



## **COGCC Remediation Project #9425 Update**

### **September 29, 2016**

# Nelson water well

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## Construction / Performance

- Completed installation of water recycle / hydro-cyclone type separation finishing system
  - Collected pre and post system samples on July 20, 2016 and had same analyzed for methane concentrations
    - Pre system sample analysis indicated that the incoming stream is still fully saturated.
    - Post system sample analysis indicated a methane concentration of 4.5 ppm

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## Area Water Well Sampling / Aerial Methane Survey

- Collected 2<sup>nd</sup> quarter domestic well water samples from Nelson, Williams Deep and Shallow, Michaels and Woods wells on July 20, 2016
  - Nelson sample analysis continues to indicated the presence of methane, butane and propane. No VOC's were detected.
  - No indications of thermogenic gas or VOC's were present in other well samples taken.
- Performed second aerial methane survey of project area August 9, 2016. With exception to a 4.167 ppm level detected at a single source within the compressor station, no concentrations above normal background levels were detected . See report beginning on Page 8.

## ECGS – well remediation

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### Dynamic

#### WP-D007-1

- Remediation work complete
  - Perforated at 5060' and 2890' and squeezed (upper perfs with cement, lower perfs with WellLock).
  - Repaired leak located at approx. 25' with WellLock.
  - Extended surface casing and replaced Larken type bradenhead with SWECO bradenhead.

#### WP-D007-2

- Remediation work complete
  - Perforated and squeezed at 5142' and 3040'
  - Performed acid job on well to improve performance after contaminating near well bore with squeeze cement

#### WP-D011-1

- Remediation work complete
  - Performed series of pressure test during course of remediation work and determined circa. 2010 and 2012 squeeze perfs at 1,170' and 1,230' were leaking.
  - Performed squeeze jobs at both of the above intervals
  - Extended surface casing and replaced Larken type bradenhead with SWECO bradenhead.

## ECGS – well remediation

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### Dynamic

#### WP-D011-2

- Remediation work complete
  - Perforated at 1,850' and performed squeeze.
  - Performed second squeeze at 1,770.
  - Performed subsequent squeeze jobs with WellLock due to perfs leaking.

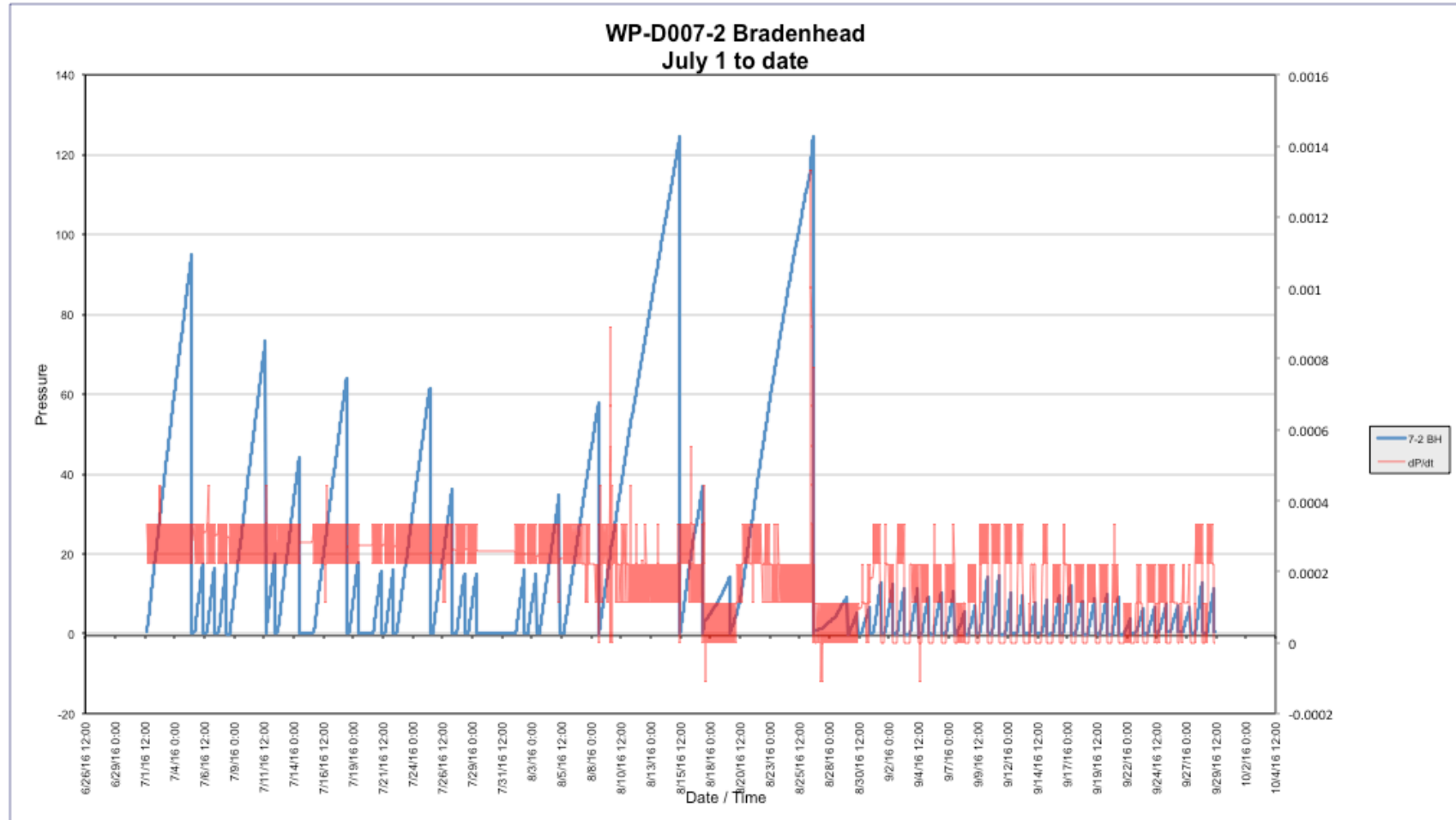
#### WP-D005-2

- Remediation work complete
  - Perforated at 5,070' and performed block squeeze.

#### Next

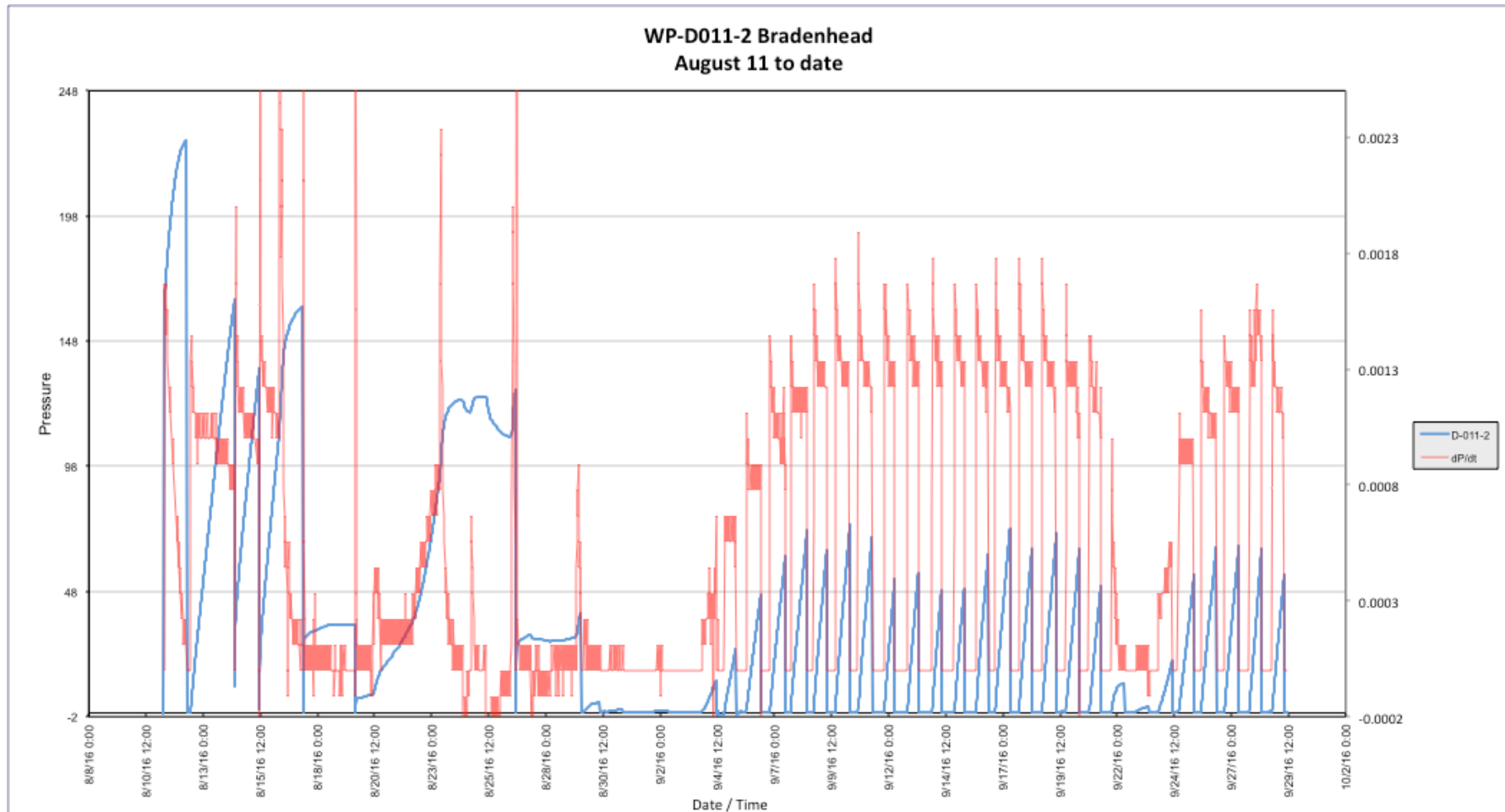
- Run pulsed neutron log through Fox Hills interval in Nelson water well
- Continue to monitor bradenhead pressures remediated wells to gauge success of completed remediation work.
- Continue to monitor bradenhead pressures on all wells during current injection period and develop mitigation plans if warranted.
- Continue development of post mitigation monitoring / evaluation plan

## WP-D007-2 post-remediation bradenhead pressure monitoring



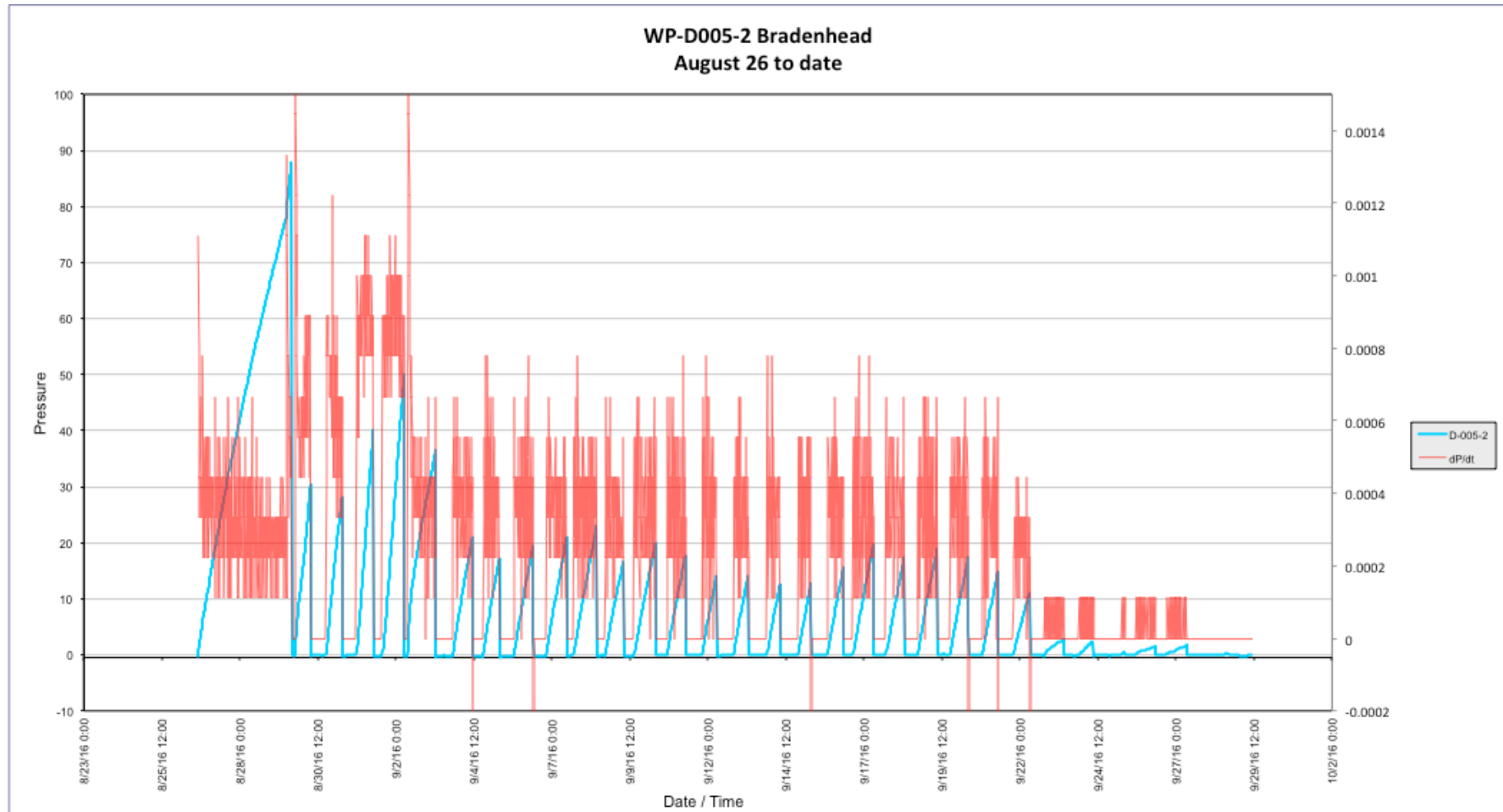
Initial Pressure 790 psig

## WP-D011-2 post-remediation bradenhead pressure monitoring



Initial Pressure 390 psig

## WP-D005-2 post-remediation bradenhead pressure monitoring



Initial Pressure 724 psig

To whom it may concern,

In this report the results of the helicopter-based pipeline and well pad integrity survey that was conducted on 08/09/2016 by Red Hen Systems, LLC and Ridgeline Aviation, Inc on behalf of Midstream Energy Holdings, LLP are summarized. After thorough examination and analysis of the recorded video and data log files it was determined that there is one event of high methane concentration classified as Class 1 (Red-Colored Point of Interest). The rest of the methane concatenation points measured in the Right-of-Way and within the area of interest belonged to Class 3 level (Green-Colored Point of Interest), below or at the ambient levels known for the area of interest. The highest methane concentration value recorded was at 4.167 Parts Per Million, classified as Class 1 point, and was located near "ECGS Facility" at:

Latitude:

40°56'28.12"N

Longitude

103°13'18.47"W

QR Code of the location



Optical Gas Imaging View of the emission source.







Color Camera View of the emission source.

The pictures above are of the possible emission source taken in post-process from the Mid-Wave Infrared Camera (MWIR) with Grayscale filter applied and Color Camera. The videos as well as all of the associated metadata acquired during survey are accessible via the secured server provided by Red Hen Systems, LLC, the access credentials to the server are provided below:

Secured server IP: <https://50.194.141.81/test/index.html>

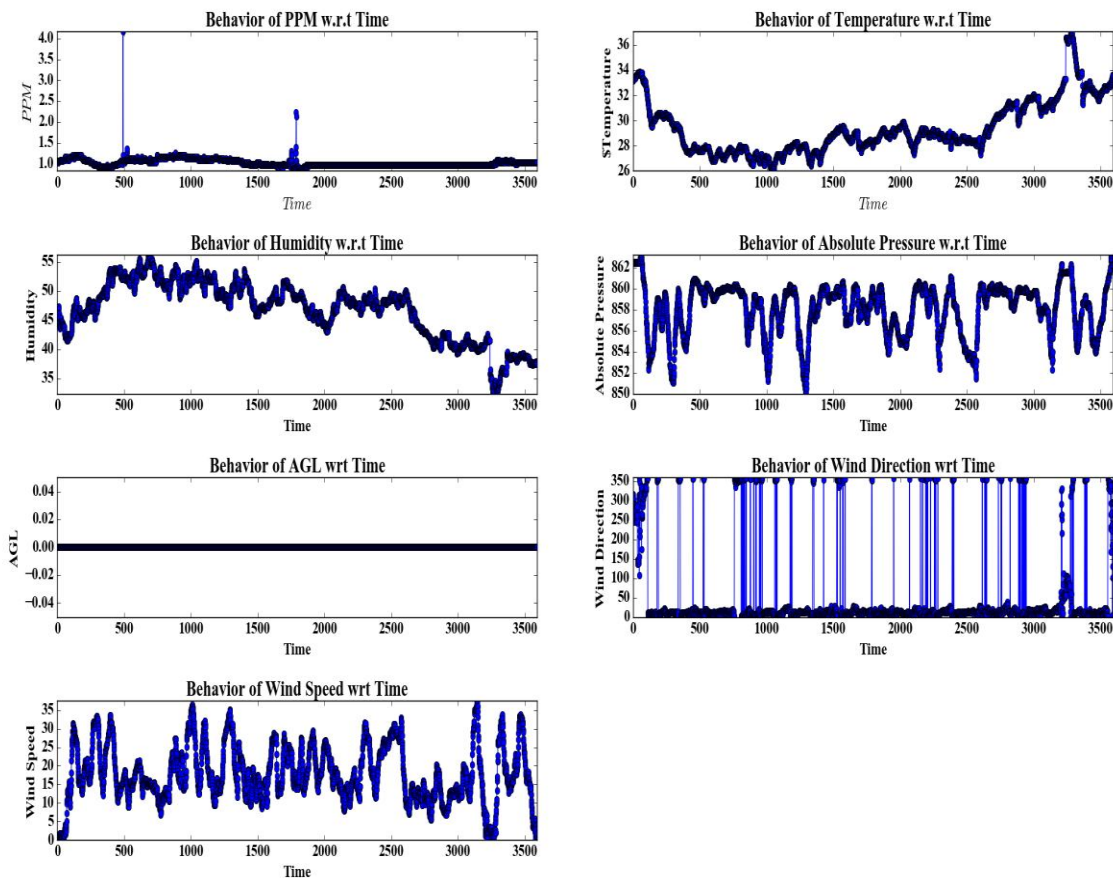
Log-in: peetz

Password: peetz

The results of the survey conducted on 04/19/2016 can also be accessed via the same server. The log-in and password of the web-portal can be changed to fit the IT department's security policies.

The information associated with the survey is provided in .kml format. The helicopter path information as well as all of the associated raw metadata that was recorded are shown in the " Midstream Energy Holdings\_Helicopter\_Route .kmz" file where points are illustrated by directed arrows representing the heading of the helicopter at the time of the helicopter path, all of the points are active (can be clicked on). The processed concentration (PPM) points can be visualized via the aforementioned server along with acquired videos where all of the points are shown in green (ambient level), yellow (suspicious level) or red-colored (anomalous level) bubbles representing their relationship to the ambient level and are also active. Wind direction and wind speed information can be visualized through the "Midstream Energy Holdings\_Wind\_Direction.kml" file. Also, the recorded metadata is provided in Excel spreadsheet called "Midstream Energy Holdings\_Data\_Recordings.csv "

In addition to classification files and data logs, behavior of the attributes such as AGL, Humidity, PPM Distribution, Wind Speed, Pressure, Speed over Ground and Temperature are illustrated in the plot below:



Statistics for the entire survey:

<b>Methane Concentration(PPM)</b>	<b>Mean:</b> 1.02660541957	<b>STD:</b> 0.0986525587167	<b>Median:</b> 0.966666667	<b>Maximum:</b> 4.166666667
<b>Speed Over Ground(KPH)</b>	<b>Mean:</b> 36.5668429844	<b>STD:</b> 17.1680416458	<b>Median:</b> 33.45	<b>Maximum:</b> 79.9
<b>Temperature(Celsius)</b>	<b>Mean:</b> 29.4366091314	<b>STD:</b> 2.1273863778	<b>Median:</b> 28.9	<b>Maximum:</b> 37.1
<b>Humidity (%)</b>	<b>Mean:</b> 46.8364142539	<b>STD:</b> 5.02004381718	<b>Median:</b> 47.9	<b>Maximum:</b> 56.3
<b>Pressure(Millibars)</b>	<b>Mean:</b> 858.103410356	<b>STD:</b> 2.43597513683	<b>Median:</b> 858.77	<b>Maximum:</b> 863.22
<b>AGL(Meter)</b>	<b>Mean:</b> 0.0	<b>STD:</b> 0.0	<b>Median:</b> 0.0	<b>Maximum:</b> 0.0
<b>Wind Speed(MPS)</b>	<b>Mean:</b> 18.0052282851	<b>STD:</b> 7.68062758093	<b>Median:</b> 16.61	<b>Maximum:</b> 37.56

Please let us know if you have any questions or concerns.