



CASE STUDY

LOCI CONTROLS AUTOMATED GAS-COLLECTION VS. THREE TIMES PER WEEK MANUAL WELL-TUNING

Case Study Summary

A field trial was undertaken to compare the performance of Loci Controls automated gas-collection with manual well-tuning for a high-BTU project landfill under development. The field trial took place at a large private landfill located in the Southeastern USA.

Table 1: Summary of Loci Controls' comparative performance

Location	Objective	Status
Southeastern USA	Demonstrate material increase in CH ₄ flow from automated tuning, in comparison to manual tuning	Improved CH₄ flow with an average sustained increase over manual tuning of 17%
	Maintain gas-composition thresholds of CH ₄ > 56%, O ₂ < 0.4%, and Bal Gas < 1.7%	Maintained composition thresholds as stipulated

Figure 1: Depiction of average CH₄ flow collection during each of the 3 phases



WHY LOCI CONTROLS?

With financial, operational, and environmental benefits, Loci Controls' product / service suite helps streamline and optimize facility management and gas-collection for power-plant operators and landfill owners alike.



INCREASE REVENUE

- Maximize methane gas flow
- Optimize gas-composition
- Automate real-time wellhead adjustment and data collection
- Boost plant uptime



DECREASE COSTS

- Lower labor costs for wellfield tuning and O&M
- Reduce equipment maintenance costs



REDUCE RISKS

- Reduce fugitive LFG emissions
- Prevent significant maintenance issues

CORPORATE OFFICE:

99 South Main Street, Suite 310
Fall River, MA 02721

Background

Loci Controls was approached by a high-BTU project developer to install its automated landfill gas-monitoring and control equipment to compare the performance of the manual wellhead tuning conducted by the operator's field technicians with Loci Controls' automated landfill gas-collection process. The 3-phase trial included the installation of controllers on 15 collection wells with continuous monitoring by Loci Controls' WellWatcher® analytics platform.

3-Phase Demonstration Trial

The trial consisted of three phases: an initial "characterization" phase (phase 1) to capture baseline information to use as a reference point for the second phase, the subsequent manual well-tuning (phase 2). Finally, Loci Controls automated gas-collection (phase 3). The overall trial lasted 90 days, with each phase lasting approximately 30 days.

Phase 1 - Characterization/Monitoring Only

Objective:

- Evaluate gas-collection on the 15 wells with Controllers, and make necessary modifications and adjustments to Loci Controls equipment (primarily the size of orifice plate and type of valve)
- Determine baseline gas-composition and flow values to use for relative comparison in trial phases 2 and 3

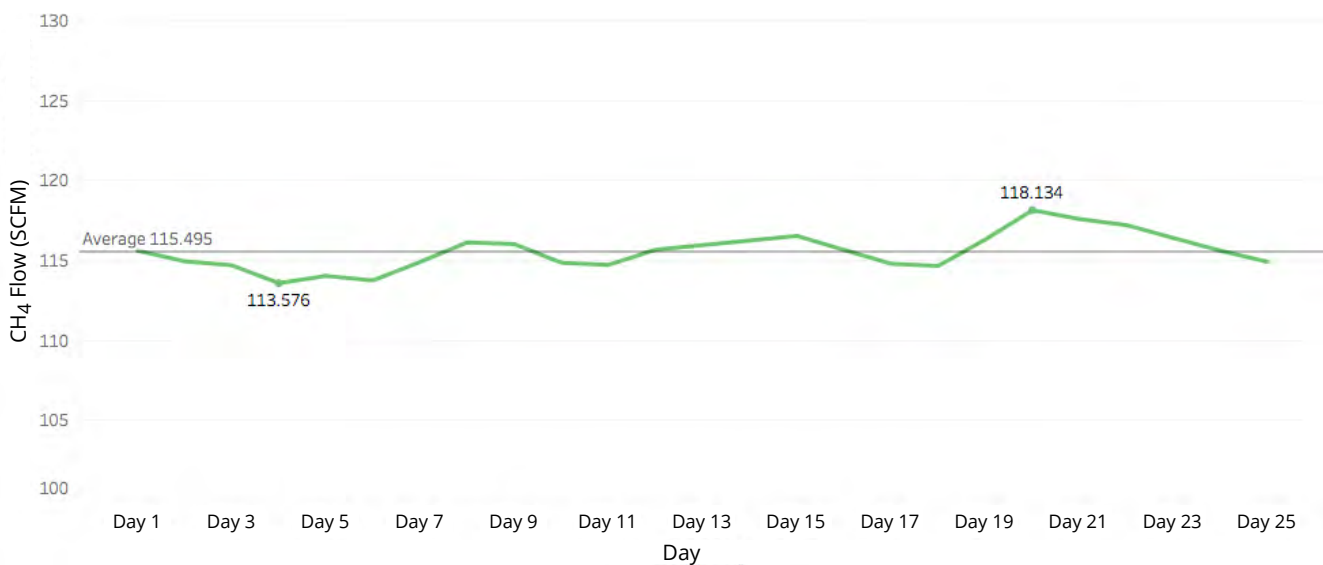
Baseline Calculation Methodology:

Over a 2-week period, Loci Controls operated its equipment in monitoring only mode and calculated average CH₄ flow.

Baseline Flow and Composition:

- CH₄ flow: Average – **115 SCFM**; Minimum – 113 SCFM; Maximum – 118 SCFM
- Gas-composition: CH₄ > 56%, O₂ < 0.4%, and Bal Gas < 1.7%

Figure 2: Phase 1 baseline average CH₄ flow per day



Phase 2 - Operator Manual Tuning

Objective:

Establish flow and composition performance of operator’s manual tuning process to use in comparison to Loci Controls automated gas-collection process.

Process:

During this 30-day phase of the demonstration trial, at a frequency of 3x per week, operator’s personnel took discrete measurements of composition and flow data to determine the tuning adjustments that needed to be made at each well.

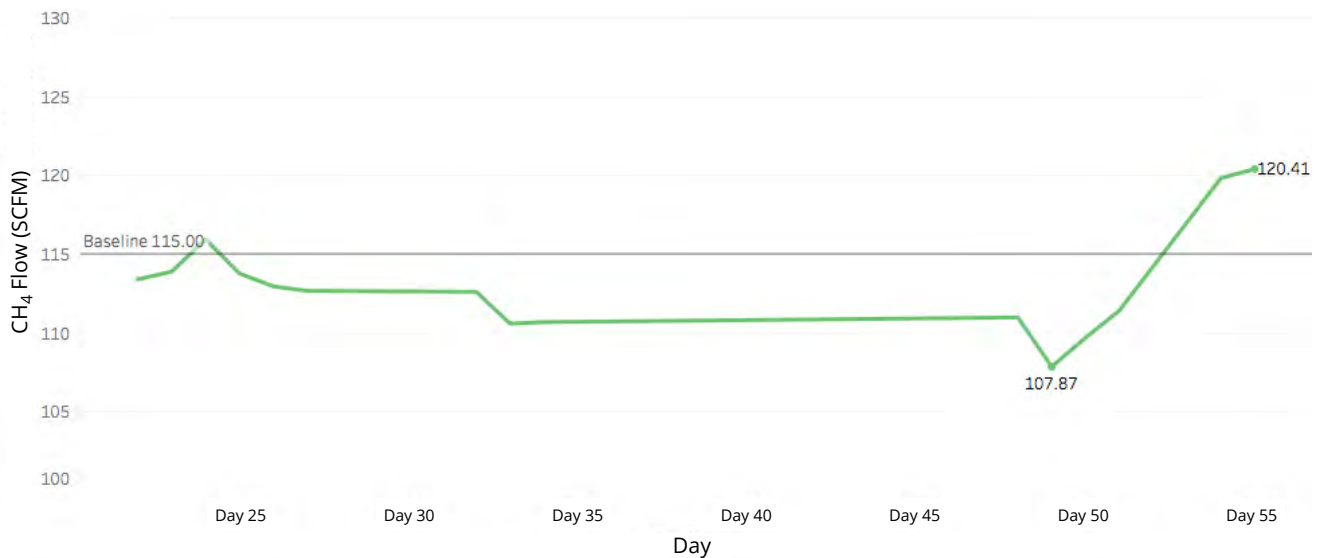
Results:

As shown below, average CH₄ flow during the manual tuning period was 113 SCFM, slightly below the original calculated baseline of 115 SCFM. Peak production reached 120 SCFM.

For comparison, and since operator field personnel were manually tuning the wells during the baseline period, we are using the slightly higher value from the baseline CH₄ flow (115 SCFM) when comparing the difference to the performance levels of automated gas-collection demonstrated during Phase 3.

Phase 2 – Manual Well-Tuning

Figure 3: Phase 2 average CH₄ flow per day - remote manual tuning by Air Liquide using Loci WellWatcher® 3x per week



Phase 3 - Loci Controls Automated Gas-Collection

Objective:

- Establish flow and composition performance of the Loci Controls automated gas-collection to use in comparison to the manual tuning performed 3x per week during Phase 2
- Target performance goal was to increase CH₄ flow by 15% over manual tuning

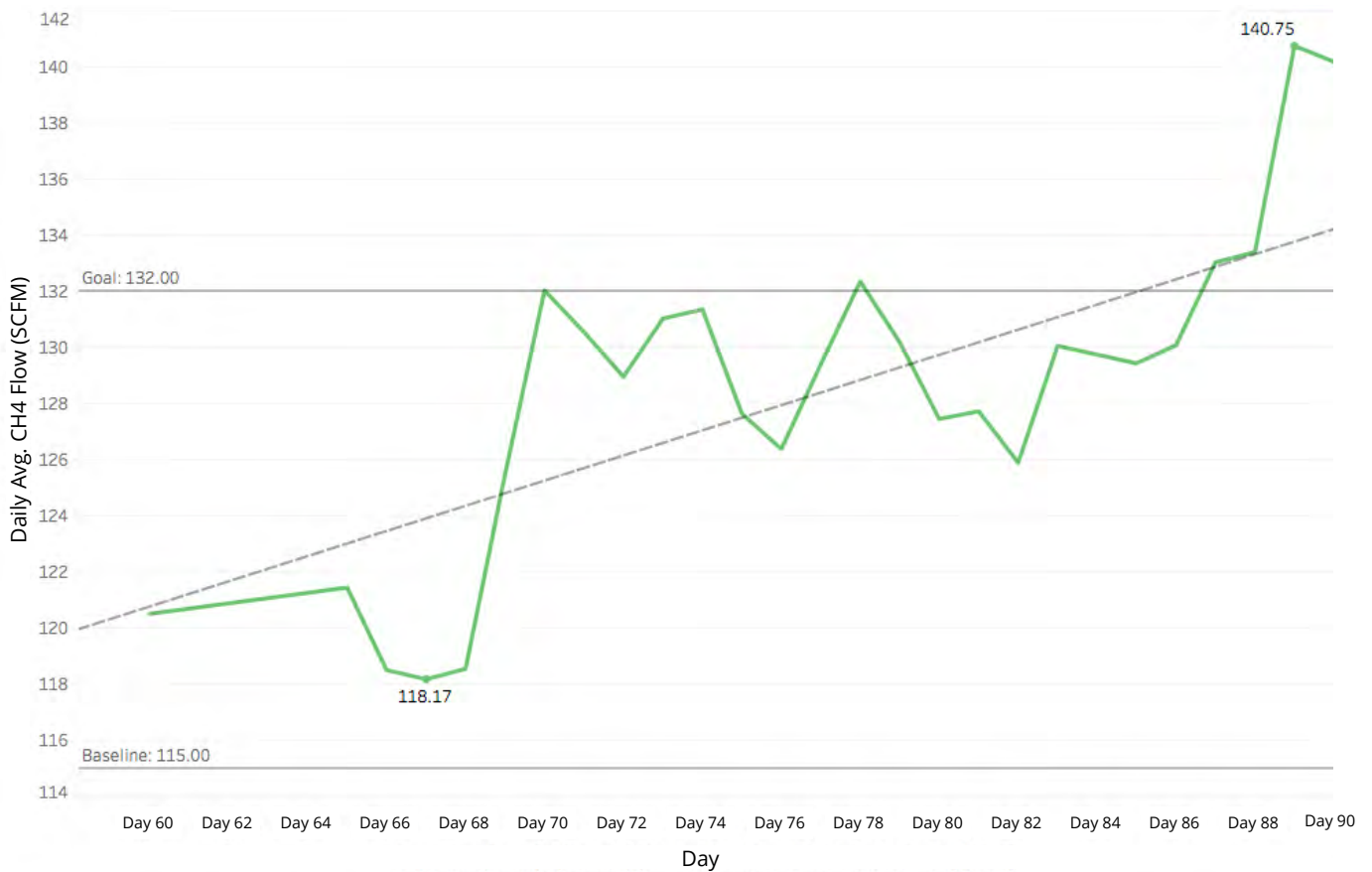
Process:

Immediately after the culmination of Phase 2, Loci Controls began its automated gas-collection for a 30-day period.

Results:

- Achieved an average CH₄ increase of 17% over manual well-tuning
 - CH₄ production was 135 SCFM with peak of 140 SCFM
- Maintained pre-established gas-composition standards of CH₄ > 56%, O₂ < .4%, and Bal Gas < 1.7%

Figure 4: Phase 3 Loci Controls automated gas-collection



Conclusion

As summarized in this report, Loci Controls has achieved the stated objectives, demonstrating that Loci Controls automated gas-collection service increased CH₄ collection by 17% on the wells with controllers installed on them, while maintaining strict gas-composition thresholds required for pipeline injection or other high-BTU applications. The economics shown below represent the value associated with the additional gas production generated, extrapolated to a full total wellfield installation with 150 collection wells, and 4,500 SCFM of landfill gas-collection from a representative landfill. A 17% increase in CH₄ collection over manual collection method resulted in a net increased profit to the high-BTU project operator of \$2.2M, or a 250% return on the annual subscription cost for the Loci Controls automated gas-collection service.

Figure 5: Loci Controls subscription service model

Loci Controls Subscription Service Model				Instructions: complete cells in blue except where not applicable		
Energy Producer Economics				Project type		
Number of wells (total)			150	High-BTU/LNG		
Average Output MMBTU/day			3,676			
Average MMBTU/Mo (30 days)			110,280			
RIN Revenue/MMBTU (11.7 RIN/MMBTU)			\$20.00			
Natural Gas Price (\$/MMBTU)						
Monthly Revenue			\$2,205,600			
% increase from Loci			17%			
Monthly Revenue Increase (Assume Operator receives 70% of total)			\$262,466			
Product Mix				Electricity Price (skip for high-BTU and LNG)		
		# of Devices	Unit Price	Monthly Cost	PPA, FIT or other (\$/MWH)	
Loci Controller	100%	150	\$500	\$75,000	\$80.00	
Loci Sentry	0%	0	\$0	\$0		
Total Monthly Cost				\$75,000		
Net Contribution to Energy Producer (Annually)				Net Gain	ROI	
Subscription			\$2,249,597	250%		
Number of Techs				Fuel use (skip for Power Generation)		
Cost/Tech/Day			\$ 500	High BTU		
Cost/Well			\$ 100	Natural Gas Price (\$/MMBTU)		
Tech productivity: Wells/day			32	LNG Price (\$/thousand cubic feet)		
Number of Man Days			5	RIN Value		
Airfare/travel			\$ 700			
One-Time Setup, Installation and Travel			\$20,700			
				Input Method		
				Avg SCFM		
				56%		
				Information--SCFM Input		
				Data	Notes	
				Average Gas Flow scfm	4,500	
				MMBTU/Day	3,676 *1013 BTU/SCF	
				Information--MMBTU/Day Input		
				Data	Notes	
				Average Output MMBTU/day	6,000	
				Average Gas Flow scfm	4,500	
				Average Monthly LFG Flow scf	194,401,354 *1013 BTU/SCF	
				Average Gas Flow / well scfm	30.00	
				Project Type		
				Power Generation	High BTU	MMBTU/Day
				High-BTU/LNG	LNG	Avg SCFM

The above economics are based on an assumed \$20.00 per incremental MMBTU of methane for a LFG to high-BTU application, and an LFG to high-BTU operator share of incremental revenue of 70%. The landfill is assumed to have 4,500 SCFM of landfill gas-collection, at 56% methane %, with 150 collection wells, and a 17% increase in CH₄ collection with Loci Controls automated gas-collection. Pricing Loci Controls' service is based on a per-well, month-to-month basis.

The metrics shown above do not consider the reduced labor costs associated with manual wellfield tuning that will be eliminated by the Loci Controls product/service suite. In addition, we are not including any value or reduced costs through use of Loci Controls' automated gas-collection products/services, such as increased gas processing plant uptime/utilization due to Loci Controls' 24/7 monitoring and oversight allowing us to readily identify and troubleshoot wellfield system problems that may impact both plant maintenance and uptime.

Appendix

Gas-Composition and Flow Graphs

Phase 1 - Baseline

Figure 6: Phase 1 baseline average composition per day

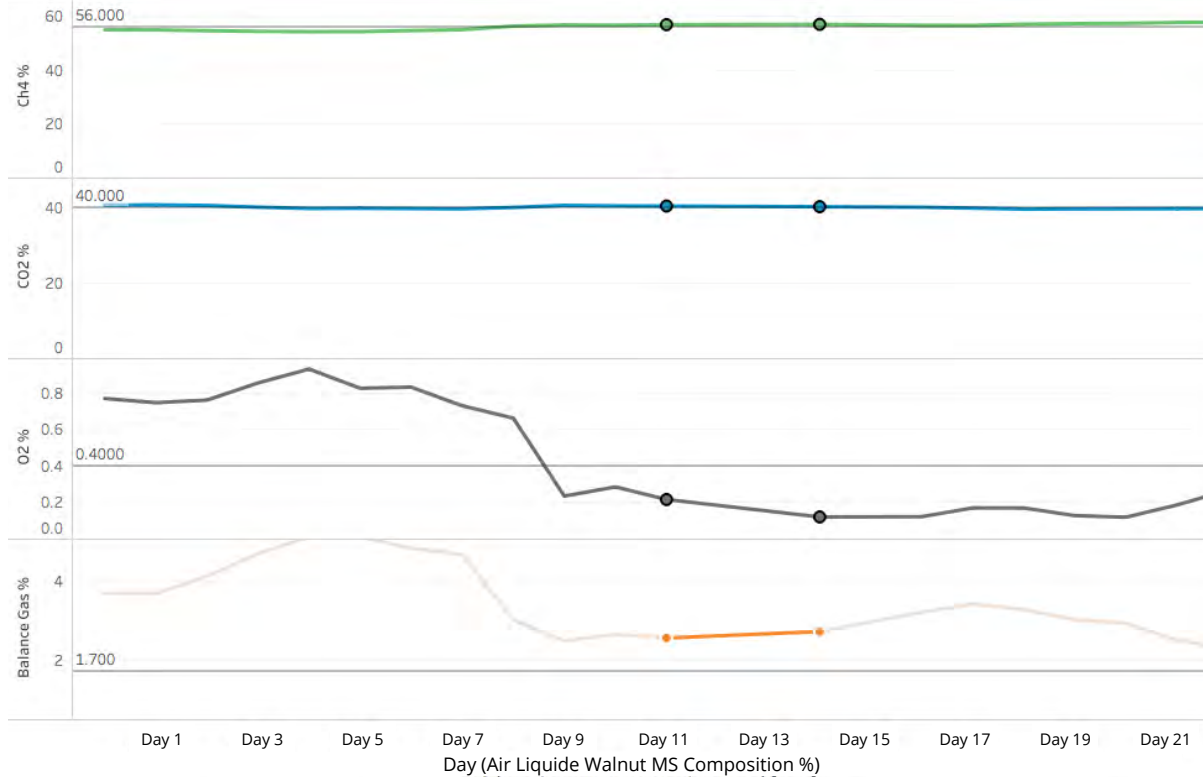
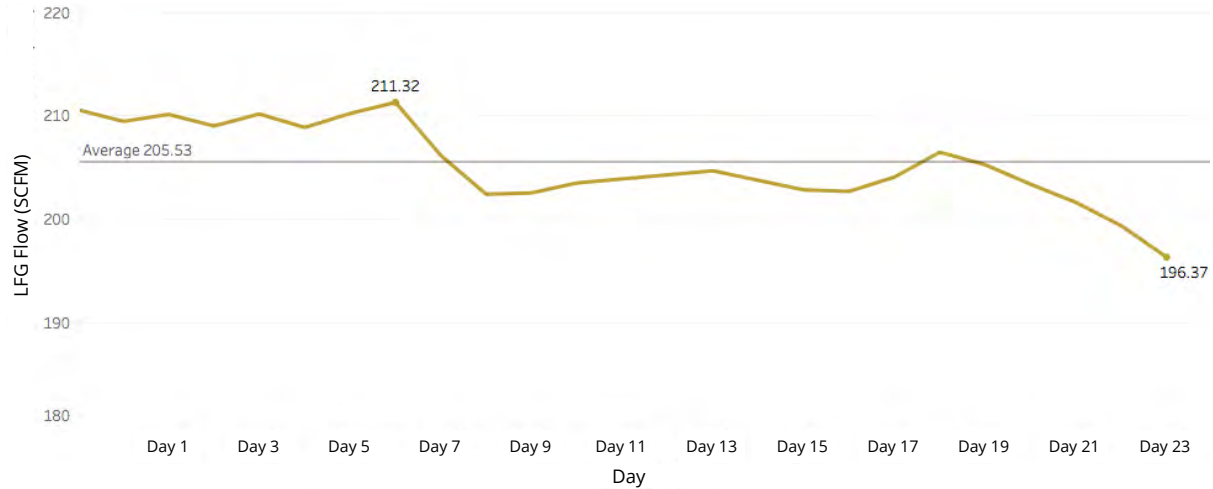
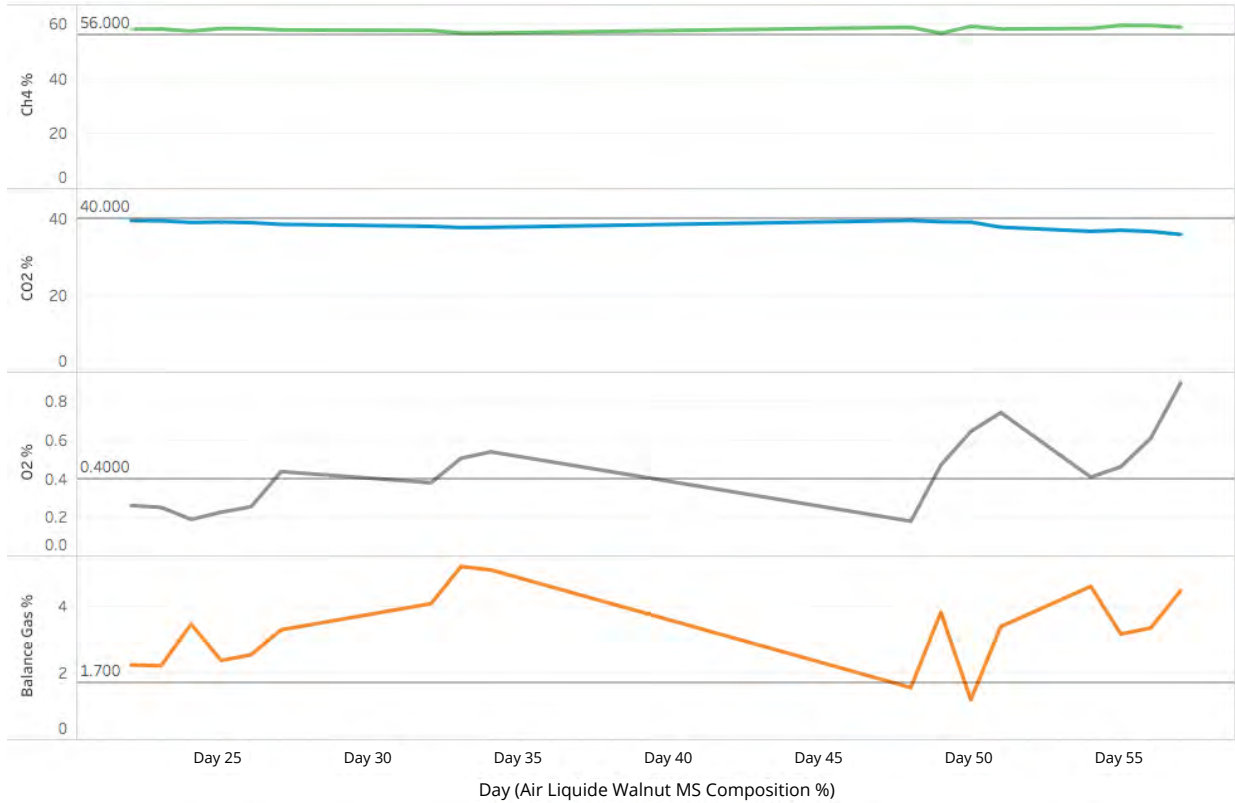


Figure 7: Phase 1 baseline average LFG flow per day



Phase 2 - Gas-Composition - 3x per Week Manual Tuning by Operator

Figure 8: Phase 2 average composition per day - remote manual tuning by Air Liquide using Loci Well Watcher - 3x per week



Phase 2 - LFG Flow per Day, 3x per week, Manual Well-Tuning

Figure 9: Phase 2 average LFG flow per day - remote manual tuning by Air Liquide using Loci WellWatcher® - 3x per week

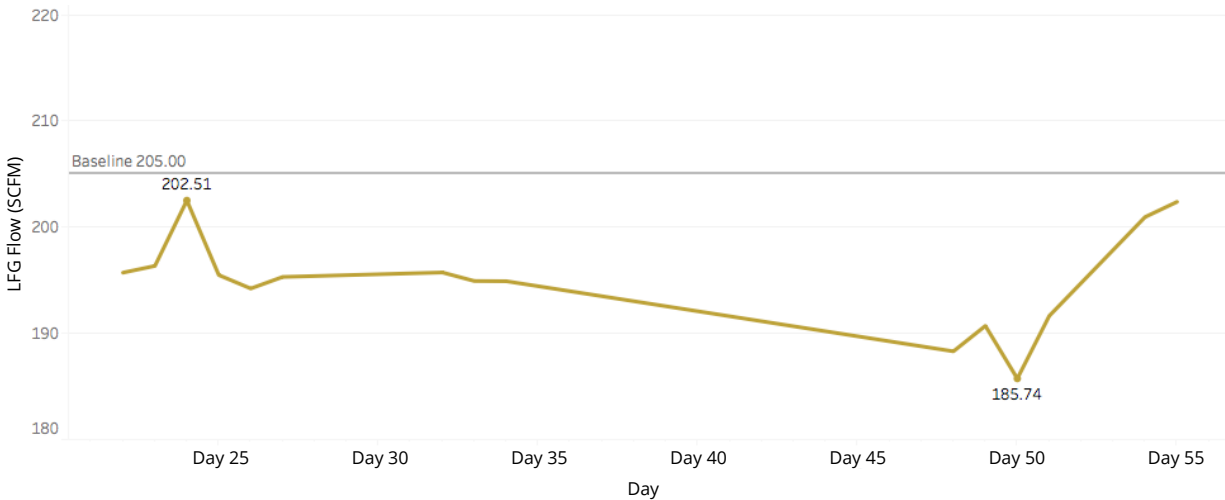


Figure 10: Phase 3 Loci Controls automated gas-collection - LFG flow

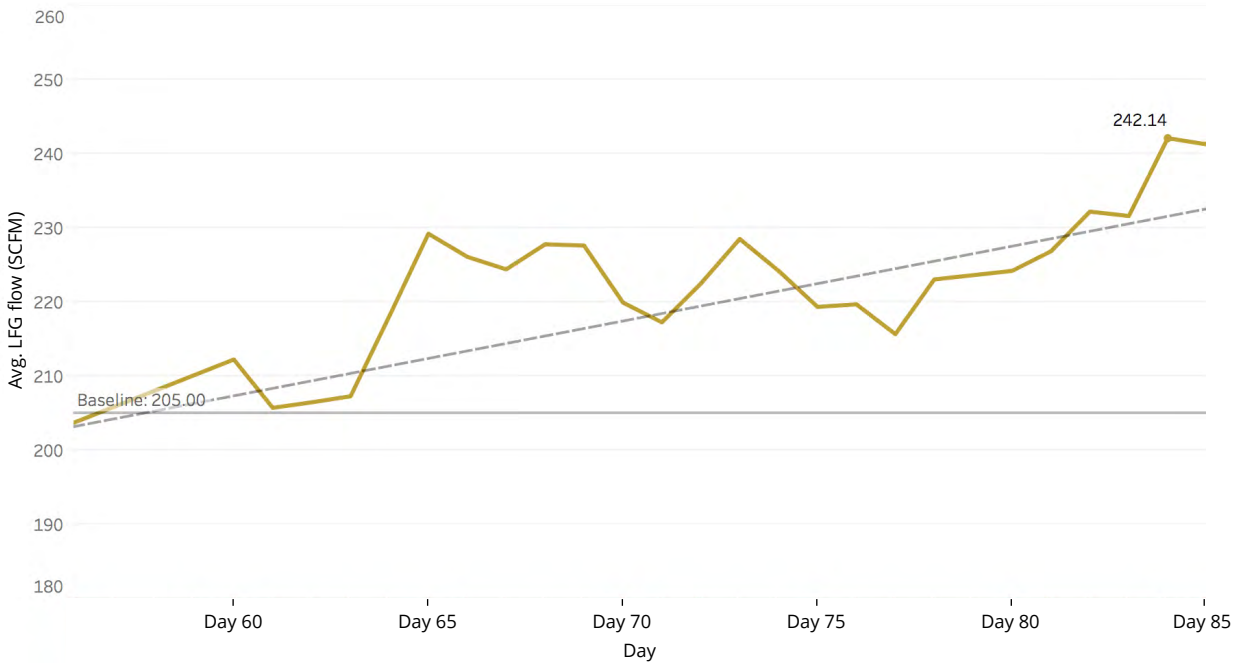


Figure 11: Phase 3 average composition per day - Loci Controls automated gas-collection

