Data-Driven Decision Making for Cost-Effective Methane Emission Mitigation

July 24, 2019
Tips

- All participants (except speaker) are in listen-only mode

- Questions submitted during the webinar will be reviewed at the end of the webinar
  - Type a question here

- If you are experiencing technical difficulties, please let us know using the Questions pane on the right side

- A copy of today’s presentation will be available on EPA’s website
Agenda

- Welcome and Opening Remarks
- Data-Driven Decision Making Kinder Morgan Natural Gas Pipeline Business Unit
  - Jim Tangeman, Kinder Morgan
- Case Study - Strengthen Reporting Assurance with Business Intelligence Tool
  - Dan McDermott, Huco Consulting
  - Dave Cox, PE, FirmoGraphs
- Questions
- Upcoming Events
Data-Driven Decision Making
Kinder Morgan Natural Gas Pipeline Business Unit

EPA Natural Gas STAR and Methane Challenge Programs
July 24, 2019

Jim Tangeman, Kinder Morgan EHS Manager
Natural Gas Pipelines Business Unit
Kinder Morgan: Leader in Energy Infrastructure

Experienced operator with unparalleled footprint built over decades

Note: Mileage and volumes are company-wide per 2019 budget.

Largest natural gas transmission network

- ~70,000 miles of natural gas pipelines
- Connected to every important U.S. natural gas resource play and key demand centers
- Move ~40% of natural gas consumed in the U.S.

Largest independent transporter of refined products

- Transport ~1.7 mmbbl/d of refined products
- ~6,900 miles of refined products pipelines
- ~5,800 miles of other liquids pipelines (crude and natural gas liquids)

Largest independent terminal operator

- 157 terminals

Largest transporter of CO₂

- Transport ~1.2 Bcf/d of CO₂
Kinder Morgan Commitment to Reduction of Methane Emissions

Kinder Morgan became one of the Founding Members of the Environmental Protection Agency’s Natural Gas STAR Methane Challenge (ONE Future Option) Program in 2016 through our participation in the ONE Future Coalition industry group. By doing so, we are recognized as leaders in our industry in reducing methane emissions using smart performance-based approaches.

Kinder Morgan believes it is important to be part of the solution toward reducing emissions of methane and other greenhouse gasses through industry-leading efforts in safely and efficiently delivering natural gas to consumers.

As a Methane Challenge Partner company, Kinder Morgan has committed our natural gas transmission and storage facilities to implement activities and technologies, and transparently report systematic and comprehensive actions to reduce methane emissions. This commitment will be met through a company policy made effective under O&M Procedure 1229 – Methane Emissions, Reporting, and Reductions.
Kinder Morgan – Decades of Commitment to Methane Reductions

- Charter Partner of EPA's Natural Gas STAR Program: 1993 to present
  - Many innovative technologies and practices resulted from the program

- A Founding Member of the ONE Future Coalition in 2014

  - KM committed to a methane emission intensity target of 0.31% across our transmission and storage operations by 2025.

- First reporting year of 2017, KM achieved a methane emission intensity of 0.04%

- Additional years of methane emission reductions and methane emission intensities need to be collected to better understand the trends and targets.

- Continuous Improvement: ONE Future’s methane management approach aligns with Kinder Morgan’s Operations Management Systems (OMS) philosophy.
Kinder Morgan – Methane Reduction Programs
Timeline (2015 to present)

- 2015: As part of ONE Future, began collaborating with USEPA on their Methane Challenge program to include a ONE Future option

- 2016: USEPA finalized the Methane Challenge-ONE Future option in August

- January 1, 2017: Official start date of Kinder Morgan’s commitments under Methane Challenge

- 2017: Rollout of Methane Challenge tools and tracking systems to be used by stakeholders within Kinder Morgan: leak survey and repair spreadsheets, leak tracking database, gas loss minimization form (next few slides)

- 2017: Updating emission reporting tools for tracking and reporting methane reductions

- 2018: Finalize and rollout internal policy and procedure implementing program

- 2018 to present: Continue collaboration with EPA and Other Agencies
Kinder Morgan’s GHG group sends out list of facilities to be surveyed & measured during first quarter of each year.

Kinder Morgan assigned Technicians or Contractors perform the annual leak surveys & measurements at the affected facilities. Technicians enter the results in the respective spreadsheet tools (see upcoming slides).

For surveys & measurements performed by Kinder Morgan assigned Technicians upload all survey & measurement results into KM Leak Database from the spreadsheet tools (see upcoming slides).

Kinder Morgan’s GHG Group collects all the leak data from the KM Leak Database and other KM databases to generate annual GHG Reports to EPA, ONE Future report, EPA’s Natural Gas STAR Report, EPA’s Methane Challenge Report, and Corporate ESG Report.
Kinder Morgan – Program Implementation

■ Key Evaluation Questions
  — Can this program be implemented using internal or external resources or a combination of both?
  — Business case: What is the estimated cost, where will the funds come from, what is the ROI, and intangible co-benefits?
  — **How will it be successfully implemented internally?**
  — Who are the internal stakeholders that will have responsibilities under this program?
  — How will the data needed for this program be collected and where will it reside?
  — **What will we do with this data after it is collected?** Calculating emissions, determining emission reductions, reporting, and other analysis TBD

■ Key Program Elements
  — Kinder Morgan Internal Procedures
  — Determining affected facilities
  — Facility leak surveys & measurement data
  — Leak repairs & confirmation data
  — Determining internal responsible parties
  — Universal and easy to use tools to track and collect the data
  — Centralized data repository tool
  — Calculation and reporting tools
Kinder Morgan – Data Collection & Management Tools

- Kinder Morgan Operation & Maintenance (O&M) Procedures: O&M 1229 Methane Emissions Reporting and Reductions
- Kinder Morgan ONE Future-Methane Challenge intranet website available to all Kinder Morgan employees and Kinder Morgan contractors
- Spreadsheets & Other materials posted on intranet website for stakeholders
  - Annual list of facilities needing surveys & measurements
  - GHG survey spreadsheet
  - Leak repair list spreadsheet
  - Other spreadsheets
  - Training materials
  - Link to O&M 1229
  - Link to Kinder Morgan Equipment Leaks and Repairs Dashboard
  - Kinder Morgan methane commitment documents
- Kinder Morgan Leak Database (MS Access and SQL)
- Kinder Morgan Equipment Leaks and Repairs Dashboard
- Sharepoint and Network Server
- OpsInfo Environmental Management System & Emission Reporting

"Your recent Amazon purchase, Tweet score and location history makes you 23.5% welcome here."
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1. Applicability
   1.1. Facility Type
       Gas Pipeline Facility:
         ☐ Gas Treatment
         ☐ Offshore Gathering
         ☐ Regulated Onshore Gathering – Type A
         ☐ Regulated Onshore Gathering – Type B
         ☐ Transmission
       Storage Facility:
         ☐ Underground Natural Gas Storage
       This procedure applies to all Company Transmission and Storage Operations.

1.2. Additions and Exceptions
       Gas pipeline facilities, including pipe and appurtenances, and underground natural gas storage facilities covered by these procedures are subject to PHMSA regulations, and may be subject to additional regulations of other governing bodies (e.g., EPA, FERC, OSHA, Intrastate Regulated - AL PSC, LA DNR, OCC, TRRC, UT PSC, etc.).

The applicability of O&M Procedures to specific Company business entities is delineated in O&M, Introduction to Company Standards.
## Kinder Morgan – Annual Survey Spreadsheet

**Division #**

0

**Station Name**

0

**Station Number**

#N/A

**Entity**

#N/A

**Day 1 Date (mm/dd/yyyy)**

1/1/2018

### Description of Color Coding

- **Fields Requiring Entry**
- **Fields Not Requiring Entry; Auto-populated**
- **Information Only**
- **Optional Measurements or Data**

### Instructions for Completing the Report Tabs

1. Go to the start menu of your PC and type **Access** into the search bar.
2. Click on Microsoft Access 2010 or 2016.
3. Your PC will automatically complete configuring Access for your PC. This will take approximately 5 minutes.
4. When complete, an access file will open on your computer. Close the file by clicking the X button in the top right.
5. You can now run the program in the spreadsheet. Continue to the steps below.
### Facility & Survey Information (Part 1 Section; complete this section first left to right)

<table>
<thead>
<tr>
<th>Division #</th>
<th>Technician 1 Name</th>
<th>Technician 2 Name</th>
<th>Technician 3 Name</th>
<th>Technician 4 Name</th>
<th>Description of Color Coding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Station Name</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>COMET II Station ID</td>
<td>n/a</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Entity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Station Elevation (feet)</td>
<td>n/a</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>State Abbreviation</td>
<td>n/a</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Ambient Conditions As-Found During Survey (Part 2 Section; complete this section second left to right & top to bottom)

<table>
<thead>
<tr>
<th>DATE (Day 1, mm/dd/yyyy): 1/1/2018</th>
<th>Temperature</th>
<th>Barometric Pressure</th>
<th>Wind Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>50°F</td>
<td>30.01&quot;Hg</td>
<td>5 mph</td>
</tr>
<tr>
<td>Cloud Cover</td>
<td>Sunny &amp; clear</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**COMPLETE THE FOLLOWING FOR EACH ADDITIONAL DAY IF SURVEY TOOK MORE THAN ONE DAY**

<table>
<thead>
<tr>
<th>DATE (Day 2, mm/dd/yyyy):</th>
<th>Temperature</th>
<th>Barometric Pressure</th>
<th>Wind Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cloud Cover</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DATE (Day 3, mm/dd/yyyy):</th>
<th>Temperature</th>
<th>Barometric Pressure</th>
<th>Wind Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cloud Cover</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DATE (Day 4, mm/dd/yyyy):</th>
<th>Temperature</th>
<th>Barometric Pressure</th>
<th>Wind Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cloud Cover</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Kinder Morgan – Leak Repair List Spreadsheet

### Table:

<table>
<thead>
<tr>
<th>Entity</th>
<th>Division</th>
<th>Station Name</th>
<th>Leak Number Tag</th>
<th>Technician(s) who Identified the Leak</th>
<th>Leak Identification Date</th>
<th>Leak Description</th>
<th>Component Type</th>
<th>Component Category</th>
<th>Observed Severity</th>
<th>Technicians Comments</th>
</tr>
</thead>
</table>

### Additional Information:

- Requires input from Operations
  - Auto-Populated, No Input Needed
- This is the initial repair deadline
- If repair is made, you must enter your name in the column below

<table>
<thead>
<tr>
<th>Leak Number Tag</th>
<th>Technicians Comments</th>
<th>Leak Repair Status</th>
<th>Leak Repair Date</th>
<th>Leak Confirm Method/Device</th>
<th>Date of Next Scheduled Station Shutdown</th>
<th>Delay of Repair Reason (complete only if repair was not repaired at next scheduled shutdown in column O)</th>
<th>Repair Not to Exceed Date</th>
<th>Operations Person Name</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>D</th>
<th>K</th>
<th>L</th>
<th>M</th>
<th>N</th>
<th>O</th>
<th>P</th>
<th>Q</th>
<th>R</th>
</tr>
</thead>
</table>

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12
Kinder Morgan – Data, Data, Data
Kinder Morgan – Current Activities and Reductions

- **ONE Future-Methane Challenge Commitments include:**
  - Leak detection & repair at T&S stations (Phase-In 2017 to 2021)
  - Reduction of Transmission Pipeline Blowdown volumes
    - Pipeline pump downs and compression sleeves
    - Other technologies & work practices on case-by-case basis

- **Year 1: 2017 Methane Reductions (volume)**
  - Vol. Leak Detection & Repair = 176,511 thousand cubic feet (MCF)
  - Reduction of Transmission Pipeline BDs = 3,115,817 MCF

- **Year 1: 2017 Methane Reductions (mass)**
  - Vol. Leak Detection & Repair = 3,389 MT CH4 (84,725 MT CO2e)
  - Reduction of Trans. Pipeline BDs = 59,823 MT CH4 (1,495,592 MT CO2e)

- **Year 2: 2018 Methane Reductions (Pending)**

*Includes the annual methane reductions associated with Kinder Morgan’s Methane Challenge commitments in 2017. Does not include the additional EPA Natural Gas STAR recurring reductions reported to EPA separately for 2017.*
This page includes leak data for all piping and equipment components at the surveyed stations and it also identifies whether a component has been repaired or not repaired. These are the component types covered under the leak repair program described in Section 3.3.7 of OBM 1229.

This page includes leak survey and measurement data for the compressor sources at the surveyed stations. These compressor source categories include reciprocating, compressor rod packings, centrifugal compressor wet seals, centrifugal compressor dry seals, unit blowdown valves, and unit isolation valves. These compressor sources are not covered under the leak repair program of OBM 1229, but this information is provided for Operations personnel to use in their decision-making about whether a repair or replacement might be warranted.

This page includes leak survey and measurement data for the tank leaks found at the surveyed stations. These tank leak sources might include thief hatches, tank vents, tank valves and other types of leak points associated with atmospheric tanks containing some type of hydrocarbon that is connected either upstream or downstream of a pressurized natural gas line. These tank leak sources are not covered under the leak repair program of OBM 1229, but this information is provided for Operations personnel to use in their decision-making about whether a repair or replacement might be warranted.
## Kinder Morgan – Leak Dashboard (sample data only)

### Leak Summary by Division

<table>
<thead>
<tr>
<th>Total Leaks Reported</th>
<th>Not Reported</th>
<th>Repaired</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>91</td>
<td>19</td>
</tr>
</tbody>
</table>

### Leak Details

**Leak Identification Date** | **Leak Description** | **Component Type** | **Observed Severity** | **Leak Repair Status** | **Leak Confirm Method Device** | **Delay of Repair Reason** | **Repair Deadline** |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>4/8/2019</td>
<td>Main fuel regulator tubing line fitting</td>
<td>Non-EPA: Connector (OF Only)</td>
<td>Low (0.01 to 1.00 atm)</td>
<td>Repaired</td>
<td>OGI (PIR or CIPGal)</td>
<td></td>
<td>4/8/2021</td>
</tr>
<tr>
<td>4/23/2019</td>
<td>Failure dump valve on fuel gas filter</td>
<td>Non-EPA: Valve (OF Only)</td>
<td>Low (0.01 to 1.00 atm)</td>
<td>Not Repaired</td>
<td>NA</td>
<td></td>
<td>4/23/2021</td>
</tr>
<tr>
<td>4/23/2019</td>
<td>Unit 379 flange on the discharge pipe #18</td>
<td>Non-EPA: Connector (OF Only)</td>
<td>Low (0.01 to 1.00 atm)</td>
<td>Not Repaired</td>
<td>NA</td>
<td></td>
<td>4/23/2021</td>
</tr>
<tr>
<td>4/23/2019</td>
<td>Unit 387 discharge isolation valve #2 nipple</td>
<td>Non-EPA: Connector (OF Only)</td>
<td>Low (0.01 to 1.00 atm)</td>
<td>Not Repaired</td>
<td>NA</td>
<td></td>
<td>4/23/2021</td>
</tr>
<tr>
<td>4/25/2019</td>
<td>1 ball valve on the fuel regulator and meter, it is the 1 blowdown valve</td>
<td>Non-EPA: OEL (OF Only)</td>
<td>Low (0.01 to 1.00 atm)</td>
<td>Not Repaired</td>
<td>NA</td>
<td></td>
<td>4/25/2021</td>
</tr>
<tr>
<td>3/9/2019</td>
<td>Underground Main line valve stem control next to A903 main line valve</td>
<td>Non-EPA: Valve (OF Only)</td>
<td>Low (0.01 to 1.00 atm)</td>
<td>Not Repaired</td>
<td></td>
<td></td>
<td>3/9/2021</td>
</tr>
</tbody>
</table>
Kinder Morgan – Elements for Successful Implementation from a Data Perspective

- Tools available to the front-line stakeholders (i.e., Operations and Technicians).
  - User-friendly spreadsheets and databases accessible across the assets
  - When possible, make use of systems already in place that are familiar with stakeholders

- Company-wide internal procedures

- Proper training and guidance

- Third year of program: continues to evolve

- Continuous Improvement: always seek opportunities to make improvements
  - Continue communicating the program up and down the chain of command
  - Improvements with data collection & management tools
  - Get feedback from internal stakeholders/customers
  - Prioritization of leaks and repair activities
  - Implement lessons learned
  - Analyze and communicate data collected, identify trends, inform future decision-making, identify other opportunities to reduce
Jim Tangeman
KINDER MORGAN

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Cell: 719-425-6601
James_Tangeman@Kindermorgan.com
Case Study - Strengthen Reporting Assurance with Business Intelligence Tool

Dan McDermott, Huco Consulting
Dave Cox, PE, FirmoGraphs
Takeaway Points

KM has implemented data collection procedures to achieve beyond-compliance improvements. The outlook is great so far, as evidenced by the One Future leak survey activities.

Huco has worked with KM and other customers to apply business intelligence tools and techniques to strengthen reporting assurance.

FirmoGraphs supports Huco leveraging public data sources inside of the BI tools.

Substantial benchmarking opportunities exist.
What are Business Intelligence (BI) Tools?

- Software for data analysis and visualization
- 100s of them available
- 4 named as leaders in the Gartner, Inc Magic Quadrant
- Free versions and free training available online
- Today, working with Qlik Sense™
Why Use BI?

- Identify issues early, before submitting public reports
- Find trends otherwise invisible in spreadsheets
  - Single values, e.g., fuel use
  - Averages
  - Calculated results, e.g., fuel x emission factor
- Make observations to improve operations
- Detect suspicious-looking changes
  - 10x difference this year compared to last
  - Difference in ratios, e.g., production to emissions
Get Ready to Explore

**Pick a tool**
- Do basic training
- Learn by doing

**Prepare your data**
- Needs to be structured
- Does not need to be perfect
- Visualization helps with Data QA

Needs to be structured
- Visualization helps with Data QA
Starting Point

- All data captured in Excel Spreadsheet
- 277497 data points
- Very difficult to extrapolate trends in data.
- Very difficult to validate that data is accurate.
Methane Emissions

- Review Methane Emissions per facility for single reporting year.
- Review how methane emissions for certain source types changed over a variety of years.
- Note that larger facilities are going to have larger emissions.
Methane Emission to Facility Throughput Ratio

- Normalize CH4 as a product of overall facility throughput.
- Ability to review how all facilities are performing and associated emissions from each source type.

<table>
<thead>
<tr>
<th>Facility Name</th>
<th>Source Type</th>
<th>CH4 (metric tons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Totals</td>
<td></td>
<td>4834.75832626.4329</td>
</tr>
<tr>
<td>Facility 10</td>
<td>Fugitive</td>
<td>10619.07690773</td>
</tr>
<tr>
<td>Facility 58</td>
<td>Fugitive</td>
<td>51371.001345350</td>
</tr>
<tr>
<td>Facility 43</td>
<td>Centrifugal Compressor</td>
<td>3498.1472608486</td>
</tr>
<tr>
<td>Facility 44</td>
<td>Fugitive</td>
<td>35591.004040401</td>
</tr>
<tr>
<td>Facility 39</td>
<td>Centrifugal Compressor</td>
<td>1718.0613565693</td>
</tr>
<tr>
<td>Facility 44</td>
<td>Centrifugal Compressor</td>
<td>1607.164834049</td>
</tr>
<tr>
<td>Facility 29</td>
<td>Blowdown System</td>
<td>1017.7701177222</td>
</tr>
<tr>
<td>Facility 41</td>
<td>Fugitive</td>
<td>1471.5104104744</td>
</tr>
<tr>
<td>Facility 45</td>
<td>Fugitive</td>
<td>830.0458168062</td>
</tr>
<tr>
<td>Facility 47</td>
<td>Fugitive</td>
<td>778.1091043983</td>
</tr>
<tr>
<td>Facility 39</td>
<td>Combustion</td>
<td>625.45927985187</td>
</tr>
<tr>
<td>Facility 27</td>
<td>Flares</td>
<td>615.86718775624</td>
</tr>
<tr>
<td>Facility 38</td>
<td>Flares</td>
<td>864.38568789711</td>
</tr>
<tr>
<td>Facility 22</td>
<td>Flares</td>
<td>478.48080935981</td>
</tr>
</tbody>
</table>
Data Validation – Change in Throughput Ratio

- Review changes in CH4 to throughput ratio between reporting years.
- Identify any outliers and investigate further.
Data Validation – Change in Throughput Ratio

- Filter to outlier.
- Review other visualizations to determine where outlier can be found.
- Investigate further.
Data – Compressor Hours

- Compressor hours of operation for all modes greater than total hours in year.
- Processing and Transmission rely on these hours for emission calculations.
- Data can be validated within Excel files, but BI tool allows quick identification of data outliers and address issues prior to submittal.
Benchmarking Opportunities

• Utilize flight publicly available data to benchmark emissions
• Production, Gathering, and Boosting
• Data available by operator, facility, and gas emitted
Conclusions

- BI software is inexpensive and powerful
- Data exploration is fun
- Insights are valuable beyond compliance to drive operational improvement
Questions
2019 Renewable Natural Gas Workshop

Save the Date!

Sept 24, 2019
Reno, NV

Photo Credit: Ken Lund, CC BY-SA 2.0
Save the Date!

Nov 4-6, 2019
Pittsburgh, PA

2019 Natural Gas STAR & Methane Challenge Workshop

Photo Credit: Ron Reiring, CC BY 2.0
EPA Methane Challenge & Natural Gas STAR Programs

Contact us:
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Natural Gas STAR Website:
www.epa.gov/natural-gas-star-program