Evaluating and Enhancing the Capacity of the States to Govern Unconventional Oil and Gas Development Risks

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Four necessary steps for evaluating risk governance and the capacity to govern

1. **Identify the risks.**

Explore known violations of rules; produce more, and more uniform ,data on risks.

2. **Identify who currently governs (institutions).**

Identify and analyze agencies and interactions among agencies, public-private initiatives.

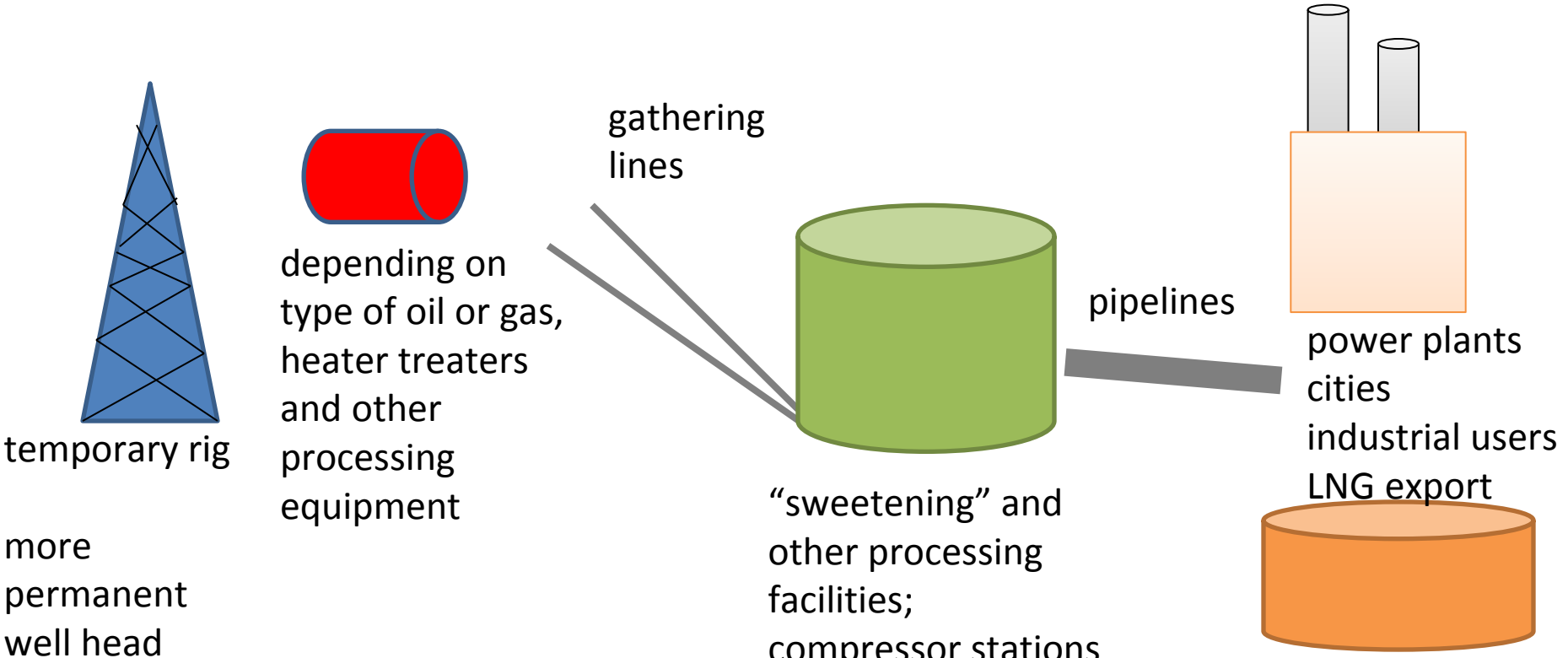
3. **Identify substantive controls/incentives and gaps.**

Explore variation and reasons behind it; address other regulatory deficiencies.

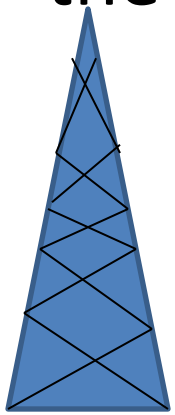
4. **Identify the capacity of institutions to inform industry entrants of rules, detect and enforce violations.**

Which risks and governance strategies to address?

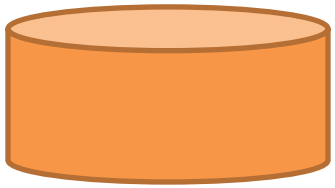
This presentation focuses on upstream activities, but increasingly, certain entities are attempting to tie together upstream, midstream, downstream.



Sierra Club et al. April 2013 DOE Petition for Rulemaking Regarding Natural Gas Export Policy: "Because roughly two-thirds . . . of gas for export would come from new unconventional gas production, export is . . . linked to intensifying environmental and public health impacts from the domestic gas boom."



temporary rig



LNG export

more
permanent
well head

This presentation: "lifecycle" upstream perspective and governance of associated risks

- building well pads and roads
- drilling and casing wells
- fracturing wells – withdrawing water, mixing with chemicals, injecting at high pressure
- handling, storing, and disposing of flowback, produced water, other wastes
- separating and initially treating oil and gas on site

1a. Identifying the risks: known rule violations

- Many risks are familiar and have long occurred at conventional sites, but now at a larger scale.
  - Colorado tight gas: "Erosion channels are present around the edge of the pad . . . . No storm water BMP's are present at the pad site." API 05-081-07359.
  - New Mexico tight sands: "A fuel pump split, allowing 1,000 gallons of diesel to be released. 100 gallons recovered." API 30-039-30557.
  - Pennsylvania Marcellus: "Methane migrated to surface through cement in 9 5/8" annulus." Permit 033-26848.

Louisiana Haynesville: Frac tanks used for temporary storage of produced saltwater. Gauging error caused overflow, and water flowed into ditch and swampy area. Permit 238585.

Texas Barnett shale: Driveway, pasture, pond polluted with low chloride drilling fluids diluted with rain water. Permit 630921.

Colorado tight sands: "Excessive oil accumulation at tank battery. Berm not sufficient at tank battery. Excessive oil on ground at wellhead, oil is migrating down grade (from wellhead) toward upper pit. Wildlife accessing both pits." API 05-103 -08459.

- Other risks arise from hydraulic fracturing and associated activities, including storage of flowback.
  - Pennsylvania Marcellus: "Flowback fluids overtopping tanks spilling out of open manholes onto ground surface beyond secondary containment." Permit 115-20341.
  - New Mexico tight sands: "During fracking a valve was left open due to human error causing a release of 245 gallons of frac water, all recovered." API 30-045-34625.

We need more analysis of types of violations and their frequency.

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	Louisiana: Haynesville Shale wells January 2009–July 2011	**Michigan:** Antrim Sha wells January 1999–May 20
	210 total violations	498 total violations
	Percent of total violations[a]	Percent of total violati
Construction of access road and well pad		
Erosion and sedimentation		0.8
Maintenance of site: vegetation, signs, fencing		
Fencing		
Signs and labeling	25.2	32.5
Site maintenance (clearing weeds, for example)		22.4
Drilling (and potentially fracturing)		
Air quality		0.2
Casing and cementing	13.8	
Commingling oil and gas		

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1b. Identifying the risks: we must produce more, and more uniform, data on impacts

- Baseline and post-development testing needed.
- Some states require testing, and federal agencies such as USGS are analyzing existing water quality data and will possibly collect additional data.
- Uniform measurements and results are needed, however, to better inform governance.

Examples of state testing and monitoring requirements

- Michigan requires "**hydrogeological investigation**" around proposed wells to "establish local background groundwater quality." Also requires "**monitoring systems to detect leakage** from hydrocarbon or brine storage secondary containment areas" – either tertiary containment or one downgradient groundwater monitoring well. Mich. Admin. R. 324.1002.

- In Ohio, operators before drilling must **sample all water wells within 1,500 feet** of proposed horizontal wellheads. OHIO REV. CODE ANN. § 1509.06.

- Colorado requires "**initial baseline samples and subsequent monitoring**" of a maximum of four water sources within a half mile radius of a proposed well site. Prefers sampling of "maintained domestic water wells." COGCC Final Rule 609.

An example of differences between testing requirements

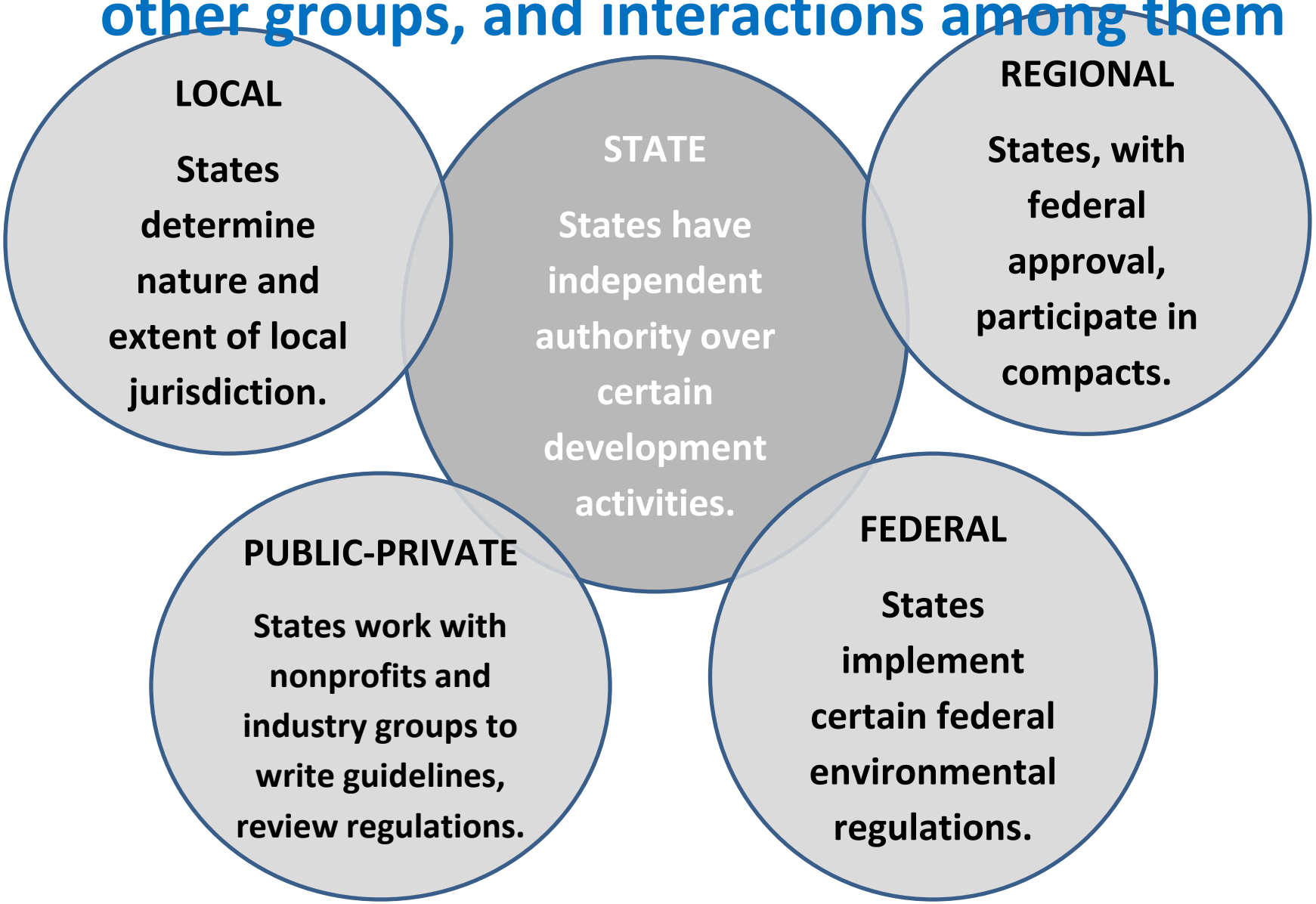
- **Ohio**: dissolved barium and iron; total calcium, magnesium, potassium, sodium, alkalinity, and dissolved solids; chloride; pH; conductivity, sulfate (most in micrograms or milligrams per liter), EPA or NELAP certified laboratory.
- **Colorado**: also requires testing for bacteria, dissolved gases, benzene, toluene, ethylbenzene. No laboratory specified, but requires analysis of samples using “standard methods” such as EPA SW-846 or an API method.

Governance to address risks

- **Substantive controls**: industry standards and best management practices, contractual provisions, statutes, regulations

- **Institutions**
  - Environmental Protection Agency, Fish and Wildlife Service, Bureau of Land Management, Army Corps of Engineers, other federal agencies
  - State environmental and natural resources agencies
  - Regional commissions
  - Industry and nonprofit groups

2. Identify who currently governs: agencies and other groups, and interactions among them



- Within each state, multiple agencies have jurisdiction over risk.
- Texas example:
  - **Railroad Commission (RRC)** governs surface oil and gas activities and casing, handling and disposal of naturally occurring radioactive materials from oil and gas.
  - RRC grants underground injection control permits.
  - **Texas Groundwater Protection Committee** "tracks groundwater pollution." RRC is a member.
  - **Texas Commission on Environmental Quality** monitors air quality; approves surface water withdrawals.
  - **Texas Department of Licensing and Regulation** has

- Does the agency have **full authority over the scope of the risks**? (If risks are regional, does a regional agency govern?)
- Do agency staff **communicate risks** that they notice to the **entities with jurisdiction over those risks**? (Do Railroad Commission inspectors in Texas identify potential air quality concerns, if they happen to notice them when visiting a site, and send them to the Texas Commission on Environmental Quality?)

In exploring who governs, **private and public-private initiatives** are also important.

- **Lenders and lessors** increasingly require environmental protections.
- **American Petroleum Institute** has many standards; we need more information on how many operators follow them, and how consistently.
- **State Review of Oil and Natural Gas Environmental Regulations** suggests state regulatory improvements, but these are not always adopted.
- Industry voluntarily produces chemical data through **FracFocus**; now required in many states.
- Must **differentiate between review/disclosure and substantive controls**. Disclosure might incentivize

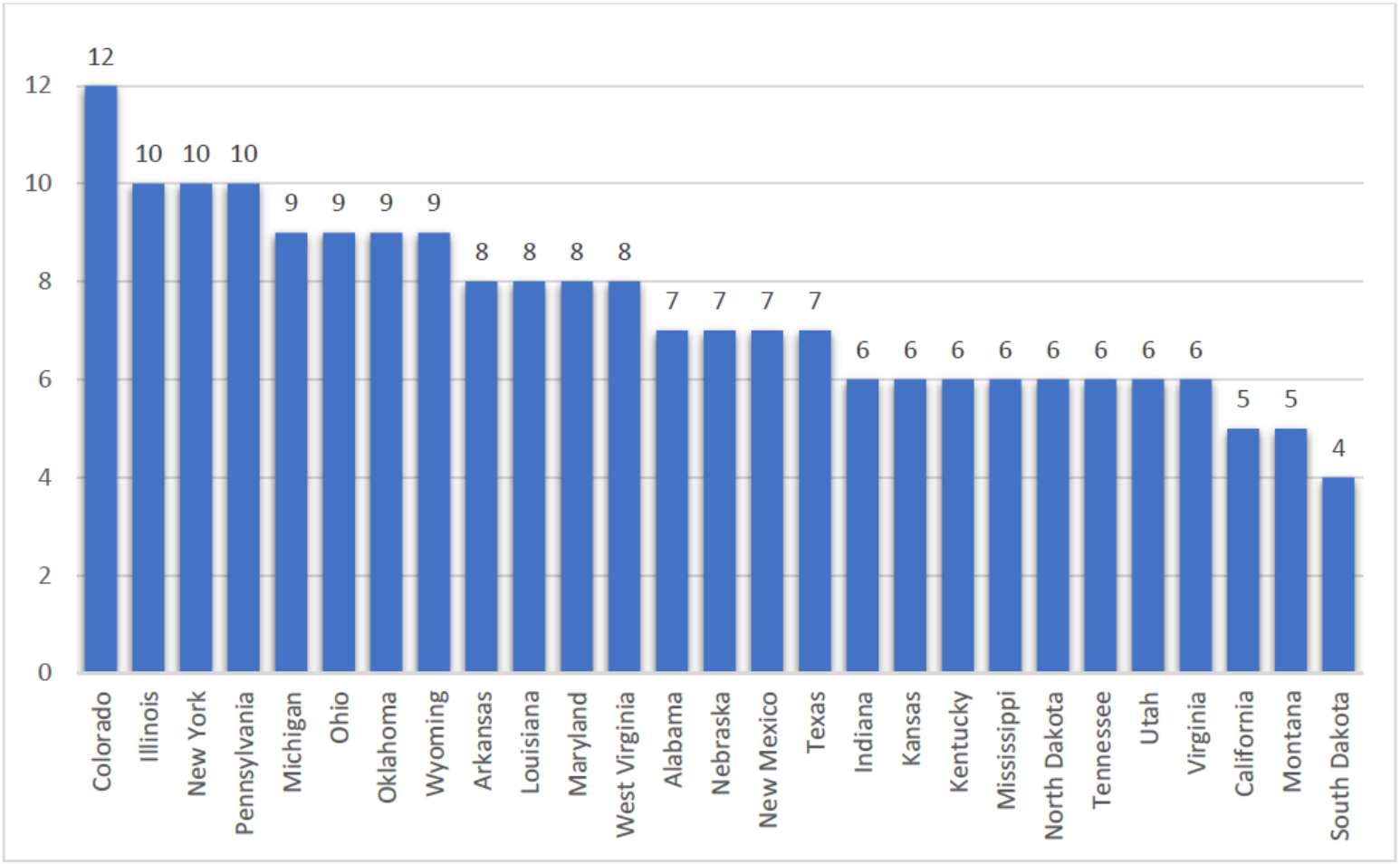
3. Identify substantive controls and gaps

	Federal	State
Groundwater contamination, induced seismicity (waste disposal)	Federal Safe Drinking Water Act standards	Often state-administered
Groundwater contamination (from drilling, surface pits)	Fracturing, with exception of diesel, not federally regulated	State casing standards State regulation of pit contsruction and use
Surface water contamination	Clean Water Act for direct discharge (uncommon) Agency threats RE: inadequate wastewater treatment	State regulation of pit construction and use; water quality acts
Soil contamination, spills	Oil and gas exploration & production wastes exempt from RCRA Subtitle C	States standards for handling of chemicals, wastes
Air quality	Some new federal standards	Some state regulation; few regs. for many emissions
Habitat fragmentation	Few regulations at federal or state level, although Endangered Species Act sometimes relevant	

- Need comparisons of state regulations for various stages of unconventional well development.
- See, e.g., Richardson et al., Resources for the Future, ***The State of State Shale Gas Regulation***.
- Identified elements regulated "quantitatively" by states, and evaluated stringency of regulations, heterogeneity, dynamism.
- Also noted non-quantitative regulation, and areas in which states have not regulated.

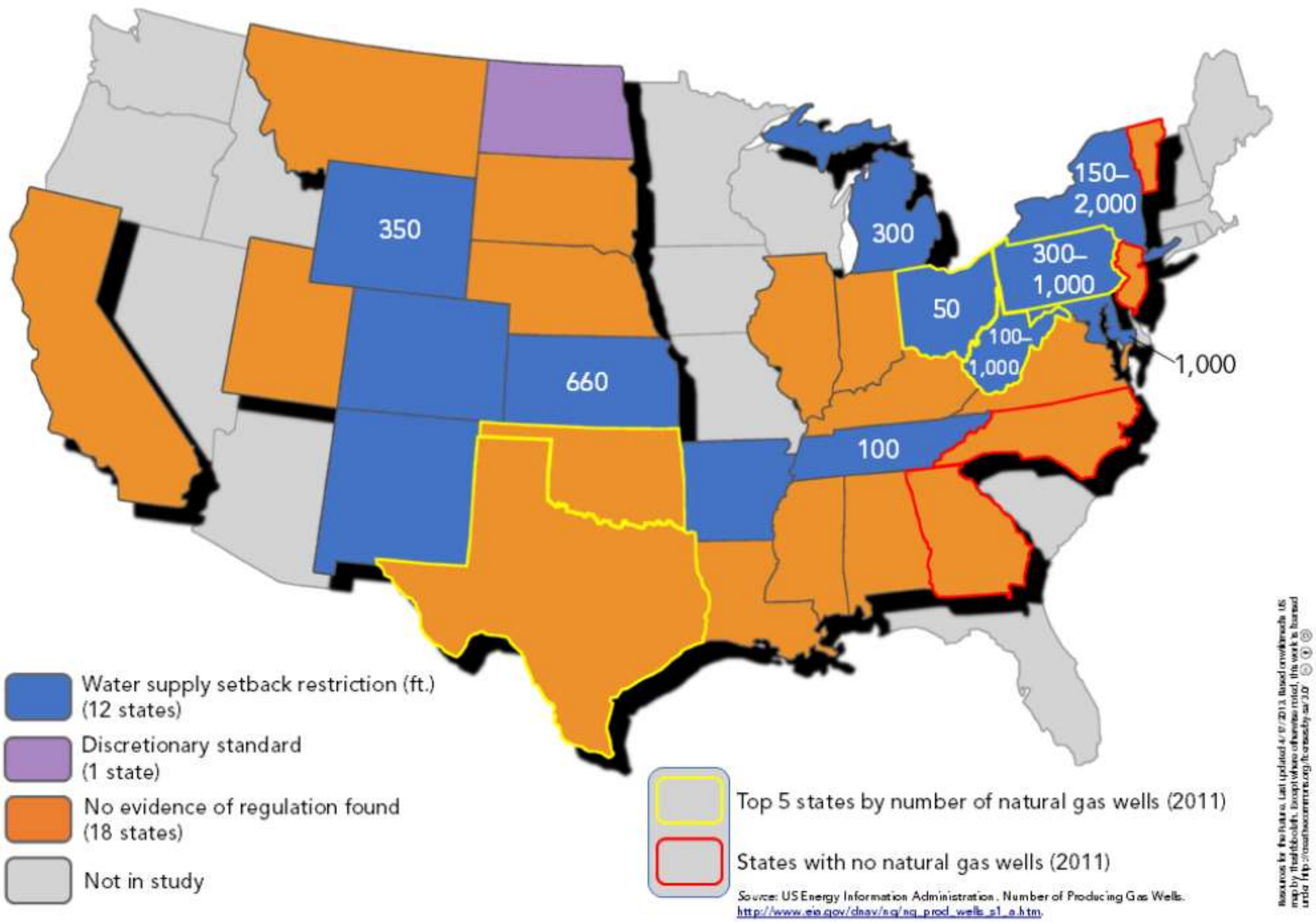
that use case-by-case permitting, for example, are excluded. This further limits its scope.

Figure 6. Number of Elements Regulated Quantitatively



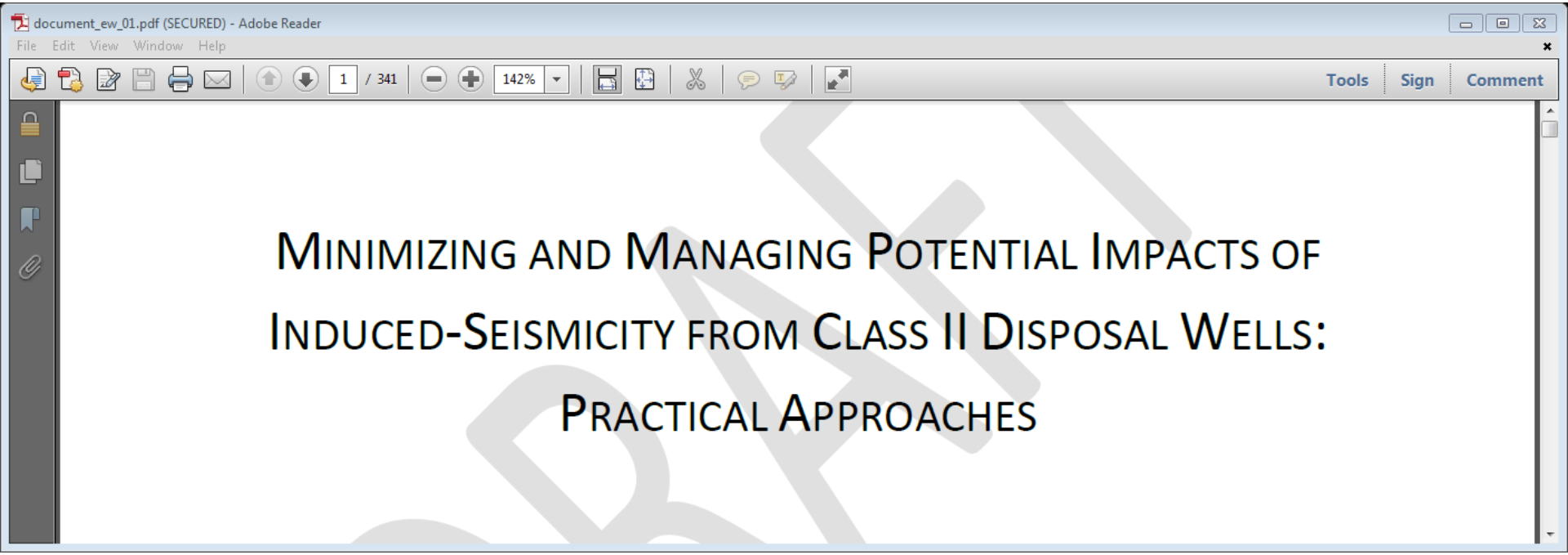
Also, states often use command and control as their primary regulatory tool, setting a uniform statewide minimum standard, but allow operators to apply for exceptions. This is effectively a hybrid command-and-control/case-by-case permitting approach. In these cases, the stringency of the

Map 3. Setback Restrictions from Water Sources



Federal regulation does not always fix variability, particularly if not updated

- **Class II Underground Injection Control wells** –regulated by federal Safe Drinking Water Act, often implemented by states.
- Ohio has updated regulations to address induced seismicity concerns, and Arkansas does not allow these wells in certain areas, but few other states have addressed the problem.



Why the variability?

Comprehensive analysis of states is needed.

- In some cases, geology, climate, and other factors may justify differences.
- Quantitative, uniform standards not always better. Case-by-case permitting sometimes addresses variable risks.
- In other cases, there may be one, accepted practice for adequately protecting against risk, yet this

Scale-based considerations in regulation

- Regulations that ignore scale: limiting individual water withdrawals to a certain volume per day or month.

- Cumulatively, operators all withdrawing water—within permitted limits—from one stream, simultaneously, could cause substantial harm.

- Do regulations have "**total harm thresholds**"—meaning do they address cumulative and interactive risks?

Example of a regulation with a total harm threshold

Susquehanna River Basin Commission, July 16, 2012, 64 Water Withdrawals for Natural Gas Drilling and Other Uses Suspended to Protect Streams

"Under SRBC's passby flow restrictions, when streams drop to predetermined protected low flow levels, operators who are required to meet the agency's passby requirement must stop taking water."

http://www.srbc.net/newsroom/NewsReleasePrintFriendly.aspx?NewsReleaseI

Considering market-based regulation through insurance

- Ohio Substitute Senate Bill No. 315 requires liability insurance "of not less than five million dollars bodily injury coverage and property damage coverage," and a "**reasonable level of coverage available for an environmental endorsement**." Codified at Ohio Rev. Code § 1509.07.

- Few states require environmental liability insurance. *But see* Maryland S.B. 854 (approved May 16, 2013).

4. Identify the capacity of agencies (and other institutions) to inform industry entrants of rules, detect and enforce violations.

4a. Informing entrants of rules

- Highly-publicized early enforcements
- Training sessions
- Operators' manuals

Example of publicized early enforcements

Thomas Beauduy, Susquehanna River Basin Commission, remarks at Villanova University School of Law, Jan. 30, 2010:

"The Commission initiated an approval-by-rule process as soon as the industry came to town. **It took nearly $2 million of fines paid by the industry to get its attention.** The Commission and the industry then began working progressively, positively, and constructively ever since."

Example of industry training

2010 IndustryTraining Workshop Agenda-4.pdf - Adobe Reader

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pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

Bureau of Oil and Gas Management
2010 Industry Training Workshop
Agenda

Morning

8:00 – 8:20 AM – Registration

8:20 – 8:25 AM – Welcome and Comments – Jim Kline

8:25 – 8:35 AM – PIOGA- Lou D'Amico

8:35 – 9:30 AM – Chapter 105 Permits, Joint Permits and Distance Waiver (OG57) - Jim Kline

9:30 – 9:45 AM – Break

9:45- 10:30 AM – Water Management Plans- Sue Weaver, Dave Jostenski or Tom Denslinger

10:30- 11:00 AM - Wastewater Transportation and Delivery –Jim Fuller

11:00 –12:00 PM – Model Erosion and Sedimentation Plan BMPs –Darl Rosenquest

12:00 – 1:00 PM - Lunch

4b. Detecting violations – inspector numbers

	CO 2012	MI 2012	NM 2012	OH 2012	PA 2010	TX 2012
Number of field inspectors	**36**	**27**	**12**	**40**	**76**	**153 (approx. 87 in field)**
Approximate number of active oil and gas wells (conventional and unconventional)	**49,062**	**15,742**	**56,366**	**55,083**	**92,326**	**279,856**

See Regulatory Risks in Tight Oil and Gas Development. Hannah Wiseman. *Natural Gas & Electricity* 29/5, ©2000, Wiley Periodicals, Inc., a Wiley company, for sources.

Earthworks also has documents that describe the number of inspectors, staff inspections, alleged violations, enforcements resulting from violations, and inconsistent reporting of violations and enforcements.

West Virginia: State agency must **“[d]etermine the number of supervising oil and gas inspectors,”** inspectors, hearing officers, and stenographers **needed** to carry out new regulatory requirements.

W. Va. Code 22-6-2

Detecting violations: random inspections

Susquehanna River Basin Commission (SRBC) “inspections occur during regular business hours, as well as **non-standard work hours including evenings, weekends and holidays**. Inspections are conducted at random of both drilling pads and water withdrawal points. Field inspectors also respond to complaints received from the public.”

http://www.srbc.net/programs/natural_gas_development_faq.htm

Pennsylvania: “DEP inspectors conduct **routine and unannounced inspections** of drilling sites and wells statewide.”

Frequency of inspections – required and actual

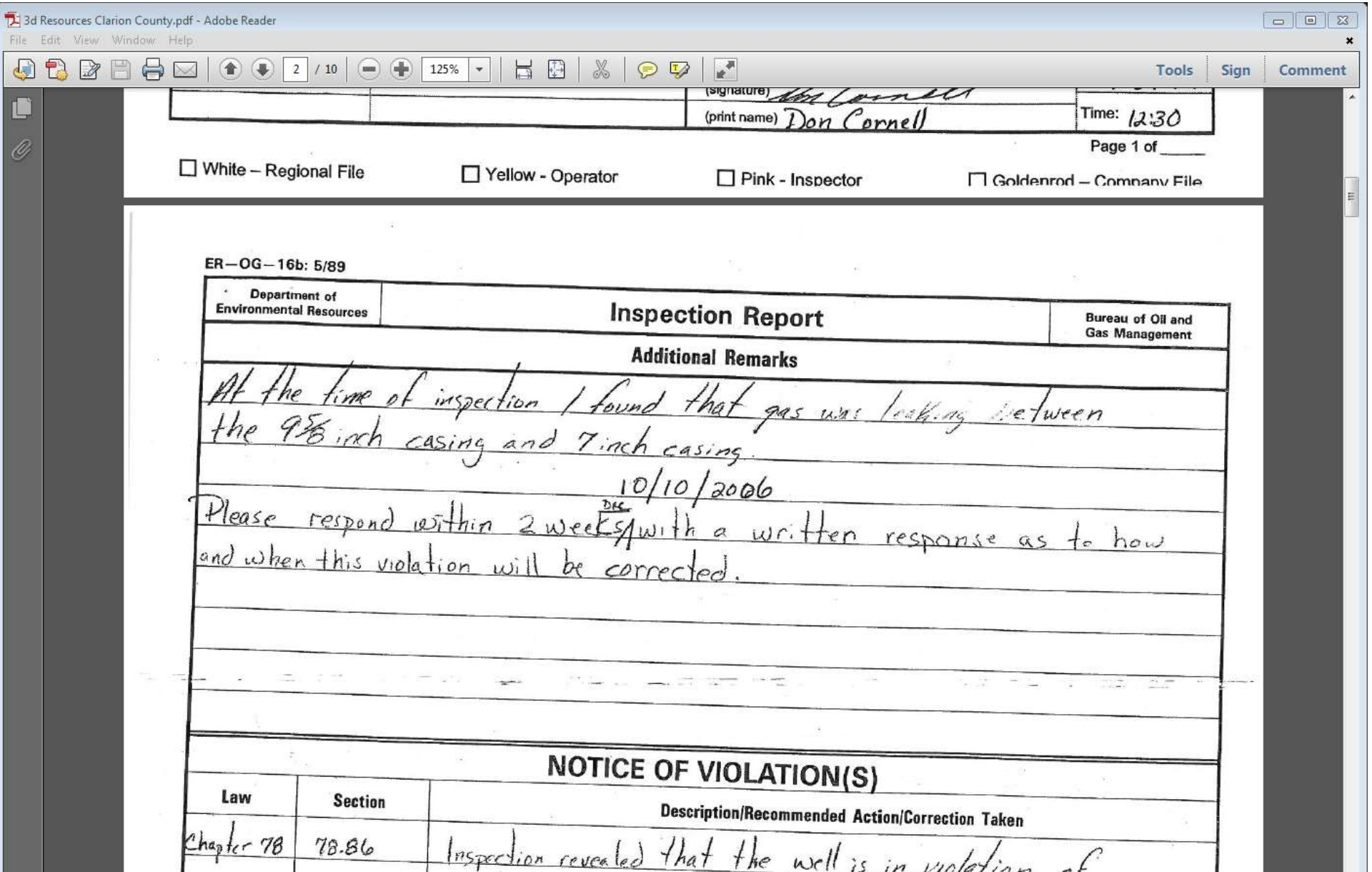
- 25 Pa. Code § 78.903: DEP agents must inspect well at least "**once prior to the issuance of a permit**" if the operator requests a waiver or exemption.
- "At **least once during each of the phases** of siting, drilling, casing, cementing, completing, altering and stimulating a well."
- "At least once **during, or within 3 months** after, **the time period in which the owner or operator is required to restore the site**, after drilling the well" (and more – plugging, abandonment).

Actual inspections and enforcement

State and year	Approximate number of active oil and gas wells	Number of inspectors	Inspections conducted	Violations noted	Enforcement actions taken
Pennsylvania 2012	92,326	76	26,913	3,378	949
Texas 2009	280,000	87	128,000	80,000	550

http://www.portal.state.pa.us/portal/server.pt/community/oil_and_gas_compliance_report/20299; http://www.sunset.state.tx.us/82ndreports/rct/rct_fr.pdf

Detecting violations: ensuring that inspectors notice and consistently document certain problems and conditions



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(signature) Don Cornell

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☐ White – Regional File ☐ Yellow - Operator ☐ Pink - Inspector ☐ Goldenrod – Company File

ER—OG—16b: 5/89

Department of Environmental Resources	Inspection Report	Bureau of Oil and Gas Management

Additional Remarks

At the time of inspection I found that gas was leaking between the 9 5/8 inch casing and 7 inch casing.

10/10/2006

Please respond within 2 weeks DEP with a written response as to how and when this violation will be corrected.

NOTICE OF VIOLATION(S)

Law	Section	Description/Recommended Action/Correction Taken
Chapter 78	78.86	Inspection revealed that the well is in violation of

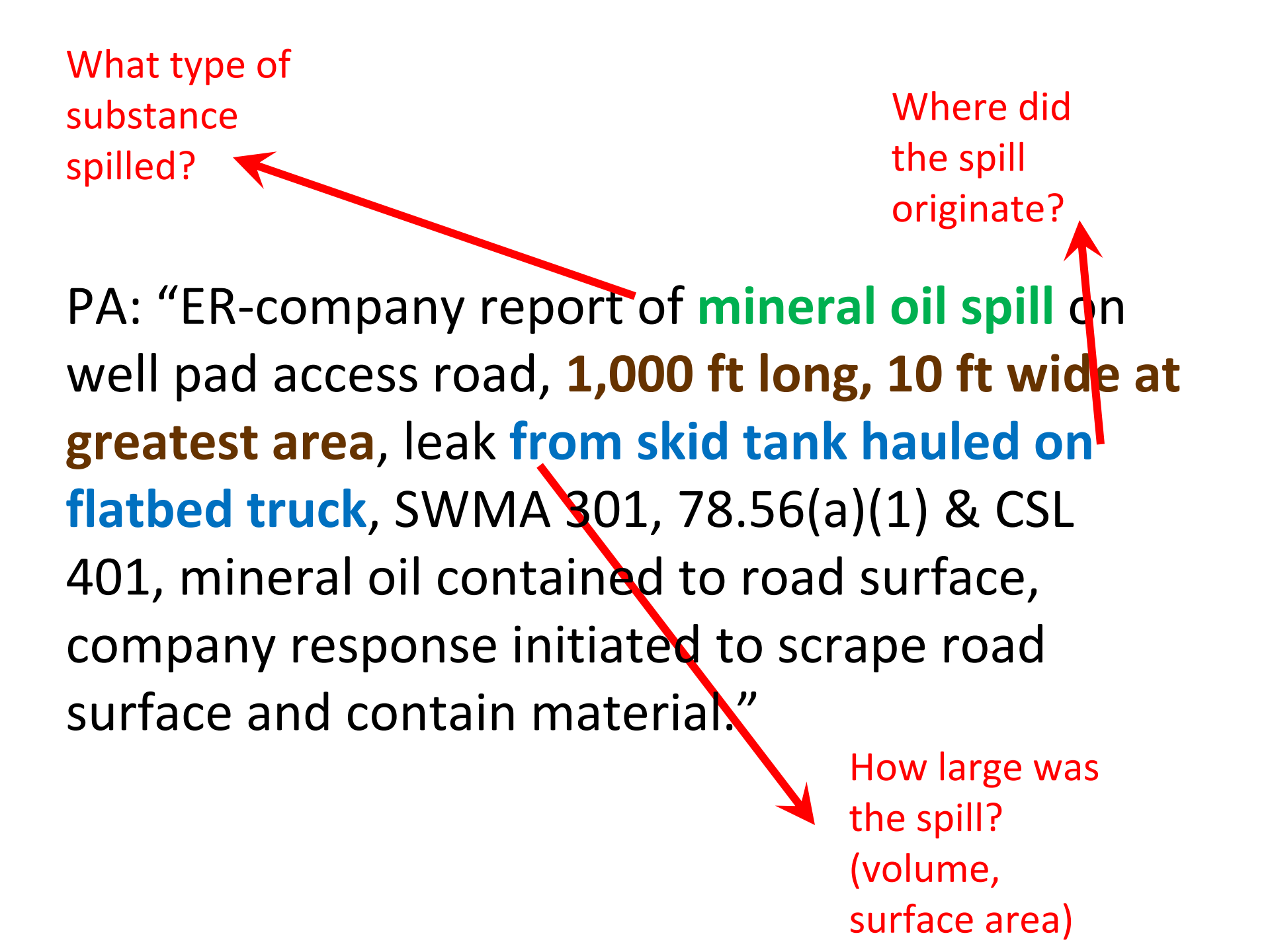
Michigan: “Compliance case #2063 No activity at site, well remains in non-compliance. **Took digital photos** of site for informal compliance hearing 4/22/03.”

Documentation of problem

What resources affected, if any?

Ohio: “Notified by [individual] of an oil line burst underground leading from well to tank battery. Approximately 1-2 barrels of oil escaped. Line was purged of oil and uncovered and plastic pipe was replaced. Soil was removed and replaced in crop field. **No water way affected**. **Cloudy, 32 degrees**.”

Conditions at and near site


What type of substance spilled?
Where did the spill originate?
PA: “ER-company report of mineral oil spill on well pad access road, 1,000 ft long, 10 ft wide at greatest area, leak from skid tank hauled on flatbed truck, SWMA 301, 78.56(a)(1) & CSL 401, mineral oil contained to road surface, company response initiated to scrape road surface and contain material.”
How large was the spill? (volume, surface area)

Type of remediation, clean-up required, and rules that require remediation/clean-up

Colorado: "**Remediate oily soil per rules 909 and 910**. Install measures to **assure that the tank will not overflow again**; 907.a(1) and 324A.a. Spacing of tank should comply with rule 604.a(5). Labeling of tanks should comply with rule 604.a(12). Remove equipment not necessary for production, including but not limited to; workover rig parked on location, old drums/barrels, oily rags, old garage door, etc, per rule 603.j."

Ensuring that staff are qualified; avoiding frequent staff turnover

- West Virginia: “Every supervising oil and gas inspector shall be paid not less than $40,000 per year. **Every oil and gas inspector shall be paid not less than $35,000 per year**.”
- Oil and gas inspectors must have “at least **two years actual relevant experience in the oil and gas industry**.”

W. Va. Code § 22-6-2a, § 22-6-2

Implementing continuous monitoring and reporting so that physical inspections are not always required

"For approved projects, SRBC requires **metering to document daily quantities withdrawn or used**, monitoring of approval conditions such as protective passby flows, and reporting (commonly quarterly) of monitoring data. The monitoring data are screened for compliance with docket conditions upon receipt."

http://www.srbc.net/programs/natural_gas_development_faq.htm

4c. Enforcement: purposes

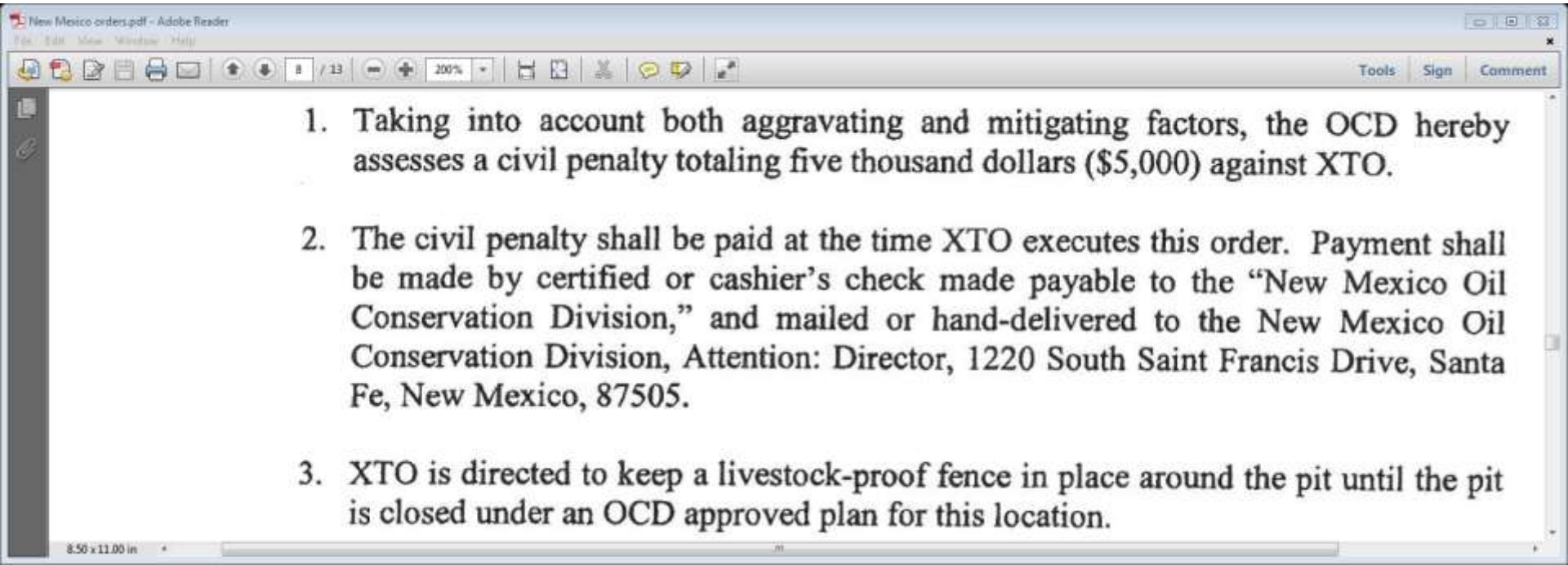
- Ensure remediation of environmental and other damage, if any, caused by violation.
- Make victims whole (sometimes)
- Deter future violations by operator who committed the violation, as well as other operators (signaling)
- “Punish” operators?

Concerns associated with enforcement

- Unfair or seemingly uneven enforcement could break relationship of trust with industry.
  - Allowing industry to immediately correct violations and to avoid formal enforcement action in certain cases seems reasonable, as does settlement in certain cases—need to verify, however, that operator actually corrected violation.

See, e.g., Clifford Rechtschaffen, *Deterrence vs. Cooperation and the Evolving Theory of Environmental Enforcement*, 71 S. Cal. L. Rev. 1181 (1998)

- Underenforcement could encourage culture of noncompliance and leave problems unaddressed.
  - Need to provide consistent policy for enforcement priorities and methodologies. Penalties must be sufficiently high to deter future noncompliance, and remediation orders or payments in lieu of remediation must ensure adequate clean-up and restoration.



Clarity of state enforcement policy

- Colorado Executive Order D 2013-004: Colorado Oil and Gas Conservation Commission must review its "rules regarding the notice of violations and **procedures for issuing notices of violations**, the penalty schedule and its policies, calculating or adjusting penalties, and imposing and collective fines."

STATE OF COLORADO

OFFICE OF THE GOVERNOR

136 State Capitol Building
Denver, Colorado 80203
Phone (303) 866 - 2471
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John W. Hickenlooper
Governor

D 2013-004

EXECUTIVE ORDER

Directing the Colorado Oil and Gas Conservation Commission to Review, Propose Regulations, and Adopt Guidance Regarding Its Enforcement and Penalty-Assessment Procedures

Pursuant to Article IV, Section 2 of the Colorado Constitution and the authority vested in the Office of the Governor, I, John W. Hickenlooper, Governor of the State of Colorado, hereby issue this Executive Order directing the Colorado Oil and Gas Conservation Commission to undertake a review of its enforcement program, penalty structure, and imposition of fines.

Colorado's Executive Order also directs that:

- Minimum violations should be established for "especially egregious violations."
- **Administrative Orders by Consent should not be allowed** for certain types of violations.
- All violations and the basis for penalty assessment shall be publicly posted.

See also Pennsylvania: "An **enforcement action is to be taken for each identified violation**. No violation is to be ignored." Penn. Dept. of Envtl. Protection, Bureau of Oil & Gas Mgmt., Doc. No. 550-4000-001, at 1 (2005), http://www.elibrary.dep.state.pa.us/dsweb/Get/Version-48291/01%20550-4000-

Enforcements vary among states

Type of violation	Louisiana	New Mexico	Texas
Failure to obtain permit before drilling or completing well or producing, transporting gas	Administrative order, $1,000	Agreed order, $23,500	Administrative order, $14,500
Pit/tank construction and maintenance	Order to take appropriate remedial action; $500	Agreed order, $5,000	Administrative order, $1,000

Some differences likely due to aggravating factors, fine and penalty schedules.

Setting enforcement priorities

Pennsylvania: The highest priority violations are those that "**result in an actual release of gas or pollutants** that endanger human life or public health or safety."

Penn. Dept. of Envtl. Protection, Bureau of Oil & Gas Mgmt., Doc. No. 550-4000-001, Enforcement Actions by DEP's Oil and Gas Management Program, at 1 (2005), http://www.elibrary.dep.state.pa.us/dsweb/Get/Version-48291/01%20550-4000-001.pdf

Paying for inspection and enforcement

-
- General funds
- Permitting fees
- Surcharges and taxes
- Fines and penalties (in some states)

How much money? In Texas, **$15,871,941** spent on monitoring and inspections in 2009 (**87 oil and gas field inspectors, 128,000 inspections**).

Need to adjust funding sources to cover expanding inspection and enforcement needs. In Texas, **most fees**

Major Fees for the Oil and Gas Program

Fee Type	FY 2011 Estimated Revenues	Fee Design for Major Fees*	Flexibility	Last Changed in Statute
Oil & Gas Well Drilling Permits	$9,500,000	Fixed Statutory Amounts	No	2001
Oil Field Cleanup Regulatory Fee on Gas	$4,552,000	Fixed Statutory Rate	No	2001
Organization Report Fees	$3,500,000	Depends on activity. Varies between fixed statutory amount and statutory range.	Minimal	2003
Oil Field Cleanup Regulatory Fee on Oil	$1,985,000	Fixed Statutory Rate	No	2001
Oil & Gas Compliance Certificate Reissue Fee	$1,020,000	Fixed Statutory Amount	No	2003
Rule Exception Fee	$380,000	Fixed Statutory Amount	No	2001
Waste Disposal Facility, Generator, and Transporter Fees	$170,000	Fixed Statutory Amount for non-hazardous oil and gas waste; set by Commission for hazardous oil and gas waste	Moderate	1991

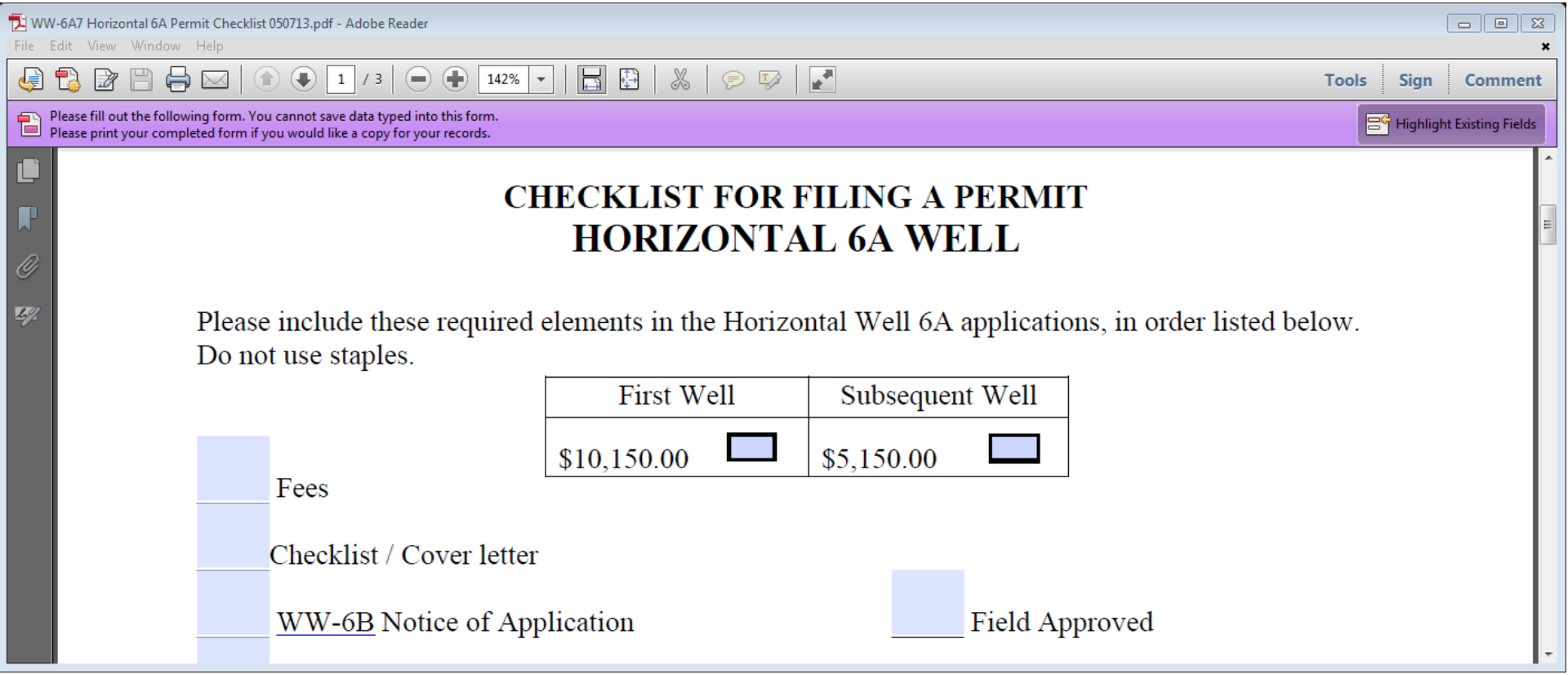
* Excludes late fees.

Unlike TABC or TDI, the Commission has no statutory authority

http://www.sunset.state.tx.us/82ndreports/rct/rct_fr.pdf

Some states have updated fees

- West Virginia: ~**$10,000 permit fee for initial horizontal well**, $5,000 for each additional well. W. Va. Code 22-6A-7.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Please fill out the following form. You cannot save data typed into this form.
Please print your completed form if you would like a copy for your records.

Highlight Existing Fields

CHECKLIST FOR FILING A PERMIT
HORIZONTAL 6A WELL

Please include these required elements in the Horizontal Well 6A applications, in order listed below.
Do not use staples.

First Well	Subsequent Well
$10,150.00 ☐	$5,150.00 ☐

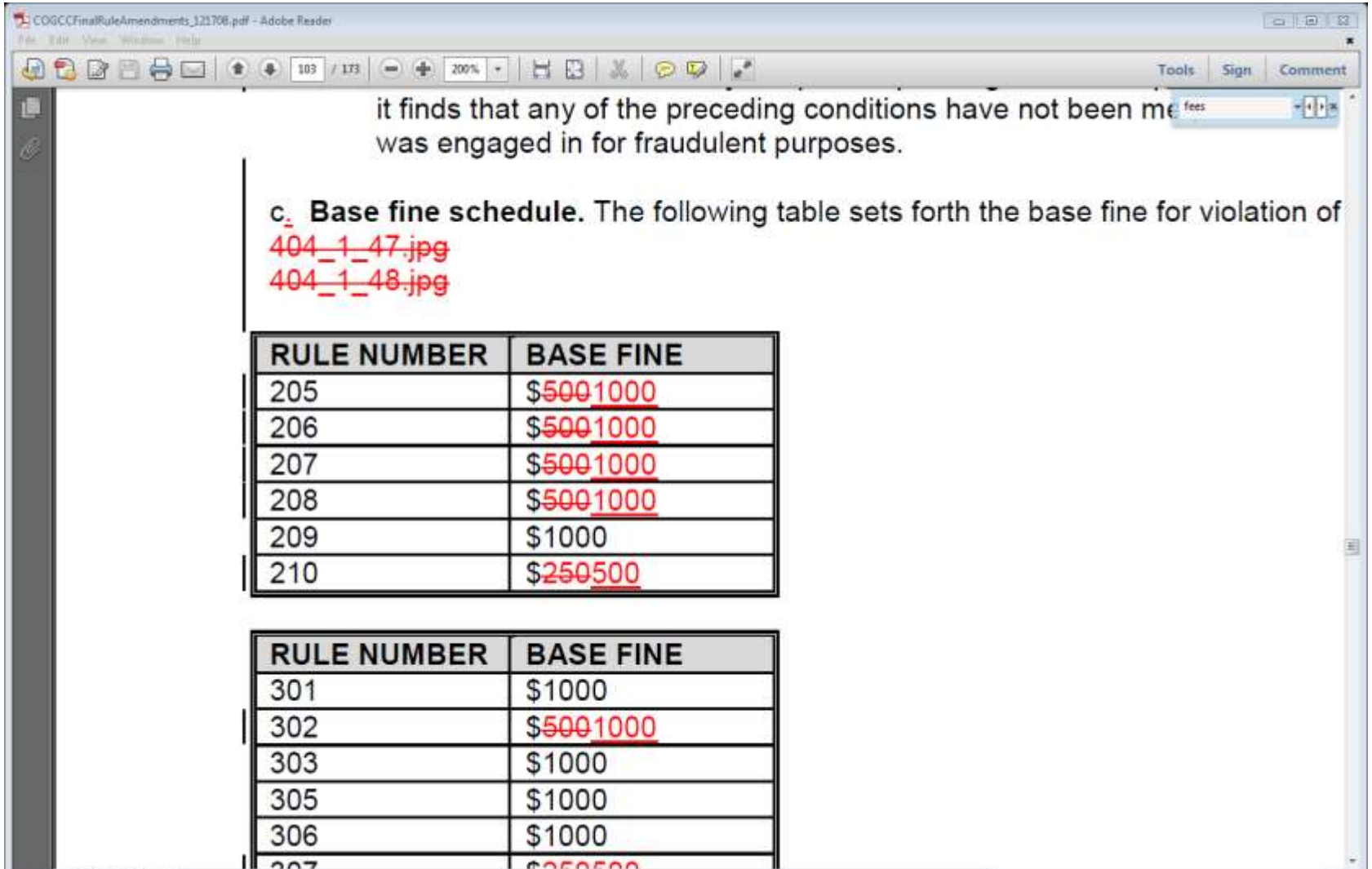
_____ Fees

_____ Checklist / Cover letter

_____ WW-6B Notice of Application

_____ Field Approved

Some states have increased fines – can cover inspection costs and deter future noncompliance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it finds that any of the preceding conditions have not been me
was engaged in for fraudulent purposes.

c. **Base fine schedule.** The following table sets forth the base fine for violation of
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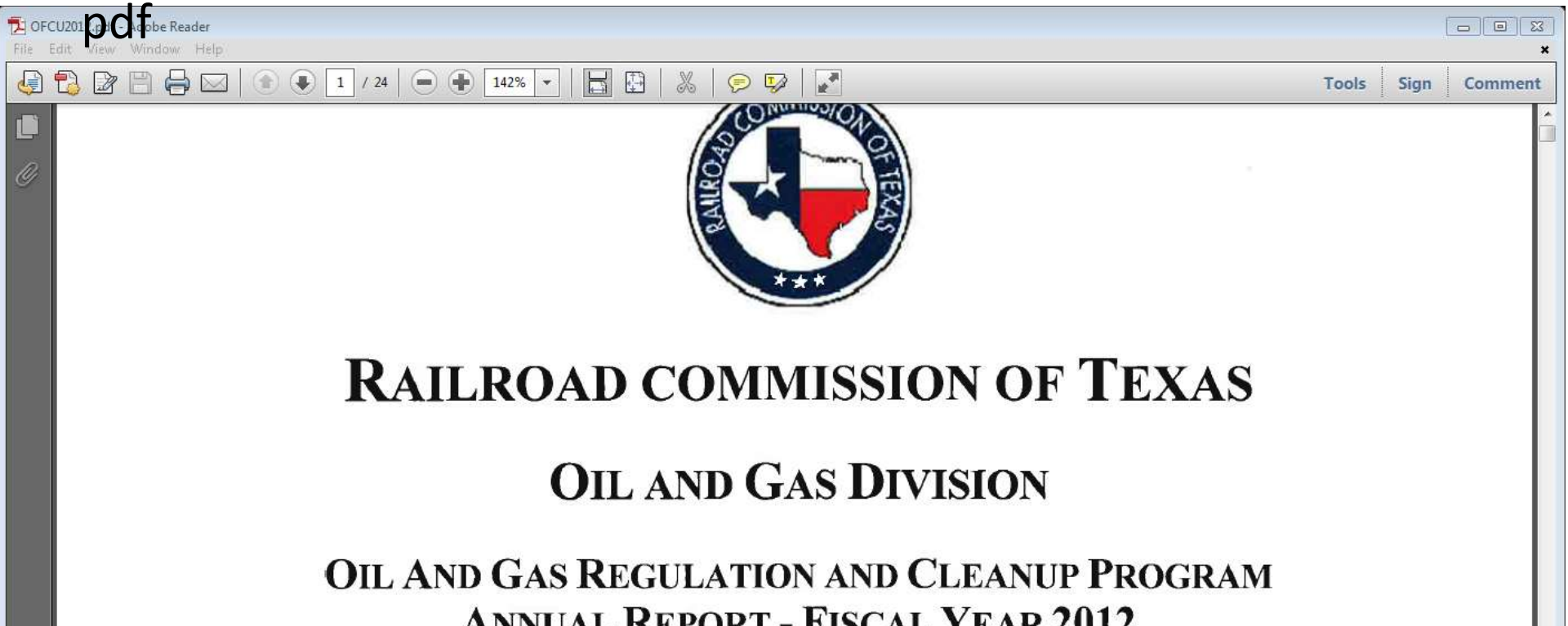
RULE NUMBER	BASE FINE
205	$~~500~~1000
206	$~~500~~1000
207	$~~500~~1000
208	$~~500~~1000
209	$1000
210	$~~250~~500

RULE NUMBER	BASE FINE
301	$1000
302	$~~500~~1000
303	$1000
305	$1000
306	$1000

Some total funds are capped. In Texas, for example, the **Oil and Gas Regulation and Cleanup Fund is balance capped at $20 million**, and the Railroad Commission suggests removing this cap.

http://www.rrc.state.tx.us/awareness/notices/ResponsetoSunset.pdf



RAILROAD COMMISSION OF TEXAS

OIL AND GAS DIVISION

OIL AND GAS REGULATION AND CLEANUP PROGRAM

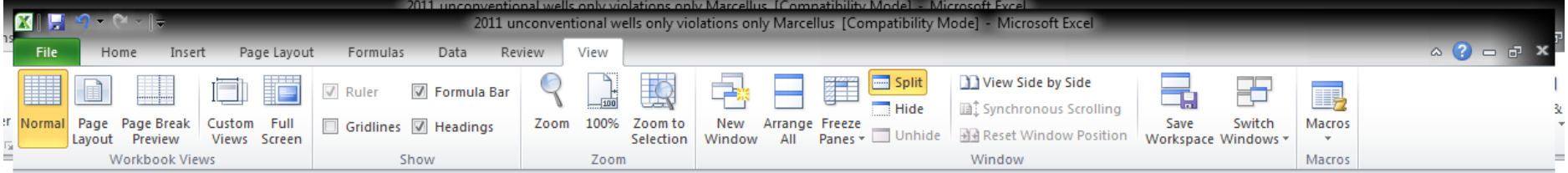
- Colorado: Must ensure that two-year average unobligated portion of **Oil and Gas Conservation and Environmental Response Fund** maintained at **approximately $4 million** (previously $1 million emergency reserve) and that there are sufficient funds to “address environmental response needs.”

2 Colo. Code Regs. 404-1:710

Disclosing inspection and enforcement

- **Risk-Based Data Management System (RBDMS)** developed and tailored to individual states by the Ground Water Protection Council.
- Pennsylvania: Excel spreadsheets, sortable by inspections, inspections that resulted in enforcement, date of inspection, unconventional and conventional wells, county, municipality, operator.

2011 unconventional wells only violations only Marcellus [Compatibility Mode] - Microsoft Excel



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1									
11	059-25679	Y	Primary Facility	Greene	Jackson Twp	Violation(s) Noted	Mud off pad across township road and into creek.	628295	12/29/2011
12	027-21653	Y	Primary Facility	Centre	Snow Shoe Twp	Viol(s) Noted & Immediately Corrected		608770	03/01/2011
13	035-21162	Y	Primary Facility	Clinton	Beech Creek Twp	Violation(s) Noted	No well Tag	602604	01/07/2011
	035-21174	Y	Primary Facility	Clinton	Beech Creek Twp	Violation(s) Noted	No well tag, pit fence fallen	602605	01/07/2011

OG_Compliance

Ready

200%

Summary

- We need **more information**, and, even more importantly, information that is **organized in a useful manner**:
  - Institutions
  - Scientific data
  - Substantive directives (best management practices, regulations) compared across states.
- We should use this information to **improve institutions**, **fill substantive regulatory gaps**, and consider whether a **shifting of institutional authority** is needed in certain areas.
- The effort to gather and synthesize more and better information should not delay needed regulatory

Substantive priorities

- **Fill substantive gaps** (centralized impoundments for flowback water reuse, pit construction and management, induced seismicity from disposal wells, others), and address scale-based harms.

- **Update state permitting fees** to cover the costs of inspection and enforcement and **fines** to ensure adequate deterrence.

- **Hire more inspectors**, ensure that inspectors are **adequately trained and paid**, and implement **clear inspection and enforcement policies**.

- Inspection and enforcement policies should, among other factors:
  - Include a provision for **random inspections** (many already do).
  - Indicate **which environmental problems are to be prioritized** in both inspections and enforcement.
  - Clearly **indicate all problems that field inspectors should look for** at sites and include in their reports. Inspection reports need to be more consistent.
  - Consider requiring more **photo documentation** at sites. Provide inspectors with

Information-based priorities

Comprehensive **comparisons** of:

- State regulations for each stage of well development.
- State monetary penalties for violations, by type, such as failure to properly case wells or maintain pits.
- State enforcement policies and priorities (types of incidents most likely to result in formal enforcement).

National database into which states or operators would input **water testing and air quality monitoring results**, pre- and post-development, and state policies that would require the production of uniform data.

National database summarizing and providing links to **studies addressing unconventional oil and gas risks**.

Searchable state databases showing all violations and enforcements, with uniform information on environmental impacts (substance spilled or pollutant

Thank you. I welcome questions and comments: hwiseman@law.fsu.edu.