Measurement And Monitoring of Chlorine Gas Emissions at Deep Well Anode Vent Tube Outlets

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A Case Study in Monitoring Toxic Gases

Agenda

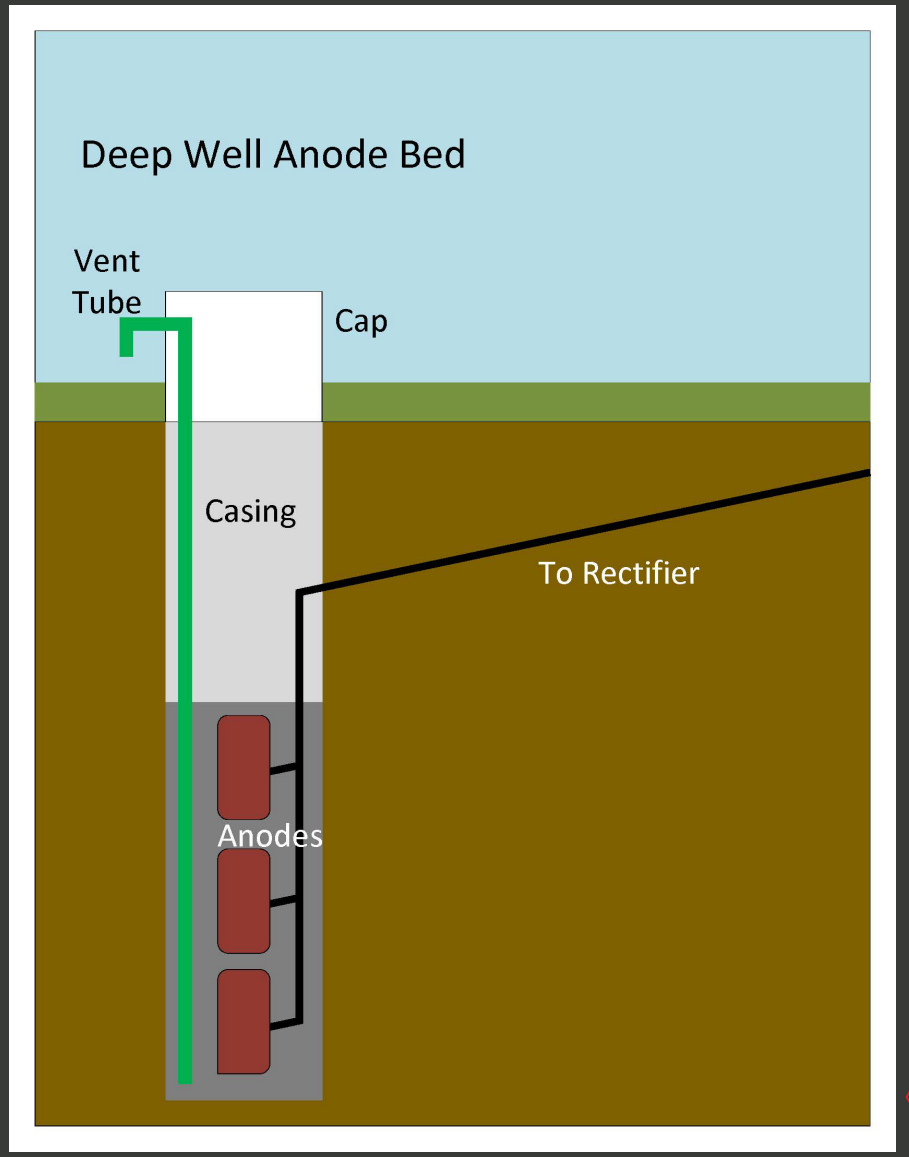
- Project introduction and background
- Equipment used
- Initial “conference room” proof of concept testing
- First field-testing deployment
- Second field-testing deployment
- Web data overview
- Subsequent field deployments
- Conclusions/Q&A

Introduction

- Deep well anode beds produce chlorine gas
- The emissions must be vented to prevent corrosion to the copper wiring and other metallic components
- A large landowner instituted a requirement for monitoring chlorine emissions from anode beds
- A project to develop a chlorine monitoring solution was started

Basic Anode Bed Diagram

- Anodes react with chlorides in the substrate
- Perforated vent tube pulls chlorine gas away from the anodes
- Gas emissions are vented to the atmosphere



Proof of Concept Testing

Components Used in the Application:

Chlorine Gas Sensor

0-5 PPM (parts per million)

4-20mA signal output

2-Channel Monitor

Cellular communication

Battery or external power

4-Channel Monitor

Cellular or satellite

Modbus SCADA option

Proof of Concept Testing (continued)

Step One (“conference room demo”):

- Tested compatibility between the sensor and monitors
- Performed sensor calibration procedure
- Learned sensor will require periodic (2-3 times per year) recalibration
- Learned users will need the calibration kit for field use

Step Two (“conference room demo”):

- Viewed and configured web data portal
- Sent test payload to the web
- Validated measurement accuracy

Field Testing and System Deployment

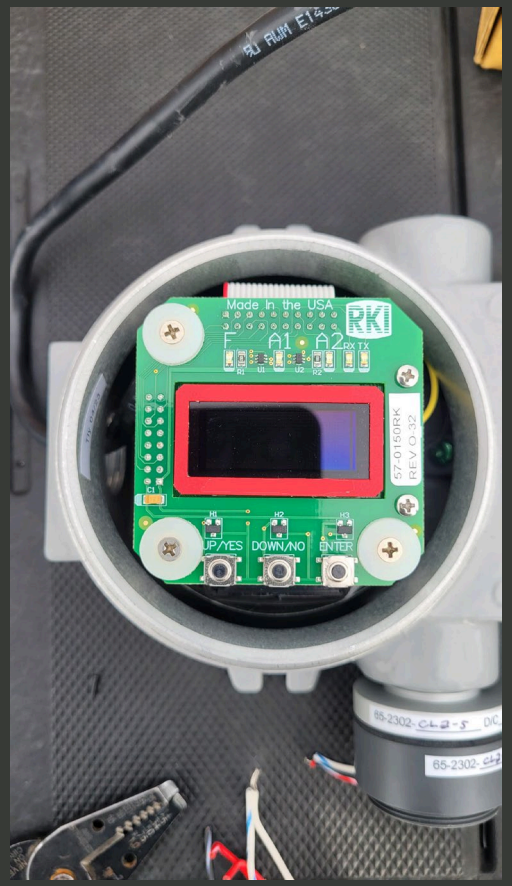
First field unit:

- 2-channel system
  - Battery powered
  - 4/5G cellular communication
- Perform initial field calibration procedure
  - Extended sensor “charge time” required

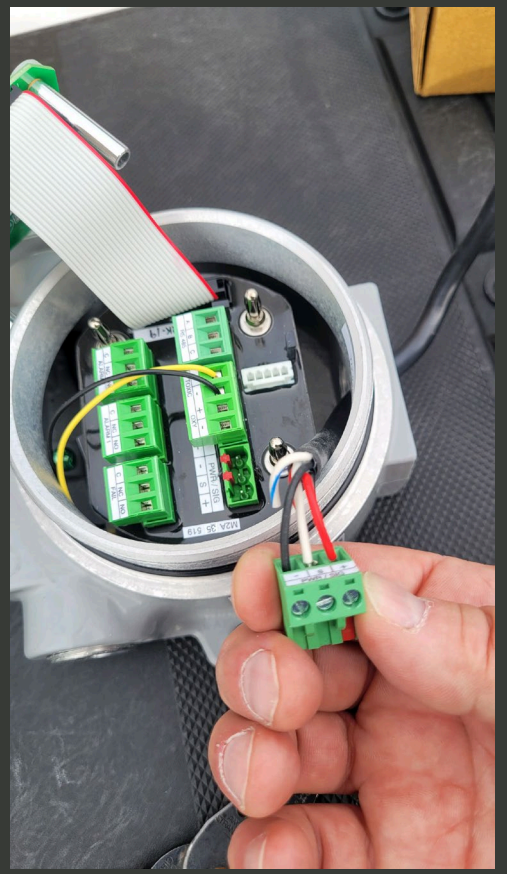
Second field unit

- 4-channel system
  - Externally powered (from rectifier power)
  - Satellite communication

First Field Test Installation



Preparing the sensor for installation



Connecting to the sensor 4-20mA output

First Field Test Installation

2-channel cellular monitoring system

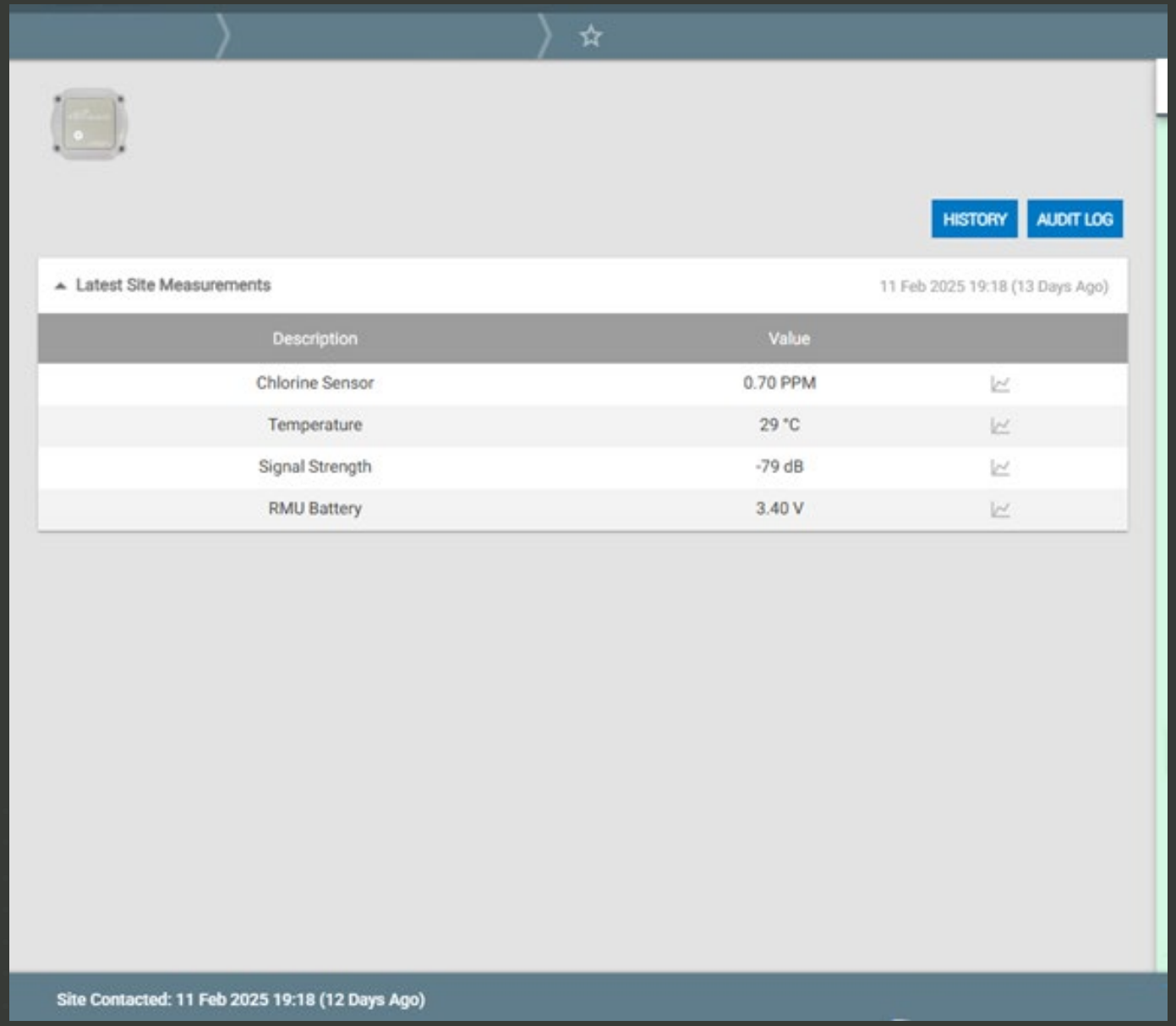
Sensor location (on post by vent tube)

Second Field Test Installation

4-channel satellite-based monitoring system

Sensor mounted next to the vent tube outlet

Web Portal Data View



Web portal site view showing most recent data

Web Portal Data View

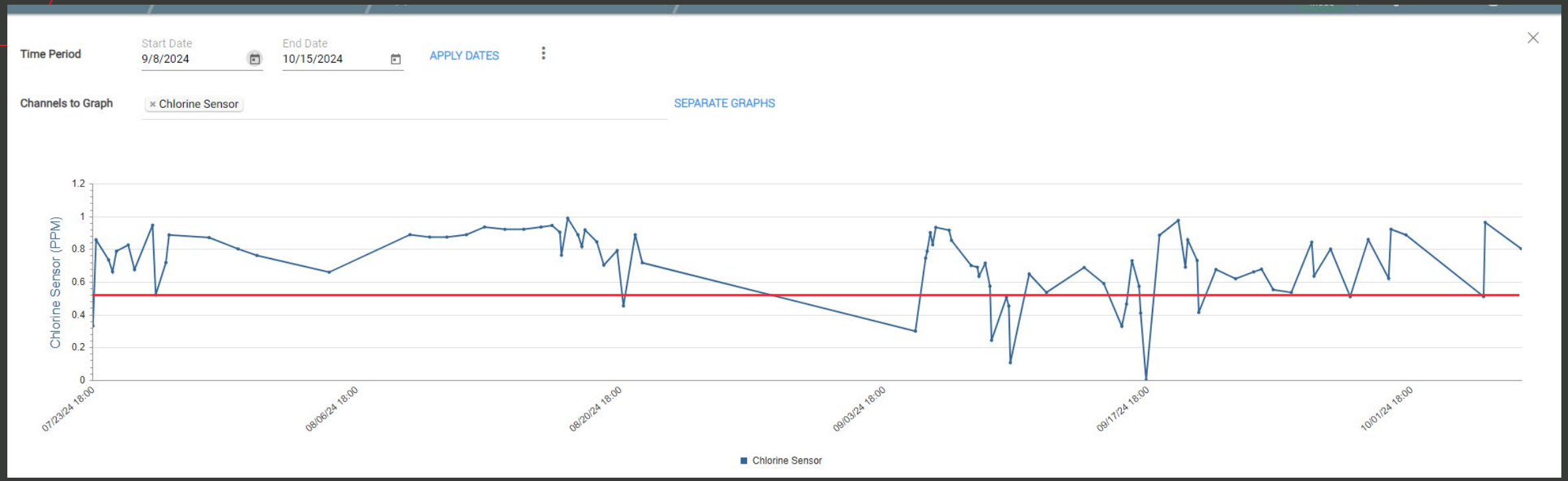
Description	Value
Chlorine Sensor	0.00 PPM
Temperature	23 °C
Signal Strength	-77 dB

Channel History

Hide/ Show	Time	Chlorine Sensor	Temperature	Signal Strength	Version
	24 Feb 2025 06:20	0.00 PPM	23 °C	-77 dB	1.22.0
	23 Feb 2025 06:19	0.01 PPM	27 °C	-75 dB	1.22.0
	23 Feb 2025 02:20	0.00 PPM	26 °C	-75 dB	1.22.0
	22 Feb 2025 22:20	2.10 PPM	29 °C	-73 dB	1.22.0
	22 Feb 2025 06:19	0.39 PPM	24 °C	-73 dB	1.22.0
	21 Feb 2025 22:20	0.71 PPM	29 °C	-73 dB	1.22.0
	21 Feb 2025 18:21	1.14 PPM	29 °C	-73 dB	1.22.0
	21 Feb 2025 18:20		29 °C	-73 dB	1.22.0
	21 Feb 2025 06:19	0.70 PPM	26 °C	-75 dB	1.22.0
	21 Feb 2025 02:20	0.45 PPM	26 °C	-75 dB	1.22.0
	20 Feb 2025 22:20	1.75 PPM	29 °C	-75 dB	1.22.0
	20 Feb 2025 06:20	0.90 PPM	21 °C	-75 dB	1.22.0
	19 Feb 2025 06:20	0.36 PPM	24 °C	-75 dB	1.22.0
	18 Feb 2025 06:20	0.01 PPM	39 °C	-77 dB	1.22.0

Data history screen capture

Web Portal Data View



Graph view of data: “X” axis 10 weeks duration, “Y” axis 0-1.2 PPM

Red line = 0.5 PPM (alarm threshold)

Additional System Deployments

Discoloration, residue, and corrosion from chlorine emissions

Conclusions

- The toxic gas sensors used are very accurate but require periodic calibration
- The “Report by Exception” monitor systems proved to be flexible and cost-effective in these applications
- Other sensor applications available:
  - Methane (underground gas storage, gas distribution pipelines
  - H_2S and SO_2 (production fields and gathering systems)
  - CO_2 (carbon sequestration sites)
- Project goals were accomplished

Thank You

Questions???

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