



CASE STUDY

- LOCI CONTROLS INCREASES GAS-COLLECTION BY 17% IN LARGE HIGH-BTU LANDFILL IN THE SOUTHWESTERN USA
- \$950,000 INCREMENTAL PROFIT TO PROJECT OPERATOR
- AUTOMATED COLLECTION MAINTAINS O2 < 0.4%, AND BALANCE GAS < 1.7%

Case Study Summary

This report summarizes the performance of a 50-well installation of Loci Controllers vs. manual well-tuning at a large LFG to high-BTU operation, located in the Southwestern USA. This project represented an installation of approximately 20% of the wells in the landfill gas-collection system. As a control, 10 Loci Controls Sentry-W's were installed to determine the historical change in gas-collection at the site due to the changes in weather during the summer. The measurements from the Sentry-W wellhead, monitoring-only devices would serve as a baseline for comparison of the change in gas-collection of manually tuned wells due to seasonal changes at this site.

Table 1: Summary of Loci Controls' comparative performance

Location	Objective	Status
Southwestern USA	Compare accuracy of product/service suite to gas chromatograph	Increased CH ₄ flow to an optimum sustainable level of 17% over historical manual tuning
	Maintain gas-composition thresholds of CH ₄ > 56%, CO ₂ < 0.4%, and Bal Gas < 1.7%	Maintained composition thresholds as stipulated

The following graph depicts the relative performance in achieving CH₄ flow during each of the three phases:

Figure 1: Increasing LFG flow from automated tuning



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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

Southwestern USA Private Landfill

Loci Controls Gas-Composition Accuracy vs. Gas Chromatograph

Loci Controls maintains high degree of accuracy compared to gas chromatograph.

Project Objectives:

- Demonstrate significant gas-collection increase from automated tuning compared to manual tuning
- Maintain gas-composition thresholds of $\text{CH}_4 > 56\%$, $\text{O}_2 < 0.4\%$, and Bal Gas $< 1.7\%$

Background and Process

The trial consisted of three phases:

- 1 An initial 2-week “characterization” phase to capture baseline information to use as point of historical comparison
- 2 An approximate 30-day remote well-tuning phase in which Loci Controllers were “remote-manually” tuned by Loci Controls landfill gas-collection analysts
- 3 Loci Controls automated gas-collection—using algorithm-based well-tuning—which spanned approximately 30 days

Phase 1 - Characterization/Monitoring Only

Phase 1 Objectives:

- Evaluate the gas-collection on the 50 wells with controllers, and make necessary modifications and adjustments to Loci Controls equipment (primarily size of orifice plate and valve type)
- Determine baseline gas-composition and flow values to document performance of operator manual-tuning process for relative comparison in trial Phases 2 and 3

Phase 1 Process (how baseline was calculated)

For the first month, Loci Controls operated its equipment in monitoring-only mode and compiled a calculated average of CH_4 flow. The values compiled for the 10 Sentry-W units were excluded from the baseline calculations. However, this Sentry-W data has been used to benchmark the routine seasonal increase in CH_4 flow, which is subtracted from the % increase over baseline, leaving an “adjusted net increase” attributed to Loci Controls automated gas-collection, as shown in Phases 2 and 3.

Phase 1 Results

- For the wells with the 50 controllers, the CH₄ rate fluctuated between 1045 SCFM and 1080 SCFM, with an average baseline of 1065 SCFM
- Gas-composition of CH₄ > 55%, with O₂ < 0.1%, and Bal Gas < 1% on these wells
 - The actual O₂ and balance gas-composition on these 50 wells was below the site-wide gas-composition upper limits of O₂ of 0.4%, and Bal Gas of 1.7%

Figure 2: Phase 1 CH₄ flow baseline/characterization – slight increase in CH₄ flow towards the end of Phase 1

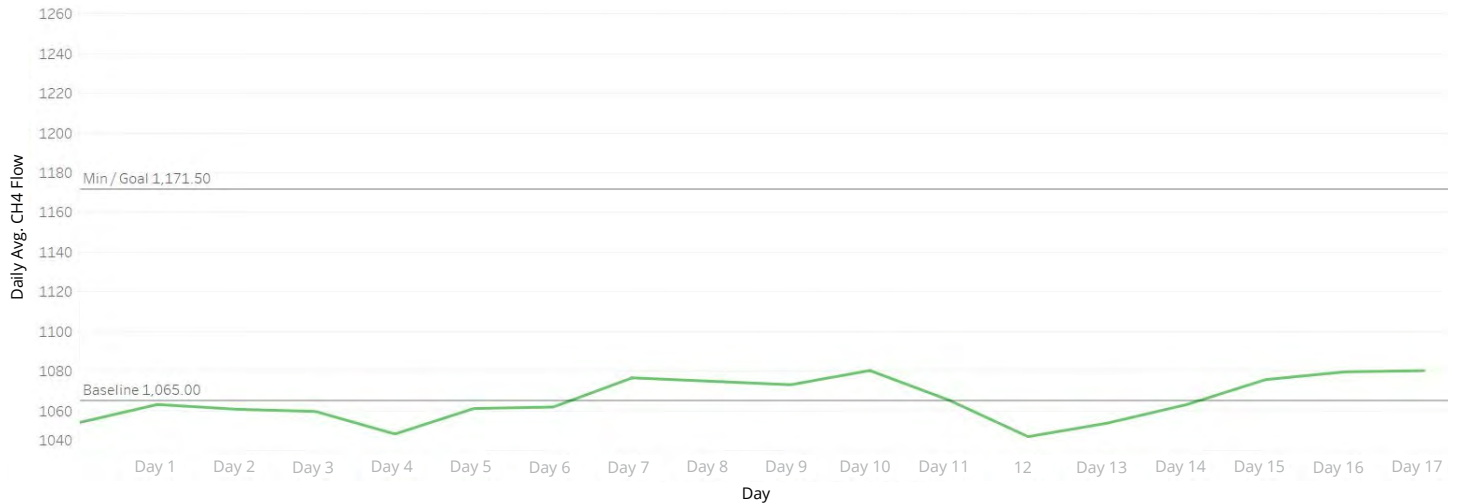
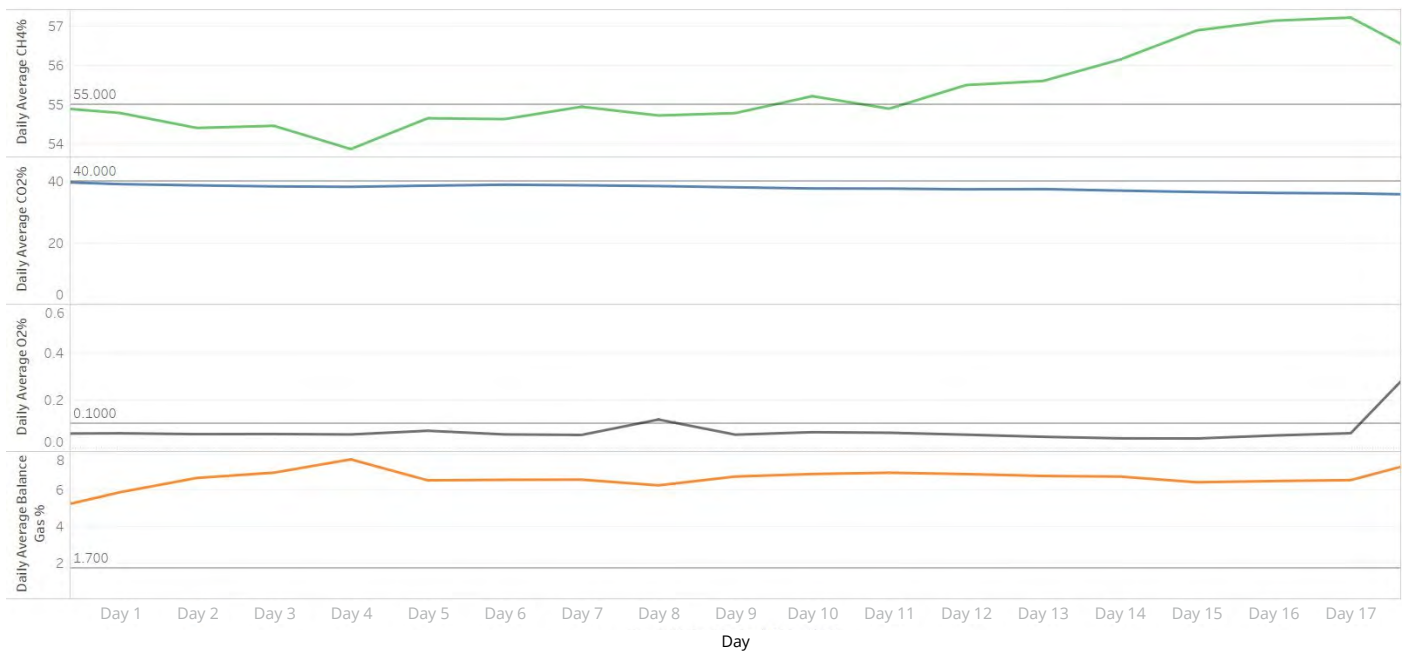


Figure 3: Phase 1 baseline composition – composition held steady during baseline period with slight increase in CH₄ percentage



Phase 2 - Remote Manual Wellfield Tuning Utilizing Loci Controls WellWatcher® User Interface

Phase 2 Process

Loci Controls gas-collection analysts working in Fall River, MA, began making remote manual well adjustments on the wells with controllers. During this period, an increasing trend of CH₄ and LFG gas-collection was generated.

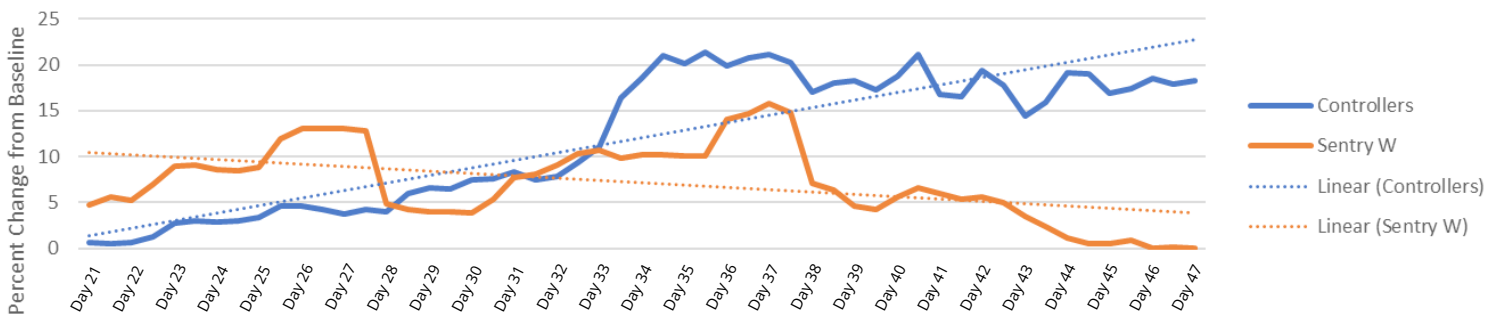
Phase 2 Results

During the approximately 4 weeks of remote manual tuning by Loci Controls analysts, with the benefit of real-time gas-composition and flow data available on the WellWatcher® user interface, remote manual valve adjustments were made, which resulted in a nearly 10% increase in CH₄ flow.

Impact of Seasonal Increase of Flow

The high-BTU project operator provided historical data indicating that there was a seasonal impact on flow at this site. To measure the impact of the seasonal variations at this site, Loci Controls used data collected by Sentry-W units and compared these results to the baseline values that were calculated. The Sentry-W values were used to benchmark the increase to be attributed to the seasonal increase compared to the impact of the Loci Controls methodology. The graph below shows a comparison between the Sentry-W and the Controller data as it relates to increase in flow during the summer months, shown as % increase over baseline.

Figure 4: Seasonal impact of CH₄ flow indexed against baseline flow in Phases 2 and 3. Increase demonstrated in Controllers, with more flow fluctuations observed in Sentry-W's



Phase 3 - Loci Controls Automated Gas-Collection

Phase 3 Objectives

- Increase CH₄ flow while maintaining strict gas-composition performance required for this LFG to high-BTU project
 - It would then be possible to make a comparison between Loci Controls' automated gas-collection vs. the manual tuning performed by operator as reflected in the baseline values for this site
- Target performance goal was to increase CH₄ flow by 10% over baseline CH₄ values while maintaining strict adherence to the composition thresholds

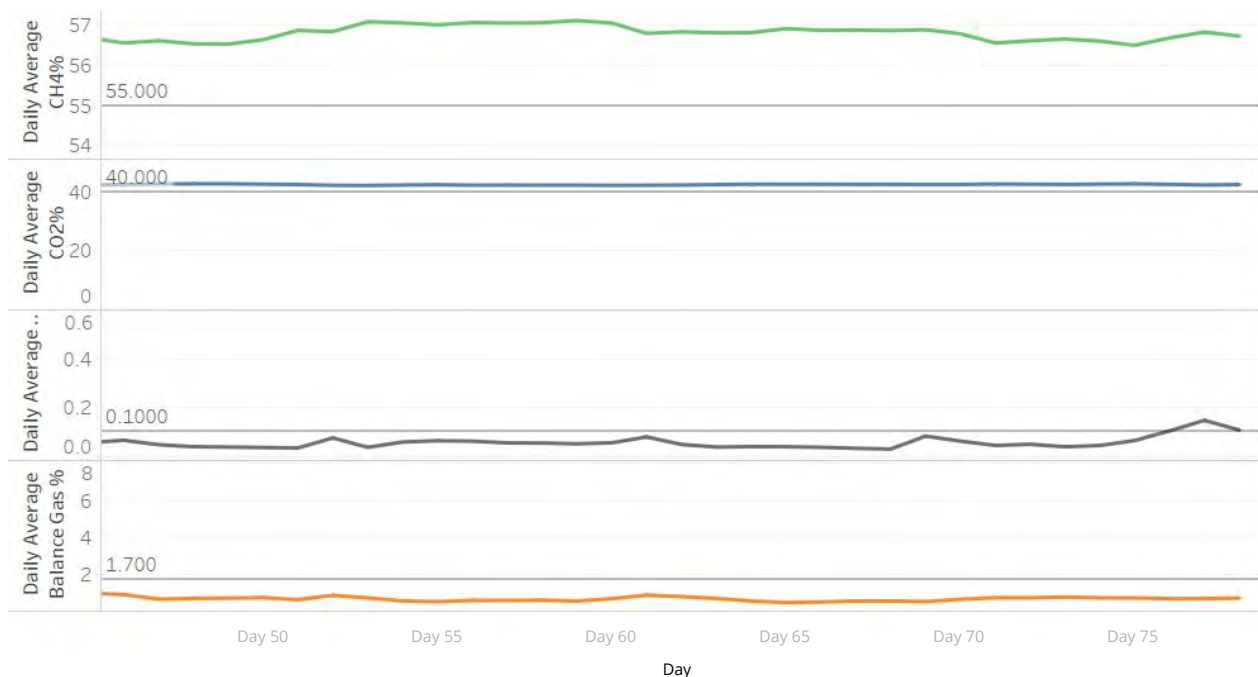
Phase 3 Process

In a transition from Phase 2 remote manual tuning, Loci Controls began its automated gas-collection using its control algorithm for a 30-day period.

Phase 3 Results

- Achieved a net adjusted average CH₄ increase of 13% and a net adjusted optimum sustainable level of 17% over baseline. The pre-established gas-composition standards of CH₄ > 56%, O₂ < .4%, and Bal Gas < 1.7% were maintained

Figure 5: Average Phase 3 daily composition – gas elements stabilized around target thresholds



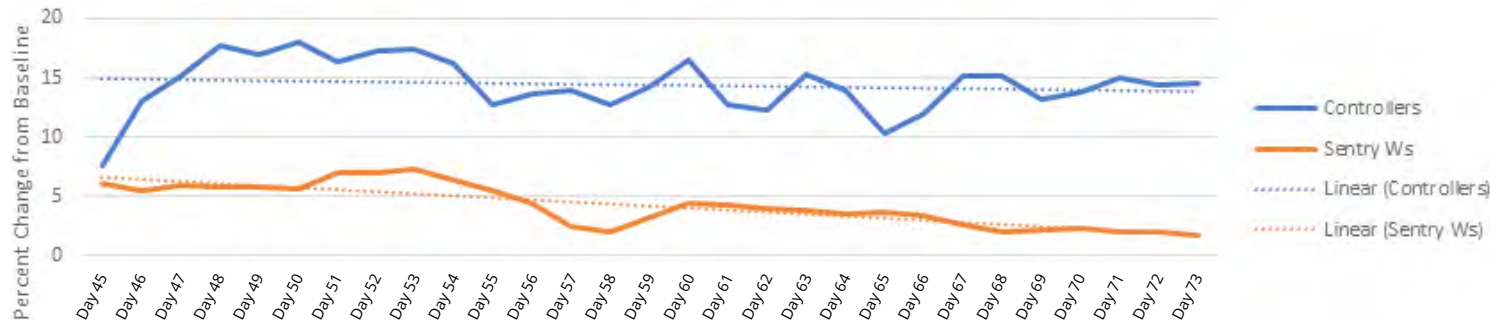
Gross value of CH₄ (not adjusted for seasonal impact) oscillated between 1220 SCFM and 1280 SCFM, reaching a peak of over 1340 SCFM compared to our targeted goal of 1171 SCFM (10% increase over baseline).

Figure 6: Phase 3 CH₄ flow – consistently above targeted goal of 1171 SCFM



The net adjusted CH₄ increase over baseline during Phase 3 averaged 13%, with an optimum sustainable level (expected ongoing performance) of 17%:

Figure 7: Phase 3 CH₄ flow vs. baseline –13% above baseline on average



Conclusion

As summarized in this case study, Loci Controls has demonstrated that our product service suite is able to materially increase CH₄ collection 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-collection generated from these 50 collection wells equipped with Loci Controls – extrapolating the increase from the one-month period of automated gas-collection, would result in an annualized gain (net of Loci Controls subscription fees) to the project operator of \$950,000.

Figure 8: Loci Controls subscription service model

Loci Controls Subscription Service Model

<i>Energy Producer Economics</i>				
Number of wells (total)				50
Average Output MMBTU/day				1,459
Average MMBTU/Mo (30 days)				43,770
RIN Revenue/MMBTU (11.7 RIN/MMBTU)				\$20.00
Natural Gas Price (\$/MMBTU)				
Monthly Revenue				\$875,400
% increase from Loci				17%
Monthly Revenue Increase (Assume Operator receives 70% of total)				\$104,173

<i>Product Mix</i>				
		# of Devices	Unit Price	Monthly Cost
Loci Controller	100%	50	\$500	\$25,000
Loci Sentry	0%	0	\$0	\$0
Total Monthly Cost				\$25,000

<i>Net Contribution to Energy Producer (Annually)</i>		Net Gain	ROI
Subscription		\$950,071	317%

<i>One-Time Setup, Installation and Travel</i>		
Number of Techs		2
Cost/Tech/Day	\$	500
Cost/Well	\$	100
Tech productivity: Wells/day		32
Number of Man Days		2
Airfare/travel	\$	700
One-Time Setup, Installation and Travel		\$7,700

Instructions: complete cells in blue except where not applicable

Project type	High-BTU/LNG		
Electricity Price (skip for high-BTU and LNG)			
PPA, FIT or other (\$/MWH)	\$80.00		
Fuel use (skip for Power Generation)			
Natural Gas Price (\$/MMBTU)	High BTU \$3.50		
LNG Price (\$/thousand cubic feet)	\$5.14		
RIN Value	\$2.50		
Input Method			
% Methane	Avg SCFM 50%		
Information--SCFM Input			
	Data	Notes	
Average Gas Flow scfm	2,000		
MMBTU/Day	1,459	*1013 BTU/SCF	
Information--MMBTU/Day Input			
	Data	Notes	
Average Output MMBTU/day	2,000		
Average Gas Flow scfm	2,000		
Average Monthly LFG Flow scf	86,416,584	*1013 BTU/SCF	
Average Gas Flow / well scfm	40.01		
Project Type		Fuel Uses	Input Method
Power Generation	High BTU	MMBTU/Day	
High-BTU/LNG	LNG	Avg SCFM	

The metrics shown above do not consider the reduced labor costs associated with manual wellfield tuning that will be saved by the Loci Controls products and services. 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 thanks to 24/7 monitoring and oversight allowing us to readily identify and troubleshoot wellfield system problems that may impact both plant maintenance and uptime.