Energy Policy Act of 2005: Effects of the 3-Year Inspection Frequency Requirement on Compliance at Underground Storage Tanks

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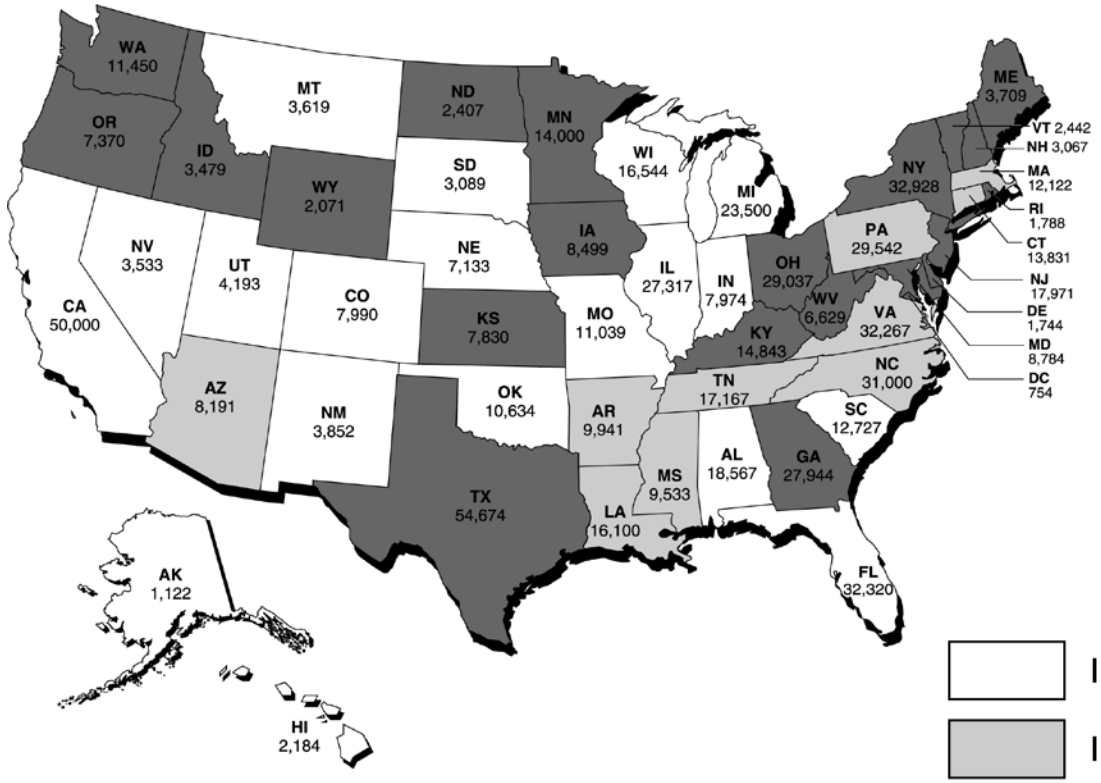
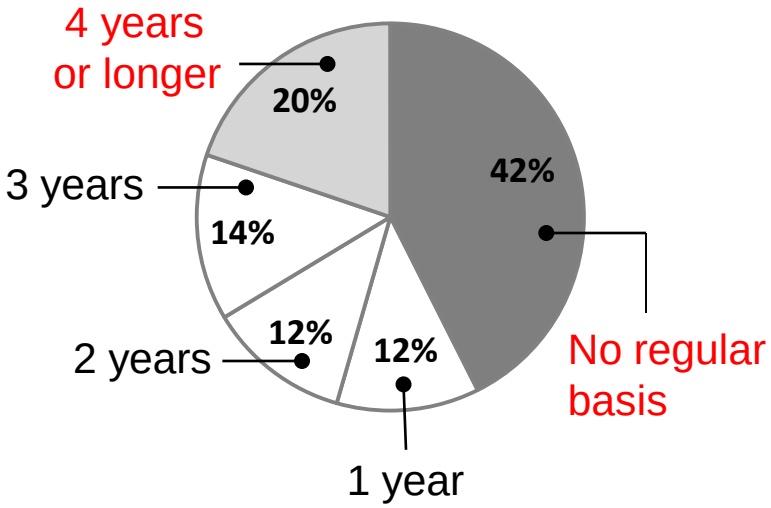
Underground Storage Tanks (USTs)

- There are approximately **561,000 USTs** in the U.S. that store petroleum or hazardous substances.
- The greatest potential threat from a leaking UST is contamination of groundwater, the source of drinking water for nearly half of all Americans.
- EPA, states, and tribes work in partnership with industry to protect the environment and human health from potential UST releases.

State Reported Inspection Frequency (2002)





Inspect all tanks at least every 3 years

Inspect all tanks at intervals of 4 years or longer

Do not inspect all tanks on a regular basis

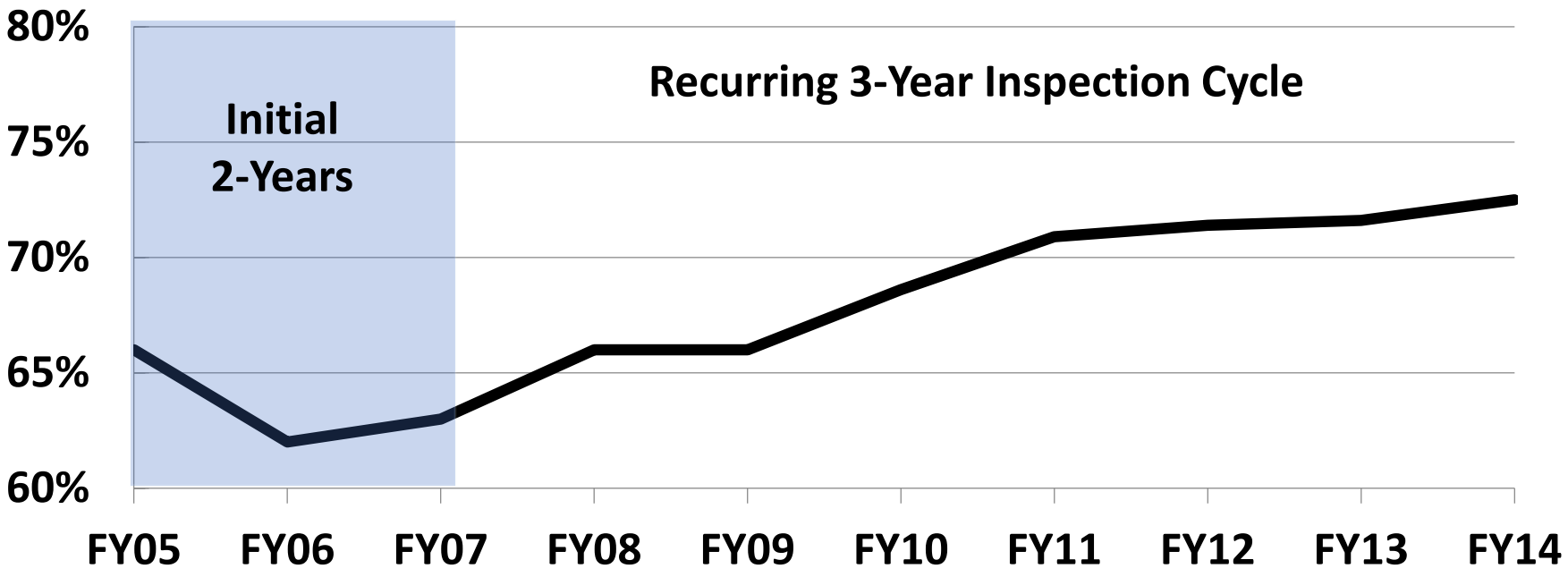
Note: US General Accountability Office (GAO) estimates based on responses to a survey of tank program managers in all 50 states and the District of Columbia. EPA implemented the federal tank program in Idaho and enforces certain requirements in New York because these states lack some or all of the necessary laws.

Sources: Environmental Protection: Improved Inspections and Enforcement Would Better Ensure the Safety of Underground Storage Tanks (GAO-01-464, May 4, 2001 and GAO-02-712T, May 8, 2002).

***August 8, 2005*:**

- Energy Policy Act of 2005 (EPAct) signed into law
- Establishes a 3-year UST compliance inspection requirement

National UST Compliance Rate



Source: U.S. EPA, Underground Storage Tanks Program

Project Objective: Determine the impact of increasing inspection frequency to every 3 years (as required by the Energy Policy Act of 2005) on UST compliance

Project Road Map:

1. Identify statistical method and data needed to conduct a rigorous evaluation
2. Acquire and prepare data for analysis
3. Analyze the data

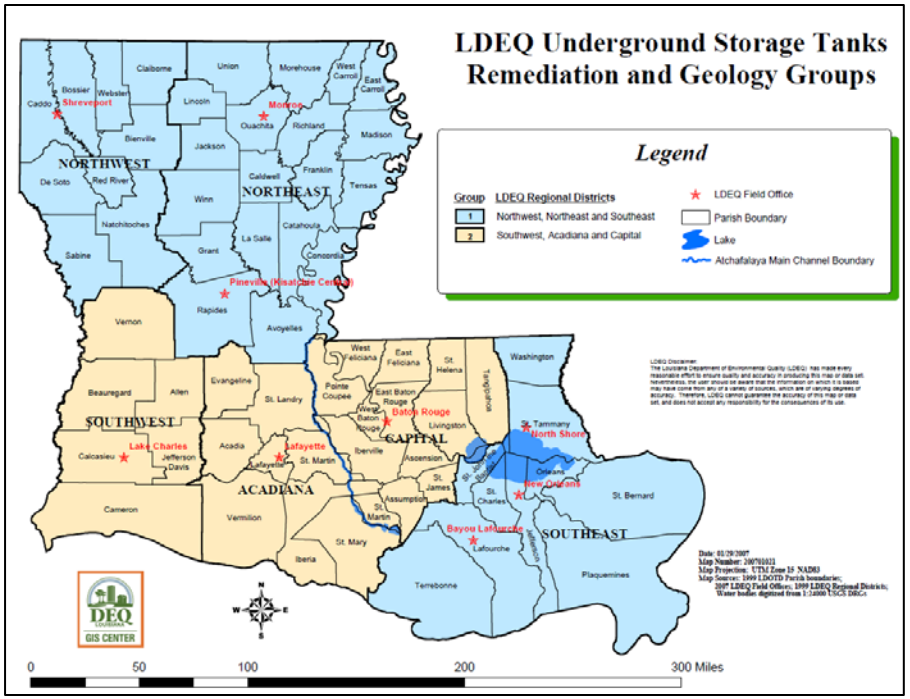
1: Identify statistical method and data needed

- What statistical methods will give us robust evidence?
  - Economic theory of compliance
  - Published peer reviewed statistical analyses

- What data do we need?
  - ✓ Facility level data on inspection, compliance, enforcement and releases
  - ✓ Data from several years before and after EPAct
  - ✓ A change in inspection frequency

2: Acquire and prepare data for analysis

- Many states were interested in sharing their data but often did not have sufficient data available for pre-EPAct years
- Start with Louisiana
  - Sufficient before/after data
  - An increase in inspection frequency
- Add more states!



2: Acquire and prepare data for analysis

Data Sources for Louisiana Analysis

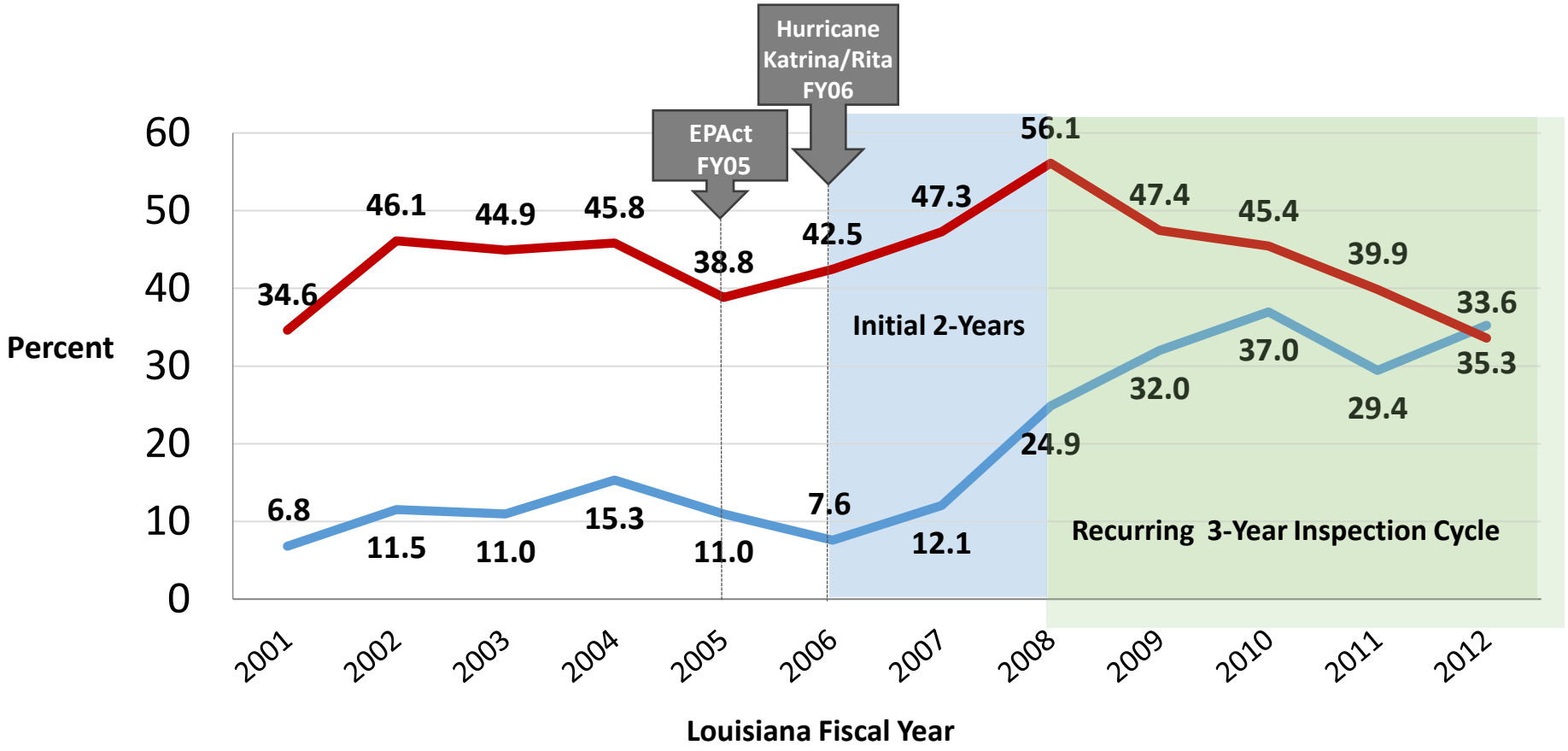
Data	Source
Facility data: • Tank characteristics • Inspections • Compliance • Enforcement • Confirmed releases	Louisiana Department of Environmental Quality UST & Remediation Division • FY 2001-2012: Inspection, compliance and releases • FY 2004-2012: Enforcement
Socioeconomic data	2009-2013 American Community Survey 5-year Estimates (U.S. Census) Block Group Data
Biophysical data	Soil Survey Geographic (SSURGO) Database (Soil Survey Staff, Natural Resources Conservation Service, USDA)

Final Sample:

- FY 2001-2012
- 10,389 inspections at 4,614 facilities

3: Analyze the data

Louisiana UST Inspection and Noncompliance (FY 2001-2012)



3: Analyze the data

Pr ($noncompliance_{it}$)

$= F$ ($years\ since\ last\ inspection_{it}$, $other\ factors_{it}$)

Noncompliance

= 1 if facility, *i*, received at least one noncompliance citation at the inspection in time period, *t*, and;

= 0 otherwise

Facility's History

Cumulative inspections

Compliance history (at last inspection and in the past)

Release history

Enforcement history

Facility Characteristics

Number of tanks

Age of tanks

Average tank capacity

Nearby Characteristics

Population density

Median income per capita

Water table depth

Soil permeability

Regulator Characteristics

Nearest distance to the regional field office

State or contracted inspector

Other

Time period when operator trainings occurred

Regions and FY quarters

3: Analyze the data

Statistical Concerns:

- Censored data: Only have information on compliance if the facility is inspected
- Selection bias: If any inspection targeting (pre-EPAct), this could bias our results

Bivariate Probit Model with Sample Selection

Y_{1i} = Noncompliance (=1 if noncompliance is observed) Y_{2i} = Inspection (=1 if facility is inspected)

Probability of Noncompliance (Y_{1i}*)

$$Y_{1i}^* = x_{1i}\beta_1 + \varepsilon_{1i}$$

$$Y_{1i} = \begin{cases} 1 \text{ if } Y_{1i}^* > 0 \\ 1 \text{ if } Y_{1i}^* \leq 0 \end{cases}$$

Probability of Inspection (Y_{2i}*)

$$Y_{2i}^* = x_{2i}\beta_2 + \varepsilon_{2i}$$

$$Y_{2i} = \begin{cases} 1 \text{ if } Y_{2i}^* > 0 \\ 1 \text{ if } Y_{2i}^* \leq 0 \end{cases}$$

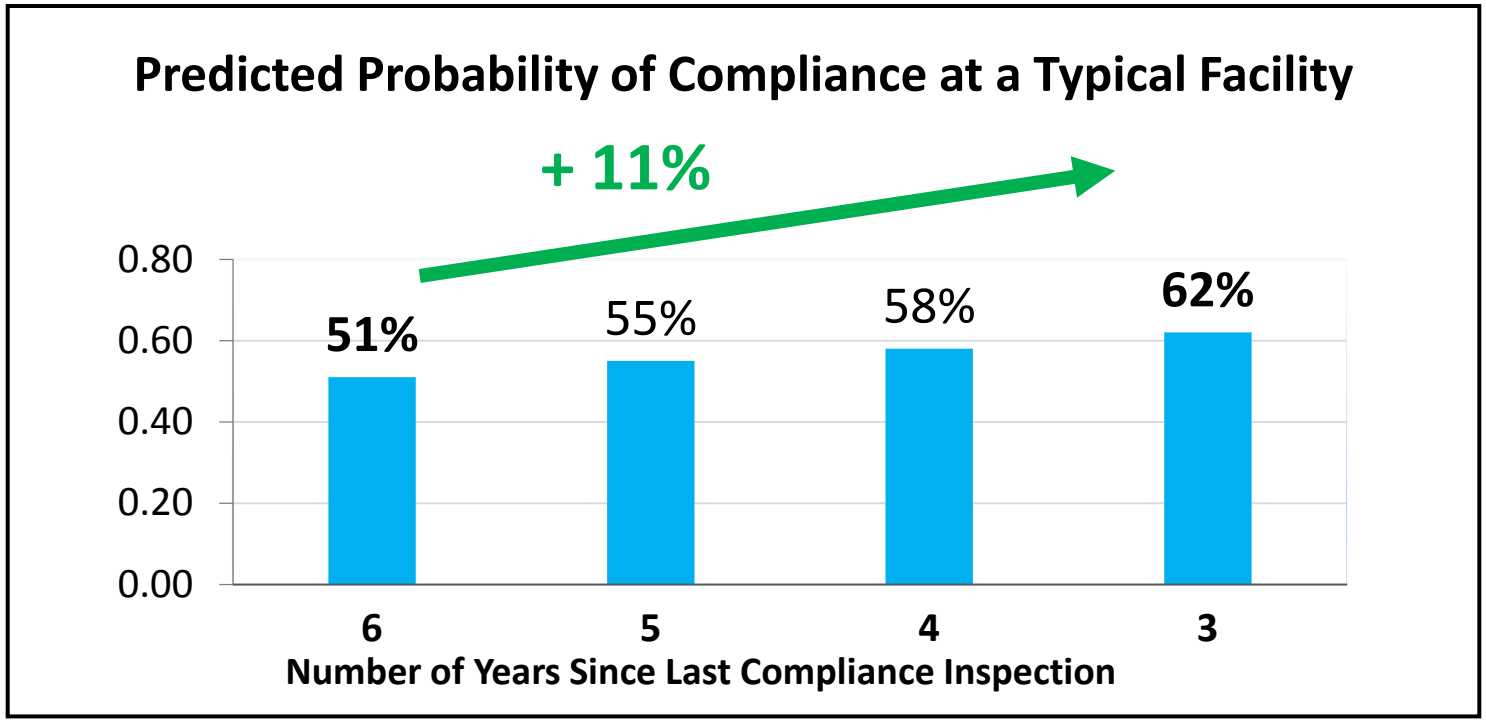
Maximum likelihood function: $L = L_{Y_{1i}=0,Y_{2i}=1} + L_{Y_{1i}=1,Y_{2i}=1} + L_{Y_{2i}=0}$

$$= \sum_{Y_{1i}=1,Y_{2i}=1} \log\{\Phi_2(x_1\beta_1, x_2\beta_2, \rho)\} + \sum_{Y_{1i}=0,Y_{2i}=1} \log\{\Phi_2(-x_1\beta_1, x_2\beta_2, -\rho)\} + \sum_{Y_{2i}=0} \log\{1 - \Phi(-x_2\beta_2)\}$$

Main Results

Results suggest that increasing inspection frequency to 3 years as required by EPAct of 2005 has improved UST compliance in Louisiana.

- Increasing inspection frequency had a positive and statistically significant effect on compliance in Louisiana
- For the typical facility, an increase in inspection frequency from 6 to 3 years increased the likelihood of compliance by 11%

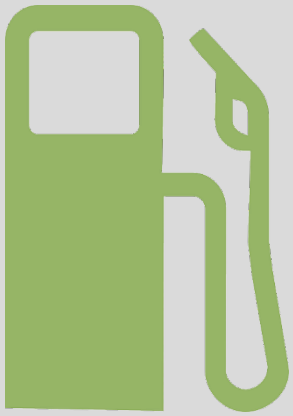


Louisiana: Heterogeneous Effect

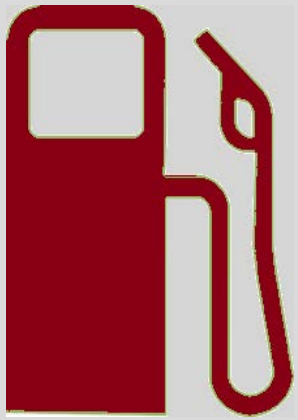
Does the effect of increasing inspection frequency differ depending on whether the facility was noncompliant or compliant at the last inspection?

Representative Facilities

At my last inspection I was **compliant**



At my last inspection I was **noncompliant**



Time since last inspection

6 years → **56%**

3 years → **69%**

13 percentage points

6 years → **44%**

3 years → **53%**

9 percentage points

Predicted Probability of Compliance

Increase in the Predicted Probability of Compliance

Some Highlighted Additional Results

<u>More</u> likely to comply if:

- Larger average tank capacity
- Newer tanks
- Higher # of previous inspections
- Compliant at last inspection
- Inspected after Louisiana began holding operator trainings (3/9/2010) but before deadline (8/8/2012)
    - Last inspection in analysis is 6/30/2012

Louisiana: Robustness Checks

- Estimated several alternative models to check robustness of results
  - Probit model of compliance equation
  - Poisson model of compliance equation using number of citations as the outcome variable rather than the binary measure of noncompliance
  - Models to explore potential effect that limited enforcement action data may have on results

- Generally, results are qualitatively robust to alternative model specifications

Conclusion and Next Steps

Louisiana Results:

- Increasing inspection frequency to at least once every 3 years (as required by EPAct of 2005) has improved UST compliance
  - For the representative facility, an increase in inspection frequency from 6 to 3 years increased the likelihood of compliance by 11 percentage points

Next: *Finish analysis for additional states!*

Acknowledgements

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