MISO is continuing its investigation into the risk to reliability from natural gas fuel delivery issues

- Over the past four years MISO has not found any significant reliability impacts in its assessment of gas related contingencies.
- MISO has recently completed a much more detailed assessment to understand if the previous work missed any risks due to physical disruption of gas infrastructure.
- MISO has found little historical evidence, nor additional contingency risks that are greater than what is currently being evaluated.
MISO has completed a detailed review of gas infrastructure outages to inform the gas contingency studies being undertaken.

**To help address:**
- How to ensure data accuracy and transparency in a useful format?
- At what point does increased dependence on gas create a severe contingency risk?
- How could such risks be integrated into operations and planning to improve reliability?

- Create detailed catalogue of historical events and refine gas system contingency list
- Estimate probability and impact and identify possible mitigations
- Review historical outages and dispatch data

**Collaboration with Industry and Stakeholders**
MISO reviewed historical pipeline and gas generator outages and found minimal impact from these events

1. The probability of any pipeline event occurring (regardless of size), is very small.¹

2. The maximum gas generation capacity outage due to fuel delivery issues was 915 MW.²

3. Fuel delivery disruptions reported by gas generators were found to not be related to unplanned pipeline outages.

Note:
1. Pipeline events (mostly due to equipment failure and “known” encroachment) between Jan. 2013 and Apr. 2018 are identified by ICF in its “Assessment and Improvement of Gas-Electric Contingencies” report to MISO.
2. Gas generator outage events (due to fuel delivery interruption) between Jan. 2013 and Jun. 2018 are studied by MISO; outage data from NERC GADS.
The probability of any pipeline event occurring (regardless of size), is very small.

**Total number of events by pipeline**

- FM (Force Majeure)
- Non-FM

**Est'd % of pipeline capacity affected at impact point**

- Line
- Compressor
- Meter

**Probability of an event in any given one mile section of a pipeline at any given time**

**Avg estimated impacted pipeline capacity (MMcf/d) at impact point in Day 1**

- Line
- Compressor
- Meter

**Pipeline Ranking by Total Number of Events**

**Ranking by Events Probability (Normalized by Line Mileage)**

**Probability of an event in any given one mile section of a pipeline at any given time**

**Avg estimated impacted pipeline capacity (MMcf/d) at impact point in Day 1**

**Pipeline Ranking by Total Number of Events**

**Ranking by Events Probability (Normalized by Line Mileage)**

**Probability of an event in any given one mile section of a pipeline at any given time**

**Avg estimated impacted pipeline capacity (MMcf/d) at impact point in Day 1**

**Pipeline Ranking by Total Number of Events**

**Ranking by Events Probability (Normalized by Line Mileage)**

**Probability of an event in any given one mile section of a pipeline at any given time**

**Avg estimated impacted pipeline capacity (MMcf/d) at impact point in Day 1**
The impact of gas unit outage (due to fuel delivery disruption) to resource availability is mostly during winter months and within a narrow portion of the footprint, with a maximum of 915MW impacted in any operating hour.

9130: Lack of fuel (coal mines; gas lines; etc) where the operator is not in control of contracts; supply lines; or delivery of fuels
9131: Lack of fuel (interruptible supply of fuel part of fuel contract)
9290: Other fuel quality problems
The majority of gas generator outages are not related to a physical disruption

- Pipeline event times and locations were compared to reported generator outages and Day Ahead and Real Time dispatch data and it was found that neither reported outages, nor sudden dispatch changes occurred around times of physical pipeline outages.
Next steps

- Refine gas contingencies for future MTEP reliability extreme event analysis

- Continue reviewing fuel related outages not relating to physical pipeline disruptions
Questions?

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