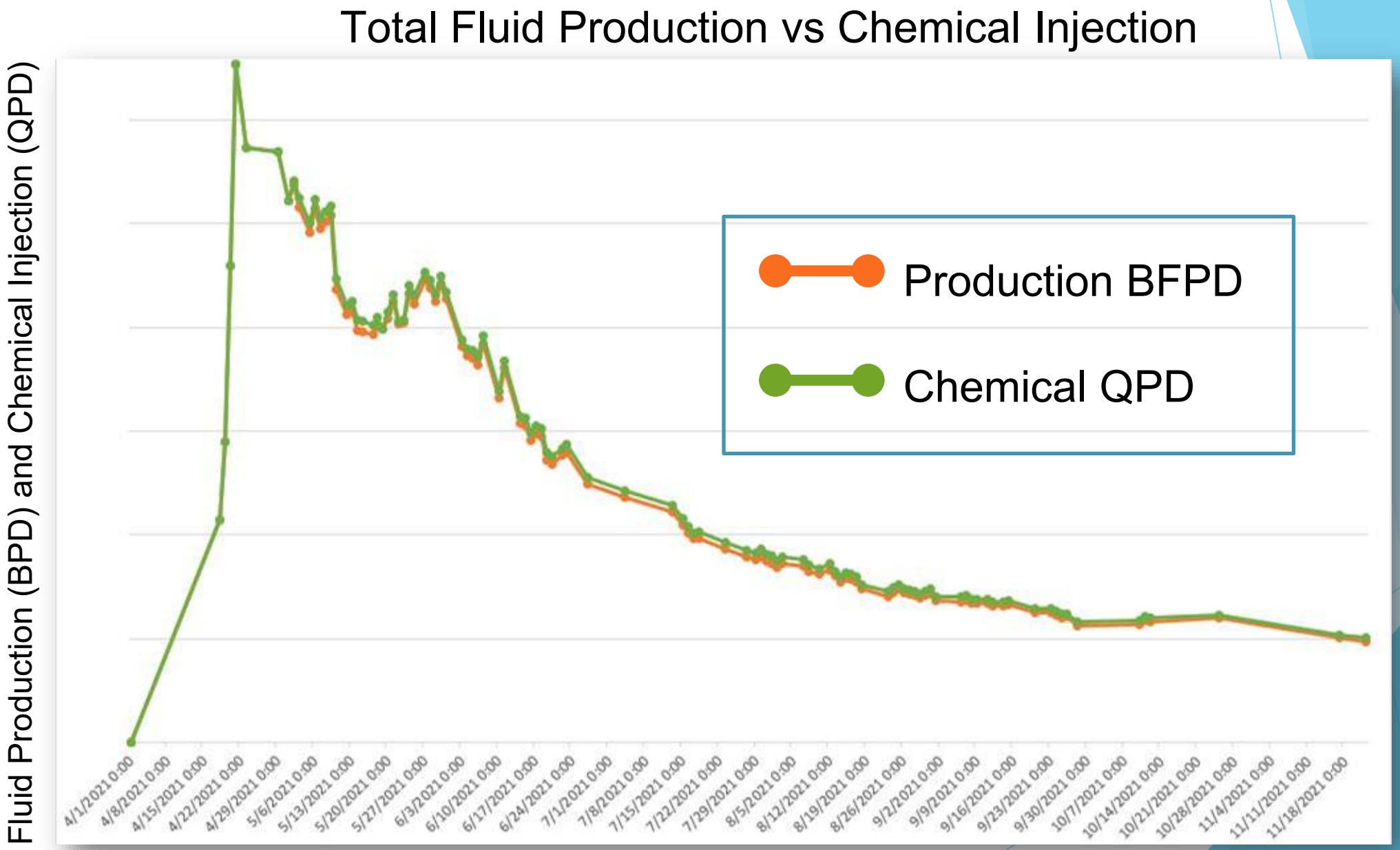


Results


Calc. Dosing Amount (qt/day) (high word)
Dosing Amount (qt/day) (high word)
Amt pumped this contract period (quarts)(h word)
Pump current (mA)
Supply voltage of the CI Controller(mV)
Chem Pump Rate Setpoint (qpd)
Chemical Tank Level 1
Chemical Pumped vs. Chemical Rate Setpoint
Tank Level
Pump Current
Supply Voltage
Added extra battery and larger solar panel
1/23/2021
1/23/2021
1/24/2021
1/24/2021
1/25/2021
1/25/2021
1/26/2021
1/26/2021
1/27/2021
1/27/2021
1/28/2021
1/28/2021
1/29/2021
1/29/2021
1/30/2021
1/30/2021
1/31/2021
1/31/2021
2/1/2021

Results

Artificial Lift R&D Council



Other Applications

- Recently started a project focused on gas-lift compressor methanol injection.
  - Applied the same techniques as the case study above.
  - We are still working on the methanol setups, but the plan is to have the target methanol rate based on the ambient temperature on location.
  - Alarm on low methanol injection rate, low supply voltage, and low tank volume.

Conclusions

- By having chemical rates automatically adjust to current production rates we have confidence that we are consistently treating our fluids at the prescribed PPM.
- By remotely monitoring tank levels and alarming on low tank levels we ensured that chemical deliveries were made on time.
- Another benefit from monitoring and trending tank levels was the ability to use the historical data to assist in confirming chemical invoices.
- Based on the preliminary data received from the chemical vendor, we did not see an overall economic benefit between the automated injection wells and the manual injection wells.
- We had to upgrade our solar power system on certain wells to provide enough power to consistently achieve target chemical injection volumes.

Acknowledgements/Thanks & Questions

ChampionX Artificial Lift would like to thank ConocoPhillips for the opportunity to work on this project to find a solution to fit their needs.

Copyright

Disclaimer

The Artificial Lift Research and Development Council and its officers and trustees, and the Artificial Lift Workshop Steering Committee members, and their supporting organizations and companies (here-in-after referred to as the Sponsoring Organizations), and the author(s) of this Technical Presentation or Artificial Lift Learning Course and their company(ies), provide this presentation and/or training material at the Artificial Lift Workshop "as is" without any warranty of any kind, express or implied, as to the accuracy of the information or the products or services referred to by any presenter (in so far as such warranties may be excluded under any relevant law) and these members and their companies will not be liable for unlawful actions and any losses or damage that may result from use of any presentation as a consequence of any inaccuracies in, or any omission from, the information which therein may be contained.

The views, opinions, and conclusions expressed in these presentations and/or training materials are those of the author and not necessarily those of the Sponsoring Organizations. The author is solely responsible for the content of the materials.

The Sponsoring Organizations cannot and do not warrant the accuracy of these documents beyond the source documents, although we do make every attempt to work from authoritative sources. The Sponsoring Organizations provide these presentations and/or training materials as a service. The Sponsoring Organizations make no representations or warranties, express or implied, with respect to the presentations and/or training materials, or any part thereof, including any warrantees of title, non-infringement of copyright or patent rights of others, merchantability, or fitness or suitability for any purpose.