

Dynamics of Marcellus Shale Environmental Health and Safety Incident Reporting in Pennsylvania*

Deborah B. Glosser¹ and Daniel J. Bain¹

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¹University of Pittsburgh, Pittsburgh, Pennsylvania (deborah.glosser@gmail.com)

Abstract

Recent studies of unconventional gas extraction "incident" rates have concluded that Environmental Health and Safety (ES&H) incidents decrease over time. We have analyzed Marcellus ES&H incidents reported by Pennsylvania Department of Environmental Protection between 2008 and 2011. PA DEP incident reports were categorized from administrative to severe along a five point scale. Administrative incidents, classified as incorrect permits, improper signage, etc., were excluded from analysis. Of the 35 counties with active drilling during the study period, eight had no incidents reported, and the overall number of reported incidents decreased between 2008 and 2011. Although the overall reporting rate declined over the study period, reports of significant and serious incidents increased in 74% of counties. This increase may not necessarily reflect a growth in serious ES&H violations, because simultaneous changes in inspection and reporting practices in Pennsylvania may have changed detection efficiency. Reporting rates were examined in the context of the regulatory environment, including changes in inspection effort, inspection practices, and public awareness of Marcellus drilling activities, to assess whether the observed trends may be confounded by these processes. Benefits of understanding Marcellus ES&H incident reporting in Pennsylvania include identification of engineering and operational risks, and the promotion of public confidence in shale gas development practices.

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D.B. Glosser

D.J. Bain

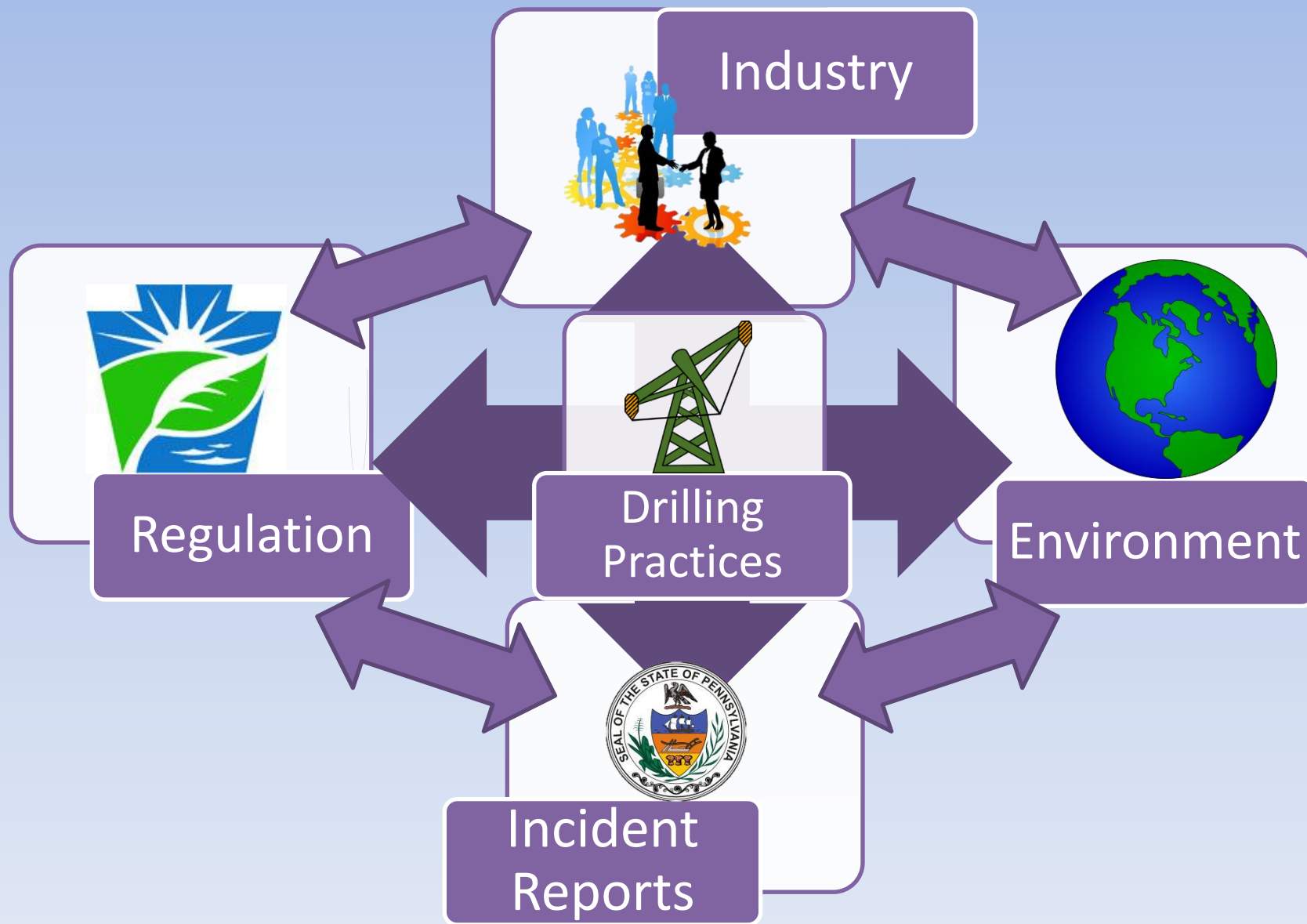
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An outline of the talk: Dynamics in environmental Incidents

1. **Study Rationale:** Confronting risk: Not all incidents (or incident reports) are of equal value for building a framework for risk assessment
2. **Objectives of the study:** Do Marcellus environmental incident report rates change over time in Pennsylvania? How do the rates change when separated by environmental impact, and contextualized by drilling phase? What are the processes influencing changes in rates?
3. **Discussion of Other Studies:** Conventional Oil and Gas Studies: Have incident reports changed over time?
4. **Methods:** Examining incident rates in the Marcellus play in Pennsylvania.
5. **Results and Discussion:** How do regulatory changes in incident rates interact in Pennsylvania? Have any other important changes happened during the study period?
6. **Conclusions and recommendations** for Marcellus related practices based on these data.

Study Rationale: We want to address questions of risk in Marcellus development



This is a complex topic, so we have several study objectives

1. Do incident report rates change over time in Pennsylvania?
2. How do we characterize severity of Marcellus Shale (ES&H) Violations in Pennsylvania based on violation's environmental impact?
3. What changes in regulation, drilling, and industry occurred, and are these changes related to observed changes in incident report rates?
4. How do Pennsylvania incident rates and compare with other studies, and what dynamics have those studies considered?

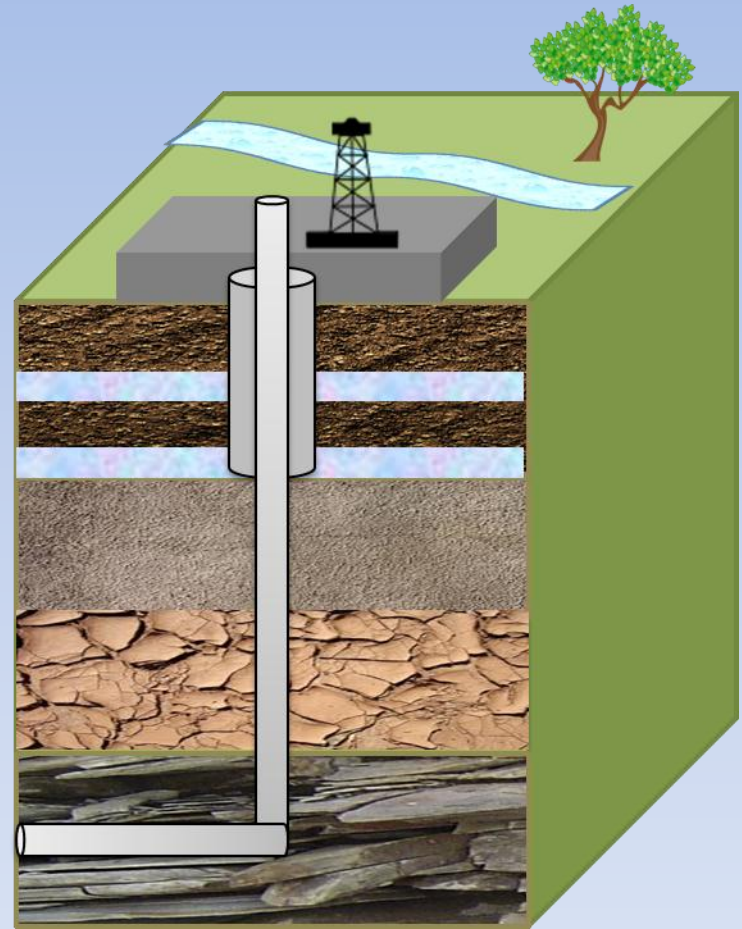
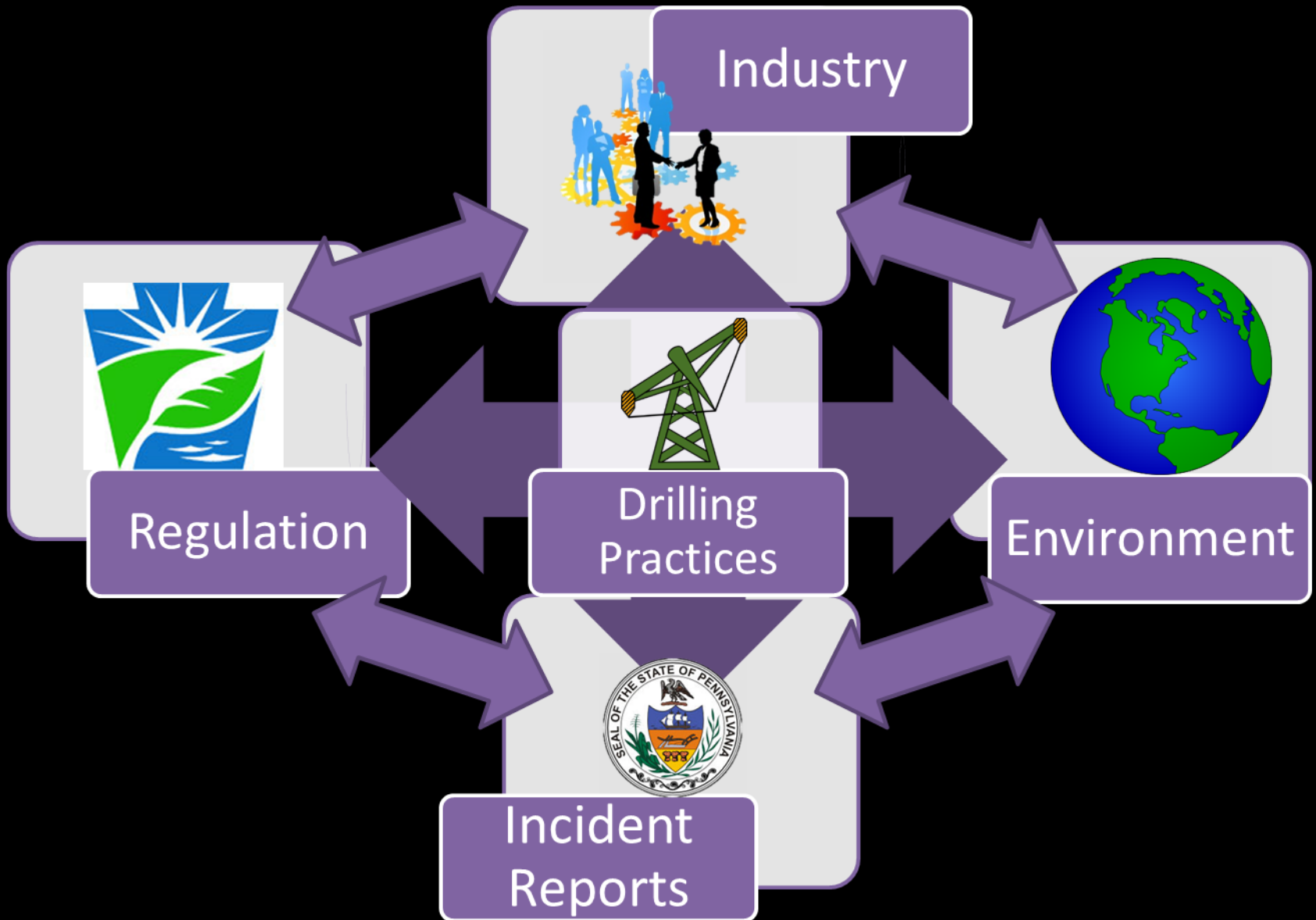


Figure NOT TO SCALE

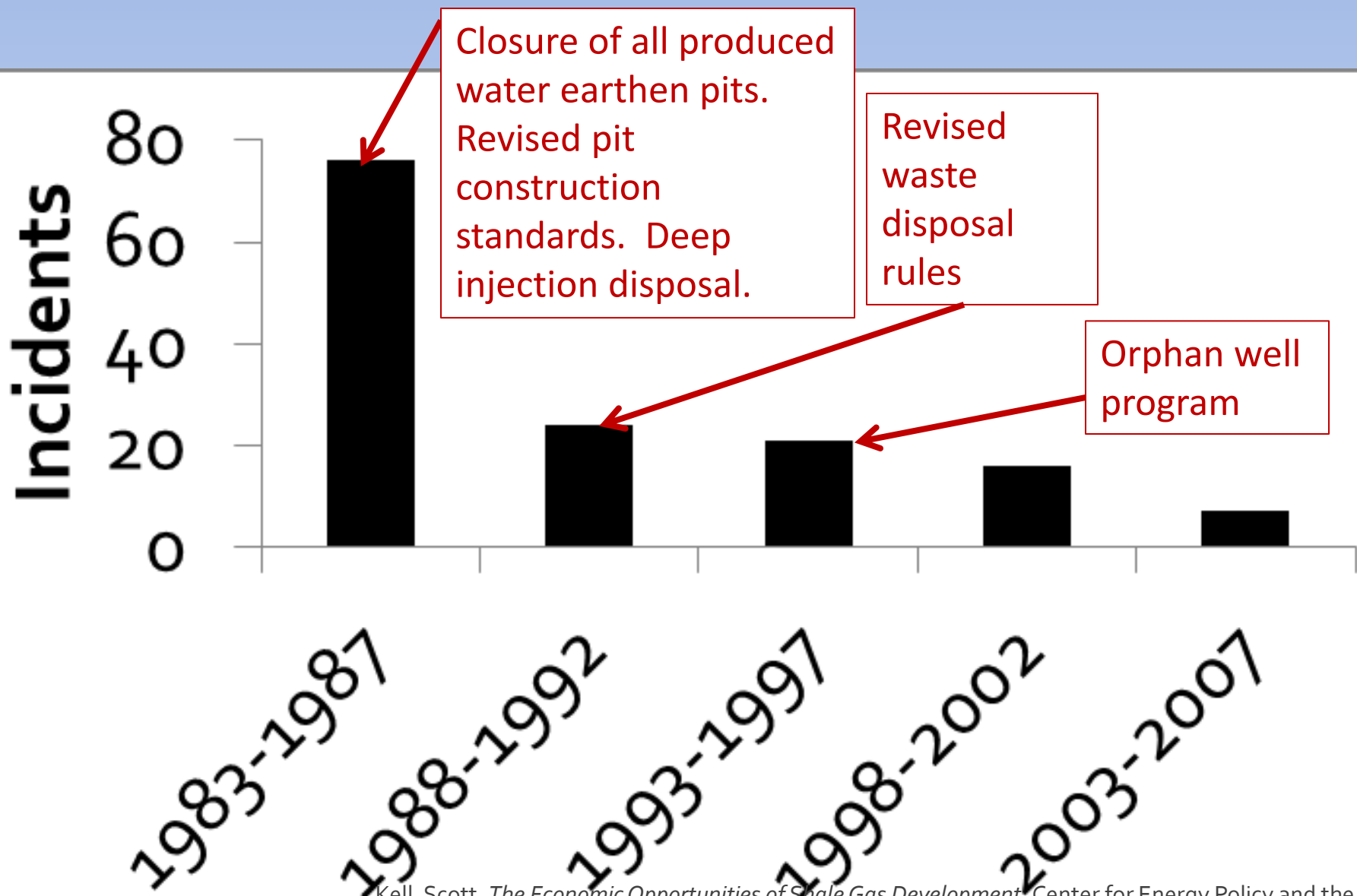
Confronting risk: Not all incidents (or incident reports) are of equal value for building a framework for risk assessment

We cannot improve incident rates if we don't know

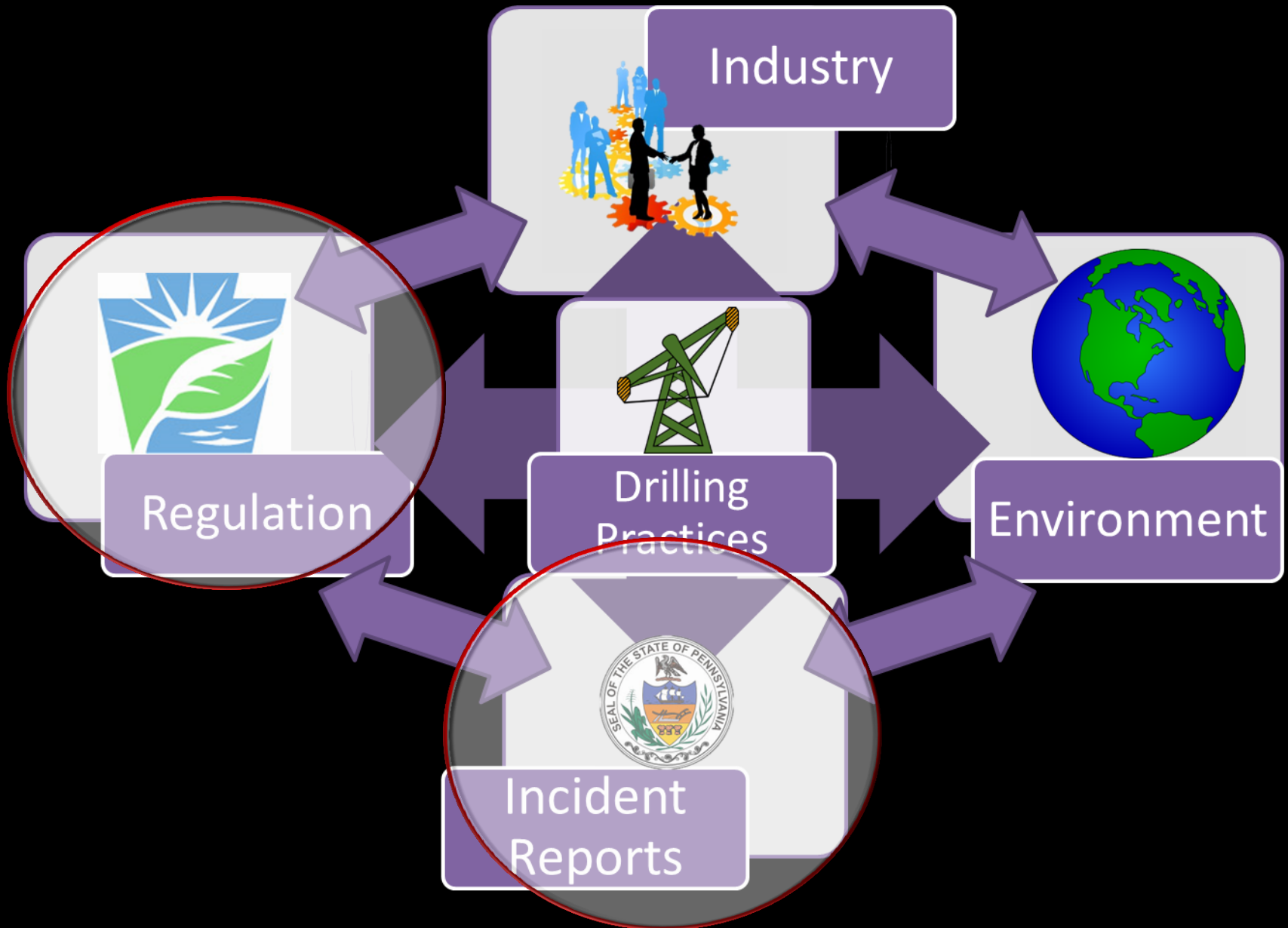


Conventional Oil and Gas Studies: Have incident reports changed over time?

In Ohio, incident report counts declined over time. The decline was attributed to regulatory changes.



In Texas, changes in the number of incidents have been



We are interested in incident *Rates*, so the denominator matters



PeysonPetro.com

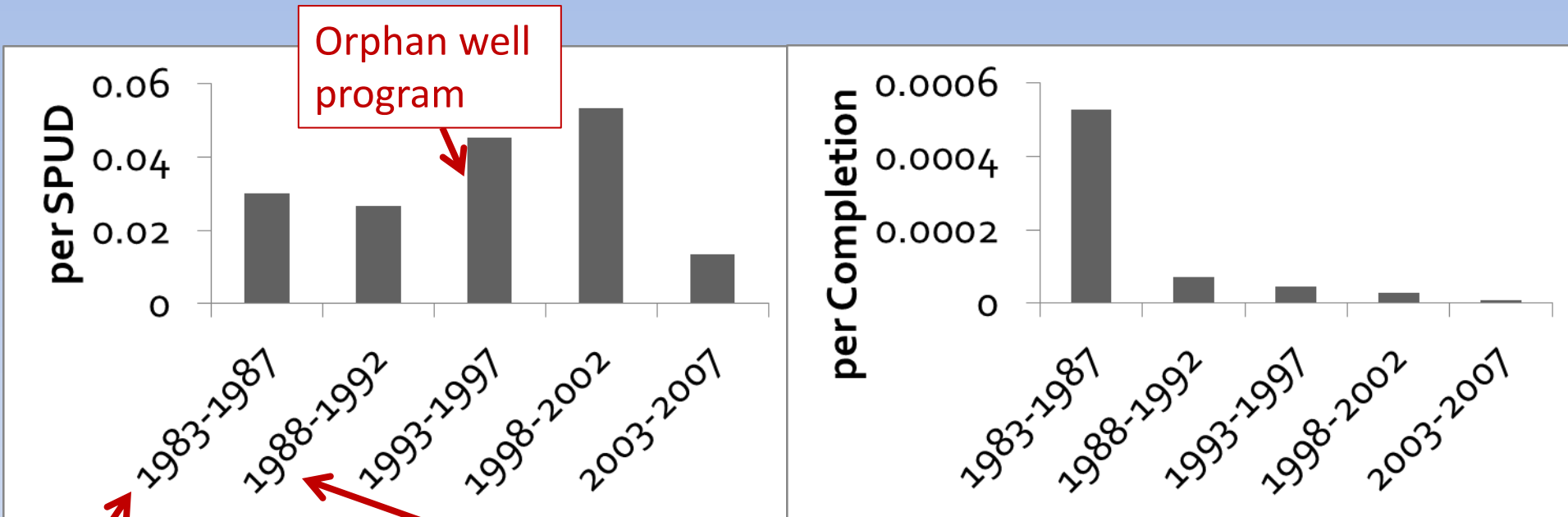
Wells only SPUD once. It's a discrete event, so it's a discrete denominator

Production is an ongoing process, so the denominator is accumulative



Pennlive.Com

When the Ohio incident data are converted to an incident *rate*, the relationship between regulation and incident rates is less clear

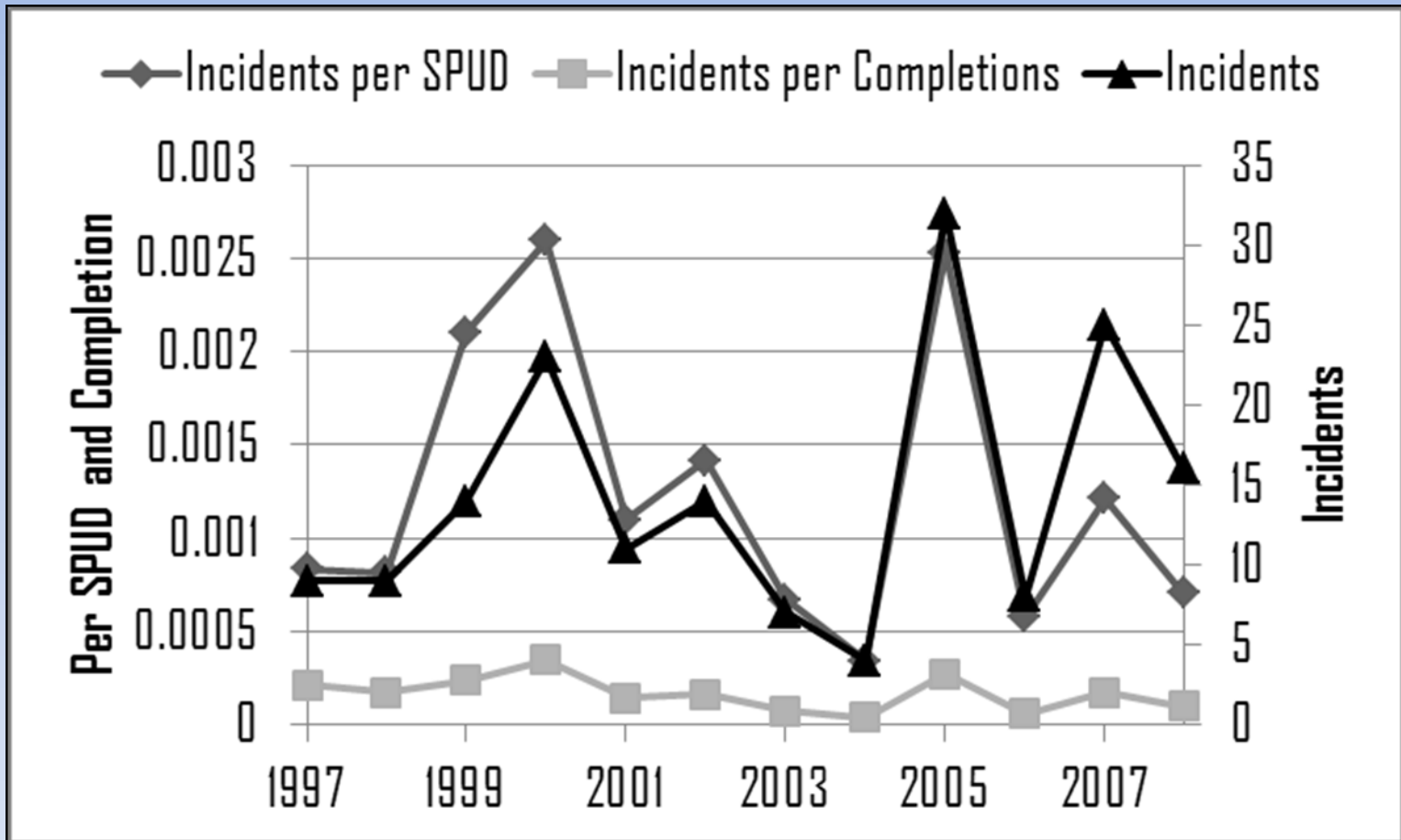


Closure of all produced water earthen pits. Revised pit construction standards. Deep injection disposal.

Revised waste disposal rules

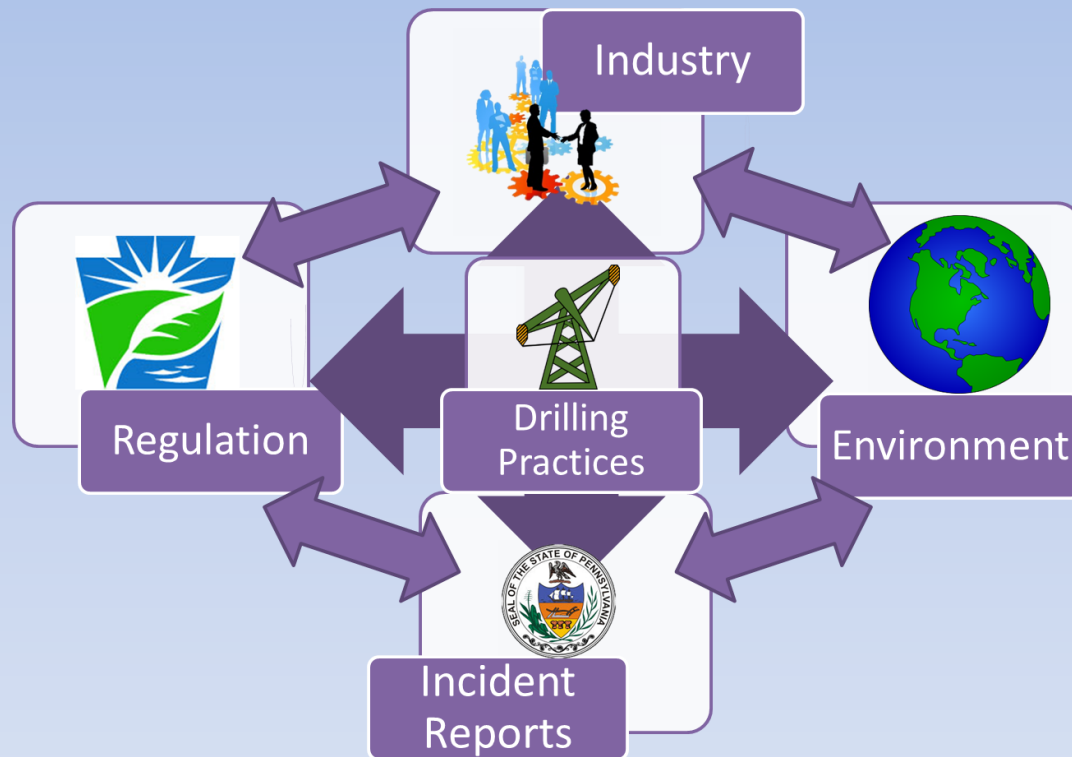
Is it appropriate to treat all incidents as equal?

Trends in Texas incident reports also change when converted to a rate



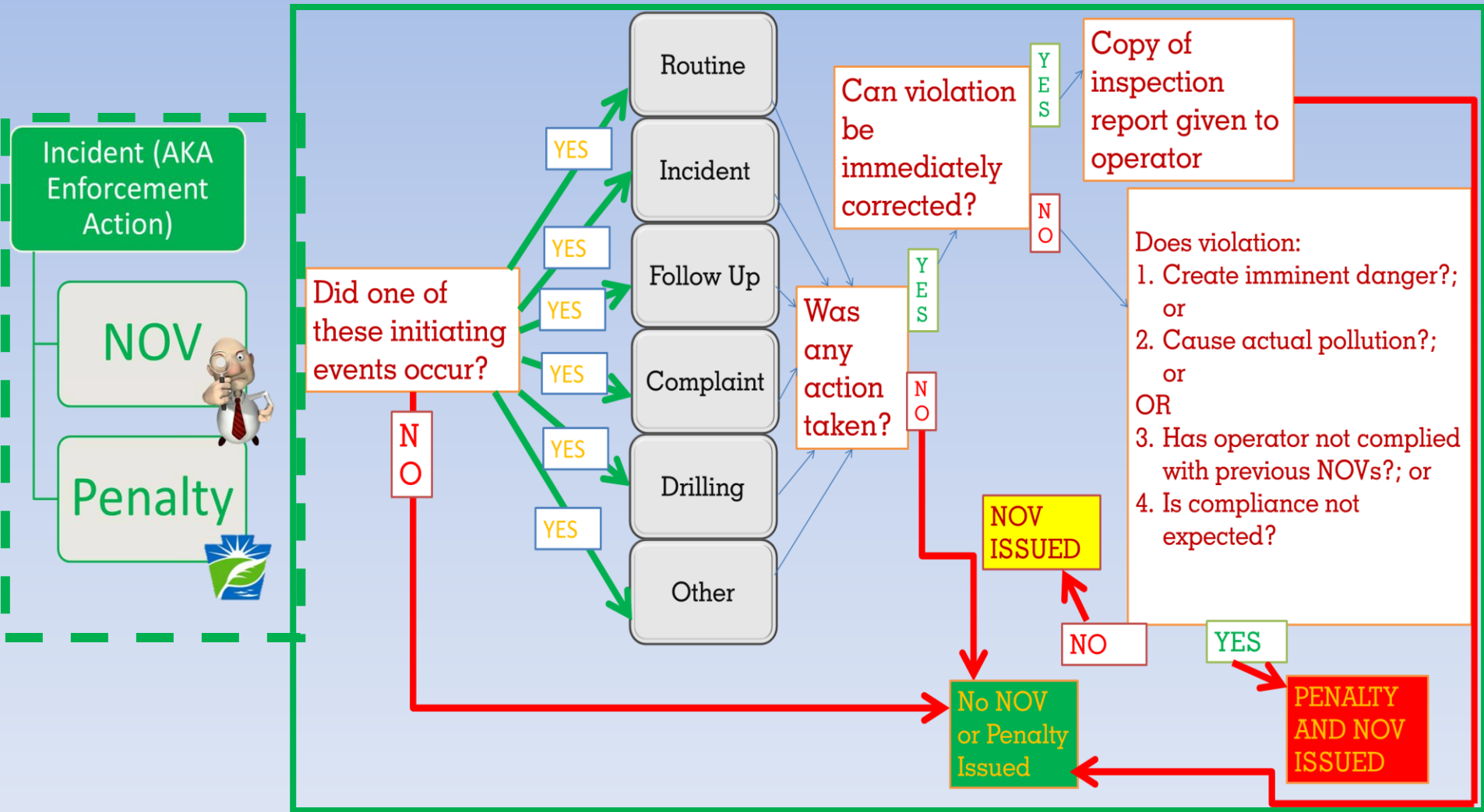
There must be other dynamics influencing environmental incidents

Examining incident rates in the Marcellus play in Pennsylvania



- *All incidents are not the same (environmental impact is key)*
- *Context matters! Counts versus Rates*
- *What other processes are important?*

What is the difference between a Penalty and a NOV?

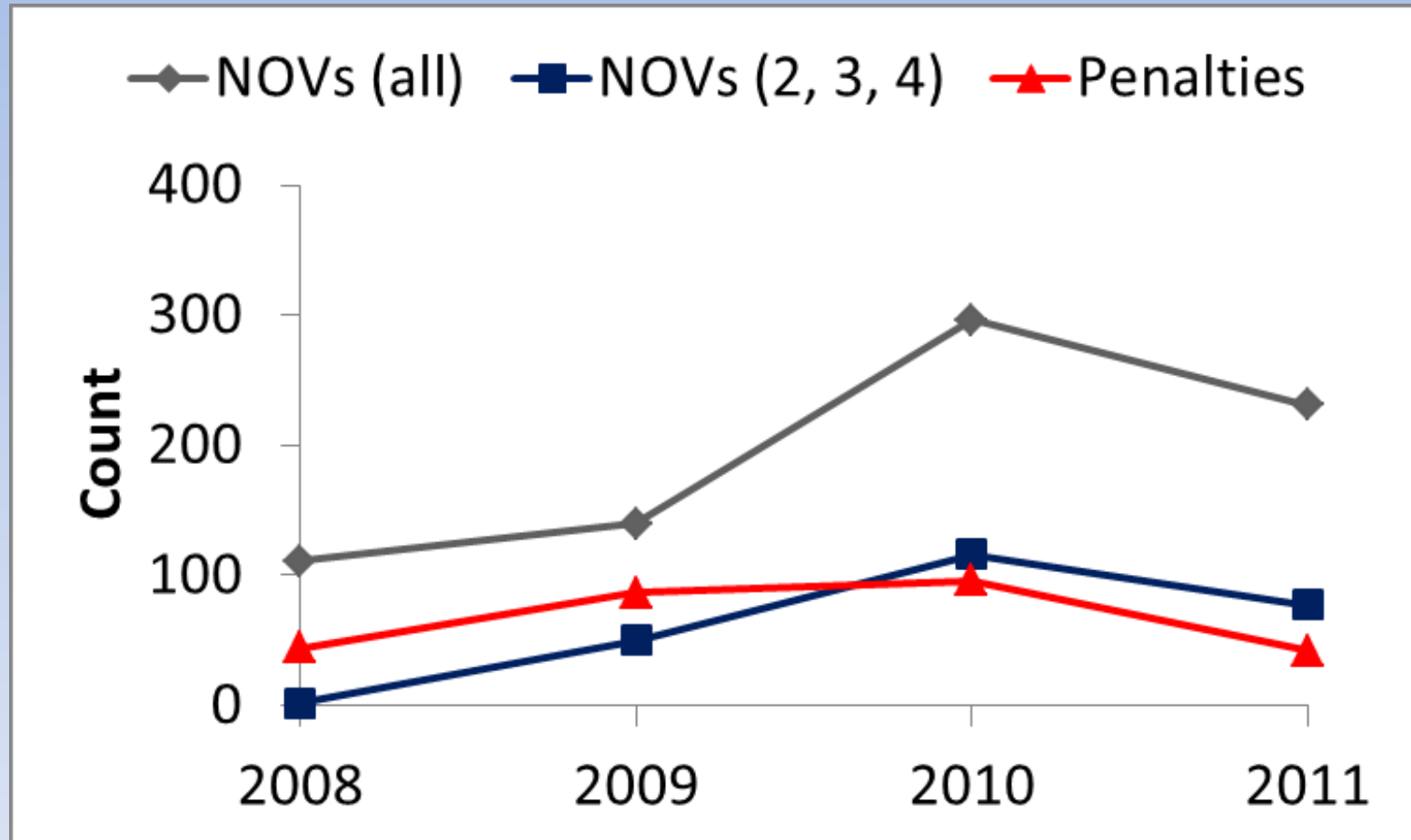


Methods: Our severity ranking system for NOVs was based on the incident's environmental impact

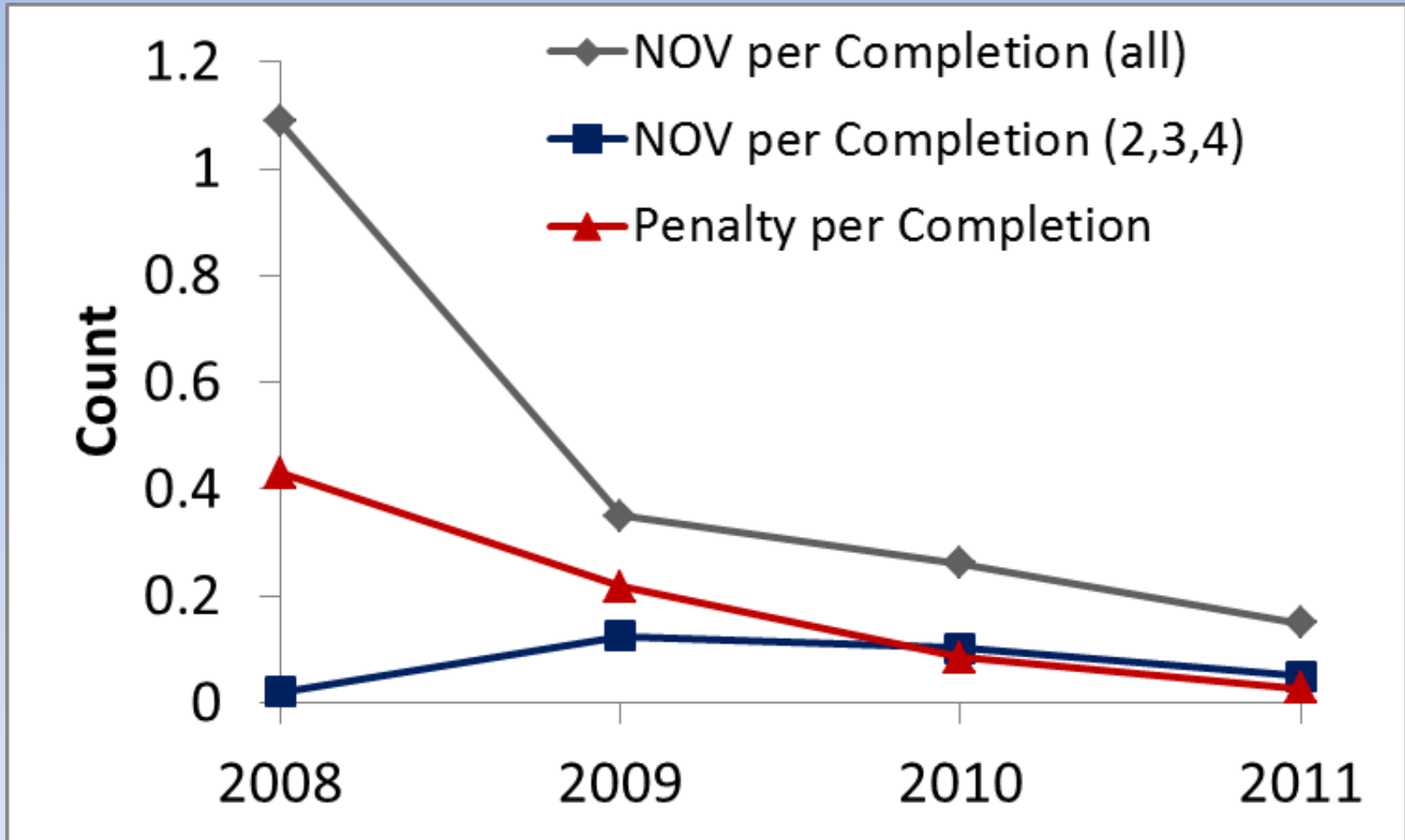


How do Marcellus related
environmental incident report rates
change over time in Pennsylvania?

Raw incident counts increase over time

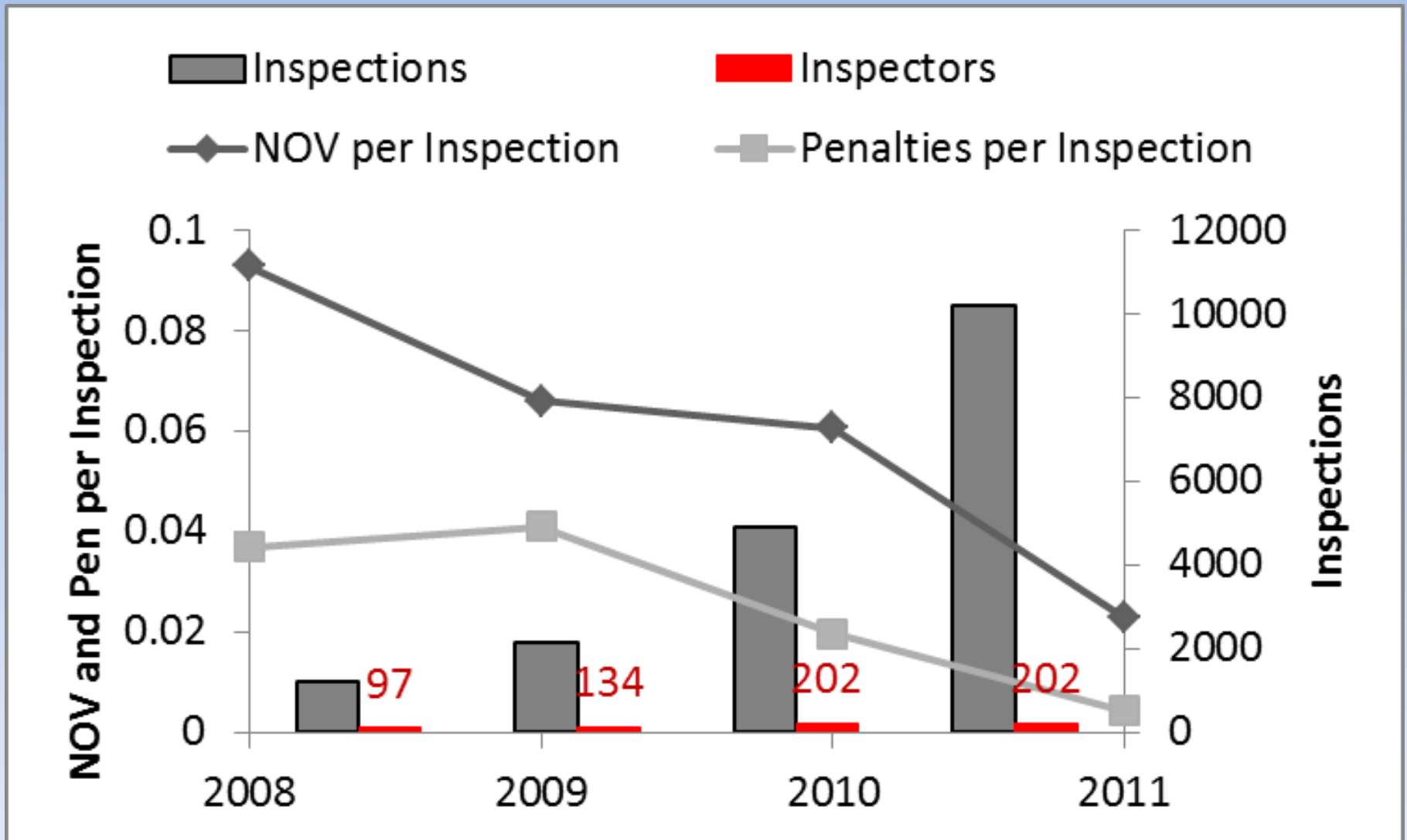


The denominator matters: When we scale the PA incident data to drilling activity, the explosion in Marcellus development changes the results



How do regulatory changes in incident rates
interact in Pennsylvania?

As inspections increased, enforcement actions decreased



Several regulatory changes occurred across the study period

1



1

2

3

2008

2009

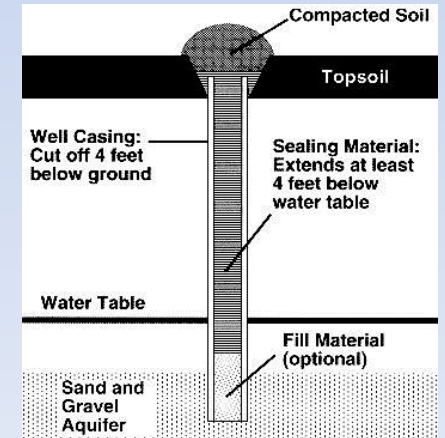
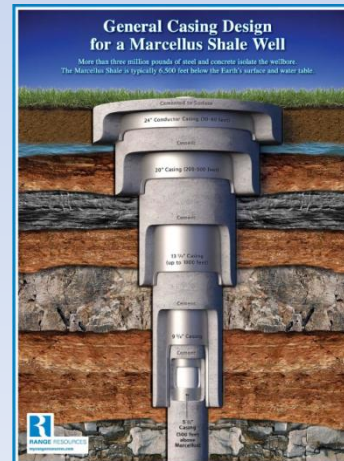
2010

2011

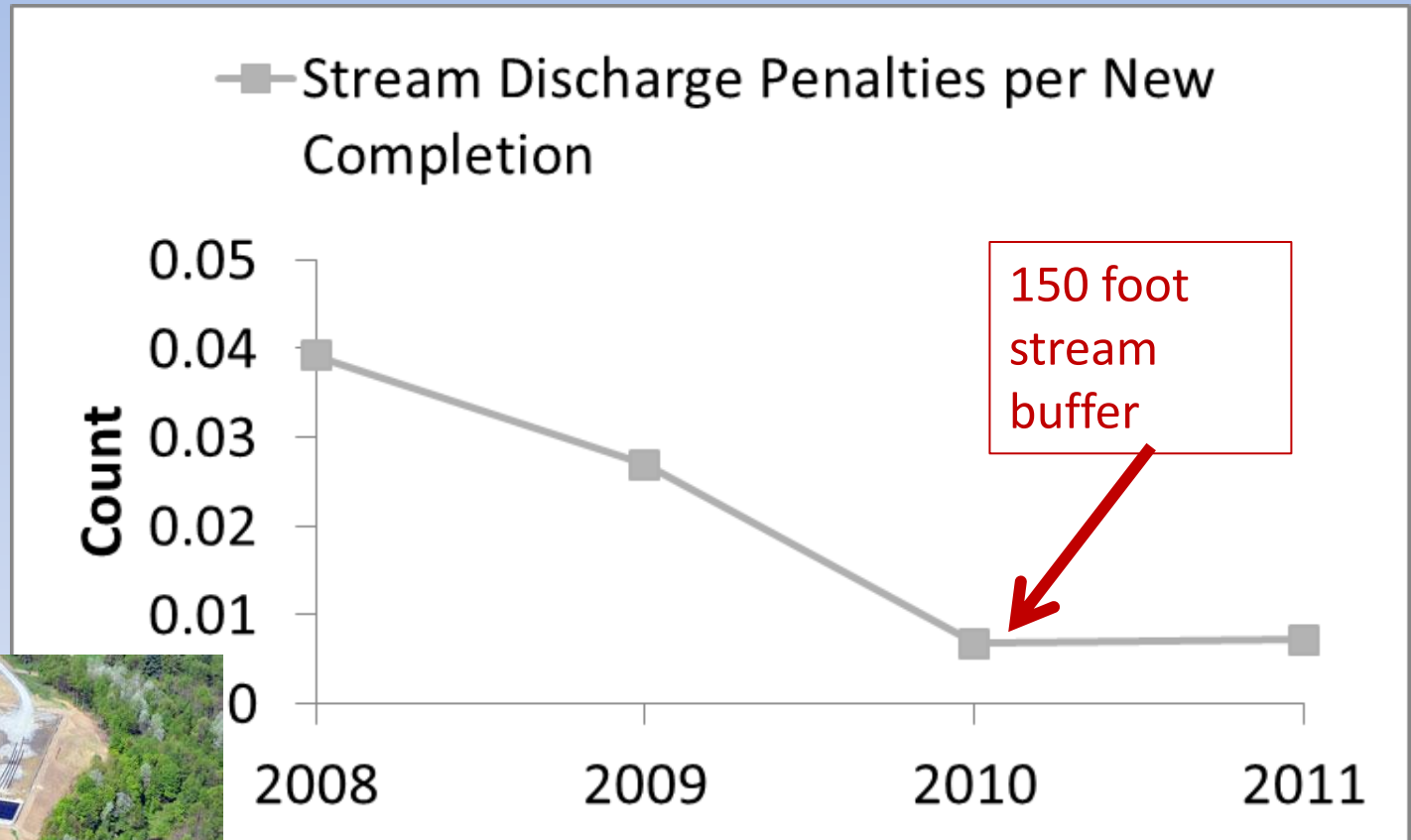
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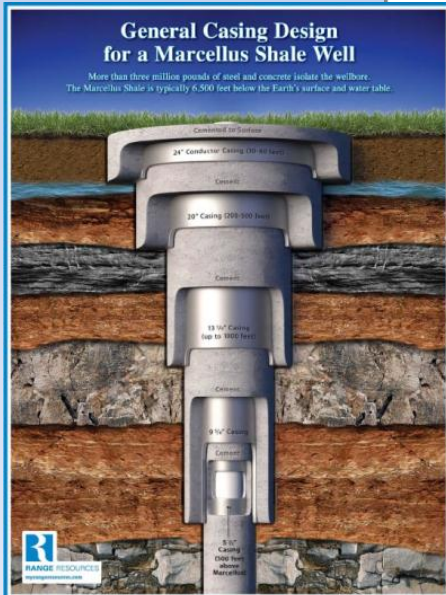
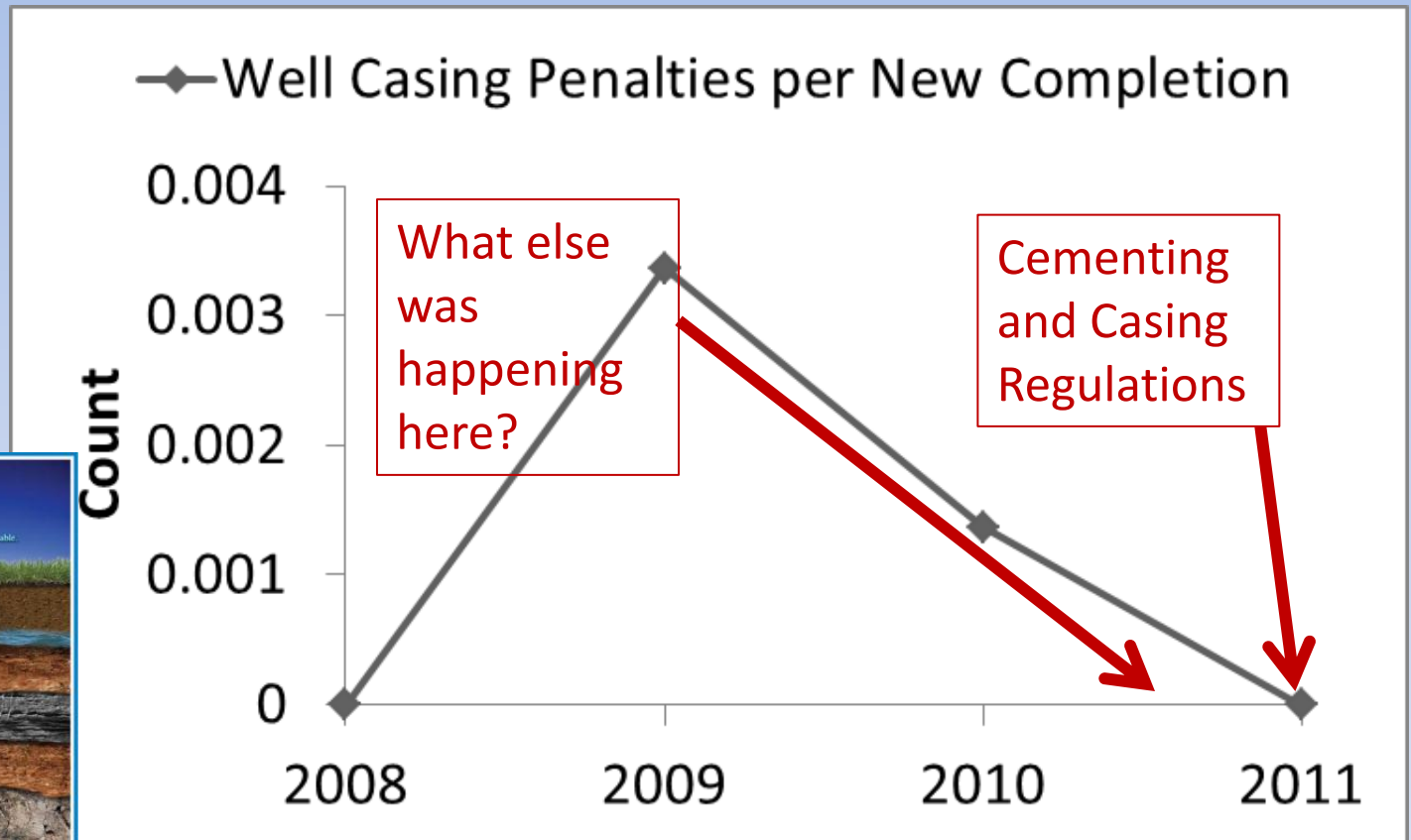
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Changes in regulation can alter incident rates arising out of specific activities



Some regulatory changes may reduce incident rates over longer time periods



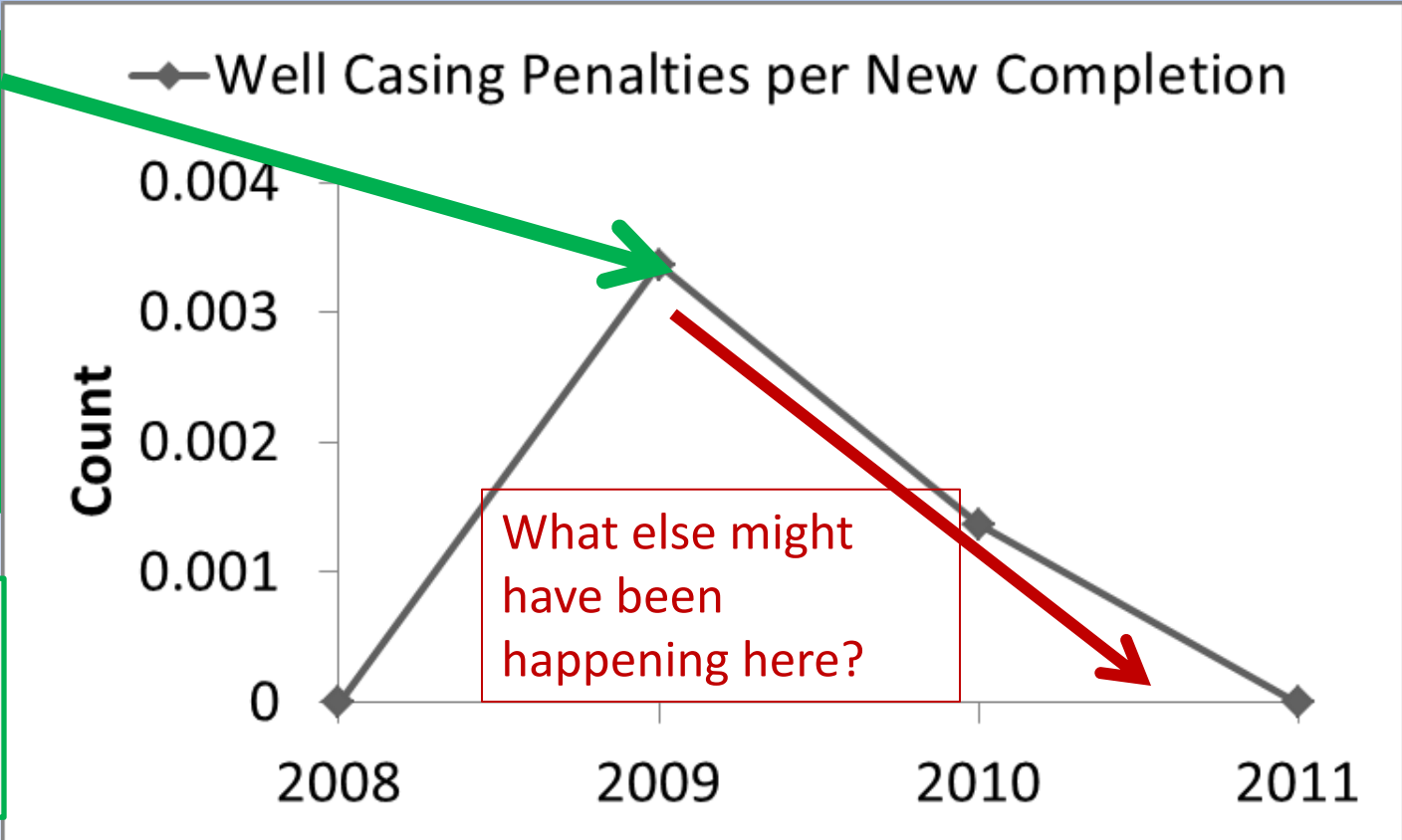
By ranking incident severity by environmental outcome, and scaling our data to drilling, and looking at regulatory changes, we have started to characterize important feedbacks – but we're not done yet...



Have any other important changes happened during the study period?

Marcellus Shale Coalition Releases Study on Drilling and Environmental Impacts

Consolidation of drilling operators?



There are many processes and feedbacks at play when it comes to incident rates



In conclusion..

1. Penalty rates decreased between 2008 and 2011 in Pennsylvania
2. Rates of more serious NOVs did not clearly decline between 2008 and 2011 in Pennsylvania
3. It is important to consider incident reports as rates, and not just counts, to understand trends over time

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