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Oil and Gas Management

DEP Office of Oil and Gas Management

Bureau of Oil and Gas Planning and Program Management

Well Plugging and Subsurface Activities Division

DEP's Mechanical Integrity Assessment Program

May 19, 2017

2017 Shale Network Workshop

State College, PA

Presentation Outline

- What is the Mechanical Integrity Assessment Program?
- Containment
- Data Collection and Applications
- Dedicated to Continual Improvement
- Accountability

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The Mechanical Integrity Assessment Program

Why we do it

- To ensure that Pennsylvania's oil and gas wells are operated safely and in a manner that is protective of human health and the environment

How it's conducted

- Surface observations are made quarterly to evaluate the overall "health" of a well
- Results are reported to DEP

What we learn

- Can signal the need for additional action
- Continuous improvement of regulatory oversight

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The Mechanical Integrity Assessment Program

- Pa. has the most comprehensive routine well integrity assessment program for screening operating wells in the country
- The program requires quarterly inspections at all operating oil and gas wells and any oil and gas wells that meet the Act 13 definition of abandoned that have not yet been plugged
- Gas, oil, combined oil and gas, and coalbed methane wells all must be inspected under the program

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Containment

Why Is This Information Important for Assessing Well Integrity?

- Each component of the well acts as a protective barrier
- By consistently monitoring for leaks inside and outside of these barriers, some judgment can be made about how effectively the well is protecting groundwater resources and whether intervention is necessary, i.e., how effectively is a well able to provide fluid “containment?”

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Containment

Leak Types:

- *Type A:* Isolation to the wellbore, meaning there is no direct evidence that leaks noted are moving beyond the “footprint” of the well, i.e., they are isolated to atmospheric venting or fluids flowing into secondary containment
- *Type B:* Leaks noted have either moved beyond the “footprint” of the well or have a strong potential to do so

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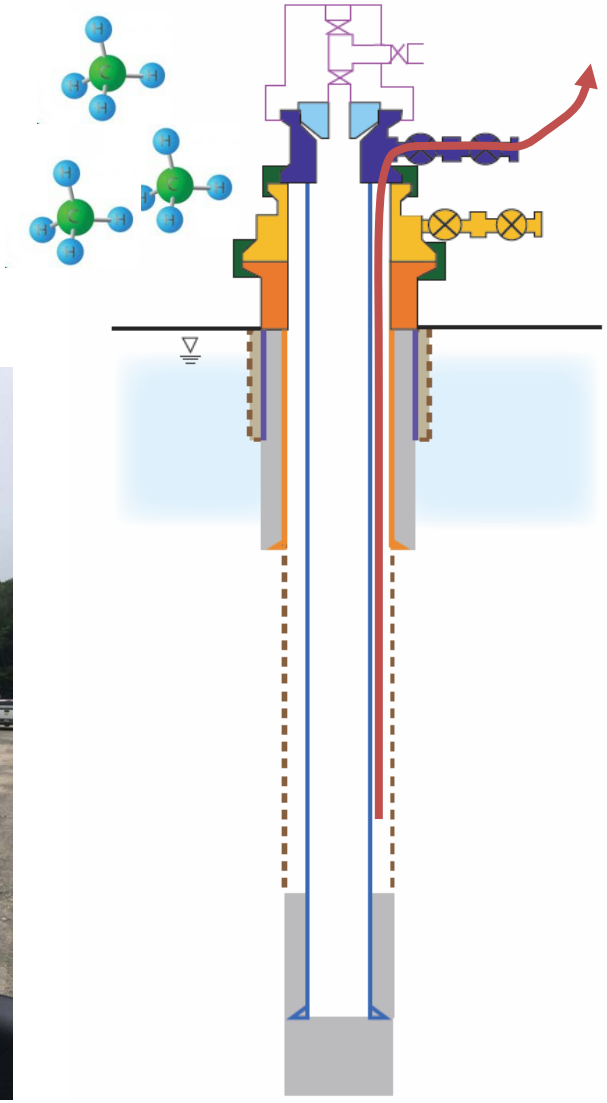
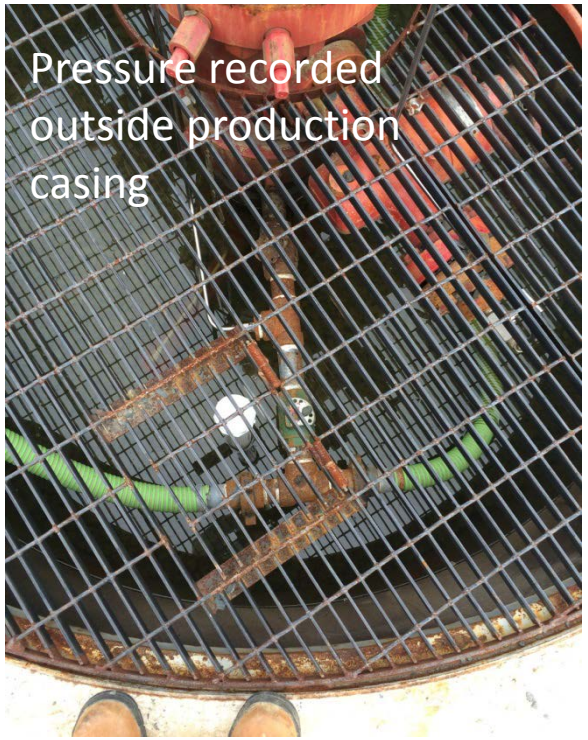
Containment

Type A Examples

LEAKING GAS FROM WELL SURFACE EQUIPMENT



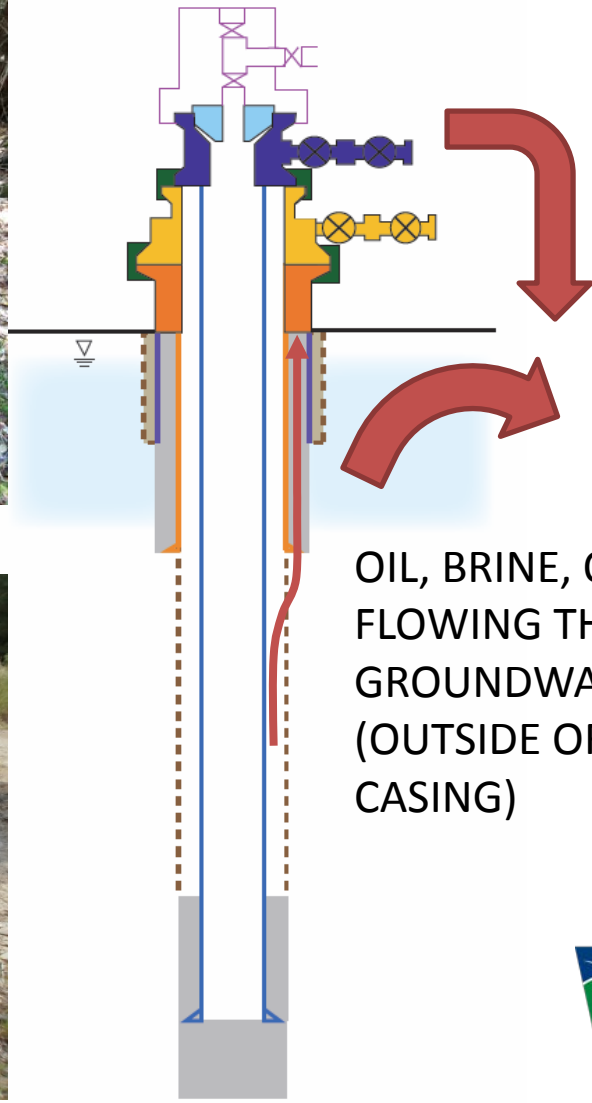
GAS/LIQUID PRESSURE OR FLOW OUTSIDE OF DEEP CASING STRINGS AND INSIDE OF SHALLOW CASING STRINGS



Containment

Type B Examples

Oil leaking to surface



OIL OR BRINE RELEASED TO GROUND SURFACE

OIL, BRINE, OR GAS FLOWING THROUGH FRESH GROUNDWATER INTERVAL (OUTSIDE OF SHALLOW CASING)

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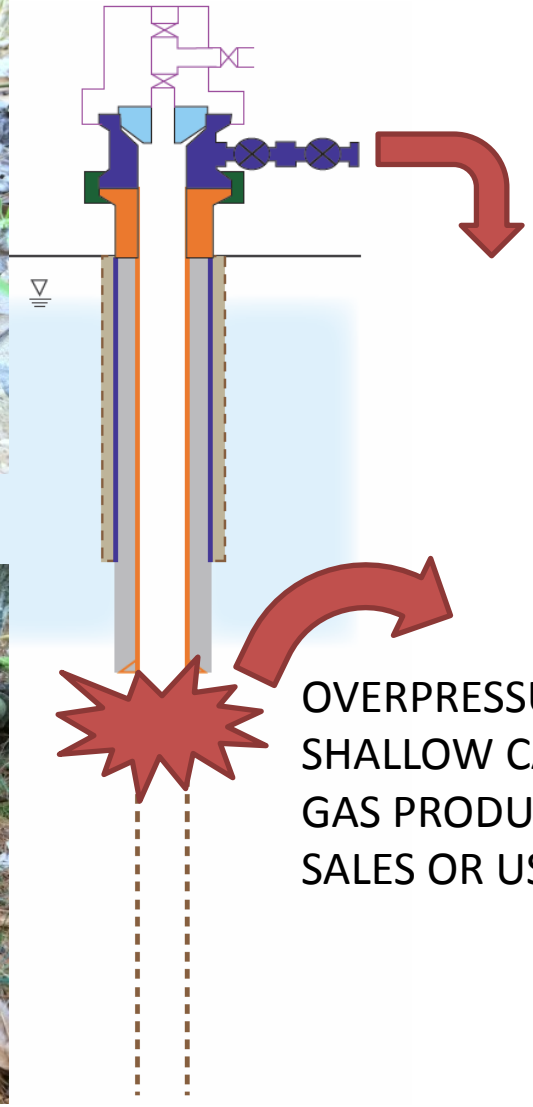
Containment

Severe corrosion



Type B Examples

SURFACE CORROSION SO SEVERE ENVIRONMENTAL RELEASE IS IMMINENT

OVERPRESSURING OF SHALLOW CASING BY GAS PRODUCED FOR SALES OR USE

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Data Collection and Applications

- Some limitations must be understood about the integrity program's dataset:
  - The program was not intended to be used as a tool for measuring greenhouse gas emissions in association with operating wells, although operators have reported flow rates for casing vent flows and "measurements or best estimates of quantity" for any escaping gas that is noted
  - The program does not require an operator to indicate whether or not they continuously vent gas to the atmosphere at a well
  - Consistency in measurement and well configuration reporting would potentially allow the dataset to be used more readily to estimate emissions

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Data Collection and Applications

- Some limitations must be understood about the integrity program's dataset:
  - There are no measurement protocols or thresholds in place for reporting leaks, and so different operators may use different procedures to record and quantify the presence of escaping gas
  - There are no provisions for reporting the presence of gas beyond a well's production casing annulus unless that gas is escaping to the atmosphere, and so outer casing strings that are shut in and have pressure are not necessarily represented in the dataset

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Data Collection and Applications

- The Mechanical Integrity Assessment Program relies on information submitted by operators, i.e., it is a “self-reporting” regulatory initiative
- “Self-reporting” initiatives are necessary, but often criticized, components of any regulatory program
- Understanding the limitations of any regulatory program is key to making sure it is as good as it can possibly be

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Data Collection and Applications

Dataset Trends for Conventional and Unconventional Wells

- 122,000 well integrity data records were available for analysis when DEP began assessing trends in April 2015
- The dataset represents a benchmark by which the agency can measure future progress
- Available information is being used to affect positive regulatory change

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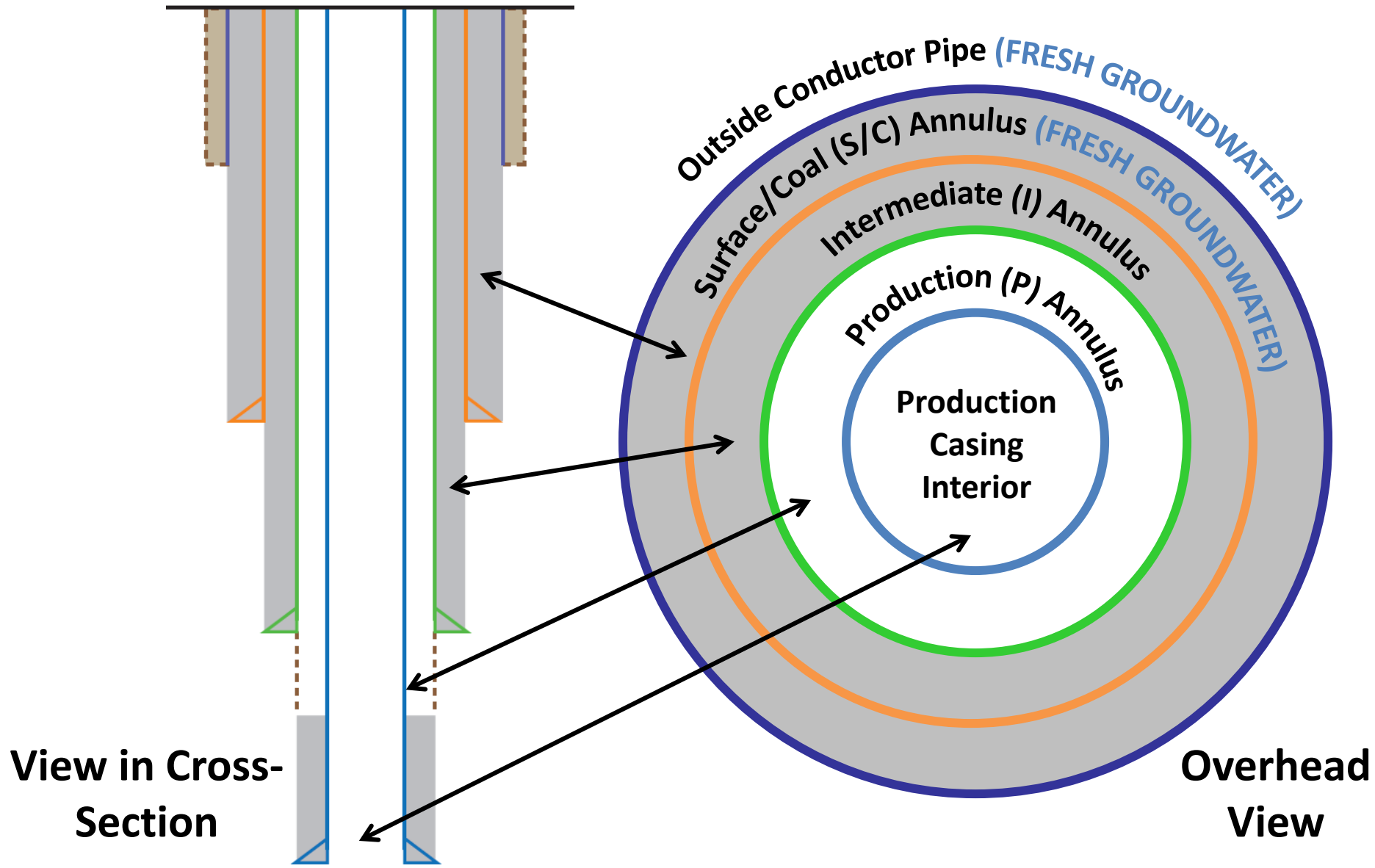
Data Collection and Applications



Data Collection and Applications

In consideration of all data submitted by April 10, 2015:

Unconventional (n = 23,316, i.e., % of all inspection events)

Occurrence of Fluids (gas, oil, or brine)	658	2.82%
Occurrence of Severe Corrosion	4	0.02%
Occurrence of Surface Casing Overpressuring	0	0%
Occurrence of Gas Outside Production Casing (pressure or flow)	7,073	30.3%
Occurrence of Gas Outside Intermediate Casing	234	1.00%
Occurrence of Gas Outside Freshwater Casing	15	0.06%

Conventional (n = 67,669, i.e., % all unique well inspection events)

Occurrence of Fluids (gas, oil, or brine)	1,390	2.05%
Occurrence of Severe Corrosion	314	0.46%
Occurrence of Surface Casing Overpressuring	4	0.01%
Occurrence of Gas Outside Production Casing (pressure or flow)	19,916	29.4%
Occurrence of Gas Outside Intermediate Casing	132	0.20%
Occurrence of Gas Outside Freshwater Casing	45	0.07%

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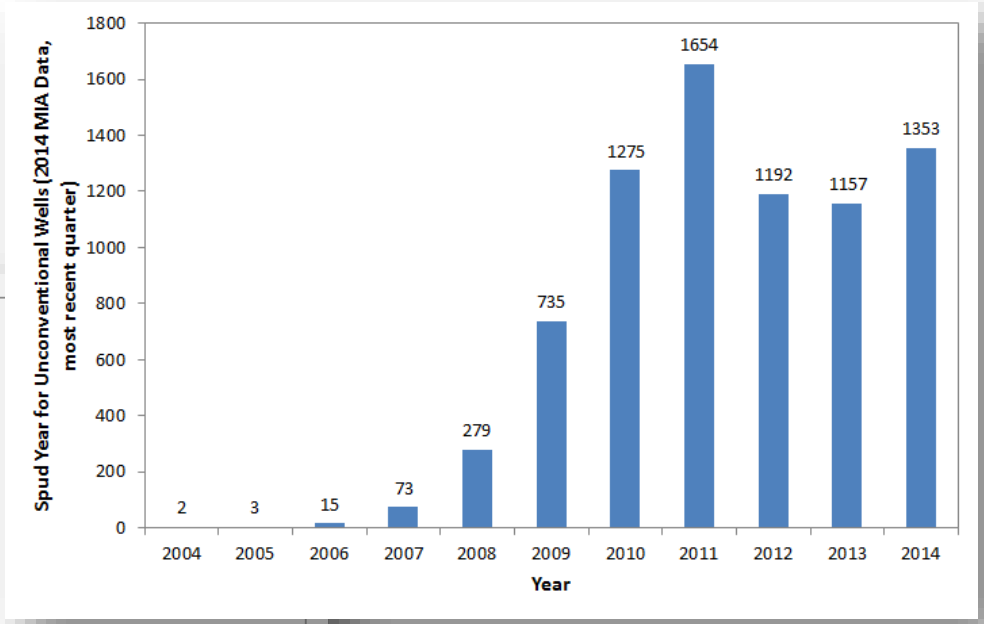
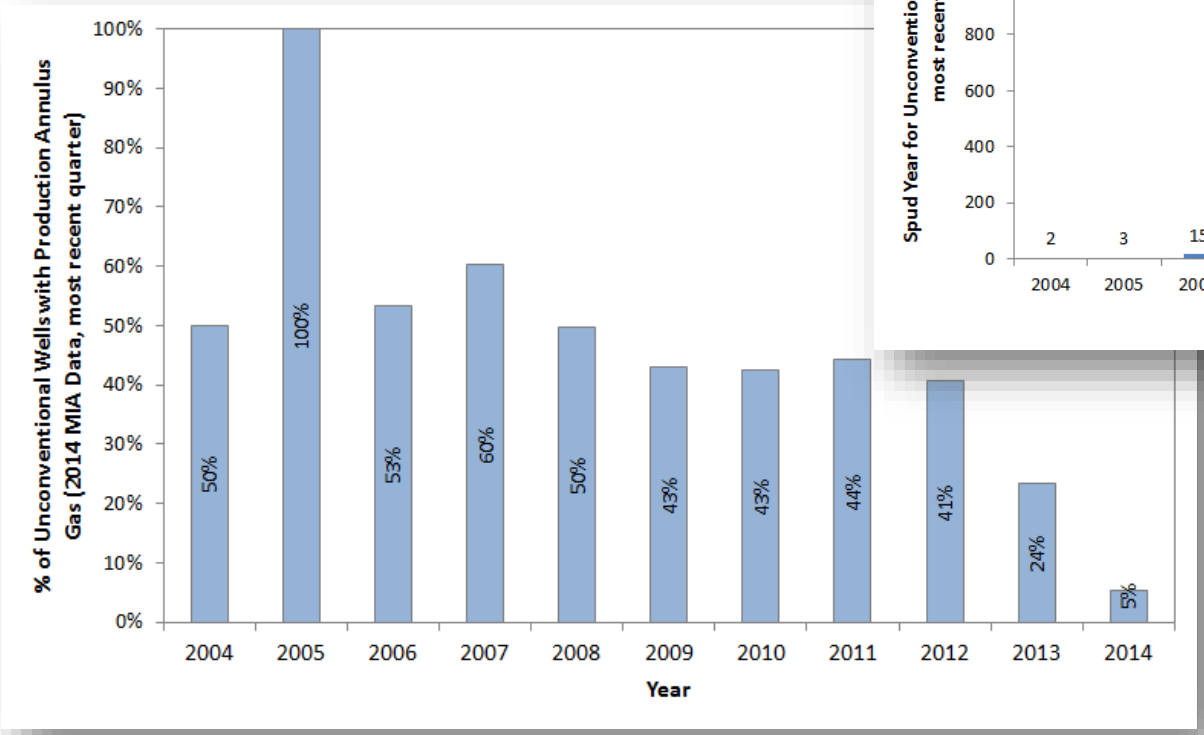
Data Collection and Applications

Presence of Gas Outside Production Casing (Unconventional)



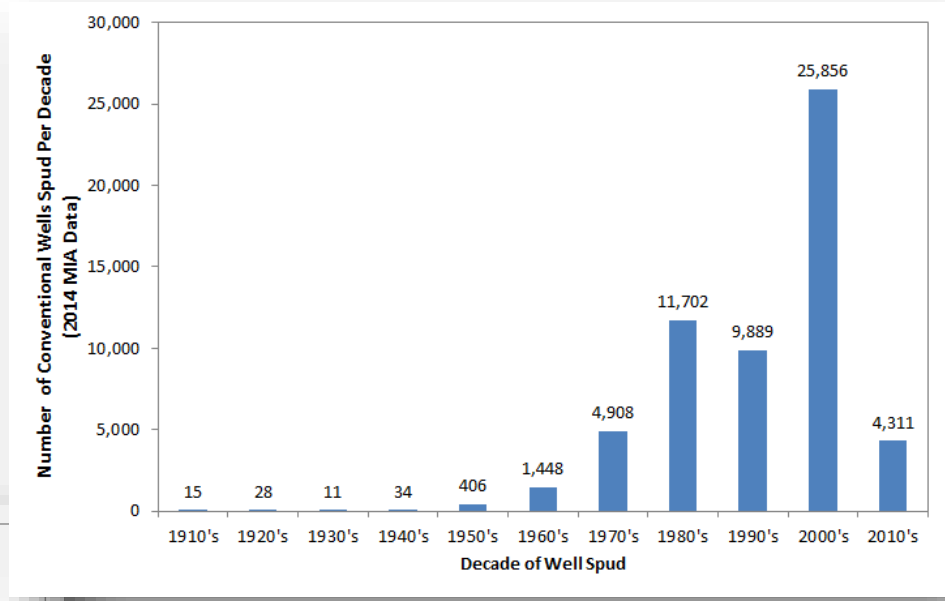


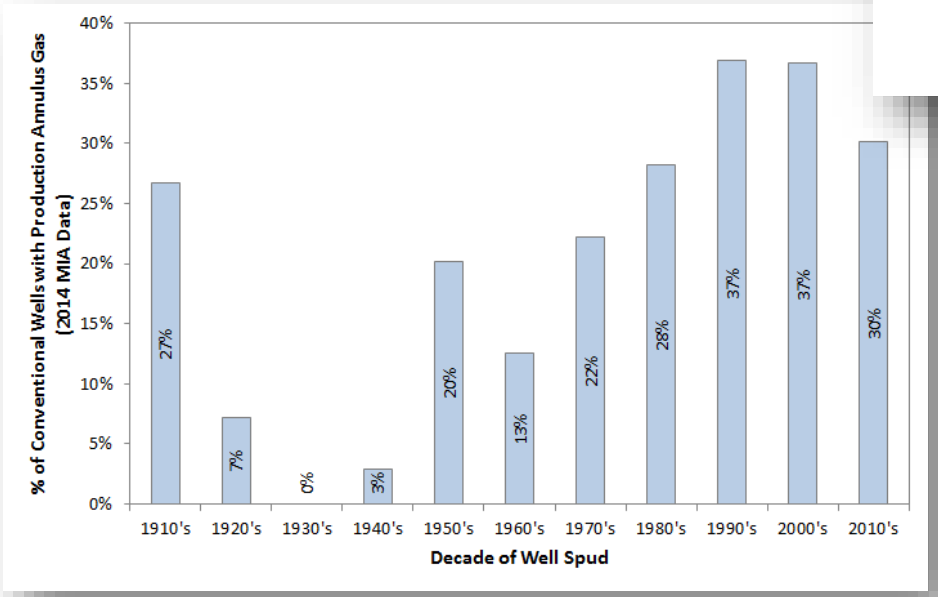
The presence of gas outside production casing is sometimes by design

Trends suggest this observation is becoming less frequent

Data Collection and Applications

Presence of Gas Outside Production Casing (Conventional)





Older conventional wells may be losing integrity outside of production casing

Newer conventional wells are often constructed to vent shallow gas to keep pressure off of shallow casing strings

Data Collection and Applications

Data Audits/Analyses

- Field and office audits were developed to independently assess information reported by operators
- The objective was to examine for environmental concerns and evaluate areas of the program that could be improved upon

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Data Collection and Applications

Field Audit

- Unconventional study locations included Lycoming, Greene and Washington counties
- Conventional study locations included McKean and Indiana counties
- Selected locations were considerate of both operator activity and diversity
- The number of wells investigated was based on statistical formulas used to determine the accuracy of results for the larger well population

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Data Collection and Applications

Lycoming County (23 Unconventional Wells total)

Lycoming County Field Unconventional Verification	Number of Reports	Percentage	Range of Possible Outcomes	
Error Free Reports Submitted	8	34.8%	14.8%	54.8%
Reports for which Additional Clarification is Recommended	4	0.58%	7.4%	37.4%
Reports Containing Errors	11	47.8%	27.8%	67.8%
Reports that Indicate the Presence of More Serious Well Integrity Concerns	0	0.0%	0%	20%

Greene/Washington Counties (24 Unconventional Wells total)

Greene and Washington Counties Field Unconventional Verification	Number of Reports	Percentage	Range of Possible Outcomes	
Error Free Reports Submitted	4	16.7%	0.25%	36.7%
Reports for which Additional Clarification is Recommended	1	4.2%	0.06%	24.2%
Reports Containing Errors	19	79.2%	59.2%	99.2%
Reports that Indicate the Presence of More Serious Well Integrity Concerns	1	4.2%	0.06%	24.2%

Data Collection and Applications

McKean County (25 Conventional Wells total)

McKean County Field Conventional Verification	Number of Reports	Percentage	Range of Possible Outcomes	
Error Free Reports Submitted	7	28.0%	8.0%	48.0%
Reports for which Additional Clarification is Recommended	4	4.0%	0.06%	24.0%
Reports Containing Errors	14	56.0%	36.0%	76.0%
Reports that Indicate the Presence of More Serious Well Integrity Concerns	2	8.0%	0.03%	28.0%

Indiana County (24 Conventional Wells total)

Indiana County Field Conventional Verification	Number of Reports	Percentage	Range of Possible Outcomes	
Error Free Reports Submitted	13	54.2%	34.2%	74.2%
Reports for which Additional Clarification is Recommended	1	4.2%	0.01%	24.2%
Reports Containing Errors	10	41.7%	21.7%	61.7%
Reports that Indicate the Presence of More Serious Well Integrity Concerns	1	4.2%	0.01%	24.2%

Data Collection and Applications

- Operators should continue to look for ways to configure wells at the surface that allow DEP to easily diagnose well site conditions
- Well site maintenance is critical for avoiding violations: covering leaks with gravel in place of making repairs is unacceptable
- Only well components that can be visually observed should be reported as not having leaks
- Well components designed to contain pressure and/or fluids experiencing pitting/wall thickness loss should be reported as having corrosion problems (failure is likely to occur soon)

Data Collection and Applications

Office Audit

- Unconventional and conventional well reports were randomly chosen statewide and compared to information contained in well records to determine if operators were completing the forms accurately

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Data Collection and Applications

Office Audit Findings

- A notably smaller percentage of reports with errors were noted in the reports reviewed during the office audit, although there are some limitations associated with not being able to observe a well in the field
- Focused training will be an important part of improving data quality moving forward

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Dedicated to Continual Improvement

- Focused Inspection Efforts and Investigations
  - Increased efficiency for inspectors
  - Better understanding of well containment concerns
  - Future development of regulations
- Data Management Improvements
  - Review and correction of eFACTS records
- Industry Response
  - Increased plugging Notices of Intent (NOIs)
  - Corrosion mitigation programs
- Electronic Enhancements and Integration
  - Mobile inspection platform

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Dedicated to Continual Improvement

Prioritization and Informed Decision Making

- Access to relevant data allows us to more readily approach complex problems scientifically
- Agency efforts become focused and existing resources are used appropriately
- Decisions are made with confidence and firmly grounded in a methodical and reproducible engineering and scientific analysis

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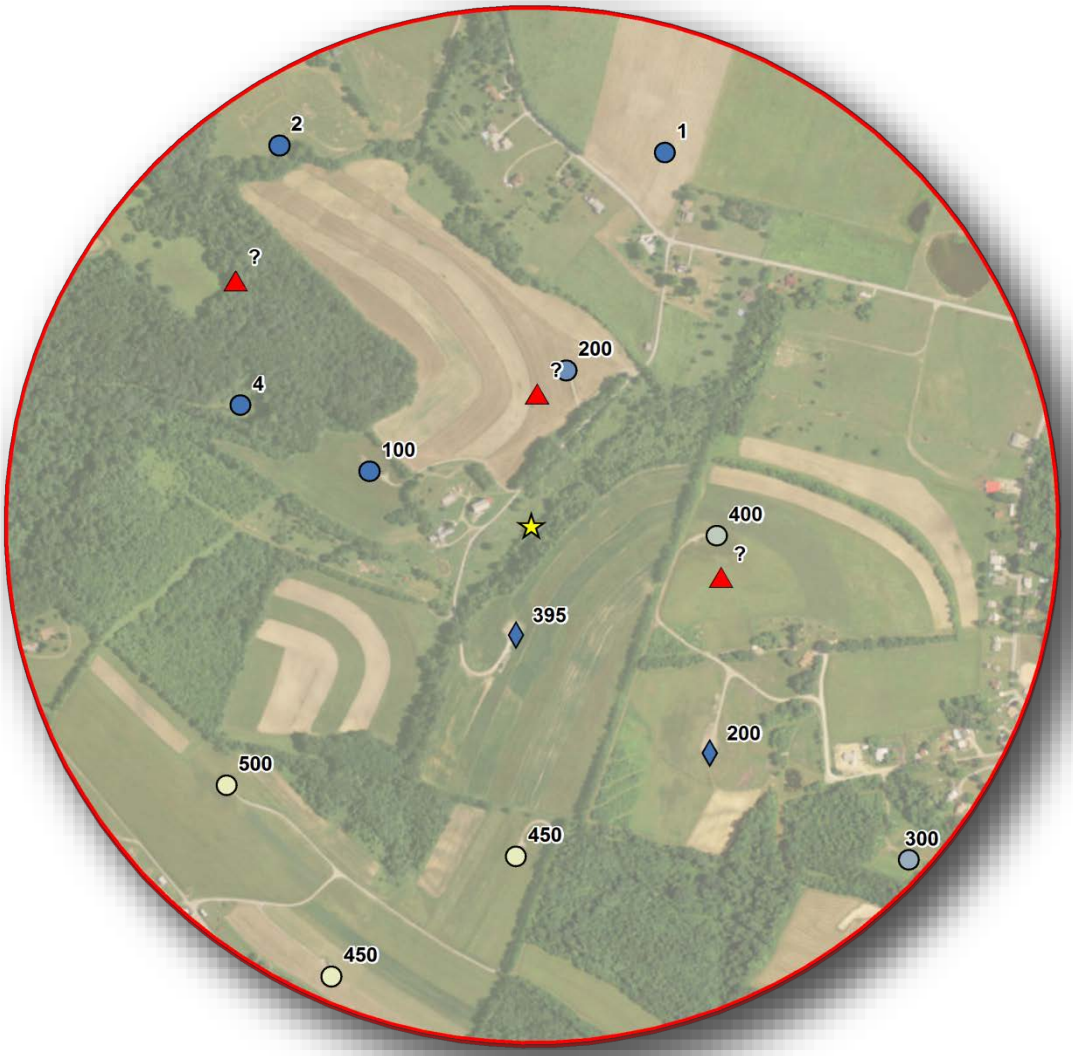
Dedicated to Continual Improvement

Improving Efficiency in Addressing Alleged Water Supply Impacts

- Figure comparing a 2,500-ft water supply complaint footprint with and without well pressure data



Conventional

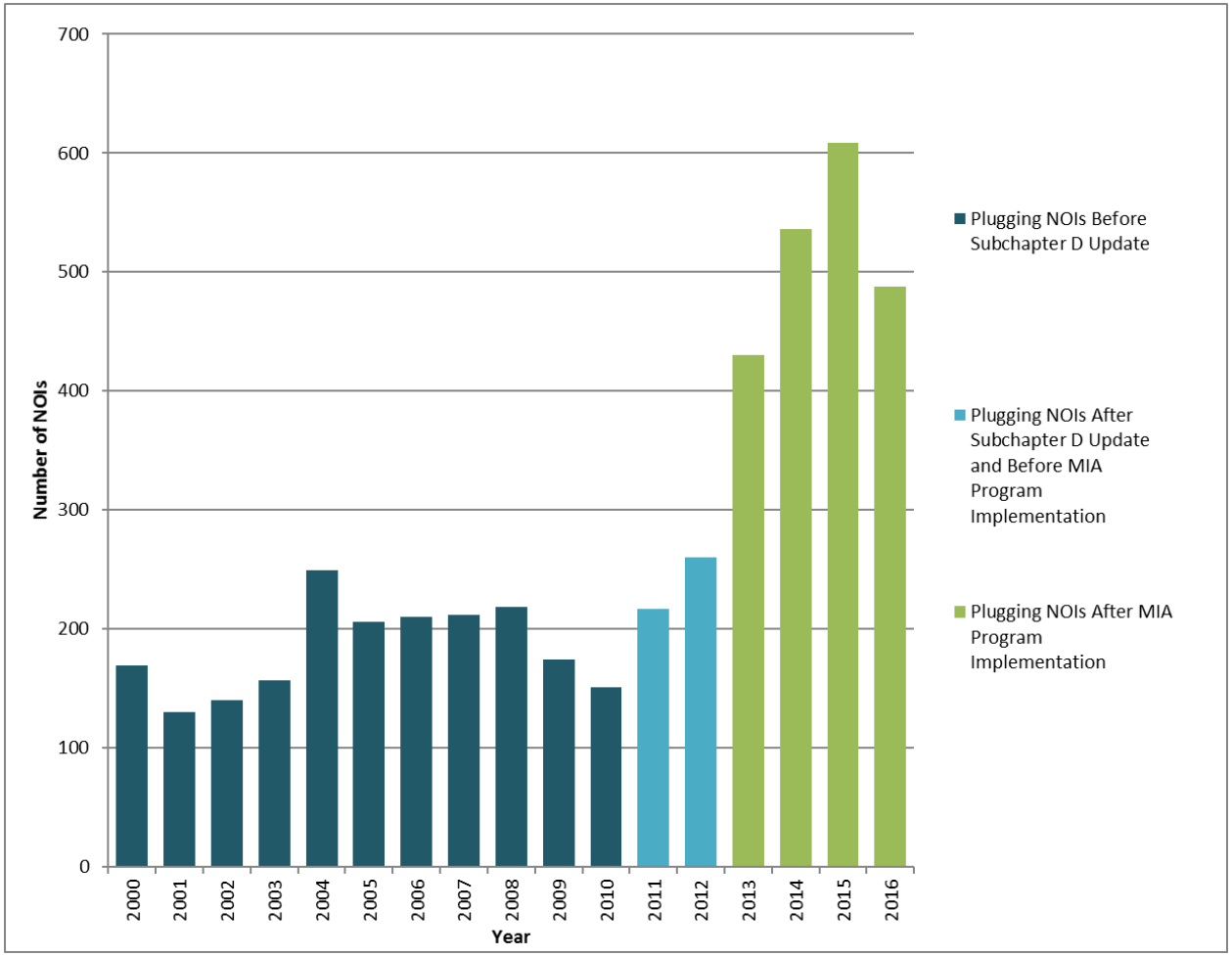
Unconventional

No Integrity Inspection

Dedicated to Continual Improvement

Industry Response

- Operators with large well inventories have begun to develop corrosion mitigation programs
- Significant increase in plugging activities has been noted in response to implementation of the program



Dedicated to Continual Improvement

Summary

- Continue validation procedures, including field verification inspections and trend-analysis reports
- Develop more streamlined data submittal process – use Form C only
- Implement informed training for internal staff and industry
- Provide educational outreach for public stakeholders
- Develop guidance related to measurement thresholds
- Prioritize problems, inform work with data and develop proactive solutions

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Accountability

"The Mechanical Integrity Assessment Program is ultimately about accountability – we are accountable to the public and operators are accountable to us."

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Questions?

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