



Natural Gas AI Use Cases

Lessons Learned from the Field

NGA Executive Conference
September 15, 2026

Today's Discussion



“Which operating decision would improve most if your team could find the right information faster?”

1

Where AI Fits in Natural Gas Operations

2

Use Cases with Near-Term Potential

3

A Field Prototype and What It Taught Us

4

Human Judgment, Safety, and Responsible Use

5

A Practical Plan for the Next 6 to 12 Months

Why AI Matters Now for Natural Gas Utilities

Better tools now coincide with greater pressure on utility employees, assets, and capital programs.

More Usable Technology

Current tools can search and organize procedures, narratives, photographs, inspection records, and other information utilities already collect.

More Operating Pressure

Aging assets, capital programs, contractor coordination, and workforce turnover increase the amount of information employees must review.

A Practical Entry Point

A focused prototype can test the process, available information, user acceptance, and potential value before major AI / integration spending.

The question has shifted from whether AI has potential to **where it can improve specific operating decisions** without weakening accountability or established controls.

Where AI is Proven, Developing, or Still Early

Deployed AI solutions span mature analytics and machine-learning (ML) applications to newer generative AI and agentic tools.

Proven

- Demand forecasting
- Sensor anomaly detection
- Route and schedule optimization
- Customer contact analytics

Developing

- Inspection image analysis
- Work order prioritization
- Safety narrative analysis
- Pipeline risk prioritization
- Voice-enabled field support

Emerging

- Dynamic job briefings
- AI-assisted control recommendations
- Agents that assemble information from several operating systems

Readiness depends as much on data quality, fit with the operating process, system integration, and employee trust.

Natural Gas AI Use Cases and Opportunities

The most relevant applications fall within five operating areas

Engineering and Construction

Search standards and records, review designs, anticipate material constraints, and improve field documentation.



Operations and Maintenance

Detect abnormal equipment conditions, support maintenance priorities, and connect asset history with current performance.



Gas Control

Support demand forecasting, compressor planning, alarm review, and preparation for emergency operating conditions.



Safety and Workforce

Review observations and near misses, strengthen job preparation, improve access to procedures, and focus training.



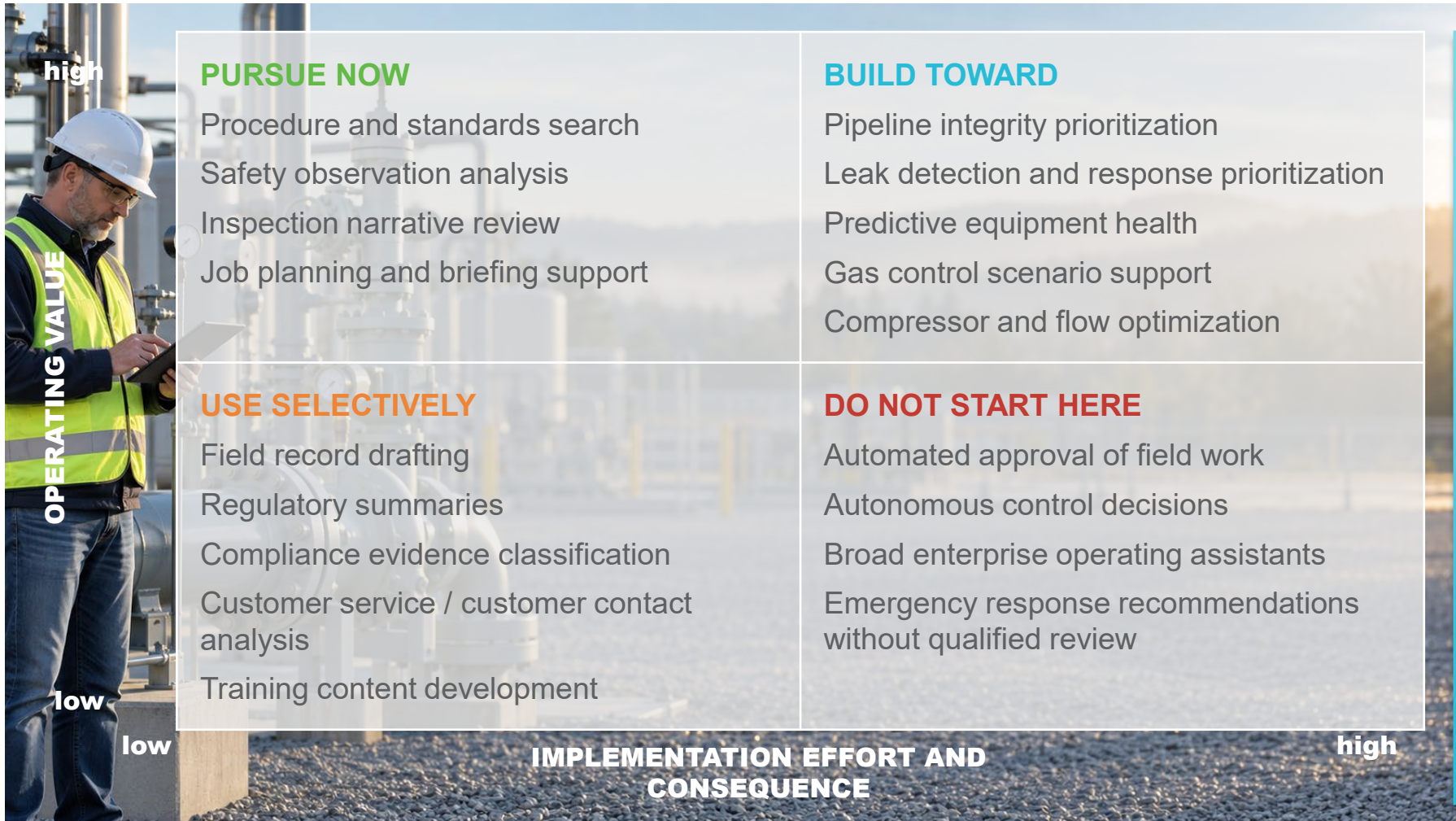
Compliance, Damage Prevention and Cybersecurity

Support evidence review, locate ticket screening, reporting, control monitoring, and investigation of unusual OT activity.



Where to Start?

Start with applications that use existing information, support a defined decision, and keep qualified employees accountable



Screening Questions

- Does the decision recur often enough to matter?
- Can the user trace the answer to reliable source information?
- Who owns the process and makes the final decision?
- Can we measure time, quality, risk, or cost?
- What happens when the tool is wrong or unavailable?

Operations and Maintenance

AI can combine asset condition, work history, and field information to support maintenance and planning decisions.



Equipment Monitoring

Identify unusual sensor patterns that may indicate declining equipment condition.

Maintenance Prioritization

Combine condition, consequence, work history, and access constraints to focus scarce resources.

Inspection Analysis

Review images and narratives for corrosion, damage, vegetation, leaks, and repeated field conditions.

Work Package Support

Help planners find approved procedures, drawings, prior experience, and equipment history.

Gas Control and and Operational Decisions

AI can improve situational awareness while controllers retain authority and follow approved procedures

INPUTS

- SCADA and alarms
- Weather and demand
- Integrity records
- Work and outage status

AI SUPPORT

- Anomaly detection
- Pattern comparison
- Scenario analysis
- Recommended questions

CONTROLLER JUDGMENT

- Validate conditions
- Apply procedures
- Coordinate field response
- Document rationale

AI tools can organize evidence and compare conditions. Qualified controllers validate the information, follow approved procedures, and retain control authority.

Engineering, Construction, and Field Work

AI can reduce preparation time and help employees apply standards more consistently

Design and Records

Search standards, compare drawings, identify missing information, and support constructability reviews.



Materials and Schedule

Identify long lead materials, forecast demand, and show how design changes affect purchasing and construction plans.



Field Documentation

Convert photographs, voice notes, and inspection narratives into draft records for employee review.



Job Preparation

Build draft checklists and briefing material using approved procedures, operating experience, and known site conditions.



Safety Signals *Can* Appear Before Incidents

The difficulty is finding them across thousands of observations, narratives, and work records.

Job plans and briefings

Training and qualifications

Work orders and schedules

Near misses and inspections

Field observations

Photos, voice notes, and video

AI can scan large volumes of observation and work records for repeated conditions, missing controls, and combinations of risk that may not appear in a record-by-record review.

Lagging

- Injuries
- TRIR
- DART

Leading

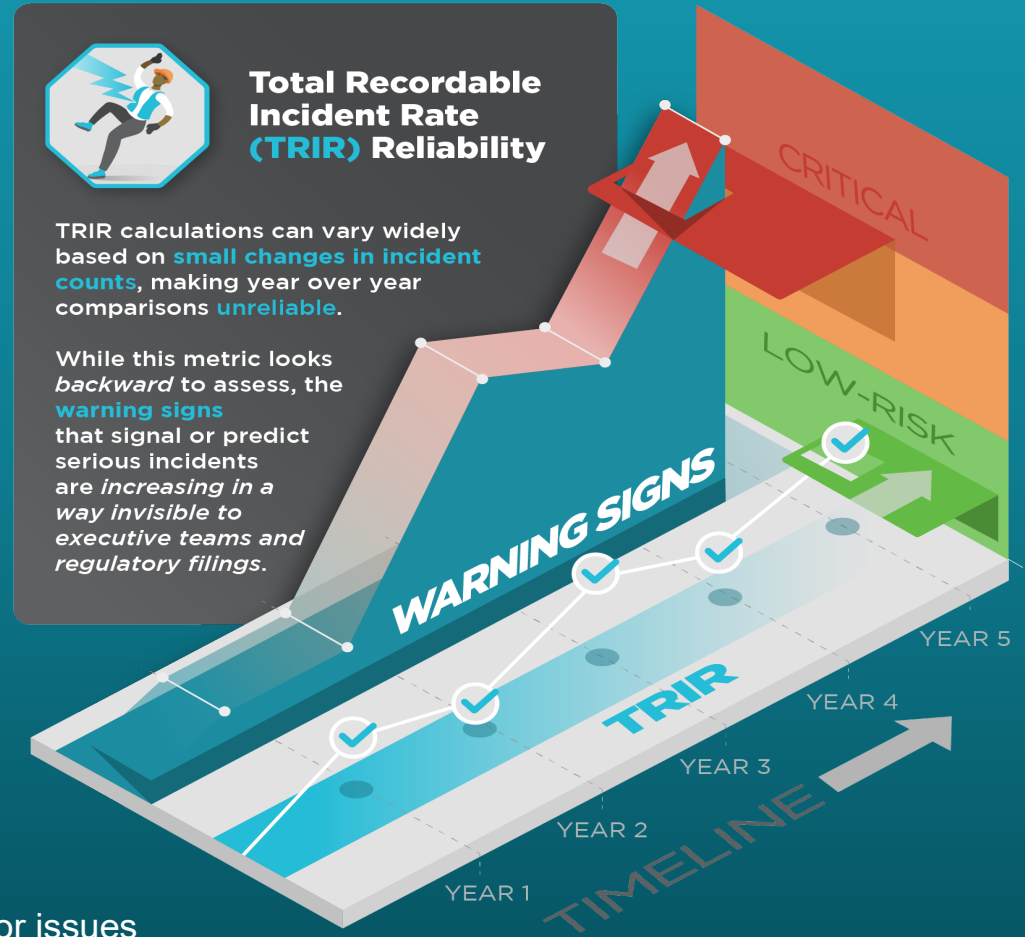
- Weak job preparation
- Repeated deviations
- Recurring equipment or contractor issues



Total Recordable Incident Rate (TRIR) Reliability

TRIR calculations can vary widely based on **small changes in incident counts**, making year over year comparisons **unreliable**.

While this metric looks *backward* to assess, the **warning signs** that signal or predict serious incidents are *increasing in a way invisible to executive teams and regulatory filings*.



Match the Human Review Approach to the Decision

AI can either help people review more information or help enhance a qualified human reviewer's capabilities

AI TRIAGE

Use when AI can support review and analysis of information that people cannot reasonably complete

- AI identifies patterns, anomalies, or items for follow-up
- The alternative is that much of the information is not reviewed at all or in detail

Examples

- Safety observations
- Inspection narratives
- Company or Operating Experience trends

HUMAN REVIEW SUPPORTED BY AI

Use when a qualified person must review

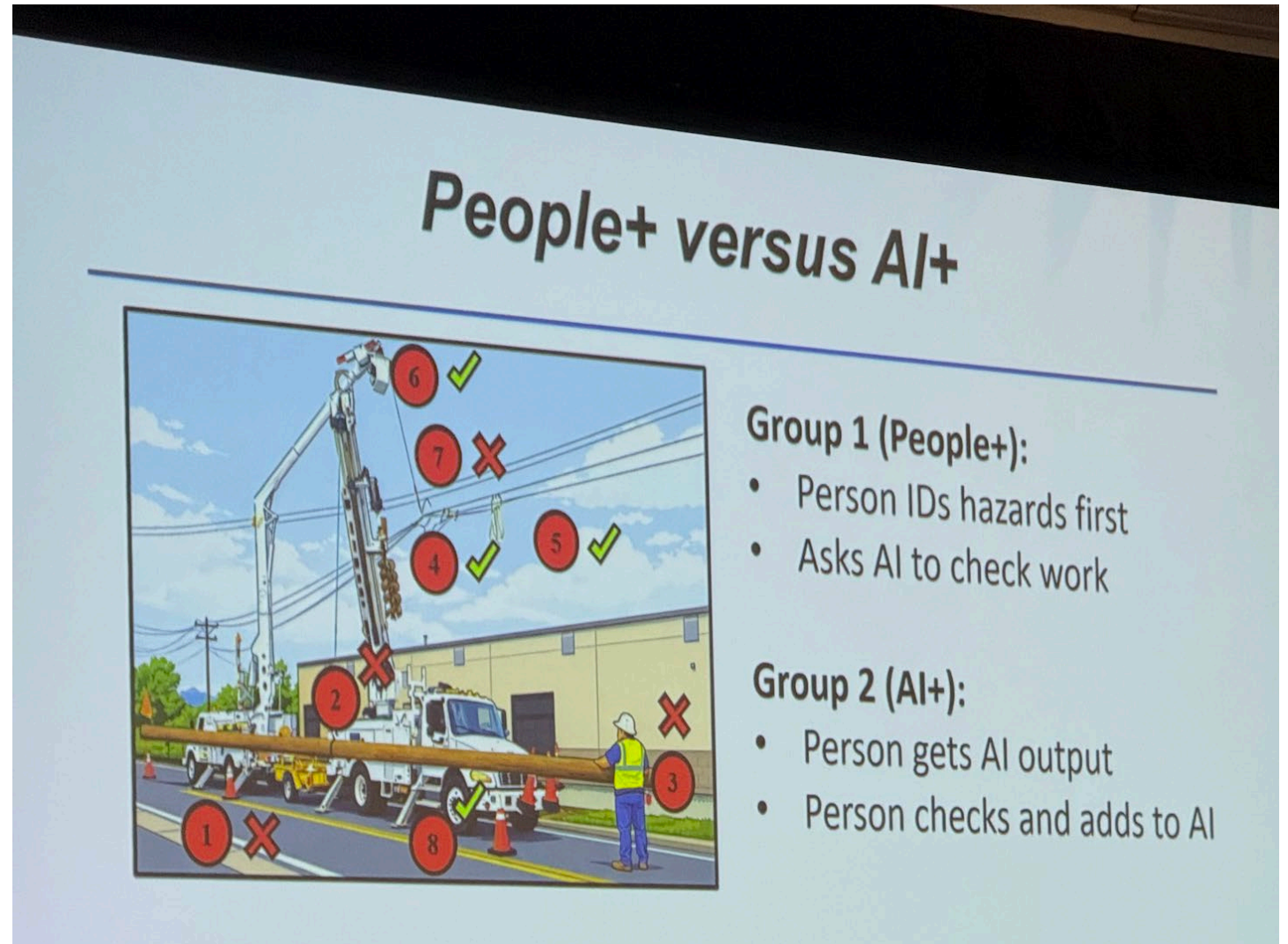
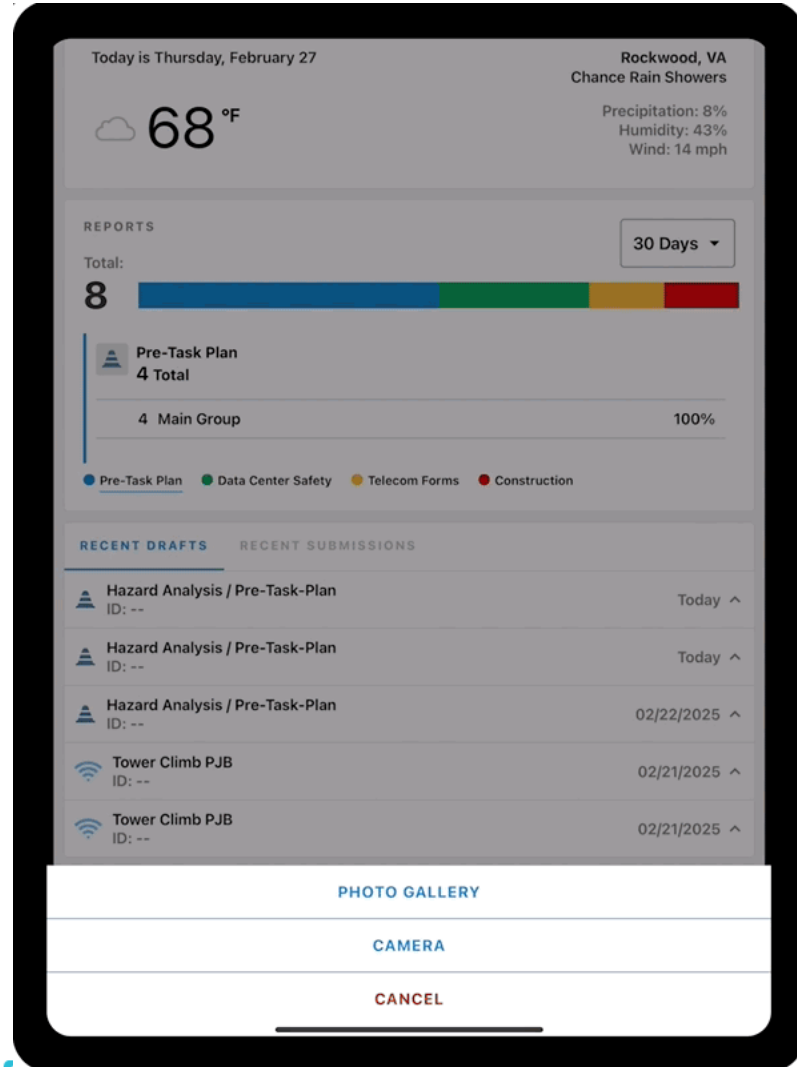
- A missed item could affect safety, compliance, or an operating decision
- AI retrieves evidence / scans imagery, flags issues, and highlights related experience
- The qualified reviewer challenges the cues and makes the judgment

Examples

- Jobsite preparation/job hazard analysis
- Investigations

When a qualified person must review the complete record, AI should support that review rather than decide which information the person receives.

Example of AI Assisted Hazard Identification



Field Case Study: The Operating Problem

A large natural gas utility wanted clearer job preparation and faster access to approved information.



Recurring field challenges:

- Crews had to navigate long procedures while preparing for work
- Job preparation practices varied across regions and contractors
- The quality and completeness of JHAs and job briefings varied
- Field observations, inspection findings, and operating experience did not consistently reach crews when they were preparing for the job
- Training videos and job aids were scattered across repositories

Prototype question: can an AI field assistant improve job preparation without becoming a substitute for the procedure?

Field Case Study: Prototype Experience

The prototype combined procedures, observations – Did Not Meet (DNM), job planning, and training into one field-oriented workflow.

CONTROLLED INPUTS

- Current procedures
- Safety requirements
- Field observations and operating experience
- Training videos and job aids
- Operator Qualification requirements
- Prior inspection and near-miss experience

ASSISTED PREPARATION

- Relevant procedure steps
- Potential hazards and controls
- Questions for the supervisor and crew
- Related operating experience
- Pressure, isolation, and purging considerations

FIELD VALIDATION

- Supervisor and crew review
- Source traceability
- Usability feedback
- Refinement before scale

The prototype created a draft for qualified review, showed the supporting sources, and allowed field users to test whether the information helped them prepare.

FIELD SAFETY ASSISTANT ACTIVATED

Your mobile-ready safety assistant is standing by.

Get step-by-step procedures, JHA generation, DNM trend analysis, and training videos — all grounded in real field data.

MAIN MENU — WHAT DO YOU NEED HELP WITH?

1  **Task Help** — Show me the right way to do a job, step-by-step

Example: Fusing pipe, pressure testing, valve maintenance, purging lines

2  **Non-Compliance Risk Heatmap & Trend Analyzer** — Visualize risk zones and trends from field observations

Example: DNM-based heatmap of violations by region, top 10 most common violations

3  **JHA / Tailboard Help** — Generate a Job Hazard Analysis with DNM-based compliance alerts

Example: Highlight past violations for this task, embed control reminders

4  **Watch a Safety Video** — Show me a quick training clip I can use now

Example: Butt fusion welding, pressure testing setup, LOTO procedures

5  **How This Assistant Works** — Quick guide to using this tool in the field

Example: How to ask questions, what's included, where info comes from

 **Pick a number above — or just type your task or safety question in plain field language.**

I'm getting ready to pressure test a newly installed gas service line. Walk me through the job step-by-step, including PPE, equipment, safety checks, applicable regulations, and whether we have any DNM observations associated with pressure testing.

Worked for 12s >

PROCEDURE: Pressure Test — Newly Installed Gas Service Line

Manual Reference: Section 3.5 — Pressure Testing Procedures by Class and Service

Primary Regulatory Standards: 49 CFR Part 192, Subpart J, especially §§ 192.503, 192.511, 192.513, and 192.515.

PRE-WORK REQUIREMENTS

Required PPE

- ANSI Z89.1 Class E hard hat
- ANSI Z87.1 safety glasses with side shields
- ASTM F2413 safety-toe boots with slip-resistant soles
- High-visibility vest/clothing appropriate to the work zone
- Cut-resistant work gloves
- FR clothing for work on natural-gas infrastructure; the field manual specifies Category 2/HRC 2 FR apparel, minimum ATPV 8 cal/cm², with sleeves down and secured.

Inspect all PPE before use. Damaged PPE is to be removed from service.

Equipment

- Approved air or inert-gas test source, as applicable
- Pressure regulator
- Calibrated pressure gauge; using two gauges where possible is recommended for redundancy
- Approved chart recorder/digital recording equipment when required by the work procedure
- Proper plugs, caps, fittings, and test connections rated above the intended test pressure
- Leak-detection/soap solution
- Barricades or other means to establish an exclusion area

Pressure gauges and pressure-test recording equipment are required by the field manual to be calibrated and certified annually. Verify current calibration status before beginning.

Qualification: Pressure testing is identified as an Operator Qualification covered task in the field program, so personnel performing it independently must have current qualification.

STEP-BY-STEP PROCEDURE

Step 1 — Confirm exactly what you are testing

Identify the service-line material, intended operating pressure/MAOP, test limits, and every component included in the test section.

VERIFY: The service is isolated from anything that should not see test pressure. Confirm caps, plugs, fittings, valves, risers, and test connections are properly installed and rated.

SAFETY NOTE: Do not assume the same pressure criterion applies to steel and plastic service. Federal requirements distinguish between them.

Step 2 — Determine the required test pressure

For a **non-plastic service line**, 49 CFR §192.511 requires:

- Intended operating pressure **1–40 psig**: test at **not less than 50 psig**
- Intended operating pressure **greater than 40 psig**: test at **not less than 90 psig**
- A steel service stressed to 20% or more of SMYS falls under the additional §192.507 requirements.

For **plastic pipe**, the provided regulatory material states that the test pressure must be at least **150% of maximum operating pressure or 50 psig, whichever is greater**, while not exceeding **2.5 times** the applicable design pressure; thermoplastic temperature limitations also apply.

The field procedure reinforces the plastic-pipe overpressure limitation and specifically warns against exceeding 2.5× design pressure.

Step 3 — Inspect and configure the test setup

Before introducing pressure:

- Check the regulator, hoses, fittings, plugs/caps and gauges.
- Confirm gauge calibration.
- Position the gauge where it can be read without standing in the likely failure path.
- Secure pressure connections.
- Establish an exclusion zone around pressurized components.

VERIFY: No personnel are positioned directly in front of caps, plugs, fittings, or other components that could become projectiles.

SAFETY NOTE: Pneumatic tests contain stored energy. The field procedure specifically warns that a failed joint can become a projectile and directs crews to limit personnel near the pipe during testing.

Analyze our DNM observations and tell me where our biggest field risks are. Show me the highest-frequency work types, geographic hot spots, recurring violations, and what management should focus on first.

Worked for 30s >

DNM FIELD RISK ANALYSIS

Database coverage: January–May 2025
Total DNM observations: 472 across 21 work types.

The clearest concentration is in **basic field execution controls**—not specialized gas procedures. Safety and equipment/tool observations alone account for **255 of 472 DNMs (54.0%)**.

Highest-Frequency Work Types

Rank	Work Type	DNMs	Share
1	Safety	135	28.6%
2	Equipment and Tools	120	25.4%
3	Bore	44	9.3%
4	Working Around Utilities	38	8.1%
5	Trench	26	5.5%
6	Worksite Clean	25	5.3%
7	Post Install	15	3.2%
8	Pressure Test	11	2.3%
9	Job Material	10	2.1%
10	Joining Plastic	9	1.9%

Bore and utility work deserve particular attention because the comments include actual utility strikes, inadequate spotting, equipment failures, and weak-link failures—not merely administrative deficiencies. For example, the observations include damaged communications facilities and other utility-damage events during work around existing facilities.

Most Recurring Violations

Recurring Failure	DNMs 
Equipment/tools did not function properly	42
Appropriate traffic control not used	38
Required equipment/tools not onsite	36
Appropriate PPE not used	34
Wheel chocks not present/used	32
Utility damage not avoided	22
Equipment did not function without interruption	18
Spoil pile placement did not meet requirements	11
Mechanical equipment had leaking fluids	10
Boring equipment not in good condition	10

The comments show that the equipment category is not just paperwork. Examples include dead batteries, bore machines breaking during operations, malfunctioning tampers, vac trucks that would not start, pressure-test compressors repeatedly stopping, expired calibration, and crews arriving without required equipment.

Likewise, traffic control and wheel chocking appear repeatedly as **controls that were corrected only after an inspector intervened**. One crew was working a five-lane roadway without the needed arrow board; work was stopped until one was obtained. Other crews had vehicles unchocked until reminded.

I'm the supervisor doing a tailboard before a PE butt-fusion job. Give me the questions I should ask the crew, the critical controls I need to verify, and the mistakes we've previously seen in the field.

PE BUTT-FUSION TAILBOARD

For this job, I'd make the tailboard interactive: have the **fuser answer the fusion-specific questions**, and have the rest of the crew confirm the work-zone and equipment controls.

Questions to Ask the Crew

Qualifications and job setup

- Who is the qualified butt-fusion operator, and is their **OQ/plastic-pipe joining qualification current**?
The company program requires qualified personnel for plastic fusion.
- What pipe material, size, and fitting are we joining, and are they compatible with the approved joining procedure?
- Has the pipe/fitting been inspected for damage, defects, contamination, or other conditions that would make it unacceptable?
- Does everyone understand their role, pinch-point exposure, and **Stop Work** responsibility?

Fusion machine

- Has the fusion machine been inspected and confirmed to be operating correctly **before we make the first joint**?
- Are the correct clamps/inserts installed for this pipe?
- Is the facer operating correctly and capable of producing clean, parallel ends?
- Is the heater clean, undamaged, and at the temperature required by the approved fusion procedure?
- Where are the pinch/crush zones when the carriage moves?
- Who controls the machine, and how will we prevent anyone else from reaching into the carriage?

Making the joint

- After facing, are the ends **square, clean, parallel and properly aligned**?
- Are we keeping prepared fusion surfaces clean and free of contamination?
- What are the approved heating, changeover/fusion-force, and cooling requirements for this pipe and machine?
- Who is watching the joint throughout the fusion cycle?
- What conditions would make us **reject the joint and cut it out instead of accepting it**?
- How long must the joint remain restrained/cooling before we handle or stress it?

The field procedure emphasizes trained operators, proper facer/heater use, clean heating surfaces, clamps for alignment, protection from the hot heater, and allowing the joint to cool without strain.

Illustrative prototype output.

WHAT OUR DNM HISTORY SAYS

There are **9 joining-plastic DNMs** in the current observation set. Not all nine involve butt fusion specifically—some concern electrofusion—so the butt-fusion lessons below are separated from the broader joining observations.

1. Bad alignment / unacceptable butt fusion

On **February 25 in Wilmington**, a badly mitered butt fusion was accepted/signed off. The same event generated an alignment DNM, and the observation states that the fuser's butt-fusion OQ was suspended.

Tailboard lesson: Don't let production pressure turn an obviously questionable joint into an accepted joint.

Supervisor challenge question: "If that completed bead is mitered or alignment is questionable, what are we going to do?"

The expected field behavior is **stop, reject/question the joint, and follow the approved corrective process—not sign off an unacceptable fusion.**

2. Fusion-machine failures

Equipment condition is a repeated joining issue. On **March 31 in Indian Trail**, a fusion machine stopped working during an 8-inch PE butt-fusion job and another machine had to be obtained. On **May 6 in Fayetteville**, a butt-fusion machine was building pressure and producing bad concave fusions.

Tailboard lesson: Machine performance is a quality control. If hydraulic pressure or machine behavior becomes abnormal, **stop making joints** rather than trying to work through the problem.

3. Improper fit/alignment conditions

A **March 14 Hickory** observation documented an 8×2 high-volume tee that wasn't forming correctly to the 8-inch main because the strap was too short to connect underneath it.

Tailboard lesson: Correct fit-up and tooling need to be verified before starting the joining process. Don't improvise around a fitting or restraint that cannot achieve the required positioning.

4. Defects introduced during preparation

A Nashville observation documented shaving equipment with a screw backing out into the PE pipe and causing a defect; the affected section was replaced.

Tailboard lesson: Preparation tools can damage the product too. Inspect both the tooling and the prepared pipe before accepting it for joining.

Field Case Study: What the Prototype Was Designed to Test

Early testing should answer operating questions before the utility invests in AI integration

WHAT THE PROTOTYPE TESTS

- Do employees understand and trust the output?
- Does the tool provide accurate and complete information?
- Can users trace the answer to the current approved source?
- Does it improve job preparation and briefing consistency?
- Does it reduce preparation time?
- What information and controls would scaling require?

WHAT THE PROTOTYPE DOES NOT PROVE

- Automatic authorization to perform work
- Replacement of approved procedures
- Unattended operational decisions
- Proof of enterprise ROI from a small sample
- Permission to bypass IT, cyber, or change control

“Prototype the work, not just the AI model.”

Four AI Delivery Models

The choice depends on product maturity, fit with existing systems, support needs, and total cost

BUY

mature vendor product

Fastest path when the use case is common and the product fits existing systems

CONFIGURE

enterprise platform

Useful when data and security services already exist and the process needs tailoring

HYBRID

vendor supported with utility input

Combine a vendor product with utility rules, information, and system connections

BUILD

targeted customer solution

Develop a utility-owned solution when the application is specialized and the organization can support it

Most utilities will use more than one approach. Choose the delivery model for each business problem rather than selecting one AI platform for every application.

Governance Should Match the Consequence

Higher consequence applications require stronger review, monitoring, and fallback procedures

	ROLE	EXAMPLE	MINIMUM CONTROL
TIER 1	Assistive	Drafting, search, summarization	Human checks output before use
TIER 2	Decision support	Prioritization, risk cues, recommendations	Validation, monitoring, source traceability
TIER 3	Safety or operational impact	Field execution or control-room recommendations	Independent review, controlled changes, documented testing, and a reliable fallback process

Lessons Learned from Utility AI Work

Operating fit and value to end users separates useful tools from impressive demonstrations.



Start with the decision and business problem to solve

Identify who will use the information and what they should be able to do better.



Use real users early

Operators, field employees, and supervisors expose process issues / improvement opportunities quickly.



Show the source

Procedure sections, records, and version dates should remain visible whenever the output affects work or risk..



Expect imperfect data

Prototype with sanitized or synthetic data while improving production data in parallel.



Measure operating results

Track preparation time, quality, consistency, adoption, and risk indicators.



Assign ownership before scaling

Integration, support, monitoring, and model changes continue after the pilot.

A Practical 6 to 12 Month Plan

A small set of AI pilots can build evidence while the utility establishes the required controls and information

0–60 DAYS

Frame and select

- Name operating sponsors
- Screen 10–15 use cases
- Choose one or two focused pilots
- Set baseline measures

2–5 MONTHS

Prototype and test

- Use sanitized or controlled data
- Test with real users
- Measure quality, employee effort, and operating results
- Document controls and gaps

5–12 MONTHS

Scale what works

- Integrate approved data
- Complete the security review and establish ongoing support
- Train users and owners
- Expand only with evidence

Address information quality, governance, and organizational change alongside the pilots.

Each area can improve as the utility learns.

Questions Executives Should Ask Before Funding an AI Pilot

1

Which operating decision should improve?

2

Who owns the process and makes the final decision?

3

Which sources must the employee be able to verify?

4

What happens when the tool is wrong or unavailable?

5

How will employees test it in the actual process?

6

What result would justify scaling, revising, or stopping?

The Practical Starting Point

Choose one important decision. Give experienced employees better information. Test the tool with them in the actual process. Scale only when it earns their trust and improves the result.



Luke Martin

Partner, OT and AI
Enablement

How ScottMadden Helps

AI use case selection and business case
Rapid prototypes and field testing
Governance and operational controls
OT, safety, workforce, and change support
Implementation and scaling

Questions and discussion



ScottMadden Natural Gas AI Categorization Framework

Capability Tier	AI Category	Representative Natural Gas Applications	Operational Value
 Tier 3 – Operational Optimization	Predictive asset health	Condition and failure prediction for compressors, regulators, valves, and other equipment	Earlier issue detection and fewer emergency repairs
	System planning and optimization	Demand forecasting, storage and LNG inventory planning, and pressure or flow optimization	Better operating plans and use of available capacity
	Integrity risk analytics	Combine inspection, corrosion, leak, work history, and environmental data to prioritize threats	Better inspection, repair, and replacement decisions
	Computer vision and remote inspection	Review patrol images, right-of-way encroachment, corrosion, coating defects, and construction quality	Faster and more consistent inspection review
 Tier 2 – Process and Decision Support	Engineering and records review	Search drawings, standards, as-builts, and technical records to support engineering review	Faster reviews and fewer record gaps
	Safety and issue trending	Analyze observations, near misses, incidents, inspection findings, and operating experience	Earlier warning signs and more focused action
	Work planning and dispatch	Support work order review, job planning, routing, and crew or material coordination	Better prepared work and fewer avoidable delays
	Compliance and damage prevention	Support locate-ticket review, excavation-risk screening, evidence collection, and reporting	More focused reviews and stronger documentation
 Tier 1 – Knowledge & Information Access	Procedure and knowledge access	Search approved procedures, manuals, job aids, and operating experience	Faster access to the right information
	Administrative and customer support	Summarize regulatory material, sort correspondence, and help draft routine service responses	Less administrative work and more time for operations

Natural Gas AI Use Case Catalog

O&M	ENGINEERING	CONTROL ROOM	SAFETY	COMPLIANCE / CYBER
Predictive maintenance	Routing and constructability	Demand forecasting	Observation and near-miss analysis	Evidence classification
Leak and anomaly detection	Drawing and standard review	Alarm and event correlation	AI-assisted JHA and job briefing	Control testing support
Asset health and work prioritization	Material demand and lead-time risk	Compressor and flow optimization	Procedure and job-aid access	Patch and inventory analysis
Inspection narrative analysis	Closeout record quality	Emergency scenario support	Targeted refresher training	OT anomaly investigation

Gas and Pipeline AI Vendor Snapshot – August 2026

Vendor	Primary focus	Why it is relevant
<u>Urbint / Itron</u>	Damage prevention and field risk	Uses AI to prioritize excavation tickets, identify higher-risk work, reduce third-party damage, and support worker safety. It helps prevent conditions that can lead to gas leaks rather than detecting the leak itself.
<u>Irth</u>	Pipeline integrity and damage prevention	Combines inline inspection, corrosion, repair, geospatial, and operating data to support integrity decisions. It also provides 811 ticket management and damage-prevention tools for gas utilities.
<u>PipeSense</u>	Pipeline leak detection and pressure testing	Uses high-frequency pressure data and machine learning to detect and locate leaks, reduce false alarms, support hydrostatic testing, and identify pipeline obstructions.
<u>Picarro</u>	Distribution leak surveys and methane analytics	Uses mobile methane measurement and analytics to locate leaks, estimate emissions, improve survey coverage, and help utilities prioritize repair work.
<u>Atmos International</u>	Transmission pipeline monitoring	Provides computational pipeline monitoring enhanced by machine learning. Applications include leak detection, line-pack analysis, theft detection, and gas pipeline operating support.