

## Quarterly Report – Public Page

**Date of Report:** April 14, 2025

**Contract Number:** 693JK32310001POTA

**Prepared for:** DOT - Pipeline And Hazardous Materials Safety Administration

**Project Title:** A Comprehensive Study of Barriers for Underground Natural Gas Storage Wells

**Prepared by:** Pennsylvania State University

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**For quarterly period ending:** March 31, 2025

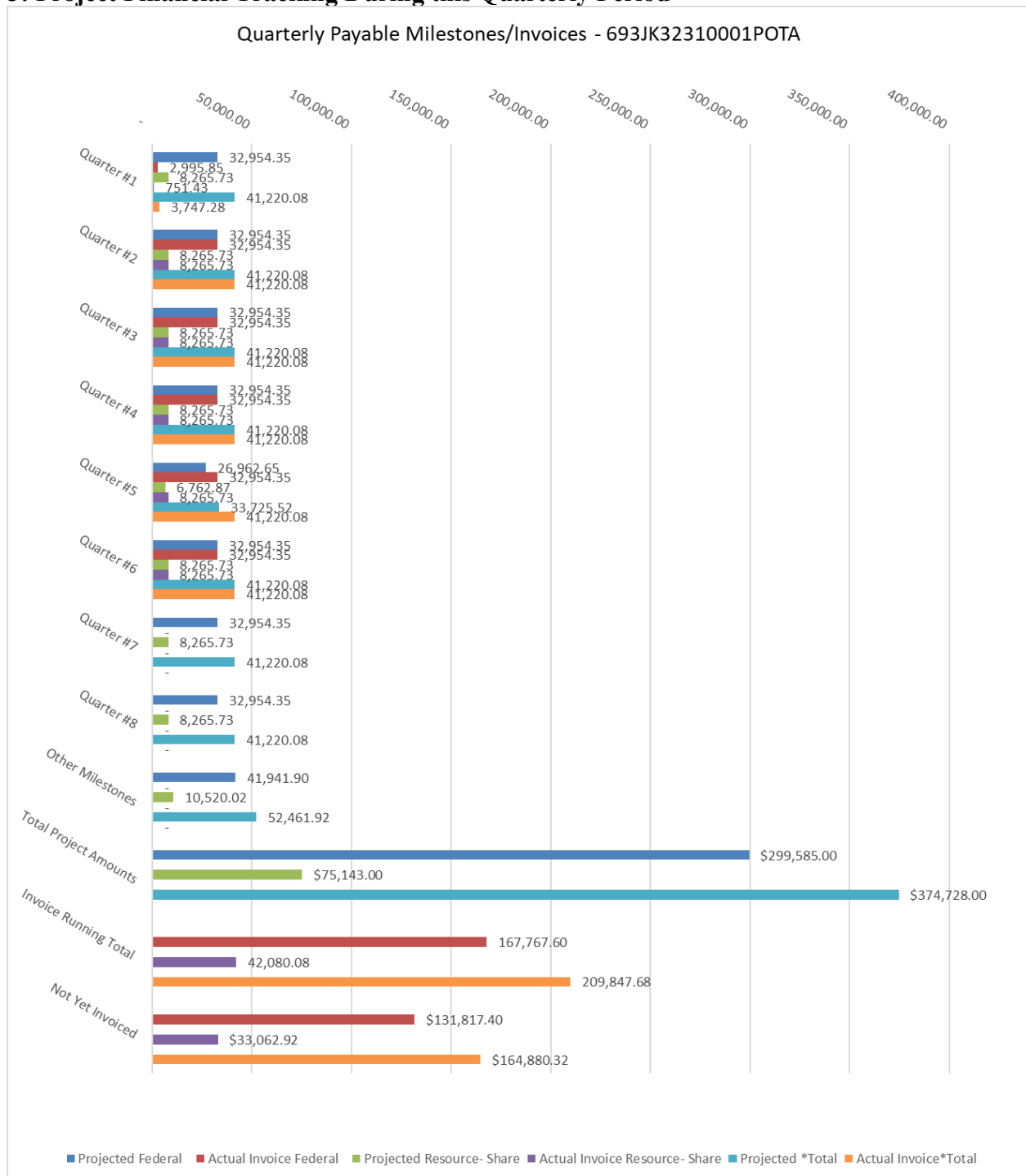
### 1: Items Completed During this Quarterly Period:

<i>Item #</i>	<i>Task #</i>	<i>Activity/Deliverable</i>	<i>Title</i>	<i>Federal Cost</i>	<i>Cost Share</i>
11	6	Integrating risk assessment and integrity management for proactive prevention	Roadmap for integrating risk assessment and integrity management practices for UNGS operations into one framework that would be further expanded in future with the development of new materials or new techniques	\$29,958.50	\$7,514.30
12	5	6th Quarterly Status Report	Submit 6th quarterly report	\$2,995.85	\$751.43

### 2: Items Not-Completed During this Quarterly Period:

<i>Item #</i>	<i>Task #</i>	<i>Activity/Deliverable</i>	<i>Title</i>	<i>Federal Cost</i>	<i>Cost Share</i>
13	7	Evaluation of norms and standards for well integrity	Set of clear, concise recommendations to be submitted to the appropriate standard development organizations (e.g., API, ISO, etc.) for incorporation into the relevant consensus guides, standards, and recommended practices manuals	\$29,958.50	\$7,514.30
14	5	7th Quarterly Status Report	Submit 7th quarterly report	\$ 2,995.85	\$ 751.43

### 3: Project Financial Tracking During this Quarterly Period



### 4: Project Technical Status –

Our project has successfully integrated Quantitative Risk Assessment (QRA) with well integrity management to provide a comprehensive solution for underground gas storage (UGS) well leakage prevention. The developed framework establishes a trigger-based surveillance system that quantifies risk through weighted parameters including annular pressure, DTS temperature

deviations, cement bond quality, and ultrasonic log anomalies. Our analysis revealed cement integrity as the critical factor in UGS well failures across both depleted reservoir and salt cavern configurations, with cement degradation often preceding mechanical component failures.

The comparative assessment of six representative well designs demonstrated how completion types significantly influence risk classification, with legacy wells exhibiting higher vulnerability despite similar anomalies. Modern wells with packer isolation demonstrated greater resilience against failure progression compared to legacy designs with open annuli. The framework incorporates real-time data feedback loops for dynamic risk reclassification and enables standardized decision-making through a color-coded risk matrix (Acceptable/ALARP/Unacceptable). This approach creates a scalable, auditable structure that bridges surveillance diagnostics with quantitative risk categorization while supporting regulatory compliance through transparent justification for remedial actions. The system's adaptability across well types and regulatory environments positions it as a valuable tool for standardizing integrity evaluation and guiding enforcement policy.

## **5: Project Schedule –**

In the past quarter of the project, everything is on track. The scheduled deliverable is going to be submitted to USDOT. The team is working to deliver the next item by the end of this quarter.