



# GAS COMMITTEE

## MONTHLY MEETING

MARCH 19, 2021

3:00 – 4:00 PM ET



# ROLL CALL



## Agenda:

1. Roll call of Committee Members
2. Welcome  
*Chairman D. Ethan Kimbrel*
3. Presentation: “A little secret: elemental sulfur and di-thiazine formation in natural gas pipelines. What are the issues?”  
*Matt Smith, Illinois Commerce Commission*
4. Q&A
5. 2021 Summer Policy Summit
6. DOE-NARUC Natural Gas Partnership update  
*Commissioner Diane X. Burman, NGP Chair*
7. Other business



# WELCOME

Chairman D. Ethan Kimbrel  
Illinois Commerce Commission



# ELEMENTAL SULFUR AND DI-THIAZINE FORMATION IN NATURAL GAS PIPELINES

**Matt Smith**

Assistant Director, Safety and Reliability Division  
Illinois Commerce Commission

# Elemental Sulfur and Di-thiazine Formation in Natural Gas Pipelines



Developed By:  
***The NAPSR / PHMSA Distribution Team***



U.S. Department of Transportation  
Pipeline and Hazardous Materials  
Safety Administration

To Protect People and the Environment From the Risks of  
Hazardous Materials Transportation



## Distribution Team Mission Statement

The NAPSRS / PHMSA Distribution Team is a collaboration of State and Federal Regulators to support improvements in the integrity of the Nations' gas distribution pipeline systems through the conduct of investigations and research to develop educational materials as well as improving our inspection methods and guidance for evaluation of Operator's Distribution systems

## Disclaimer

The document is intended to provide clarity to the public regarding existing pipeline safety standards. The contents of this document do not have the force and effect of law and are not meant to bind the public in any way, but pipeline operators must comply with the underlying safety standards.

The materials contained in this work product are for educational and awareness purposes only.



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# Elemental Sulfur and Di-Thiazine Formation in Natural Gas Pipelines

- The Issue
- Recent Occurrences
- Incidents and Failures
- Regulatory Requirements
- Path Forward



# The Issue

- In 2019 deposits of what appeared to be sulfur (visually and by smell in some cases) was identified by Regulators
  - This was the cause of equipment failures in natural gas transmission and distribution pipelines
- Regulators began investigating
- Samples of the solids formed in pipelines have not been regularly collected for testing
- Continuing to capture data related to equipment failures



# Photographs of Recent Deposits



# Photographs of Sulfur Deposits

The following photographs illustrate the ESD phenomenon:

- Flow Restrictors



- Compressor inlets



- Filter housing outlets



- Valves (Valve Cage)



Four Photo credits: Dr. David Pack

- Image from An Effective Solution for Elemental Sulfur Deposition in Natural Gas Systems, Kimtantis and Taylor, 2014, Bechtel Hydrocarbon Technology Solutions, Inc.



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# Varying Appearances and Odors of Solid Deposits

- Observed colors of deposits vary from white to yellow to yellow-brown apparently depending on constituents in the gas stream and where the deposits forms (condenses) in pressure reduction equipment
- In some cases, the only odor is a normal pipeline odor or in a distribution system only the smell of odorant.
- $H_2S$  has a rotten egg smell, and the lack of a rotten egg smell should not alleviate the need for analysis of the deposits



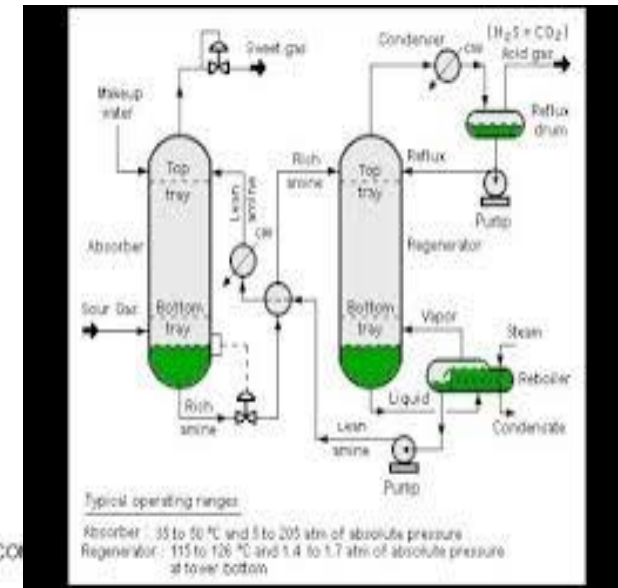
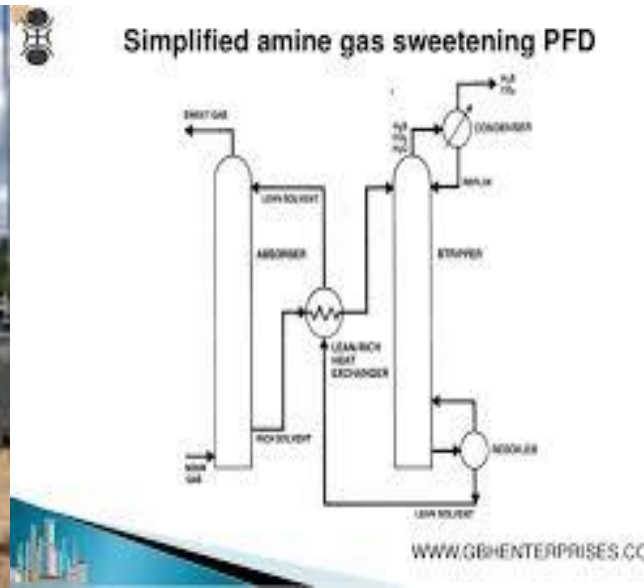
# Composition of Solid Deposits

- Deposits from the same gas stream varied depending on the type of pressure reduction equipment used.
- The location of the deposit in the equipment varied depending on the body style.
- Constituents of the deposits analyzed primarily included elemental Sulfur, Di-thiazine, and lubricating oil.
- Sulfur and Di-thiazine form as deposits in pressure reduction equipment as gas streams experience a reduction in pressure and vapors turn to solids.
- A recent occurrence identified higher flows of gas versus larger pressure drop as the factor for sulfur to appear



# How Does Di-thiazine Occur?

- Triazine is prevalent in the natural gas industry to treat gas containing Sulfur (sour gas) by either injecting Triazine directly into the transmission pipelines or by bubbling the gas through amine treatment towers.
- Di-thiazine is a common result of Triazine which react with the  $H_2S$  to form the insoluble compound Di-thiazine.



# Di-thiazine Solids Formation

- While the Triazines are effective H<sub>2</sub>S Scavengers, Di-thiazine and Sulfur vapors that are produced entrain in the gas stream.
- Elemental Sulfur and Di-thiazine solids form from vapors where pressure and flow are reduced and form as solids within pipelines.
- Industry practices for removing Di-thiazine solids include mechanical and chemical cleaning processes or equipment replacement if solids cannot be removed efficiently.



# Recent Events

- Regulators have reached out to stakeholders to gather information on the scope of “issue” and identify any similarities in source of gas and area/region where “issue” may be most common
- Occurrence of “Sulfur” deposits identified as a cause or contributing cause in failures in natural gas pressure reduction equipment in Western, Central, and Southern Regions of USA
- Gas streams/feeds where the “issue” has occurred have been identified as originating from transmission pipelines from US and Canada production and storage fields
- Idaho – Numerous occurrences related to sulfur discovered in regulator stations, including a recent incident



# Recent Incidents and Failures

- PHMSA Form F 7100.2 Incident Report – Gas Transmission And Gathering Systems
  - No. 20170011- 16784, Incident Date: 01/13/2017, Location – Gem County, Idaho
  - No. 20190109 – 32765, Incident Date: 09/04/2019, Location – Spokane, Washington
  - An incident occurred in Goshen Idaho on March 1, 2021 related to pressure buildup in the pipeline
- Several equipment failures have been observed by Regulators during inspections and investigations across the country
  - Failures may/should require accelerated maintenance schedules or sometimes equipment replacement



# Regulatory Requirements: §192.617

- Operators are required to investigate failures, collect samples, identify cause(s), and take action to prevent recurrence.
- Operators are required to have procedures for analyzing accidents and failures.



# Investigation of Failures

- Operators need to document all details related to a failure due to Sulfur or Di-thiazine, including equipment, location, gas stream origination point, etc.
  - Laboratory analyses of the samples collected
  - Risk mitigation actions identified and implemented to minimize the possibility of a recurrence



# Regulatory Requirements - DIMP

Operators must identify potential and existing threats, evaluate and rank the risks, and take risk mitigation actions to address risks

- Since 2011, operators have been required to gather all available information gained from past design, operations, and maintenance to identify threats - *§192.1007(a) Knowledge*
- Regulators clearly see the formations of solid deposits in pressure reducing equipment as a significant threat- *§192.1007(b) Identify threats.*
- To address risks, operators must determine and implement measures (actions) designed to reduce the risks from failure of its gas distribution pipeline - *§192.1007(d) Identify and implement measures to address risks.*



# Management Systems Require Communication and Documentation

- Operators are not identifying threats within DIMP.
- Lack of communication of information and data within an operator's organization.
- An example is regulator station inspections - If a regulator station fails lock-up (regulator failed to stop the flow of gas) when first inspected, the DIMP group may not be capturing this as a failure (threat) or is not looking for this.
  - If the regulator failed lock-up, what was the cause? Was the cause Sulfur and/or Di-thiazine deposits, corrosion, etc.?



# Perspective

- The issue of solids formations in gas pipelines, upstream processing equipment, and downstream user facilities is well documented and appears to have been occurring for decades.
- There are solutions offered by industry to remove or mitigate the issue of solids formation in pipeline pressure reduction equipment.
- Incident reports submitted to PHMSA provide limited data and information on the significance of the threat that Sulfur and/or Di-thiazine deposits pose to pipeline safety.
  - Due to a lack of understanding related to the issue



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# Summary

- Sulfur or sour gas requires treatment
- The treatment via adding Triazine may allow a by-product called Di-thiazine to change from a gas to a solid in the pipeline
- Both Sulfur and Di-thiazine have accumulated in the pipeline after large pressure reductions or very high flows of gas at regulator stations
- This has caused failures in pressure reduction equipment
- The failures have over pressured gas systems or caused excessive amounts of gas to relieve into the atmosphere
- Operators are failing to investigate failures and identify the root cause, which may be Sulfur or Di-thiazine
- The information on failures and the cause is needed for the operator to take appropriate actions to prevent a recurrence
- Education is needed for both the gas operators and the regulators



# Path Forward

- While the issue of solids formations in gas pipelines, upstream processing equipment, and downstream user facilities is well documented, the recent upward trend in incidents needs to be evaluated and the threat understood
- Regulators will continue to gather information from inspections and investigations into failures and take compliance actions, as appropriate
- Regulators will continue to review DIMP programs for the identification of potential and existing threats, including the reliability of pressure control equipment and formation of solids within the equipment
- PHMSA will review research and development options and continue to learn more about the threat of solids deposition in pressure reducing equipment





# Q&A

PLEASE SPEAK UP OR USE THE CHAT IF YOU HAVE ANY  
QUESTIONS OR COMMENTS



# SUMMER POLICY SUMMIT

Topic discussion



# DOE-NARUC NATURAL GAS PARTNERSHIP UPDATE

Chair Diane X. Burman  
New York Public Service Commission



# OTHER BUSINESS

# RESOURCE ADEQUACY COMMITTEE CALL



## RESOURCE ADEQUACY: HOW TO PLAN FOR RESILIENCE AND EXTREME WEATHER EVENTS

*A Joint Session of the Committees on Electricity and Energy Resources and the Environment*

Friday, March 26 | 2 pm Eastern / 11 am Pacific | <https://global.gotomeeting.com/join/939280885>

With the events in Texas in February and California in August fresh in our minds, we explore the important topic of resource adequacy in the electric industry. From ice storms to heat waves, the drastic changes in extreme weather patterns have wreaked havoc over electric infrastructure, crippling economies and compromising public safety. While these events have revitalized conversations and definitions around the concept of resiliency between utilities, regulators, and the public, the response to the events has not yet addressed the need to evolve reliability assessment and planning to mitigate the effect of increasingly frequent high impact extreme weather. With electricity serving as a lifeline to so many people in the 21<sup>st</sup> century, the stakes have never been higher for utilities, grid operators, and regulators to develop state of the art approaches to ensuring the grid's future reliability. This presentation will focus on the varying approaches to resource adequacy across the industry, as well as recent research into planning for extreme weather, and development of new tools and methodologies regarding forecasting that will be crucial to ensuring safe, reliable, and resilient electricity in the clean energy future.

### Speakers:

**Daniel Brooks**, VP, EPRI Integrated Grid and Energy Systems

**Paul Centolella**, Tabors Caramanis Rudkevich

# NGA-NARUC GRIDEX VI WEBINAR



## **Webinar on state participation in GridEx VI, the biennial energy security exercise**

*Wednesday, March 31 | 3:30 – 4:30 pm ET*

Participants will learn about this NERC-hosted energy security exercise broadly and how they can participate. Attendees will also hear from two state representatives who participated in GridEx VI.

Speakers will include:

- Kate Ledesma, Resilience and Policy Coordination Manager, Electricity Information Sharing and Analysis Center, North American Electric Reliability Corporation
- Dan Searfoorce, Manager – Water, Reliability and Emergency Preparedness Division, Pennsylvania Public Utility Commission
- Jimmie Collins, Senior Planner, Hawaii Office of Homeland Security

Please click [HERE](#) to register for the webinar and contact NARUC with any questions.



# THANK YOU

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