
CP Monitoring for Pipeline Integrity & Compliance

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Appalachian Underground Corrosion Short Course

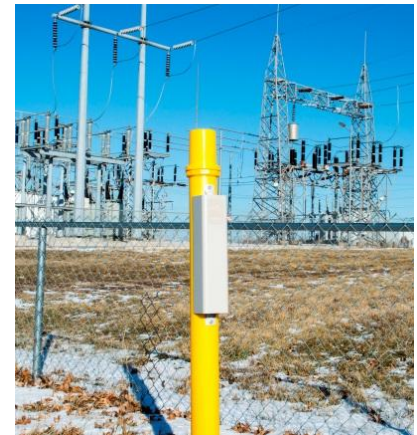
CP Monitoring

- **Remote monitoring basics**
- **Key features and applications**
 - **Timeliness & accuracy of CP data acquisition**
 - **Data management & reporting**
 - **Communication & data security**
 - **Special features & functions**
 - **Alarms & notifications**
 - **Rectifier current interruption**
 - **Additional measurements**



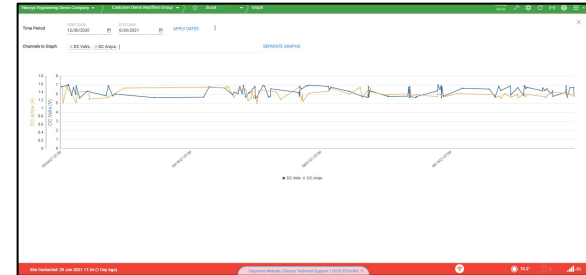
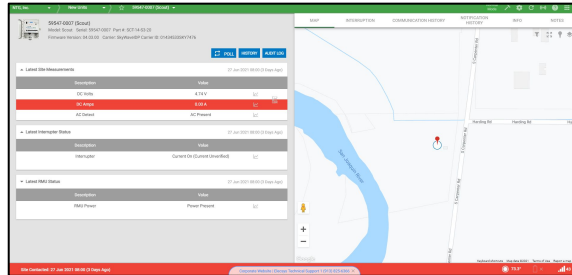
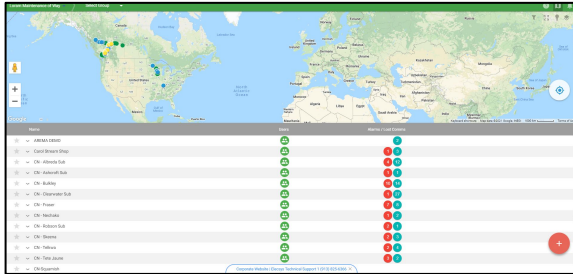
Remote Monitoring Basics

- **Rectifier monitors**
 - Typically, 4 to 10+ channels
 - Voltage and current output
 - Rectifier power detection
 - Interruption control
- **Test point/bond monitors**
 - Typically, 2 to 10 channels
 - On/Off potential
 - AC voltage, current density, drain
 - Remote data-logging capability
 - Corrosion rate monitoring

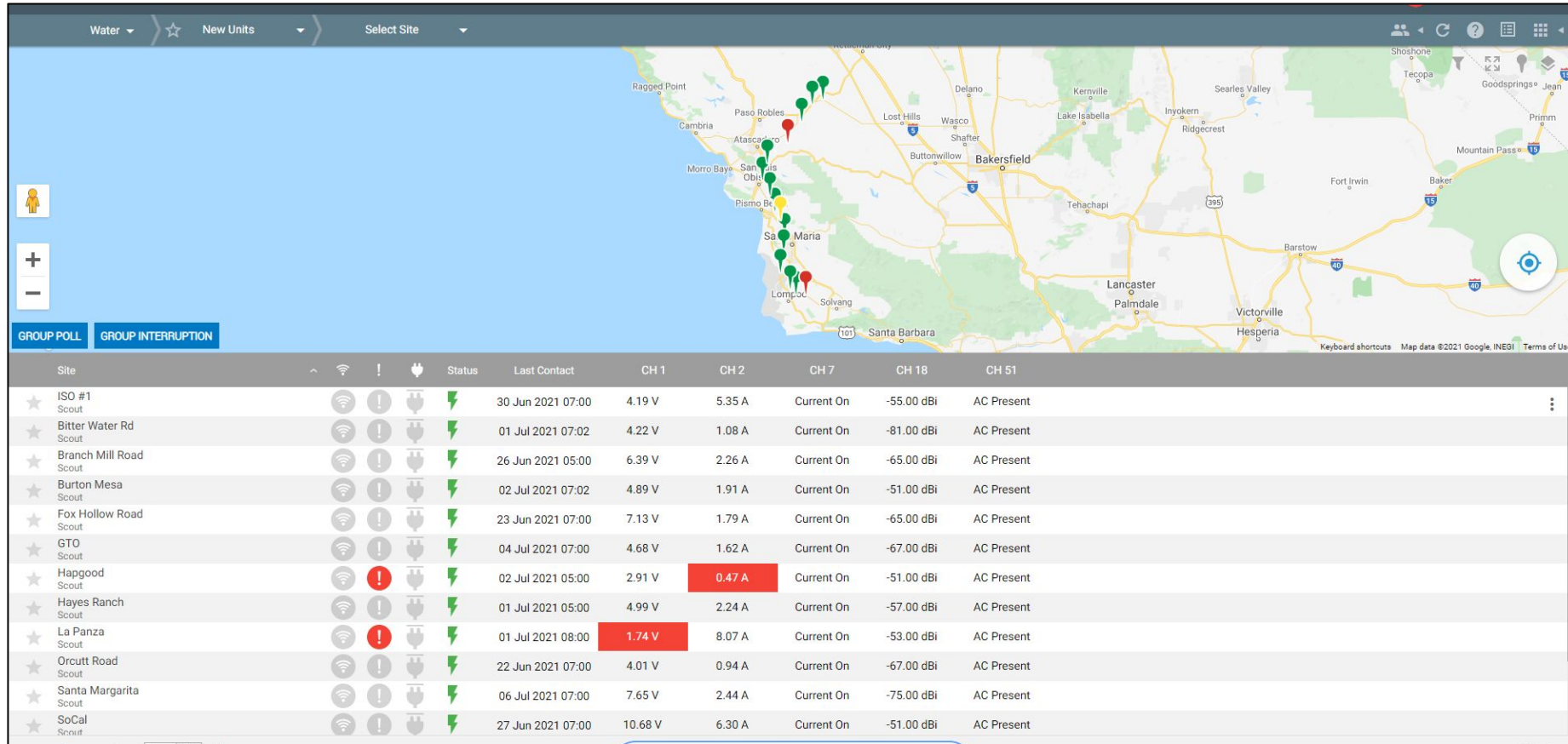


Remote Monitoring Basics

- **Why use monitors?**
 - Data acquisition (quality & accuracy)
 - Alarms & notifications
 - Automate integrity reporting
 - CP survey and IR drop testing
 - Specialized measurements



Web Monitor Group View



Web Monitor Site View

The screenshot displays the 'Web Monitor Site View' for a device named 'Bitter Water Rd'. The interface is divided into two main sections: a left sidebar with device details and measurement history, and a right section with a map and navigation tabs.

Device Details:

- Model: Scout
- Serial: 62135-0037
- Part #: SCT-14-N7-50
- Firmware Version: 04.05.05
- Carrier: Verizon
- Carrier ID: 311270001269259

Navigation Tabs: MAP, INTERRUPTION, COMMUNICATION HISTORY, NOTIFICATION HISTORY, INFO, NOTES

Latest Site Measurements (1 Jul 2021 07:02 (5 Days Ago))

Description	Value
DC Volts	4.22 V
DC Amps	1.08 A
AC Detect	AC Present

Latest Interrupter Status (15 Jun 2021 22:30 (21 Days Ago))

Description	Value
Interrupter	Current On

Latest RMU Status (1 Jul 2021 07:02 (5 Days Ago))

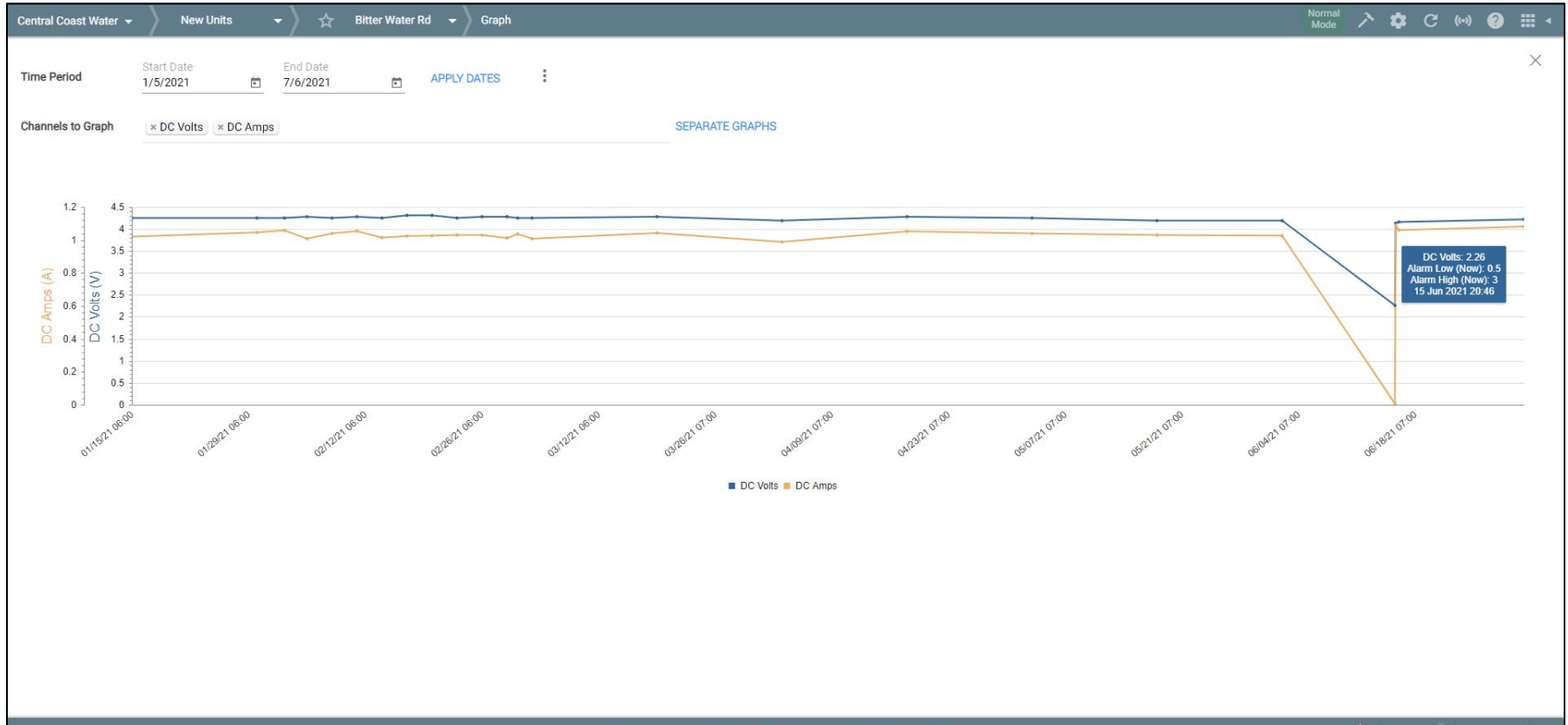
Description	Value
RMU Power	Power Present

The map on the right shows the location of the device on Bitterwater Rd, with Chocoma Creek visible to the north. The map includes standard Google Maps controls like zoom in (+) and zoom out (-) buttons.

Web Monitor Site History - Tabular

Water ▾ New Units ▾ ☆ Bitter Water Rd ▾ Channel History									Normal Mode		⚙	↺	⌂	⋮	⌵
Hide/ Show	Time	RMU Power	DC Volts	DC Amps	Interrupter	Signal Strength	AC Detect	Version							
<input checked="" type="checkbox"/>	1 Jul 2021 07:02	Power Present	4.22 V	1.08 A		-81.00 dBi	AC Present	04.05.05							
<input checked="" type="checkbox"/>	16 Jun 2021 07:00	Power Present	4.16 V	1.06 A		-83.00 dBi	AC Present	04.05.05							
<input checked="" type="checkbox"/>	15 Jun 2021 22:30	Power Present	4.13 V	1.09 A		-81.00 dBi	AC Present	04.05.05							
<input checked="" type="checkbox"/>	15 Jun 2021 20:46	Power Failed	2.26 V	0.01 A		-79.00 dBi	No AC	04.05.05							
<input checked="" type="checkbox"/>	2 Jun 2021 07:01	Power Present	4.19 V	1.03 A		-83.00 dBi	AC Present	04.05.05							
<input checked="" type="checkbox"/>	18 May 2021 07:00	Power Present	4.19 V	1.03 A		-83.00 dBi	AC Present	04.05.05							
<input checked="" type="checkbox"/>	3 May 2021 07:00	Power Present	4.25 V	1.04 A		-83.00 dBi	AC Present	04.05.05							
<input checked="" type="checkbox"/>	18 Apr 2021 07:00	Power Present	4.28 V	1.05 A		-81.00 dBi	AC Present	04.05.05							
<input checked="" type="checkbox"/>	3 Apr 2021 07:01	Power Present	4.19 V	0.99 A		-81.00 dBi	AC Present	04.05.05							
<input checked="" type="checkbox"/>	19 Mar 2021 07:00	Power Present	4.28 V	1.04 A		-81.00 dBi	AC Present	04.05.05							
<input checked="" type="checkbox"/>	4 Mar 2021 06:00	Power Present	4.25 V	1.01 A		-79.00 dBi	AC Present	04.05.05							
<input checked="" type="checkbox"/>	2 Mar 2021 13:41	Power Present	4.25 V	1.04 A		-77.00 dBi	AC Present	04.05.05							
<input checked="" type="checkbox"/>	1 Mar 2021 06:01	Power Failed	4.28 V	1.01 A		0.00 dBi	AC Present	04.05.05							
<input checked="" type="checkbox"/>	26 Feb 2021 06:00	Power Failed	4.28 V	1.03 A		0.00 dBi	AC Present	04.05.05							
<input checked="" type="checkbox"/>	23 Feb 2021 06:00	Power Failed	4.25 V	1.03 A		0.00 dBi	AC Present	04.05.05							
<input checked="" type="checkbox"/>	20 Feb 2021 06:00	Power Failed	4.31 V	1.03 A		0.00 dBi	No AC	04.05.05							
<input checked="" type="checkbox"/>	17 Feb 2021 06:00	Power Failed	4.31 V	1.02 A		0.00 dBi	AC Present	04.05.05							
<input checked="" type="checkbox"/>	14 Feb 2021 06:01	Power Failed	4.25 V	1.01 A		0.00 dBi	AC Present	04.05.05							
<input checked="" type="checkbox"/>	11 Feb 2021 06:00	Power Failed	4.28 V	1.05 A		0.00 dBi	AC Present	04.05.05							
<input checked="" type="checkbox"/>	8 Feb 2021 06:00	Power Failed	4.25 V	1.04 A		0.00 dBi	AC Present	04.05.05							
<< (1 2) >> Page 2 Go 48 ▾									96 items						

Web Monitor Site History - Graphical



Data Acquisition

- **Manual data acquisition**
 - Potential for human error
 - Prioritizing tasks
- **Automated data acquisition**
 - Data collection directly from the measurement instrument
 - Scheduled reporting & “on-demand” measurements
 - PHMSA approved (Part 192 and Part 195)



Alarms and Notifications

- **Manual data acquisition**
 - Failure events unnoticed until manual measurement
 - Potential for human error or omission
- **Automated data acquisition**
 - Immediate notification of abnormal conditions
 - Notification to all desired personnel
 - “Re-notification” at scheduled intervals



Alarm Report Generation

- **Alarm Generation**
 - Alarm thresholds assignable to any channel
 - Field unit overrides reporting schedule to report alarm
- **Alarm Notifications**
 - Notifications sent to any authorized users
 - Sent via email and/or text
 - “Re-report” of unaddressed alarm conditions

MAP		INTERRUPTION	COMMUNICATION HISTORY	NOTIFICATION HISTORY
Date		Summary		
▼	15 Jun 2021 22:31	RTN Notification		
▲	15 Jun 2021 20:47	Alarm Notification		
Sent To: ajs@ .com (Adam Scheer) eak@ .com (Adam Scheer) eak@ .com (Eric Kieding) dhr@ .com (Don Ross)				
Message: The Bitter Water Rd site has received an alarm report. The following values were reported by the site: DC Volts: 2.26 V *DC Amps: 0.01 A Interrupter: Current On (Current Unverified) Signal Strength: -79.00 dBi AC Detect: No AC *RMU Power: Power Failed * indicates alarm value To view the details of this alarm, visit https://connect.elecsyscorp.com .				

Data Management

- Display collected data in tabular and graphical form
- Organize data by group, site, parameter
- Automated, scheduled report generation
- Data export to CP data management systems
- Automated compliance reporting



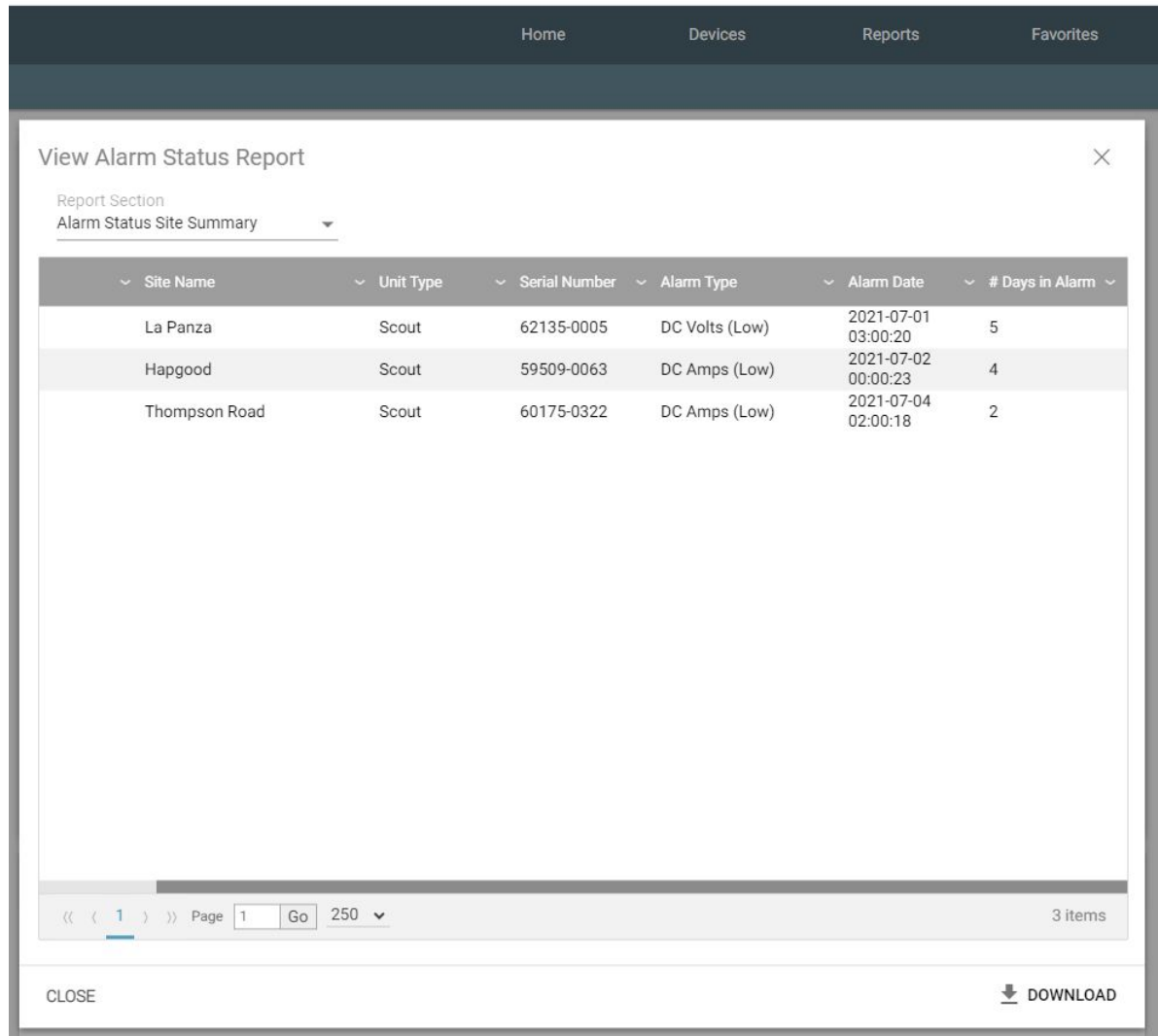
Report Generation

Basic Compliance Reporting

Home Devices Reports Favorites					
View New Report					
Site Name	Report Date	Ch 1	Ch 2	Survey Year	
ISO #1	2021-06-30 07:00:20	4.19	5.352	2021	
Bitter Water Rd	2021-07-01 07:02:06	4.22	1.082	2021	
Branch Mill Road	2021-06-26 05:00:23	6.39	2.262	2021	
Burton Mesa	2021-07-02 07:02:43	4.89	1.908	2021	
Fox Hollow Road	2021-06-23 07:00:14	7.13	1.791	2021	
GTO	2021-07-04 07:00:15	4.68	1.624	2021	
Hapgood	2021-07-02 05:00:20	2.91	0.468	2021	
Hayes Ranch	2021-07-01 05:00:28	4.99	2.238	2021	
La Panza	2021-07-01 08:00:18	1.74	8.073	2021	
Orcutt Road	2021-06-22 07:00:16	4.01	0.936	2021	
Santa Margarita	2021-07-06 07:00:15	7.65	2.439	2021	
SoCal	2021-06-27 07:00:13	10.68	6.296	2021	
Thompson Road	2021-07-04 07:00:15	1.59	-0.006	2021	
Truesdale	2021-06-27 08:00:11	3.18	1.072	2021	
WTP	2021-06-26 07:00:12	25.51	5.44	2021	
<< < 1 > >> Page 1 Go 250 15 items					
CLOSE					DOWNLOAD

Report Generation

Units in Alarm Condition



The screenshot shows a web application interface with a dark navigation bar at the top containing links for Home, Devices, Reports, and Favorites. The main content area is titled "View Alarm Status Report" and includes a dropdown menu for "Report Section" set to "Alarm Status Site Summary". Below this is a table with columns for Site Name, Unit Type, Serial Number, Alarm Type, Alarm Date, and # Days in Alarm. The table lists three entries: La Panza (Scout, 62135-0005, DC Volts (Low), 2021-07-01 03:00:20, 5 days), Hapgood (Scout, 59509-0063, DC Amps (Low), 2021-07-02 00:00:23, 4 days), and Thompson Road (Scout, 60175-0322, DC Amps (Low), 2021-07-04 02:00:18, 2 days). At the bottom of the table, there is a pagination bar showing "Page 1" of "250" items, with a "Go" button and a "3 items" count. A "CLOSE" button is located at the bottom left, and a "DOWNLOAD" button is at the bottom right.

Site Name	Unit Type	Serial Number	Alarm Type	Alarm Date	# Days in Alarm
La Panza	Scout	62135-0005	DC Volts (Low)	2021-07-01 03:00:20	5
Hapgood	Scout	59509-0063	DC Amps (Low)	2021-07-02 00:00:23	4
Thompson Road	Scout	60175-0322	DC Amps (Low)	2021-07-04 02:00:18	2

Data Security

- **Secure data transmittal**
 - Data encryption & authentication
 - Data communication options
- **Secure access**
 - User/password-controlled access levels
 - Methods of interfacing with field assets
- **Website security**
 - Encrypted secure web interface
 - “Tier 4” data center housing
 - Continual data backup



Additional Applications

- Rectifier interruption
- AC and DC Interference Monitoring
- Measure CP at isolation flanges
- Corrosion rate monitoring
- Leak detection



Current Interruption

- **Interrupt by site or group**
 - Scheduled or manual
 - Testing flexibility
- **GPS synchronized cycle times**
 - Synchronization with any interrupters
- **Scheduled “current off” by site or group**
 - Facilitates interference testing
- **Specialized interruption sequences**
- **On/Off potential measurements**
- **Notification of anomalies**



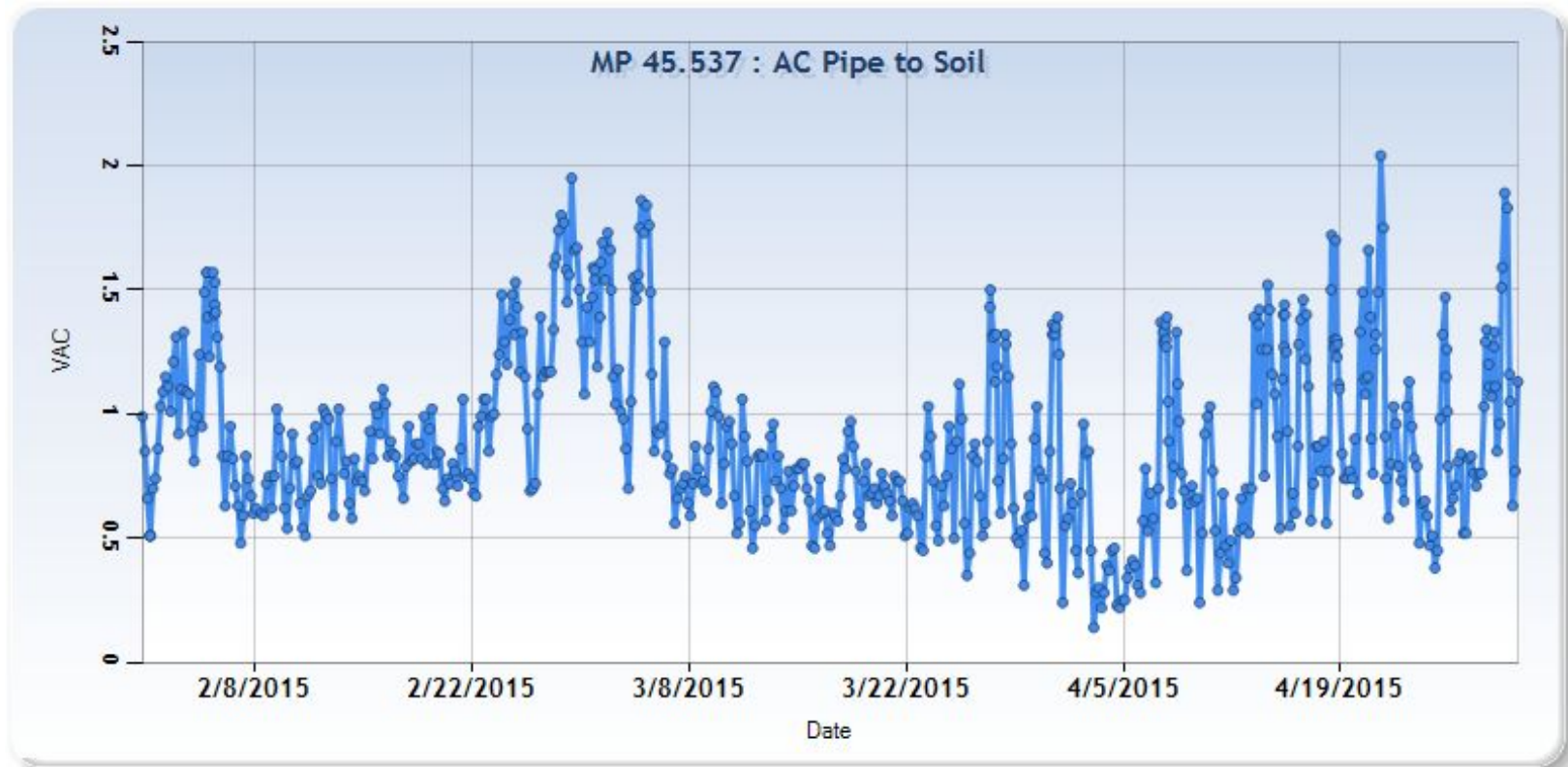
AC and DC Interference

- **Current density measurements**
 - Particularly in high AC areas with FBE coated pipeline
- **Measure AC drain**
- **Remote access data-logging**
- **Measure corrosion rate**
- **Track soil resistivity changes**



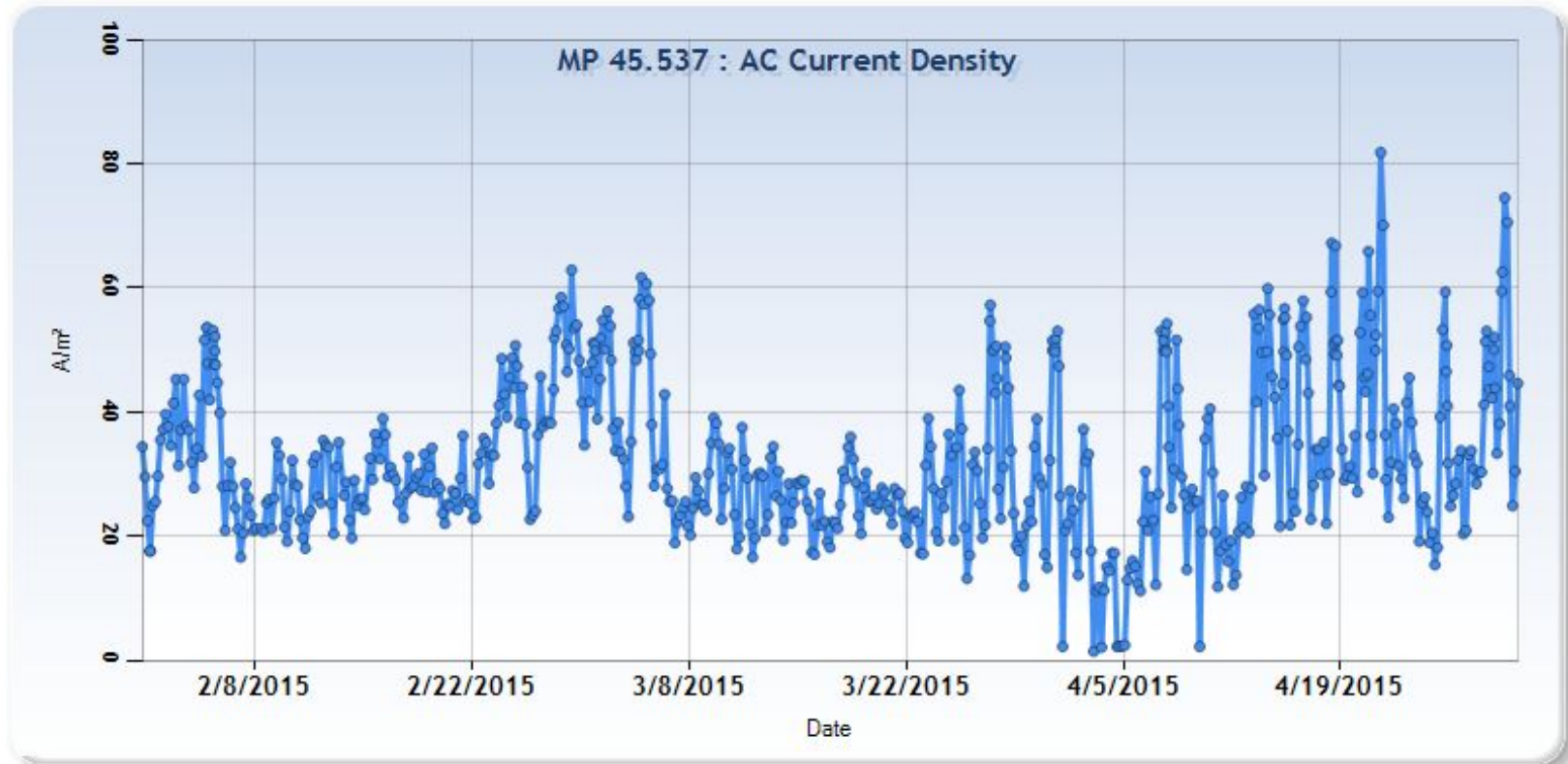
Induced AC Measurements

AC Voltage



Induced AC Measurements

AC Current Density



Corrosion Rate Monitoring

- **Compatible with most ER and LPR corrosion probes**
- **Measure corrosion rate inside annular space (casing, tank bottom)**
- **Evaluate external corrosion rate of a protected surface in soil**
- **Track internal corrosion rates and inhibitor effectiveness**



Leak Detection Monitoring

- Monitor sensor output from “Polymer Absorption” hydrocarbon sensors (PAS)
- Generate notifications to users
- Enables leak detection sensor use in areas without SCADA
- Applications for additional sensor types



CP Monitoring

- **Summary**
 - Monitoring systems can measure all CP compliance values
 - Alarms & notifications alert users to problems in the system
 - Specialized functions enhance indirect inspection and field testing
 - Cost effective method of acquiring and using pipeline integrity data



CP Monitoring

Questions???

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Thank You!



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