

PIPELINE SAFETY WHITE PAPER · 2010 TO 2025

Pipeline Safety Performance and Regulatory Expansion

What fifteen years of expanding regulation changed, what it did not, and where the next safety gains will come from | Kevin Graham, Founder

We all want the same thing: zero incidents. Fifteen years of new requirements moved most of the numbers toward it. This paper is about what will move the rest.

Kevin Graham, Founder, Systemic Compliance · First edition, September 2026 · Prepared for publication and general distribution. Scope: U.S. natural gas transmission, gas distribution, and hazardous liquid pipelines regulated by PHMSA and certified state programs.

A note on the data: the incident, fatality, and injury figures in this paper are computed directly from PHMSA's own incident and accident report files for gas transmission, gas distribution, and hazardous liquid pipelines, covering January 2010 through mid-2026. Regulatory dates are tied to the enacting statutes, Federal Register rules, and standards. The full method and sources are listed at the end. Systemic Compliance is not a law firm, and this paper is analysis, not legal or investment advice.

This series. Three papers, one argument in three steps. *The System You Already Have* asks why an operator would build a pipeline safety management system while it is still voluntary, and shows how much of one the required programs already build. *Pipeline Safety Performance and Regulatory Expansion* reads the public safety record since 2010 and asks what the growing rulebook moved and what it did not. *Coherence* takes the part that did not move and locates it in the connections between an operator's own documents. Any one of them stands alone. In that order, each sets up the next.

Executive Summary

Start where we all agree. Operators, regulators and the public want the same things: zero incidents and zero releases, compliance programs that hold up in the field, in an audit, and after an incident, and an industry that gets safer over time. Systemic Compliance works for pipeline operators, and this paper was written to help them. Nothing in it questions the effort or the intent that has gone into that goal.

The pipeline safety rulebook has never been larger, and the industry has real progress to show for it. Read from PHMSA's own records, reported incidents across gas transmission, gas distribution and hazardous liquid fell by about a third from their 2015 peak, and reported injuries fell from roughly seventy a year in the early 2010s to roughly thirty. That did not happen on its own. It took capital replacement programs measured in decades, integrity management programs built and matured, corrosion control and leak survey work that never makes the news, and operators and inspectors who kept at it year after year. The improvement is real, it is large, and the credit belongs to the people who did the work. It is also not the finish line. Fewer is not none, and the goal we all stated at the top of this page is zero.

One measure is the exception, and it is the subject of this paper. The most serious outcomes have leveled off over the past decade. That is not a cause for alarm and it is not a criticism of the effort. It is a useful signal about where the next safety gains will, and will not, come from.

Since 2010, the United States pipeline safety regime has expanded dramatically in scope and complexity. Three reauthorization statutes, a series of major PHMSA final

rules including the Gas Transmission Mega Rule, the extension of federal reporting to gas gathering lines, and the arrival of Pipeline Safety Management Systems under API RP 1173 have together raised the compliance burden on operators to a level that did not exist fifteen years ago.

The exception is the highest-consequence outcome. Pipeline fatalities dropped in the early 2010s, from about fifteen a year to about ten, and have held roughly level at about ten a year since, even through the most active period of rulemaking in the program's history. The point is not alarm; it is direction. When the most serious outcome stops responding to added requirements, that is the signal that the next gains lie somewhere other than the next rule.

This paper tests a single thesis: regulatory requirements and their complexity increased dramatically since 2010, while the highest-consequence safety outcome has not improved for a decade. Using PHMSA's own records and verified regulatory milestones, the analysis finds the thesis supported, with meaningful variation by segment and by metric. Then it argues the constructive part: the next increment of safety is unlikely to come from adding another discrete requirement. It will come from making the requirements already in place work together as one system.

The finding can be put in one line. You can have a garage full of car parts and still not have a car. Fifteen years of new requirements added more parts to the garage; safety comes from assembling them into a working system. That is what coherence means, and it is why compliance should be systemic.

1 Introduction and Thesis

The period beginning in 2010 was shaped by two high-consequence failures.

On September 9, 2010, a PG&E gas transmission line ruptured and exploded in San Bruno, California, killing eight people. Weeks earlier, on July 25, 2010, an Enbridge hazardous liquid line ruptured near Marshall, Michigan, releasing roughly 843,000 gallons of crude oil into a creek and the Kalamazoo River. These events, and the congressional and regulatory response that followed, produced a sustained wave of new requirements that has continued for fifteen years.

The thesis of this paper is stated plainly:

Regulatory requirements and the complexity of those requirements have increased dramatically since 2010. Pipeline

safety improved on several measures over the same period, but on the most serious outcomes, progress stalled a decade ago and has not resumed, even as the regulatory build-out accelerated to its heaviest.

The paper tests this through two parallel analyses: the growth and complexity of the regulatory regime, and trends in pipeline safety performance computed from PHMSA's incident records, read by severity, by segment, and against the most serious outcomes. It also examines the state layer, where a large and uneven set of state-specific requirements sits on top of the federal baseline and multiplies the compliance burden an operator has to manage.

2 Methodology and Data Sources

Two kinds of source sit behind this paper.

The regulatory dates come from the enacting statutes (Public Laws 112-90, 114-183 and 116-260), from PHMSA's final rules as published in the Federal Register, and from API RP 1173.

The safety figures come from PHMSA's own incident and accident report files, which carry one record for every reportable event. Three forms cover the three segments: F7100.2 for gas transmission, F7100.1 for gas distribution, and F7000.1 for hazardous liquid. The data run from January 2010 through mid-2026. Mileage comes from PHMSA's annual reports.

A note on what is counted, and what is not. This paper counts the three segments named above, because they were reported the same way for the whole period. Two things are left out on purpose.

LNG facilities are left out because they are a small category and a different kind of asset.

Type R gathering lines are left out because they only became federally reportable under the 2021 Gas Gathering Rule. Adding them partway through a series that starts in

2010 would show a rise in incidents that is really a rise in reporting. Nothing about the pipe would have changed.

That last point matters when comparing these figures with others. Some widely cited all-incident totals now include those newly reportable gathering lines, so their recent years are not comparable with their own earlier years. The counts here are built to stay comparable across the whole period.

A note on method. Where this paper calls a trend real or flat, that is a tested statement rather than an impression. For each yearly series over 2015 to 2025, the decade of heaviest rulemaking activity, we drew the trend line and then checked whether the direction it shows could be chance. Because the yearly counts are small, we also redrew each line eleven times, leaving out a different year each time, to be sure no single year is carrying the result. The body of this paper reports the outcome in plain words: a trend either holds up, holds up weakly, or shows no measurable direction in either direction. The Appendix carries the fitted slopes and the test results for every series, for readers who want them.

How to reproduce the counts. The incident files were extracted from PHMSA in August 2026 and cover reports received through early July 2026. Calendar year 2025 is a complete reporting year; 2026 is partial, shown only where noted and excluded from the trend fits, which run 2010 to 2025. Each row in a file is one reportable incident, so an annual count is a count of rows by year. Fatalities and injuries are the sums of PHMSA's fatality and injury fields, and a serious incident is any incident with at least one fatality or injury. No filters are applied beyond the scope described above, and a reader with the same three files can regenerate every count in this paper.

The enforcement figures in Section 4.5 are computed from PHMSA's own enforcement case listings, its record of proposed civil penalties and its record of cases completing the penalty-collection process, tallied by the year each case was opened for 2010 through 2023. The dollar totals were validated against PHMSA's separately published

figures, including its reported total of more than \$9.7 million in penalties proposed in 2013. More recent years are read with caution, because enforcement actions lag the conduct they address and assessed totals trail proposed totals until cases close.

Key definitions used by PHMSA:

- **Serious incident:** a fatality or an injury requiring in-patient hospitalization (with specified exclusions for certain gas distribution events caused by a nearby fire or explosion).
- **Significant incident:** a serious incident, or an event with total costs at or above 50,000 dollars measured in 1984 dollars, or larger liquid releases, or a liquid release involving fire or explosion.
- **All reported incident:** all incident reports submitted to PHMSA. PHMSA cautions that changes to its reporting regulations have caused large shifts in this trend line over time.

3 The Expansion of the Regulatory Regime Since 2010

Three reauthorization statutes framed the period.

The Pipeline Safety, Regulatory Certainty, and Job Creation Act, titled for 2011 and signed into law in January 2012, directed PHMSA to complete numerous rulemakings following San Bruno. The PIPES Act of 2016 added underground gas storage standards and emergency order

authority. The PIPES Act of 2020 strengthened leak detection and repair expectations and continued program authorization. On top of these came the major final rules summarized below. Figure 1 places the major milestones in sequence.

Fifteen years of expanding pipeline-safety regulation (2010-2025)

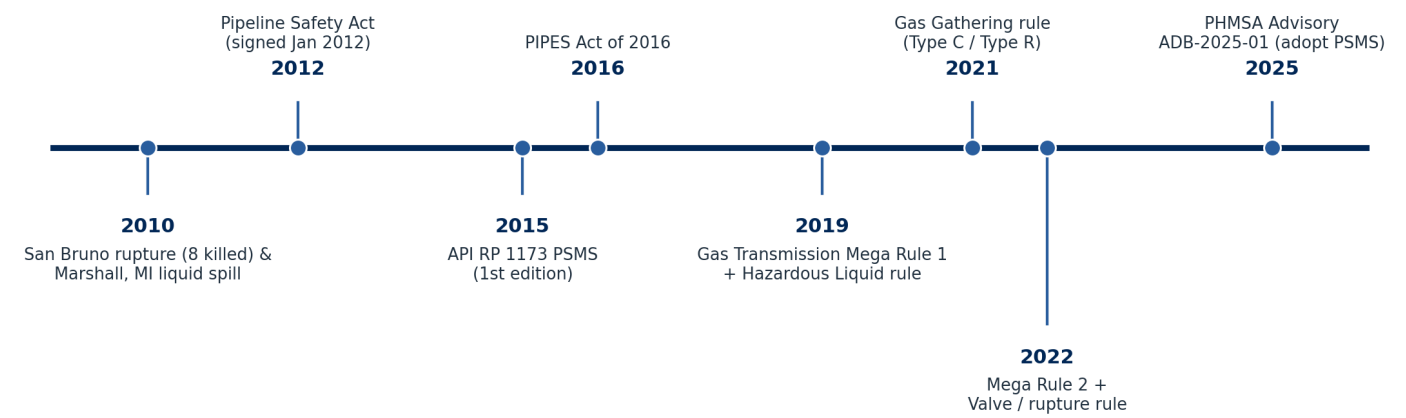


Figure 1. Fifteen years of expanding pipeline-safety regulation. Milestone dates verified against NTSB, the enacting Public Laws, Federal Register final rules, and API.

The table below collects them. The dates and rule identifiers are verified against the enacting rules. The complexity ratings are our own assessment and are labelled as such.

Table 1. Major Regulatory Expansions and Their Complexity, 2010 to 2025

AREA	KEY DEVELOPMENTS (VERIFIED RULE / RIN AND DATE)	COMPLEXITY IMPACT	PERIOD
Gas transmission	Gas Transmission Mega Rule Part 1 (RIN 2137-AE72, final Oct 2019): MAOP reconfirmation, material verification, expanded assessments. Part 2 (RIN 2137-AF39, final Aug 2022): repair criteria, integrity-management and MOC improvements. Valve installation and rupture-detection rule (RIN 2137-AF06, final Apr 2022).	Very high	2019-2023
Gas distribution	Distribution integrity management maturation; excess flow valve and other distribution safety requirements.	High	2011-ongoing
Gas gathering	Gas Gathering final rule (RIN 2137-AF38, final Nov 2021): new Type C safety standards and Type R reporting extended federal reach to previously lightly regulated lines.	High	2021-2022
Hazardous liquid	Hazardous Liquid final rule (RIN 2137-AE66, final Oct 2019): expanded reporting, leak detection, periodic assessments, and inspections beyond high-consequence areas.	High	2019-ongoing
Cross-cutting	Control room management; growing management-of-change expectations; adoption of Pipeline Safety Management Systems under API RP 1173.	High	2010-present
Standards incorporation	Continuing incorporation of updated industry standards into 49 CFR Parts 192 and 195, most recently by the periodic standards rules (RIN 2137-AF13, effective June 2024; RIN 2137-AF48, effective January 2026).	Cumulative	Continuous

The rulebook did not only get bigger. It also changed in kind. API RP 1173, first published in 2015, introduced a set of ten management-system elements. It is a voluntary consensus standard, not a federal regulation, so no operator is legally compelled to adopt it. In practice, though, it has moved quickly from an option toward a

baseline expectation. By the mid-2020s adoption was broad: an industry team reported that nearly 85 percent of transmission and gathering mileage participated in voluntary PSMS implementation, and PHMSA cited roughly 86 percent of gas distribution mileage operated by companies that had begun implementing PSMS. In March 2025, PHMSA issued Advisory Bulletin ADB-2025-01 urging operators to adopt a PSMS covering the RP 1173 elements.

RP 1173 is voluntary today. The NTSB has recommended that safety management systems be required, Congress has directed PHMSA to promote them, and PHMSA's 2025 advisory bulletin encourages their adoption. We are not going to predict a mandate, because nobody knows that. What is clear is more modest and still consequential: the expectation is no longer only to comply with discrete rules, but to run a coherent, continually improving management system. That is a real increase in required organizational capability, whatever its legal status.

4 Pipeline Safety Performance, 2010 to 2025

4.1 Reported incident counts have declined

Start with the good news, because it is real.

Computed from PHMSA's own incident files, the number of reported incidents across gas transmission, gas distribution, and hazardous liquid rose to a peak of about 710 in 2015 and has fallen steadily since, to 464 in 2025, the most recent complete year (Figure 2). That is a decline of roughly a third from the peak. Reported injuries fell too, from about 72 a year in the early 2010s to about 31 a year over 2021 to 2025. On the raw counts, this looks like a system that improved.

The decline is not evenly shared. It is driven mostly by hazardous liquid, where reported accidents fell from about 460 in 2015 to 269 in 2025, and by gas distribution. Much of that reflects real safety work, and some of it reflects the oil-market swing after 2015, which reduced hazardous liquid activity. Gas transmission, by contrast, held essentially flat at about 123 incidents a year across the whole period. The point of this section is simply that the counts came down. The next section is where the story turns.

Reported incident counts have fallen since the mid-2010s (gas transmission, gas distribution, and hazardous liquid combined)

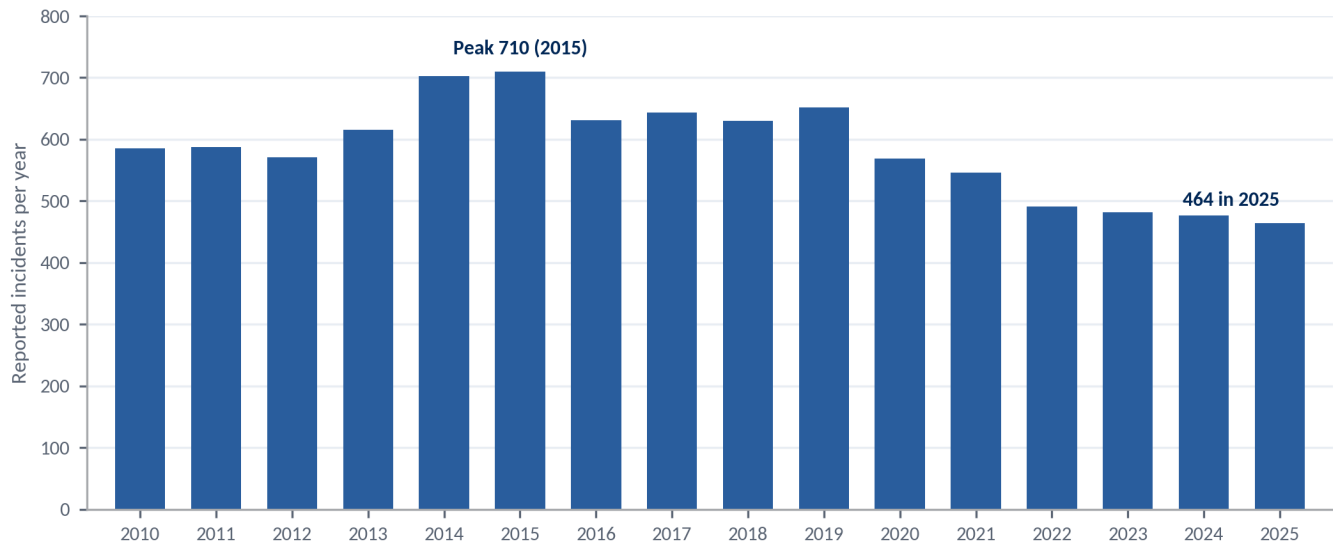


Figure 2. Reported incidents per year for gas transmission, gas distribution, and hazardous liquid combined, computed from PHMSA incident and accident report files (2010 to 2025). A fitted trend over 2015 to 2025 falls by about 25 incidents a year, a decline far too strong to be chance.

4.2 The most serious outcomes have leveled off

There is one measure the falling counts do not capture, and it is the one the whole system exists to protect. Fatalities did not track the incident decline. Computed from the same PHMSA files, pipeline fatalities across the three segments fell in the early 2010s, from about fifteen a year in 2010 to 2014 to about ten a year in 2015 to 2019, and then leveled off. Across 2015 through 2025 they have held roughly flat at about ten a year, with no downward trend, even as the Gas Transmission Mega Rule, the valve and rupture-detection rule, the gathering rule, and the push toward pipeline safety management systems all took effect (Figure 3). The most active regulatory decade in the program's history is also the decade in which the fatality curve leveled.

The most recent years are consistent with that plateau rather than an improvement on it: fatalities were 15 in 2023, 12 in 2024, and 11 in 2025. The shape is plain: an early step down, then a decade with little further movement on the most serious outcome.

This is not an impression from looking at a chart, and it matters that it is not. Each series was tested across 2015 to 2025, and the three do not behave the same way. (1) Reported incidents fall steadily, by roughly twenty-five a year, and that decline holds up under testing. (2) Fatalities, over the very same years, show no measurable direction at all. (3) Injuries and serious incidents drift downward, but not strongly enough for eleven years of data to settle the question. So the ordinary measures improved over that decade and the most serious one did not. That gap is what the rest of this paper is about.

Pipeline fatalities fell early in the 2010s, then held about level (gas transmission, gas distribution, and hazardous liquid combined)

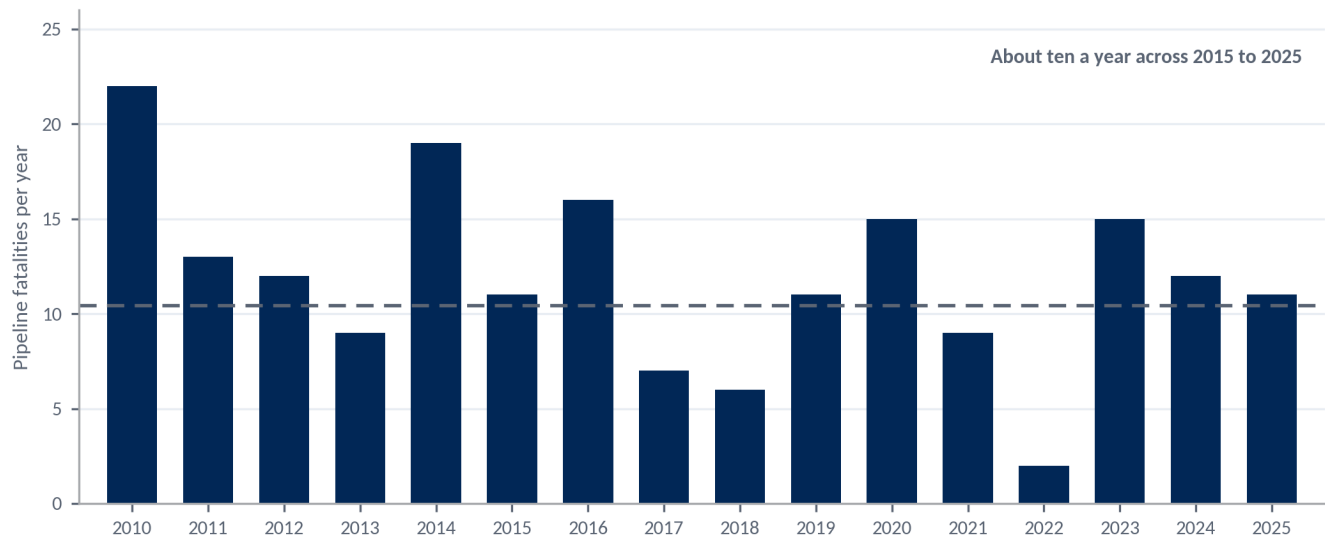


Figure 3. Pipeline fatalities per year across the three segments, computed from PHMSA incident and accident report files (2010 to 2025). Fatalities fell early, then held flat: a fitted trend over 2015 to 2025 is essentially level, showing no detectable improvement.

The most serious events resist the trend for a reason PHMSA has stated itself. In its March 2025 advisory bulletin the agency wrote that major pipeline accidents with serious consequences are rare, and that when they occur they are "generally because of an alignment of weaknesses or failures across multiple activities." That describes a failure no single program owns. A rule can raise the standard for one activity. It cannot on its own make several activities line up, and the alignment is what the regulator is pointing at.

Where the remaining exposure sits is a matter of geometry rather than performance. Gas distribution accounts for 82 of the 115 fatalities over 2015 to 2025, and for 37,980 of the 50,491 people evacuated. Distribution pipe runs under streets and into buildings, so people are far more often exposed to pipeline risks there than they are near a transmission line in a right of way. That is a statement about where the pipe is, not a comparison of oversight quality between the federal and state layers, and this paper does not offer it as one.

4.3 Variation by segment

The pattern is not uniform across systems, and the differences matter. Two measures are involved here, reported incident counts and fatalities, and they do not move together. Counts first.

Reported incident counts. Hazardous liquid shows the largest drop, from about 460 in 2015 to 269 in 2025. Gas distribution also fell, from about 101 in 2015 to 61 in 2025. Gas transmission stayed flat, at about 123 a year across the period.

Fatalities. These behave differently, and again not uniformly. Gas transmission fatalities do show a detectable decline over 2015 to 2025, from an already small base of about two a year. Gas distribution fatalities show no trend at all, even though gas distribution incident counts fell over the same years. The reason distribution carries most of the fatalities is geometry rather than performance: distribution pipe runs under streets and into buildings, so people are far more often exposed to pipeline risks there than they are near a transmission line in a right of way. Hazardous liquid fatalities are too few to trend, at about one a year.

Fatalities remain episodic and dominated by a small number of high-consequence events, which is why the count trend and the fatality trend diverge. Table 2 summarizes both measures side by side.

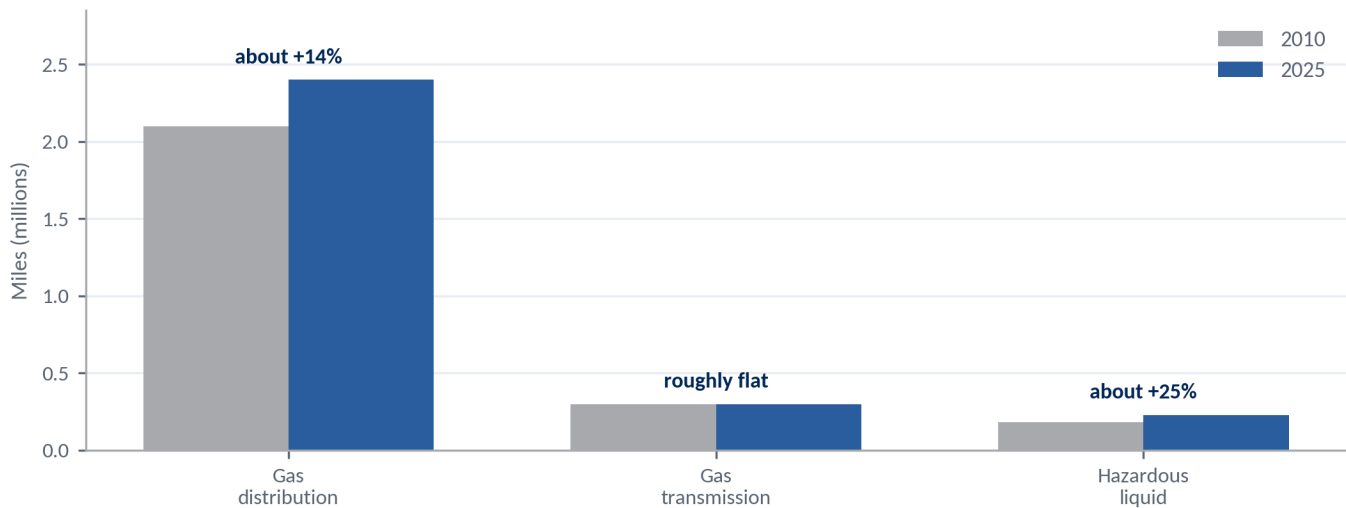
Table 2. Safety Performance by Segment, 2010 to 2025

SEGMENT	REPORTED INCIDENT COUNTS	FATALITIES AND SERIOUS OUTCOMES	OVERALL READ
Hazardous liquid	Down sharply, about 460 in 2015 to 269 in 2025	Low fatality counts, no clear recent trend	Counts improved most; serious events not the driver
Gas distribution	Down (about 101 in 2015 to 61 in 2025)	Episodic, tied to high-consequence events	Counts improved; severe outcomes uneven
Gas transmission	Flat at about 123 per year	Serious ruptures persist; fatalities down from a small base	Counts flat; the serious-event risk is stubborn

4.4 Exposure grew while the network aged in place

The counts fell even though exposure grew. PHMSA mileage data show gas distribution up about 14 percent and hazardous liquid up about 25 percent from 2010 to 2025, while gas transmission mileage stayed roughly flat. Fewer incidents against more miles is a genuine improvement in the incident rate, and it deserves to be said plainly (Figure 4). But the network is also older and more interconnected than it was in 2010, and the improvement in counts did not carry through to the fatality rate, which is what the regulatory build-out was above all meant to reduce.

U.S. pipeline mileage grew while the network aged in place, 2010 to 2025



Source: PHMSA Annual Report Mileage. Gathering mileage is excluded because its post-2021 jump reflects a reporting-rule change, not physical growth.

Figure 4. U.S. pipeline mileage by segment, 2010 versus 2025, from PHMSA Annual Report Mileage. Gathering mileage is excluded because its post-2021 jump reflects a reporting-rule change rather than physical growth.

4.5 Enforcement intensified over the same period

A rulebook is only half of a regulatory regime; the other half is enforcement. Over the same years, PHMSA did not simply publish requirements, it enforced them, and increasingly so. Computed from PHMSA's own enforcement case listings, the agency proposed civil penalties in more than 600 pipeline enforcement cases between 2010 and 2023, seeking about \$93 million, of which about \$70 million has been assessed (Figure 5). Enforcement was not static: proposed penalties rose in the 2020s, exceeding \$10 million a year in 2021, 2022, and 2023, well above the early-decade pace. This was a real and intensifying effort, and it is to the agency's credit that the rules were backed by active enforcement rather than left on paper. The assessed line runs below the proposed line in the most recent years because those cases are still working through resolution, not because the penalties were withdrawn.

Set that record beside the outcome trend and the same divergence appears. The heaviest-rulemaking decade was also the decade of heaviest enforcement, hundreds of cases and tens of millions of dollars in penalties, and the most serious outcome still did not improve after its early-

2010s step down. That closes off a natural objection to this paper's thesis, that the rules would have delivered if only they had been enforced. They were enforced, and enforced harder over time, and the most serious outcome still did not move. That points away from enforcement effort as the missing ingredient rather than toward any shortfall in it. The lever that has not been pulled is not more rules, and it is not harder enforcement of the rules as they stand. It is coherence. By coherence we mean the largest safety gain still inside the operator's control, not a claim that connecting the documents would have prevented any particular incident.

There is a further signal in the shape of enforcement itself. PHMSA cites violations section by section, building each case from individual CFR citations, one subsection at a time. Enforcement follows the shape of the rulebook it backs, which is organized section by section. That is not a criticism of how cases are built, because a citation has to attach to a provision. It does mean neither the rulebook nor the enforcement behind it has a natural place to record that two of an operator's own documents disagree with each other. That is the gap this paper is about, and it is why the next gain is unlikely to come from another discrete requirement. It will come from making the parts already in place work together.

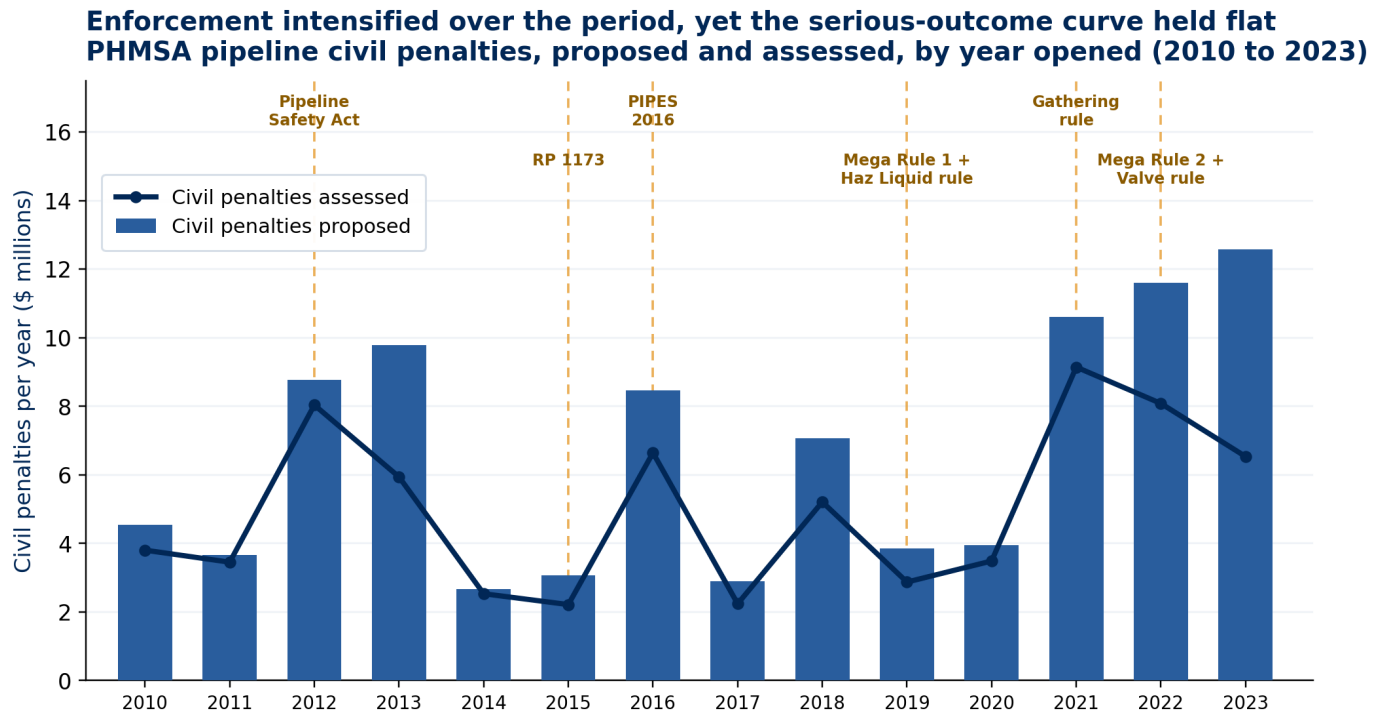


Figure 5. PHMSA pipeline civil penalties proposed and assessed per year, by the year each case was opened (2010 to 2023), from PHMSA's own enforcement case listings. Proposed penalties rose in the 2020s. Assessed totals for the most recent years run below proposed because some cases remain open, and 2024 onward is omitted as still maturing. The series was validated against PHMSA's separately published figure of more than \$9.7 million proposed in 2013.

4.6 What the rules were expected to achieve

The comparison so far has been one-sided: it measures outcomes without asking what the rules were meant to deliver. Close that gap, and do it in the agency's own words. Read the preambles and impact analyses PHMSA published with each major rule and a consistent justification appears. Every one was expected to reduce not only the frequency of failures but their consequences, including the human ones. Table 3 collects the language.

Table 3. What the Major Rules Said They Would Achieve

RULE (RIN, YEAR)	STATED SAFETY EXPECTATION, IN PHMSA'S WORDS	HOW THE PREAMBLE TREATED BENEFITS
Gas Transmission Mega Rule Part 1 (2137-AE72, 2019)	To "increase the level of safety associated with the transportation of gas"	Discussed qualitatively; PHMSA "elected to not quantify the benefits of this rulemaking"
Gas Transmission Mega Rule Part 2 (2137-AF39, 2022)	Will "reduce the frequency and consequences of failures and incidents"	Costs quantified; safety benefits discussed qualitatively
Valve and Rupture-Detection rule (2137-AF06, 2022)	Reduce the "loss of life, property damage, and environmental harm" a slow response allows	Justified on "(unquantified) public safety, environmental, and equity benefits"
Gas Gathering rule (2137-AF38, 2021)	Will "reduce the frequency and consequences of failures of onshore gas gathering lines"	Costs quantified; safety benefits discussed qualitatively
Hazardous Liquid rule (2137-AE66, 2019)	Expected to "reduce pipeline incident damages, including injuries and fatalities"	Costs quantified; several benefits stated as not quantified

Sources: Federal Register final-rule preambles for RINs 2137-AE72 (2019), 2137-AF39 (2022), 2137-AF06 (2022), 2137-AF38 (2021), and 2137-AE66 (2019). All quoted phrases are verbatim from those preambles; the remaining text describes each rule's quantification status.

Two things stand out, and they pull in the same direction. First, the agency justified the build-out on expected reductions in the consequences of failures, up to and including fewer fatalities, in its own words. The hazardous liquid rule states it is expected to "reduce pipeline incident damages, including injuries and fatalities." The valve rule, which requires rupture isolation in "no more than 30 minutes after rupture identification," rests on reducing the "loss of life, property damage, and environmental harm" that a slow response allows. Second, in case after case the preambles quantify costs and describe safety benefits qualitatively. That is a description of what the record says rather than a criticism of how the analyses were done. For the Gas Transmission Mega Rule it "elected to not quantify the benefits of this rulemaking

and instead discusses them qualitatively," and it justified the valve rule on "(unquantified) public safety, environmental, and equity benefits." That makes the rules hard to hold to any numeric promise, which is one more reason an outcome read matters. The stated purpose was fewer and less severe failures, including fewer fatalities, and the fatality record over the period these rules took effect does not show that further reduction.

This is not a controlled test of any single rule, and PHMSA never predicted a specific number of avoided fatalities. The point is about the direction of travel, and it is a fair one: the rules were justified, reasonably, on the expectation of fewer and less severe consequences including loss of life, and on that measure the record has not moved since the early 2010s.

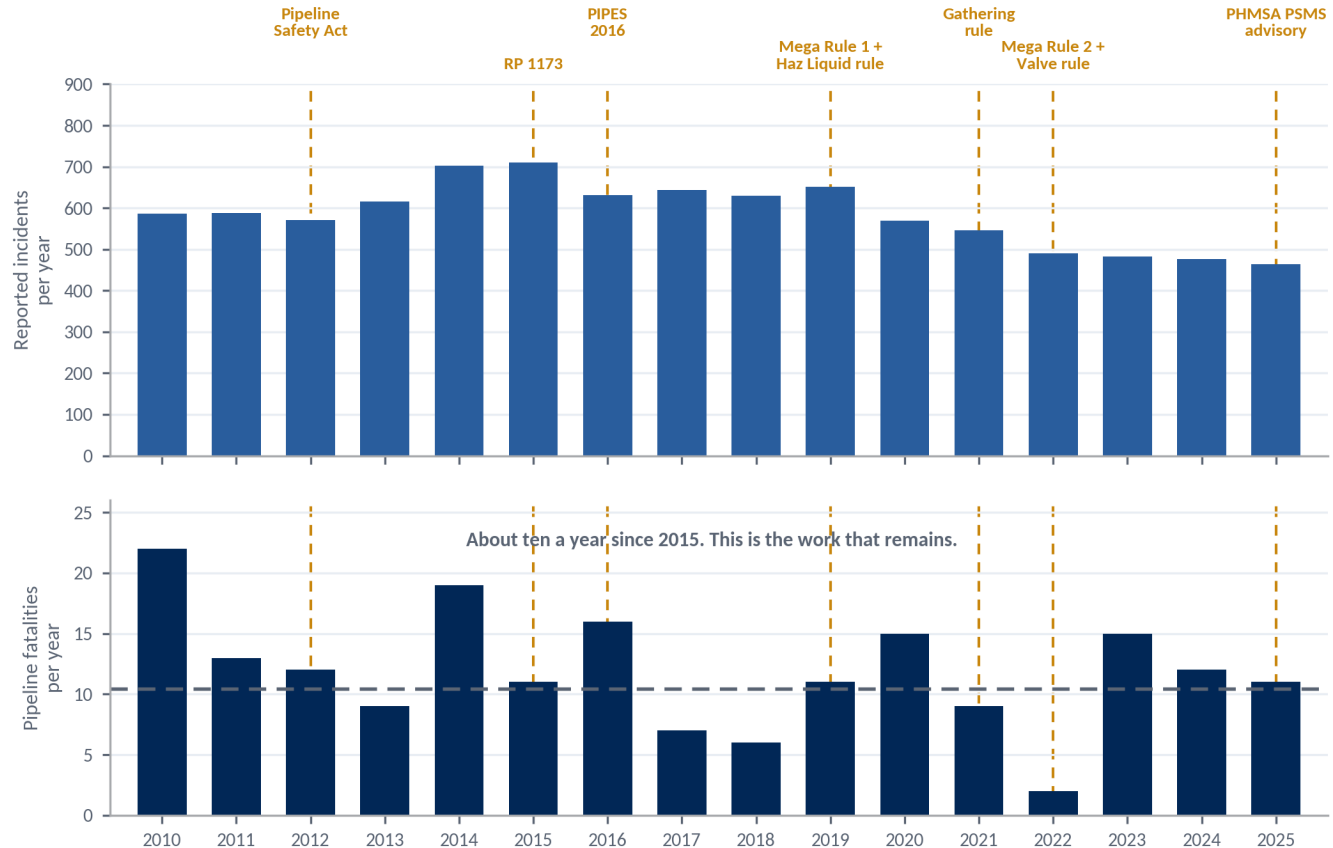
5 The Compliance Paradox in One View

Two lines tell the whole story when you put them one above the other (Figure 6). The top panel is reported incident counts, which fell. The bottom panel is the most serious events, which did not.

The vertical markers are the major regulatory milestones, and notice where they cluster: the Mega Rules, the valve rule, the gathering rule, and the management-system push all land in the second half of the period, exactly the

span in which the fatality line goes flat. Regulation escalated. Counts came down. The most serious outcomes held steady.

Fifteen years of expanding regulation: incident counts came down, the most serious events did not



Computed from PHMSA incident and accident report files, 2010 to 2025. Milestones dated to the enacting statute, Federal Register rule, or standard.

Figure 6. Regulatory milestones plotted against reported incident counts (top) and the most serious events (bottom), computed from PHMSA files (2010 to 2025). Over 2015 to 2025 the fall in counts is strong and holds up under testing, while the serious-event line is indistinguishable from flat. The relationship is directional, not a controlled causal test, but the divergence is where the remaining work sits.

This does not say regulation failed, and it is not a criticism of the people who wrote or enforce the rules. Many of those rules drove specific, real technical and integrity improvements, and the drop in reported incidents is partly their doing. The regulators built them in good faith, and operators have worked hard and professionally to meet them. The finding is narrower and more useful: the accumulation of requirements pulled the ordinary incident count down but has run into diminishing returns on the most serious outcome. That is where the next gain calls for a different kind of work.

Put plainly: the last fifteen years added parts to the garage. Rules are parts. Standards are parts. Audits are parts. You can keep buying parts and still not close the last gap,

because the last gap is not a missing part. It is coherence, the connection of the parts into one system that actually runs. That is where the next gain in safety is found, and it is why compliance should be systemic.

What this paper does not claim:

It does not claim that regulation failed, that any single rule caused the plateau, or that the most serious events have become more frequent. It claims something narrower and better supported: across the period of heaviest rulemaking, the most serious outcomes stopped improving, so the next increment of safety is unlikely to come from another discrete requirement. The paper reads the regulation-and-outcomes relationship as directional, not causal, and does not treat correlation as cause.

6 The State Dimension

Regulatory expansion is not only federal, and any honest account of the compliance burden has to include the states.

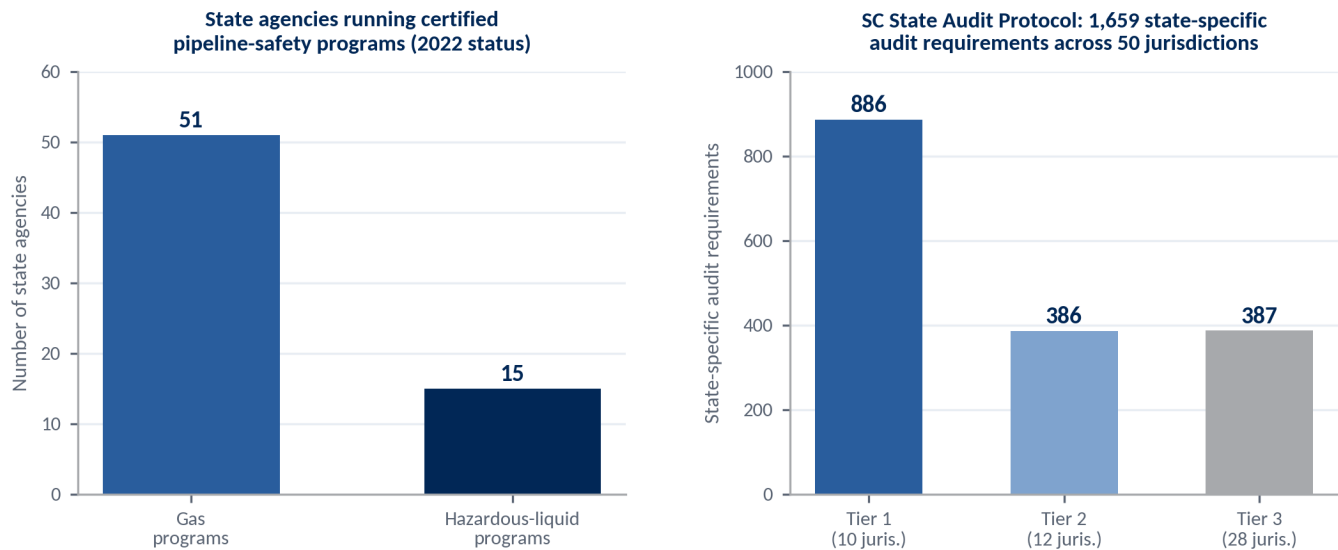
Under 49 USC 60105 a state may certify to PHMSA that it will regulate intrastate pipeline facilities under standards at least as stringent as the federal ones, and under 49 USC 60106 a state without certification may act as PHMSA's agent by agreement. PHMSA's own State Programs page states that the District of Columbia, Puerto Rico, and every state except Alaska and Hawaii participate, and that state programs provide safety oversight for over 85 percent of the infrastructure under PHMSA's safety authority. As of the 2022 certification status, the most recent PHMSA compilation we have been able to verify, 51 state agencies operated certified natural gas programs and 15 operated certified hazardous liquid programs.

The scale of the state layer is easier to see in units than in percentages. Gas distribution is roughly 1.39 million miles of mains and 73 million service lines, and it is predominantly state-inspected. Of the roughly 298,000 miles of gas transmission reported by state for 2025, about 105,000 miles, or 35 percent, are intrastate and therefore under state jurisdiction; even in the system most readers think of as federal, a third of the mileage is covered by a state program. And "at least as stringent" is a floor, not a ceiling. Many states add requirements above the federal baseline, and what they add varies widely. An operator that crosses state lines does not face one rulebook. It faces the federal baseline plus a set of state-specific overlays, most of which do not add documents but instead add

statements inside the documents the operator already maintains.

Systemic Compliance has quantified that overlay directly (Figure 7). Its State Audit Protocol reduces each participating jurisdiction's primary pipeline code to an inspectable question set, the way PHMSA's inspection protocols do for the federal layer. It currently captures 1,659 state-specific audit requirements across the 50 participating jurisdictions, which are the 48 states plus the District of Columbia and Puerto Rico, organized into three tiers by program depth. Of those, 1,509 are additions above the federal floor: requirements more stringent than their federal analog, or state-only requirements with no federal analog at all. The protocol is a structured library of audit checks derived from each state's program requirements, and its methodology is available on request. The point is not the exact count, which is a live figure, but the scale and the unevenness. The most active jurisdiction carries 165 additions touching 48 distinct federal requirement areas, while seventeen jurisdictions carry fewer than ten. That spread reflects different systems, different histories and different direction from legislatures and commissions, not different levels of commitment. The state layer is large, it differs by jurisdiction, and it multiplies what an operator crossing state lines has to keep aligned. It is offered to show that scale, not to suggest that any state requirement is unnecessary.

Regulatory expansion is not only federal: states add a large, uneven layer



1,509 of the 1,659 are additions above the federal floor: more stringent than the federal analog, or state-only with no federal analog.

Figure 7. The state layer. Left: state agencies running certified natural gas and hazardous liquid programs, as of PHMSA's 2022 certification status. Right: Systemic Compliance State Audit Protocol coverage, 1,659 state-specific audit requirements across 50 participating jurisdictions, of which 1,509 are additions above the federal floor.

That protocol also allows a test this paper's thesis invites. Before the result, it is worth being plain about what the test can and cannot see. It compares a count of requirements against a rate of reported incidents. It does not weigh requirements by importance, and one well-aimed requirement may matter more than twenty routine ones. It cannot see anything a state catches below the federal reporting threshold. And it cannot separate a state's requirements from the exposure that state happens to carry.

With those limits stated, the result is worth reporting. If the plateau reflected a federal build-out that was simply the wrong build-out, we would expect the states that went furthest above the federal floor to show the better outcome record. They do not. Across the 49 scored jurisdictions that operate a state program, the count of a state's requirements above the federal floor has no relationship to that state's federally reportable incidents per thousand miles, and none to federally reportable distribution incidents per thousand distribution miles. Breadth performs no better than volume: measuring how many distinct federal requirement areas a state's additions touch produces no relationship either. All four comparisons were tested and none of them showed any

connection at all, in either direction; the Appendix reports each one. Three jurisdictions sit outside the test. Puerto Rico participates, but its state-specific requirements could not be established from the sources available to us, so it carries no count to compare. Alaska and Hawaii run no state program, so their counts are zero by construction rather than by simplicity.

Two things about that result deserve emphasis rather than a footnote.

It does not establish that any particular state requirement is useless, and nothing here ranks state programs against one another. The exposure differences alone are large enough to swamp the variable being tested: services per mile of main, legacy cast iron and bare steel mileage, class location, and operator population each vary across states by more than an order of magnitude.

And the outcome measured here is the federal one. States run their own reporting streams alongside the federal one, at their own thresholds and on their own definitions. New York, for example, requires accident reports to its Department of Public Service under 16 NYCRR 255.801 with state-specific notice and timing, and separate reports of service interruptions under 255.823 against New York's

own definition of a reportable interruption. Roughly one in five of the state requirements in the protocol behind Figure 7 is a reporting or notification requirement. None of that state-held data was available for this comparison. The federal thresholds are at least uniform across states, which is what makes the comparison possible at all, but a benefit that shows up only below the federal threshold, in leaks found and fixed or interruptions caught early, would not appear in this test. Nothing here ranks state programs against one another, and this paper publishes no such ranking. What the result does establish is narrower and more useful. The volume of requirements did not move the national number across the heaviest federal

rulemaking decade, and the volume a state adds on top of the federal floor does not distinguish that state's federally reportable incident record either. Two levels of government, two independent measures of requirement volume, the same null result.

The state dimension reinforces the paper's central point rather than complicating it. More requirements from more authorities, applied unevenly across a growing network, is exactly the condition under which a fragmented, requirement-by-requirement approach to compliance breaks down and an integrated one becomes necessary.

7 Testing the Thesis

The test is simple: lay the regulatory side next to the safety performance side, dimension by dimension, and see where they line up. Table 4 does that.

Table 4. Testing the Thesis: Regulatory Side Against Performance Side

DIMENSION	REGULATORY SIDE	SAFETY PERFORMANCE SIDE	ALIGNMENT WITH THESIS
Reported incident counts	Requirements grew dramatically	Fell about a third from the 2015 peak	Counter, and the paper says so
Injuries	Requirements grew dramatically	Declined over the period	Counter
Fatalities	Heaviest rulemaking of the era	Flat at about ten per year since 2015	Strongly supports
Complexity and interdependency	Significantly increased	Most serious outcomes leveled off	Supports
Hazardous liquid	Major rule expansions	Largest count drop, part activity-driven	Counter on counts
Gas transmission	Mega Rule and related requirements	Counts flat; serious ruptures persist	Supports
State overlay	51 gas and 15 liquid certified programs	Requirements differ by jurisdiction	Supports
Management-system expectations	API RP 1173 introduced and broadly adopted	Adoption up; fatality outcome flat	Supports

Overall finding: the thesis holds, in its sharpened form. Regulatory requirements and complexity increased dramatically, and safety genuinely improved on the ordinary measures, fewer reported incidents and fewer

injuries. That improvement is real, it is to the credit of operators and regulators alike, and the paper keeps it in full view. But on the most serious outcomes, the ones the regulation exists above all to prevent, the record shows an

early gain and then a decade-long plateau, straight through the heaviest period of rulemaking. The rules

moved the common case and have reached diminishing returns on the most serious one.

8 Discussion: Why the Gap Persists

So why does the gap persist? Not because anyone failed to try. The rules were written in good faith and have done real good, and operators have invested heavily and professionally to meet them. The problem is not effort or intent. It is structure. Rules are parts, and parts do not assemble themselves.

The pattern is consistent with a regulatory system that has successfully driven specific technical and integrity improvements, and pulled the ordinary incident count down, while struggling to convert all that activity into fewer of the most serious events. The gap to explain is narrow and specific: why did fatalities stop improving a decade ago even as the rulebook grew fastest? Several factors help.

- **Process is not outcome.** Many new requirements govern integrity and assessment processes. Turning those processes into fewer catastrophic outcomes depends on integration, strong management of change, and execution in the field, including by contractors, none of which a rule can mandate into existence.
- **Capability lags adoption.** Performance-based and management-system expectations raise the bar for organizational capability, but implementation maturity varies widely. Broad adoption is a real step, and in any industry it takes time for a new management system to change outcomes.
- **The easy gains are spent.** The most obvious higher-risk pipe has already been addressed, and the network has

grown in mileage and interconnection. Marginal risk reduction is genuinely harder now than it was in 2010.

- **Fragmentation compounds.** More requirements, from more authorities, applied to more assets, means more seams, and a seam is a place where two programs each meet their own rule and still do not reach each other.
- **The question we ask cannot find the seams.** A compliance question asks whether each document meets the rule it answers to, and every document can pass it. No rule owns the space between two documents, so nothing in an inspection protocol comes back and says these two disagree. Change the goal from passing an inspection to minimizing risk and that changes, because a risk question crosses documents on its own. Failures cross documents, so the question that finds them has to as well.

For operators the lesson is practical. Piling on more compliance work will not close the remaining gap by itself. What matters is treating the growing pile of requirements as inputs to one connected system, rather than a stack of separate obligations worked one at a time.

9 Implications for Operators

The evidence points one way, and it is not toward another rule. It points toward integration: making the requirements already on the books work as one system. That is what a Pipeline Safety Management System is for.

- **Integrate, do not accumulate:** move from fragmented, requirement-by-requirement compliance to one integrated management system, so that federal rules, state overlays, and standards operate together rather than as parallel stacks.
- **Compliance as a by-product:** treat a current, defensible compliance posture as the by-product of running the

system well, not as the primary goal pursued document by document.

- **Work the three places where the connection is easiest to lose:** contractor control, competence and training, and management of change, supported by a connected system of record.

- **Stay coherent as the rules move:** keep the growing and uneven requirement set current and connected as it changes, so a new rule or a new state overlay updates the system instead of opening a silent gap.

In day-to-day terms, coherence is one connected record in which the federal rule, the state overlay, and the operator's own procedure that govern the same asset are linked to each other. An operator cannot change a federal rule or a state requirement. What an operator can do is know, on the day one of them changes, every procedure, record, qualification and training item that has to change with it, and be able to show that each one did. The same link runs the other way when the operator revises its own

procedure, because the training, the covered-task list and the contractor's qualification all have to follow. Without those links, the requirement moves and the documents quietly drift out of alignment with it. The practical question for an operator is no longer whether it has the required documents. It is whether those documents still form one working system when a requirement, a procedure, or a contractor's status changes.

None of this argues against regulation. It argues that the next increment of safety is more likely to come from how operators integrate what already exists than from any single new requirement layered on top.

10 Conclusions

1. Regulatory requirements and complexity increased dramatically since 2010, across federal statutes, major PHMSA final rules, gathering-line reporting, management-system expectations, and a large state overlay.
2. Computed from PHMSA's own incident records, reported incidents and injuries declined over the period, most sharply for hazardous liquid. On the ordinary measures, safety improved, and the paper says so plainly. Improved is not finished. There were still 464 reported incidents in 2025 and roughly 31 injuries a year, and the goal on those measures is the same zero as on every other one. Nothing here argues for easing off the work that brought them down.
3. The most serious outcomes are the exception. Fatalities fell in the early 2010s and then held roughly flat at about ten a year across 2015 through 2025, the most active regulatory decade, with no detectable downward trend.

4. The thesis holds in its sharpened form: the regulatory build-out moved the common case but has reached diminishing returns on the most serious one. Another discrete requirement is no longer the lever on the outcome that matters most.
5. The constructive path is systemic integration: making the requirements already on the books operate as one connected system. That is the orientation underlying Pipeline Safety Management Systems.

Regulations are the floor. Zero incidents is the ceiling we all share, and the distance still to close is a structural problem before it is a regulatory one. A garage full of parts is not a car. Compliance should be systemic.

About Systemic Compliance. Systemic Compliance works with pipeline operators to make the requirements they already carry operate as one connected system. That is the work behind this paper.

Appendix: How the trends were tested

The body of this paper states each finding in plain words. This appendix carries the numbers behind those words, so that a reader who wants to check the arithmetic can, and so that nobody has to take the plain-language version on trust.

What was fitted. Each annual series was fitted with a straight line over 2015 through 2025, the decade of heaviest rulemaking activity. Fits are confined to that window because PHMSA's reporting criteria changed several times before it, which makes longer comparisons of all-reported incidents unreliable. Calendar 2026 is a partial reporting year and is excluded from every fit. Each

fit is reported with the significance of its slope, which is the probability that a trend this strong could have arisen from chance alone in a series with no real direction. Values below about 0.05 are conventionally treated as unlikely to be chance.

Why the fits were also refitted. Pipeline fatalities are small annual counts, between three and sixteen a year in

the split series, and a single unusual year can drive a fitted slope on its own. Every fatality series was therefore refitted eleven times, each time with one year deleted, and what is reported below is whether the direction survives all eleven. That test is the reason the paper is willing to state a direction at all, and the reason it declines to quote exact slopes for the small series.

Table A1. Fitted trends, 2015 to 2025

SERIES	FITTED DIRECTION	SIGNIFICANCE	REPORTED IN THE BODY AS
Reported incidents, three segments combined	About -25 per year; the line accounts for roughly 90 percent of the year-to-year movement	$p < 0.001$	A real decline that holds up under testing
Fatalities, three segments combined	Essentially zero	$p = 0.97$	No detectable direction
Injuries and serious incidents	Weakly downward	$p = 0.08$	Drifting down, too weakly for eleven years of data to settle
Gas transmission fatalities	Downward from a base of about two a year	$p = 0.02$	A detectable decline from a small base
Gas distribution fatalities	No direction	$p = 0.21$	No trend at all
Hazardous liquid fatalities	About one a year	$p = 0.37$	Too few to trend

Table A2. State requirement volume against outcomes, 49 scored jurisdictions

Rank correlation, which asks whether states that add more requirements rank better on outcomes, without assuming the relationship is a straight line. Alaska and

Hawaii are excluded because they operate no certified state program, so their counts are zero by rule rather than by choice. Puerto Rico participates but is also excluded, because its state-specific requirements could not be established from the sources available.

WHAT WAS COMPARED	RANK CORRELATION	SIGNIFICANCE
State additions above the federal floor, against incidents per 1,000 miles	0.026	$p = 0.86$
State additions above the federal floor, against distribution incidents per 1,000 distribution miles	-0.034	$p = 0.82$
Federal requirement areas a state's additions touch, against incidents per 1,000 miles	-0.021	$p = 0.89$

None of the four reaches even a weak association, in either direction.

What these tests do and do not establish. They establish that the reported-incident decline is real and that the fatality plateau is real, in the sense that neither is something we read off a chart by eye. They do not establish that any rule caused any outcome, that

requirement volume is useless, or that a state with more requirements is worse run. A rank correlation across 49 jurisdictions cannot control for the exposure differences that make one state's job much harder than another's, and those differences are large. The paper reads the regulation-and-outcomes relationship as directional rather than causal, and Section 5 says so in those words.

Sources

Every figure in this paper is tied to a named source, and the incident numbers are computed from PHMSA's own records rather than taken from a third party. Counts, fatalities, and injuries by year are tallied directly from PHMSA's incident and accident report files for the three main segments (Forms F7100.2, F7100.1, and F7000.1),

covering January 2010 through mid-2026. Mileage comes from PHMSA's Annual Report Mileage. The state figures come from PHMSA's program-certification records and from Systemic Compliance's State Audit Protocol. Every regulatory date is tied to the enacting statute, the Federal Register rule, or the standard itself.

Table 5. Key Figures and Their Sources

FIGURE OR CLAIM	VALUE	SOURCE
Reported incidents per year, three segments	Peak about 710 in 2015; 464 in 2025; down about a third	Computed from PHMSA incident and accident report files (2010 to 2025)
Pipeline fatalities per year, three segments	About 15 per year in 2010-2014; about 10 per year and flat in 2015-2025	Computed from PHMSA incident and accident report files
Reported injuries per year	About 72 per year in 2010-2014; about 31 per year in 2021-2025	Computed from PHMSA incident and accident report files
Gas transmission incidents	Flat at about 123 per year, 2010 to 2025	Computed from PHMSA Form F7100.2 file
Civil penalties proposed, 2010-2023	About \$93 million across more than 600 cases; rose above \$10M a year in 2021-2023	Computed from PHMSA proposed-penalty case listing; 2013 total validated to PHMSA's published figure of more than \$9.7M
Civil penalties assessed, 2010-2023	About \$70 million	Computed from PHMSA completed-penalty (collection) case listing
Mileage by segment, 2010 and 2025	Gas dist. 2.10M to 2.40M; transmission ~0.30M flat; haz liquid 0.182M to 0.228M	PHMSA Annual Report Mileage
Certified state programs (2022)	51 gas, 15 hazardous liquid state agencies	PHMSA 2022 Appendix F, State Program Certification
State-specific audit requirements	1,659 across 50 jurisdictions; 1,509 above the federal floor	Systemic Compliance State Audit Protocol (2026)
PSMS adoption	~85% transmission/gathering mileage; ~86% gas distribution mileage (2023)	Pipeline SMS Industry Team 2023 report; PHMSA ADB-2025-01
Regulatory milestone dates	San Bruno 2010; Acts 2012/2016/2020; Mega Rule 2019/2022; gathering 2021; valve 2022; PSMS advisory 2025	NTSB; Public Laws 112-90/114-183/116-260; Federal Register; API
Rule benefit statements	Reduce frequency and consequences of failures; reduce injuries and fatalities; benefits described qualitatively	Federal Register preambles and RIAs: RINs 2137-AE72, AF39, AF06, AF38, AE66

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Prepared by Systemic Compliance. Incident, fatality and injury figures computed directly from PHMSA incident and accident report files. Systemic Compliance is not a law firm, and this paper is analysis, not legal or investment advice.