

Data Dictionary & Variable Construction Reference

Repo A: PA UST Combined Datasets

Analytical Engine

January 13, 2026

This document serves as the definitive technical reference for the raw datasets in Repo A (Facility/Tank Master Database). It characterizes the distributions of key variables—including tank status, substance types, and component attributes—and identifies specific data quality issues such as default installation dates. The frequency tables presented herein are intended to guide the “hotcoding” of binary variables and the treatment of missing data for downstream econometric analysis.

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1 Facility & Tank Characteristics

This section details the primary grouping variables derived from the harmonized Active (PADEP) and Inactive (SSRS) datasets.

1.1 Tank Status

[Description: Explanation of how Active vs. Inactive status is defined.]

Table 1

Table 2Tank Status Distribution

| STATUS_CODE | Tank_Status_Meaning | N | Pct |
|-------------|-----------------------------|-------|-------|
| W | Closed | 45557 | 44.8% |
| R | Removed | 24173 | 23.8% |
| C | Currently In Use | 20579 | 20.2% |
| E | Exempt From State Law | 7339 | 7.2% |
| UR | Unregulated Removed | 1641 | 1.6% |
| T | Temporarily Out of Use | 1269 | 1.2% |
| P | Permanently Closed in Place | 899 | 0.9% |
| TRANS | Transferred | 142 | 0.1% |
| DC | 2004 Data/Fee Cleanup | 80 | 0.1% |
| UC | Unsubstantiated Claim | 22 | 0.0% |

[Table Note: Verify if ‘Temporarily Out of Use’ tanks should be treated as active for auction eligibility.]

1.2 Substance Profile

[Description: Breakdown of fuel types stored in the tanks, mapped from raw substance codes to boolean flags.]

Table 3

Table 4Fuel Types

| Fuel | N |
|-----------------|-------|
| Gasoline | 51104 |
| Diesel | 20170 |
| Other_Substance | 30427 |

[Table Note: These counts are based on the mapping of raw substance codes (e.g., “GAS”, “DIESEL”) to consolidated categories.]

1.3 Installation Date Diagnostics

[Description: Assessment of data quality for DATE_INSTALLED.]

Table 5

Table 6Top 10 Most Frequent Installation Dates

| DATE_INSTALLED | N |
|----------------|-----|
| 1974-01-01 | 587 |
| 1981-12-01 | 580 |
| 1985-12-01 | 572 |
| 1979-12-01 | 565 |
| 1980-01-01 | 564 |
| 1980-12-01 | 541 |
| 1970-01-01 | 531 |
| 1987-12-01 | 529 |
| 1983-12-01 | 526 |
| 1978-12-01 | 515 |

[Table Note: The dates listed above are likely system defaults (e.g., 01/01/1900) and should be treated as missing values.]

1.3.1 KNN Date Imputation Diagnostics

[Description: Comparison of reported installation dates vs. KNN-imputed dates for records with suspect default values. KNN regression ($k=5$) uses capacity, substance type, and region as features.]

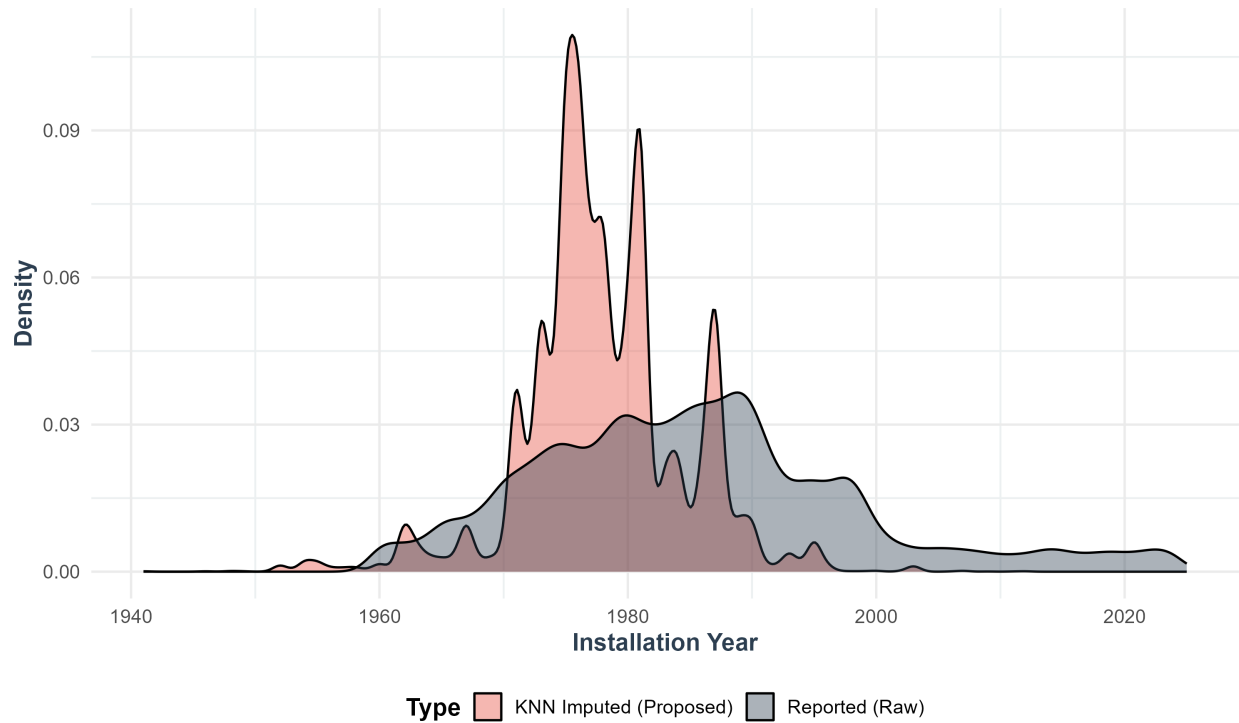


Figure 1: KNN Date Imputation Diagnostics: Reported vs. Imputed Installation Years

[Figure Note: Density comparison showing distributional plausibility of KNN-imputed dates relative to observed installation years. Imputed values should align with historical installation patterns.]

2 Component Universe

This section details the raw attributes available in the ‘Compounds’ table. These tables help map specific attributes to what the ‘hotcoded’ variables mean. We will also use these tables to determine and build the corseined human-derired characteristics variables.

2.1 Tank Specifics

2.1.1 Release Detection

Table 7

Table 8Component Universe: TANK RELEASE DETECTION METHOD

| COMPONENT_ATTRIBUTE_CODE | COMPONENT_TYPE | N |
|--------------------------|--|-------|
| 1299 | OTHER | 8 |
| 12A | MONTHLY INVENTORY CONTROL | 3611 |
| 12B | ANNUAL TANK TIGHTNESS TESTING | 2985 |
| 12C | TANK TIGHTNESS TESTING (EVERY 5 YEARS) | 535 |
| 12D | STATISTICAL INVENTORY RECONCILIATION | 4683 |
| 12E | AUTOMATIC TANK GAUGING | 17834 |
| 12F | MANUAL TANK GAUGING (36 HRS) | 407 |
| 12G | MANUAL TANK GAUGING (44 OR 58 HRS) | 383 |
| 12H | INTERSTITIAL MONITORING (2 WALLS) | 13753 |
| 12I | INTERSTITIAL MONITORING (LINER) | 9 |
| 12J | GROUNDWATER MONITORING | 79 |
| 12K | VAPOR MONITORING | 58 |
| 12L | GROOVES MADE IN THE IMPERMEABLE PAD | 2 |
| 12M | SLOTTED PIPE ABOVE THE IMPERMEABLE PAD | 4 |
| 12N | NONE | 2833 |
| 12O | EXEMPT | 953 |

Using Table 7 the table below is how we coarsen the release detection variables `release_detection_method`:

2.1.1.1 Release Detection - Coarsened mapping

Table 9:

| CODE | COMPONENT_TYPE | N | METHOD CATEGORY | REQ |
|------|--|-------|----------------------------|------|
| 12H | INTERSTITIAL MONITORING (2 WALLS) | 13753 | Secondary Containment (IM) | 40 C |
| 12I | INTERSTITIAL MONITORING (LINER) | 9 | Secondary Containment (IM) | 40 C |
| 12L | GROOVES MADE IN THE IMPERMEABLE PAD | 2 | Secondary Containment (IM) | 40 C |
| 12M | SLOTTED PIPE ABOVE THE IMPERMEABLE PAD | 4 | Secondary Containment (IM) | 40 C |
| 12E | AUTOMATIC TANK GAUGING | 17834 | Internal Monitoring (ATG) | 40 C |
| 12D | STATISTICAL INVENTORY RECONCILIATION | 4683 | Internal Monitoring (SIR) | 40 C |
| 12F | MANUAL TANK GAUGING (36 HRS) | 407 | Internal Monitoring (MTG)* | 40 C |
| 12G | MANUAL TANK GAUGING (44 OR 58 HRS) | 383 | Internal Monitoring (MTG)* | 40 C |
| 12A | MONTHLY INVENTORY CONTROL | 3611 | Inventory Control** | 40 C |
| 12B | ANNUAL TANK TIGHTNESS TESTING | 2985 | Tightness Testing** | 40 C |
| 12C | TANK TIGHTNESS TESTING (EVERY 5 YEARS) | 535 | Tightness Testing** | 40 C |
| 12J | GROUNDWATER MONITORING | 79 | External Monitoring | 40 C |
| 12K | VAPOR MONITORING | 58 | External Monitoring | 40 C |
| 1299 | OTHER | 8 | Other/Unclassified | 40 C |
| 12N | NONE | 2833 | Non-Compliant/Missing | Viol |
| 12O | EXEMPT | 953 | Exempt/Deferred | 40 C |

Notes on Classifications: * MTG (12F/12G): Only valid for tanks \leq 1,000 gallons (or up to 2,000 gallons un

Table 10: Regulatory Validity Mapping

| Cohort | Compliance_Status | Method_Codes | Method_Description |
|---------------------------------|-------------------|--------------------|---------------------------------------|
| 2016 Rule (New Installs) | VALID | 12H, 12I, 12L, 12M | Interstitial Monitoring (Secondary) |
| | INVALID | 12E, 12D, 12J, 12K | Internal/External Monitoring (Single) |
| | INVALID | 12A + 12B/12C | Inventory Control + Tightness Test |
| 1998 Rule (Legacy) | VALID | 12H, 12I | Interstitial Monitoring |
| | VALID | 12E | Automatic Tank Gauging (ATG) |
| | VALID | 12D | Statistical Inventory Reconciliation |
| | CONDITIONAL | 12J, 12K | Groundwater / Vapor Monitoring |
| | CONDITIONAL | 12F, 12G | Manual Tank Gauging (MTG) |
| | SUNSET/EXPIRED | 12A + 12B | Inventory Control + Annual TTT |
| | INVALID | 12A (Solo) | Inventory Control (Solo) |

2.1.2 Tank Construction

Table 11

Table 12 Component Universe: TANK CONSTRUCTION

| COMPONENT_ATTRIBUTE_CODE | COMPONENT_TYPE | N |
|--------------------------|---|------|
| 188 | OTHER (COMPLIANT) | 15 |
| 199 | OTHER | 69 |
| 1A | UNPROTECTED STEEL (SINGLE WALL) | 5368 |
| 1B | CATHODICALLY PROTECTED STEEL (GALVANIC) | 7094 |
| 1C | CATHODICALLY PROTECTED STEEL (IMPRESSED CURRENT) | 2284 |
| 1D | UNPROTECTED STEEL (DOUBLE WALL) | 75 |
| 1E | FIBERGLASS (SINGLE WALL) | 8647 |
| 1F | FIBERGLASS (DOUBLE WALL) | 8272 |
| 1G | STEEL W/PLASTIC OR FIBERGLASS JACKET (DOUBLE WALL) | 5378 |
| 1H | STEEL W/FRP COATING (ACT 100 OR EQUIVALENT) (SINGLE WALL) | 961 |
| 1I | STEEL W/LINED INTERIOR | 750 |
| 1J | CONCRETE | 31 |
| 1K | BOTTOM MODIFICATION | 1 |
| 1N | UNKNOWN | 194 |
| 1O | CATHODICALLY PROTECTED DOUBLE WALL STEEL (GALVANIC) | 3100 |
| 1P | CATHODICALLY PROTECTED STEEL WITH LINER | 572 |
| 1V | STEEL W/PLASTIC OR FRP JACKET W/ ANODES (DOUBLE WALL) | 445 |
| 1W | STEEL W/FRP COATING W/ ANODES (SINGLE WALL) | 15 |

2.1.2.1 Tank Construction - Coarsened mapping

Using Table 11 the table below is how we coarsen the construction variables `construction_type`:

Table 13: Component Universe: TANK CONSTRUCTION (CLASSIFIED)

| CODE | COMPONENT_TYPE | N | Construction |
|------|---|------|-----------------------|
| 1D | UNPROTECTED STEEL (DOUBLE WALL) | 75 | Secondary Containment |
| 1F | FIBERGLASS (DOUBLE WALL) | 8272 | Secondary Containment |
| 1G | STEEL W/PLASTIC OR FIBERGLASS JACKET (DOUBLE WALL) | 5378 | Secondary Containment |
| 1O | CATHODICALLY PROTECTED DOUBLE WALL STEEL (GALVANIC) | 3100 | Secondary Containment |
| 1V | STEEL W/PLASTIC OR FRP JACKET W/ ANODES (DOUBLE WALL) | 445 | Secondary Containment |
| 1A | UNPROTECTED STEEL (SINGLE WALL) | 5368 | Single Wall (Leakage) |
| 1B | CATHODICALLY PROTECTED STEEL (GALVANIC) | 7094 | Single Wall (Leakage) |
| 1C | CATHODICALLY PROTECTED STEEL (IMPRESSED CURRENT) | 2284 | Single Wall (Leakage) |
| 1E | FIBERGLASS (SINGLE WALL) | 8647 | Single Wall (Leakage) |
| 1H | STEEL W/FRP COATING (ACT 100 OR EQUIV) (SINGLE WALL) | 961 | Single Wall (Leakage) |
| 1I | STEEL W/LINED INTERIOR | 750 | Single Wall (Leakage) |
| 1J | CONCRETE | 31 | Single Wall (Leakage) |
| 1P | CATHODICALLY PROTECTED STEEL WITH LINER | 572 | Single Wall (Leakage) |
| 1W | STEEL W/FRP COATING W/ ANODES (SINGLE WALL) | 15 | Single Wall (Leakage) |
| 188 | OTHER (COMPLIANT) | 15 | Unknown/Other |
| 199 | OTHER | 69 | Unknown/Other |
| 1K | BOTTOM MODIFICATION | 1 | Unknown/Other |
| 1N | UNKNOWN | 194 | Unknown/Other |

Note:

Codes 1I and 1P (Lined Interior) generally indicate internal lining repairs (280.21(b)(1)), not secondary containment.

2.2 Piping Infrastructure

2.2.1 Underground Piping Construction

Table 14

Table 15 Component Universe: UG PIPING CONSTRUCTION

| COMPONENT_ATTRIBUTE_CODE | COMPONENT_TYPE | N |
|--------------------------|----------------------------------|------|
| 288 | OTHER (COMPLIANT) | 31 |
| 299 | OTHER | 39 |
| 2A | BARE STEEL | 5870 |
| 2B | CATHODICALLY PROTECTED, METALLIC | 2137 |
| 2C | COPPER | 213 |
| 2D | FIBERGLASS | 6331 |
| 2E | FLEXIBLE NON-METALLIC | 488 |
| 2F | UNKNOWN | 218 |
| 2G | NONE | 793 |
| 2H | MODIFICATION OF PIPING | 15 |
| 2I | Double wall, metallic primary | 490 |
| 2J | Double wall, rigid (FRP) primary | 1623 |
| 2K | Double wall, flexible primary | 2756 |
| 2L | TRENCH LINER | 16 |
| 2M | JACKETED | 15 |

[Table Note: Key variable for leak risk (e.g., Single Wall vs Double Wall, Galvanized vs Fiber-glass).]

2.2.1.1 Piping - Coarsend Mapping

| COARSENEDED_CATEGORY | CODE | COMPONENT_TYPE | N | REGULATORY_STATUS |
|--|------|----------------------------------|------|--------------------------|
| SECONDARY CONTAINMENT (Required for Post-2016 Installs) | 2I | Double wall, metallic primary | 490 | Valid for All Cohorts (F |
| | 2J | Double wall, rigid (FRP) primary | 1623 | Valid for All Cohorts (F |
| | 2K | Double wall, flexible primary | 2756 | Valid for All Cohorts (F |
| | 2L | TRENCH LINER | 16 | Valid (Functional Secon |
| | 2M | JACKETED | 15 | Valid for All Cohorts (F |
| SINGLE WALL | 2A | BARE STEEL | 5870 | Legacy Only (High Risk |
| | 2B | CP METALLIC | 2137 | Legacy Only (Req 3-yr |
| | 2C | COPPER | 213 | Legacy Only (Rare/Gen |
| | 2D | FIBERGLASS | 6331 | Legacy Only (Standard |

(Legacy Only - Pre-2016)

| | | | | |
|-----------------|-----|------------------------|-----|--------------------------|
| OTHER / UNKNOWN | 2E | FLEXIBLE NON-METALLIC | 488 | Legacy Only (Standard |
| | 288 | OTHER (COMPLIANT) | 31 | Unclassified - Likely Sp |
| | 299 | OTHER | 39 | Unclassified |
| | 2F | UNKNOWN | 218 | Data Gap |
| | 2G | NONE | 793 | No Piping / Direct Fill |
| | 2H | MODIFICATION OF PIPING | 15 | Maintenance Record (N |

¹ Post-2016 Rule: Installs after April 11, 2016 must use Secondary Containment with Interstitial Monitoring (IM)

2.2.2 Underground Piping: Single Inner Wall

Table 17

Table 18 Component Universe: UG SINGLE / INNER WALL PIPING

| COMPONENT_ATTRIBUTE_CODE | COMPONENT_TYPE | N |
|--------------------------|----------------------|-------|
| 2899 | OTHER | 34 |
| 28A | BARE STEEL | 465 |
| 28B | CP PROTECTED | 712 |
| 28C | COPPER | 167 |
| 28D | FRP | 8859 |
| 28E | FLEX | 12507 |
| 28F | UNKNOWN | 10 |
| 28G | NO DISPENSING PIPING | 373 |
| 28I | STAINLESS STEEL | 47 |

[Table Note: [Placeholder: Description of single inner wall piping characteristics.]]

2.2.2.1 Underground Piping: Single Inner Wall Coarsened

| COARSENEDED_CATEGORY | CODE | COMPONENT_TYPE | N | REGULATORY_STATUS |
|----------------------------------|------|----------------------|-------|-----------------------------|
| NON-CORRODIBLE | 28E | FLEX | 12507 | Modern Standard (Inherent) |
| (Modern Standard - No CP Needed) | 28D | FRP | 8859 | Modern Standard (Inherent) |
| METALLIC / CORRODIBLE | 28A | BARE STEEL | 465 | High Risk (Requires CP) |
| (Legacy - Maintenance Required) | 28B | CP PROTECTED | 712 | High Risk (Requires 3-Year) |
| | 28C | COPPER | 167 | Legacy (Often generator/ |
| | 28I | STAINLESS STEEL | 47 | Low Risk (Corrosion Res) |
| OTHER / EXEMPT | 28G | NO DISPENSING PIPING | 373 | Exempt (Suction/Gravity) |
| | 2889 | OTHER | 34 | Unclassified |
| | 28F | UNKNOWN | 10 | Data Gap |

¹ Non-Corrodible: Fiberglass (FRP) and Flexible piping (Flex) do not rust and require no cathodic protection

Component Definition: This variable describes the material composition of the **primary** product-carrying pipe (the inner wall), which determines the system's susceptibility to corrosion and whether Cathodic Protection (CP) maintenance is legally required.

2.2.3 Underground Piping: Outer Wall

Table 20

Table 21Component Universe: UG OUTER WALL PIPING

| COMPONENT_ATTRIBUTE_CODE | COMPONENT_TYPE | N |
|--------------------------|-------------------------------------|-------|
| 2999 | OTHER, OUTER | 263 |
| 29A | BARE STEEL, OUTER | 204 |
| 29B | CP PROTECTED, OUTER | 51 |
| 29D | FRP, OUTER | 3985 |
| 29E | FLEX, OUTER | 12227 |
| 29F | UNKNOWN, OUTER | 14 |
| 29I | POLY-ENCASED STAINLESS STEEL, OUTER | 19 |
| 29N | NONE | 6295 |

[Table Note: [Placeholder: Description of outer wall piping characteristics.]]

Table 22: Component Universe: Secondary Containment (Outer Wall) Material

| COARSENEDED_CATEGORIES | COMPONENT_TYPE | N | REGULATORY_STATUS |
|------------------------------|---|-------|--|
| MODERN SECONDARY CONTAINMENT | 29E FLEX, OUTER | 12227 | Standard Compliant (Non-Corrodible) |
| MODERN SECONDARY CONTAINMENT | 29D FRP, OUTER | 3985 | Standard Compliant (Non-Corrodible) |
| MODERN SECONDARY CONTAINMENT | 29I POLY-ENCASED STAINLESS STEEL, OUTER | 19 | Compliant (Specialized) |
| MODERN SECONDARY CONTAINMENT | 2999 OTHER, OUTER | 263 | Likely Compliant (Non-Standard Material) |
| NO SECONDARY CONTAINMENT | 29N NONE | 6295 | Single Wall System (Legacy Only) |
| METALLIC SECONDARY | 29A BARE STEEL, OUTER | 204 | High Risk (Outer Wall Requires CP) |
| METALLIC SECONDARY | 29B CP PROTECTED, OUTER | 51 | High Risk (Requires 3-Year Testing) |
| UNKNOWN / DATA GAP | 29F UNKNOWN, OUTER | 14 | Data Gap |

¹ None (29N): Indicates Single Wall system (Legacy). ² Metallic Outer: Requires separate cathodic protection.

Component Definition: This variable identifies the material of the secondary containment layer (the outer tube in a double-walled system) which serves to capture leaks from the primary pipe and create the interstitial space necessary for leak detection monitoring.

2.2.4 Aboveground Piping: Corrosion Protection

Table 23

Table 24Component Universe: AG PIPING CONSTRUCTION & CORROSION PROTECTION

| COMPONENT_ATTRIBUTE_CODE | COMPONENT_TYPE | N |
|--------------------------|----------------------------------|-----|
| 388 | OTHER (COMPLIANT) | 156 |
| 399 | OTHER | 21 |
| 3A | CARBON STEEL | 615 |
| 3B | CATHODICALLY PROTECTED, METALLIC | 72 |
| 3C | COPPER | 30 |
| 3D | FIBERGLASS | 40 |
| 3E | FLEXIBLE NON-METALLIC | 29 |
| 3F | PVC | 10 |
| 3G | NONE | 448 |
| 3H | PIPING MODIFICATION | 5 |
| 3I | DOUBLE WALL METALLIC PRIMARY | 19 |
| 3J | DOUBLE WALL RIGID (FRP) PRIMARY | 11 |
| 3K | DOUBLE WALL FLEXIBLE PRIMARY | 8 |
| 3L | STAINLESS STEEL | 9 |

[Table Note: [Placeholder: Description of aboveground piping corrosion protection methods.]]

2.2.5 Piping Release Detection

Table 25

Table 26Component Universe: PIPE RELEASE DETECTION METHOD

| COMPONENT_ATTRIBUTE_CODE | COMPONENT_TYPE | N |
|--------------------------|---|-------|
| 5A | AUTOMATIC LINE LEAK DETECTOR | 15109 |
| 5B | ANNUAL LINE TIGHTNESS TESTING (PRESSURE) | 12413 |
| 5C | LINE TIGHTNESS TEST - 3 YEARS (SUCTION) | 1646 |
| 5D | INTERSTITIAL MONITORING | 10888 |
| 5E | GROUNDWATER MONITORING | 63 |
| 5F | VAPOR MONITORING | 33 |
| 5G | VISUAL INSPECTION | 62 |
| 5H | NONE | 2796 |
| 5I | EXEMPT | 11903 |
| 5J | STATISTICAL INVENTORY RECONCILIATION | 2558 |
| 5K | ELECTRONIC LINE LEAK DETECTOR | 4762 |
| 5L | INTERSTITIAL MONITORING W/CONTINUOUS ALARM/SHUT OFF | 7686 |

[Table Note: [Placeholder: Description of piping release detection methods.]]

2.2.6 Line Leak Detectors

Table 27

Table 28Component Universe: LINE LEAK DETECTOR SHUTS OFF PUMP

| COMPONENT_ATTRIBUTE_CODE | COMPONENT_TYPE | N |
|--------------------------|----------------|-------|
| 23N | NO | 17043 |
| 23Y | YES | 10425 |

[Table Note: [Placeholder: Description of line leak detector functionality.]]

2.2.7 Secondary Containment

Table 29

Table 30Component Universe: UST TOTAL SECONDARILY CONTAINED

| COMPONENT_ATTRIBUTE_CODE | COMPONENT_TYPE | N |
|--------------------------|----------------|-------|
| 18N | NO | 20287 |
| 18Y | YES | 12244 |

[Table Note: [Placeholder: Description of secondary containment systems.]]

3 Regulatory & Compliance

3.1 Certificates & Permits

Table 31

Table 32 Component Universe: REGISTRATION CERTIFICATE

| COMPONENT_ATTRIBUTE_CODE | COMPONENT_TYPE | N |
|--------------------------|----------------|-------|
| 8N | NO | 1397 |
| 8Y | YES | 11677 |

[Table Note: [Placeholder: Description of registration certificate requirements.]]

Table 33

Table 34 Component Universe: FIRE MARSHAL PERMIT

| COMPONENT_ATTRIBUTE_CODE | COMPONENT_TYPE | N |
|--------------------------|-------------------------------------|------|
| 9A | ISSUED PRIOR TO AUGUST 5, 1989 | 3316 |
| 9B | ISSUED ON OR AFTER AUGUST 5, 1989 | 1288 |
| 9C | NO PERMIT OBTAINED | 3709 |
| 9D | TANKS NOT REGULATED BY FIRE MARSHAL | 268 |

[Table Note: [Placeholder: Description of fire marshal permit requirements.]]

3.2 Prevention Systems (Spill & Overfill)

Table 35

Table 36Component Universe: SPILL PREVENTION

| COMPONENT_ATTRIBUTE_CODE | COMPONENT_TYPE | N |
|--------------------------|------------------------|-------|
| 6D | DOUBLE WALL SPILL PREV | 2564 |
| 6E | EXEMPT | 512 |
| 6N | NO | 5543 |
| 6S | SINGLE WALL SPILL PREV | 4680 |
| 6Y | YES | 29689 |

[Table Note: [Placeholder: Description of spill prevention systems.]]

Table 37

Table 38Component Universe: OVERFILL PREVENTION

| COMPONENT_ATTRIBUTE_CODE | COMPONENT_TYPE | N |
|--------------------------|--------------------------|-------|
| 7A | OVERFILL ALARM | 9490 |
| 7B | BALL FLOAT VALVE | 2598 |
| 7E | EXEMPT | 885 |
| 7N | NO | 6183 |
| 7S | DROP TUBE SHUTOFF DEVICE | 24814 |
| 7Y | YES | 3550 |

[Table Note: Presence of these systems often correlates with lower premiums.]

3.3 Vapor Recovery Systems

Table 39

Table 40Component Universe: VAPOR RECOVERY

| COMPONENT_ATTRIBUTE_CODE | COMPONENT_TYPE | N |
|--------------------------|--------------------------------|------|
| 11A | STAGE I INSTALLED | 3693 |
| 11B | STAGE II INSTALLED | 89 |
| 11C | STAGE I AND STAGE II INSTALLED | 774 |
| 11D | NONE | 4494 |

[Table Note: [Placeholder: Description of vapor recovery systems.]]

Table 41

Table 42Component Universe: STAGE I VAPOR RECOVERY

| COMPONENT_ATTRIBUTE_CODE | COMPONENT_TYPE | N |
|--------------------------|-------------------------------|-------|
| 19A | COAX | 8099 |
| 19B | 2 POINT | 13101 |
| 19N | NONE OR INCOMPLETE | 12382 |
| 2I | Double wall, metallic primary | 1 |

[Table Note: [Placeholder: Description of Stage I vapor recovery.]]

Table 43

Table 44Component Universe: STAGE II VAPOR RECOVERY

| COMPONENT_ATTRIBUTE_CODE | COMPONENT_TYPE | N |
|--------------------------|-------------------------|-------|
| 20A | COMPLETE BALANCE SYSTEM | 623 |
| 20B | COMPLETE ASSIST SYSTEM | 2256 |
| 20C | UG PIPING ONLY | 6248 |
| 20D | DECOMMISSIONED | 2359 |
| 20N | NONE | 21258 |

[Table Note: Stage II recovery is largely phased out; check if this indicates older infrastructure.]

3.4 Containment & Sumps

Table 45

Table 46Component Universe: TANK-TOP CONTAINMENT SUMPS

| COMPONENT_ATTRIBUTE_CODE | COMPONENT_TYPE | N |
|--------------------------|----------------------|-------|
| 21A | AT ALL PENETRATIONS | 18857 |
| 21N | NONE | 7554 |
| 21S | AT SOME PENETRATIONS | 1127 |

[Table Note: [Placeholder: Description of tank top containment sumps.]]

Table 47

Table 48Component Universe: UNDER-DISPENSER CONTAINMENT

| COMPONENT_ATTRIBUTE_CODE | COMPONENT_TYPE | N |
|--------------------------|--------------------|-------|
| 22A | AT ALL DISPENSERS | 18566 |
| 22N | NONE | 8667 |
| 22S | AT SOME DISPENSERS | 253 |

[Table Note: ‘UDC’ (Under Dispenser Containment) is a critical modern safety feature.]

4 Miscellaneous Components

4.1 Flexible Connectors

Table 49

Table 50Component Universe: Piping Flexible Connectors

| COMPONENT_ATTRIBUTE_CODE | COMPONENT_TYPE | N |
|--------------------------|---|------|
| 88 | Other (Compliant) | 225 |
| 99 | Other (Noncompliant) | 4 |
| PFLXA | Unprotected Metallic Components (incl wrapped or coated) | 478 |
| PFLXB | Cathodically Protected, Metallic | 2465 |
| PFLXC | Flexible Coupling w/ Protected Metallic Ends | 53 |
| PFLXD | Completely Inside Containment Sump, Secondary Pipe or Liner | 4816 |
| PFLXE | Completely Jacketed w/ Sealed Boot | 1596 |
| PFLXF | Not in Contact w/ Ground | 976 |
| PFLXX | None | 197 |
| UNK | Unknown | 336 |

[Table Note: [Placeholder: Description of flexible connector types.]]

Table 51

Table 52Component Universe: FLEX - TANK END

| COMPONENT_ATTRIBUTE_CODE | COMPONENT_TYPE | N |
|--------------------------|---|-------|
| 2699 | OTHER | 343 |
| 26A | UNPROTECTED METALLIC COMPONENTS (INCL WRAPPED OR COATED) | 51 |
| 26B | CATHODICALLY PROTECTED, METALLIC | 1676 |
| 26F | UNKNOWN | 338 |
| 26I | COMPLETELY INSIDE CONTAINMENT SUMP, SECONDARY PIPE OR LINER | 17133 |
| 26M | COMPLETELY JACKETED W/ SEALED BOOT | 876 |
| 26N | NOT IN CONTACT W/ GROUND | 1355 |
| 26X | NONE | 476 |

[Table Note: [Placeholder: Description of flexible connectors at tank end.]]

Table 53

Table 54Component Universe: FLEX - DISPENSER END

| COMPONENT_ATTRIBUTE_CODE | COMPONENT_TYPE | N |
|--------------------------|---|-------|
| 2799 | OTHER | 190 |
| 27A | UNPROTECTED METALLIC COMPONENTS (INCL WRAPPED OR COATED) | 27 |
| 27B | CATHODICALLY PROTECTED, METALLIC | 1788 |
| 27F | UNKNOWN | 34 |
| 27I | COMPLETELY INSIDE CONTAINMENT SUMP, SECONDARY PIPE OR LINER | 16280 |
| 27M | COMPLETELY JACKETED W/ SEALED BOOT | 1926 |
| 27N | NOT IN CONTACT W/ GROUND | 1344 |
| 27X | NONE | 763 |

[Table Note: [Placeholder: Description of flexible connectors at dispenser end.]]

4.2 Other Hardware

Table 55

Table 56Component Universe: PUMP/DELIVERY SYSTEM

| COMPONENT_ATTRIBUTE_CODE | COMPONENT_TYPE | N |
|--------------------------|------------------------------|-------|
| 4A | SUCTION: CHECK VALVE AT PUMP | 11641 |
| 4B | SUCTION: CHECK VALVE AT TANK | 3899 |
| 4C | PRESSURE | 25845 |
| 4D | GRAVITY FED | 201 |
| 4E | NONE | 1110 |

[Table Note: [Placeholder: Description of pump delivery system types.]]

Table 57

Table 58Component Universe: EMERGENCY GENERATOR

| COMPONENT_ATTRIBUTE_CODE | COMPONENT_TYPE | N |
|--------------------------|----------------|-------|
| 25N | NO - EMER GEN | 21543 |
| 25Y | YES - EMER GEN | 678 |

[Table Note: [Placeholder: Description of emergency generator installations.]]

4.3 Unclassified / Other

Table 59

Table 60Component Universe: NA

| COMPONENT_ATTRIBUTE_CODE | COMPONENT_TYPE | N |
|--------------------------|----------------|---|
|--------------------------|----------------|---|

[Table Note: [Placeholder: Description of unclassified or N/A component entries.]]

Table 61

Table 62Component Universe: TANK UPGRADE

| COMPONENT_ATTRIBUTE_CODE | COMPONENT_TYPE | N |
|--------------------------|---|------|
| 10A | TANK WAS RETROFITTED WITH CATHODIC PROTECTION | 1689 |
| 10B | TANK WAS RETROFITTED WITH LINING | 859 |
| 10C | TANK WAS RETROFITTED WITH RIGID BLADDER (EX. PHOENIX SYS) | 4 |

[Table Note: [Placeholder: Description of tank upgrade activities.]]

5 Owner & Business Intelligence

This section characterizes facility ownership structure, business model classification, and market segmentation derived from the harmonized facility linkage table.

5.1 Business Model Distribution

[Description: Classification of facilities by business category based on owner sector and facility count logic.]

Table 63

Table 64 Facility Counts by Business Category

| business_category | N |
|---|-------|
| Unknown/Unclassified | 58226 |
| Private Firm - Non-motor fuel seller | 10646 |
| Retail Gas (Branded Commercial) | 10223 |
| Retail Gas - Single Proprietor | 9258 |
| Retail Gas - Multi-property Not Branded | 6746 |
| Non-Retail: Fleet Fuel Facility | 3341 |
| Publicly Owned | 3261 |

[Table Note: Business categories derived from owner name pattern matching and facility count thresholds. “Publicly Owned” includes government and municipal entities; “Retail Gas (Branded Commercial)” includes major chains.]

5.2 Owner Fleet Size Distribution

[Description: Distribution of facilities and tanks across owner size classes.]

Table 65

Table 66Distribution by Owner Fleet Size

| Owner_Size_Class | Facilities | Tanks | Pct_Tanks |
|-------------------------------|------------|-------|-----------|
| Unknown/Unlinked | 22863 | 58226 | 57.3% |
| Single-Site Owner (Mom & Pop) | 3799 | 18631 | 18.3% |
| Large Fleet/Corporate (50+) | 2049 | 10746 | 10.6% |
| Small Fleet (2-9) | 1510 | 7913 | 7.8% |
| Medium Fleet (10-49) | 1114 | 6185 | 6.1% |

[Table Note: Owner size classification based on facility count per owner: Single-Site (1), Small Fleet (2-9), Medium Fleet (10-49), Large Fleet/Corporate (50+).]

5.3 Owner Sector Breakdown

[Description: Top 25 owner sectors by tank count, derived from owner name pattern classification.]

Table 67

Table 68Top 25 Owner Sectors by Tank Count

| final_owner_sector | Facilities | Tanks |
|--------------------------------|------------|-------|
| Unknown | 22863 | 58226 |
| Private Commercial/Other | 3098 | 16004 |
| Real Estate/Property Mgmt | 1703 | 9437 |
| Major Chain (Sheetz) | 313 | 2126 |
| Major Chain (7-Eleven) | 182 | 1377 |
| Local Govt/Muni | 395 | 1324 |
| State Govt/Agency | 189 | 1011 |
| Major Chain (Sunoco) | 153 | 969 |
| Utility/Energy | 179 | 869 |
| Major Chain (Wawa) | 184 | 843 |
| Major Chain (Speedway) | 90 | 838 |
| Major Chain (Turkey Hill/EG) | 215 | 831 |
| Education/School | 168 | 809 |
| Trucking/Logistics | 171 | 806 |
| Major Chain (United Refining) | 140 | 802 |
| Major Chain (GetGo/Giant) | 199 | 695 |
| Auto Dealership/Repair | 128 | 694 |
| Construction/Development | 140 | 630 |
| Major Chain (Rutters) | 81 | 518 |
| Major Chain (Other Fuel Brand) | 81 | 467 |
| Recreation/Hospitality | 89 | 360 |
| Agriculture | 89 | 360 |
| Utility/Telecom | 166 | 342 |
| Healthcare | 58 | 262 |
| Major Chain (Country Fair) | 53 | 230 |

[Table Note: Sector classification uses regex pattern matching on owner names to identify major chains, government entities, utilities, and commercial sectors.]

5.4 Facility Operational Status

[Description: Aggregate facility-level operational status based on tank closure patterns.]

Table 69

Table 70 Facility Operational Status

| facility__status | N | Pct |
|------------------|-------|-------|
| Fully Closed | 24428 | 78.0% |
| Mixed Status | 4057 | 12.9% |
| Fully Active | 2850 | 9.1% |

[Table Note: “Fully Active” = all tanks in use; “Fully Closed” = all tanks closed; “Mixed Status” = some active/some closed.]

5.5 Owner Size vs Business Model Cross-Tabulation

[Description: Cross-tabulation of owner fleet size against business category to identify structural patterns.]

Table 71

Table 72Facility Counts: Owner Size vs Business Model

| Owner Size Class | Non-Retail: Fleet Fuel Facility | Private Firm - Non-motor fuel seller | Publicly Owned | Retail Gas (Branded Commercial) | Retail Gas - Multi-property Not Branded | Retail Gas - Single Proprietor | Unknown/Unclassified |
|-------------------------------|---------------------------------|--------------------------------------|----------------|---------------------------------|---|--------------------------------|----------------------|
| Large Fleet/Corporate (50+) | 156 | 3 | 151 | 1667 | 72 | 0 | 0 |
| Medium Fleet (10-49) | 151 | 403 | 68 | 84 | 408 | 0 | 0 |
| Single-Site Owner (Mom & Pop) | 303 | 1166 | 429 | 41 | 0 | 1860 | 0 |
| Small Fleet (2-9) | 174 | 412 | 151 | 15 | 758 | 0 | 0 |
| Unknown/Unlinked | 0 | 0 | 0 | 0 | 0 | 0 | 22863 |

[Table Note: Cell values represent unique facility counts. Useful for identifying which business models are dominated by small vs. large operators.]

5.6 Closure Rates by Business Category

[Description: Tank closure rates stratified by business category to identify differential attrition patterns.]

Table 73

Table 74 Tank Closure Rates by Business Category

| business_category | Total_Tanks | Closed_Tanks | Active_Tanks | Closure_Rate |
|---|-------------|--------------|--------------|--------------|
| Unknown/Unclassified | 58226 | 58226 | 0 | 100.0% |
| Private Firm - Non-motor fuel seller | 10646 | 5152 | 5494 | 48.4% |
| Retail Gas (Branded Commercial) | 10223 | 3372 | 6851 | 33.0% |
| Retail Gas - Single Proprietor | 9258 | 5155 | 4103 | 55.7% |
| Retail Gas - Multi-property Not Branded | 6746 | 3573 | 3173 | 53.0% |
| Non-Retail: Fleet Fuel Facility | 3341 | 2127 | 1214 | 63.7% |
| Publicly Owned | 3261 | 2248 | 1013 | 68.9% |

[Table Note: Higher closure rates may indicate market exit, consolidation, or infrastructure modernization patterns specific to certain business types.]

6 Temporal Evolution & Trends

This section presents visualizations of how tank characteristics, fuel types, and facility attributes have evolved over time. These temporal patterns inform understanding of regulatory compliance trends and infrastructure modernization.

6.1 Capacity Distribution

[Description: Overall distribution of tank capacities across the fleet.]

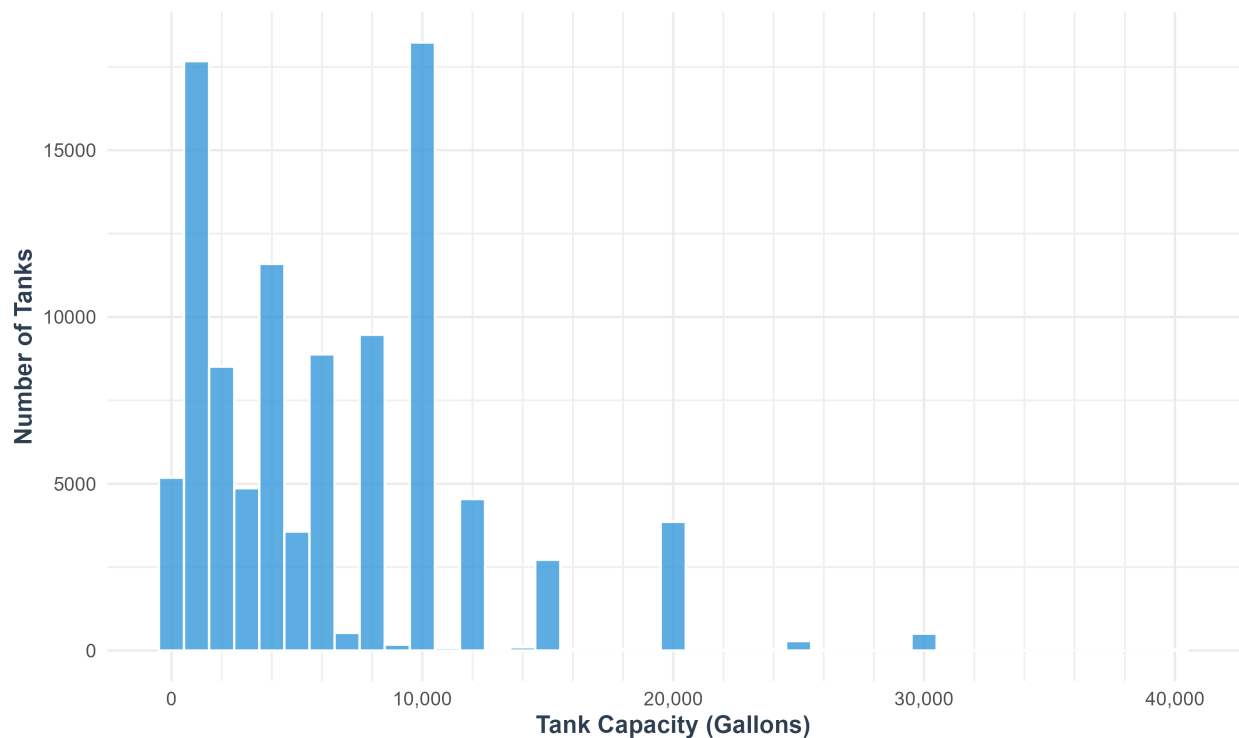


Figure 2: Distribution of Tank Capacities (Gallons)

[Figure Note: Modal peaks at standard capacities (e.g., 10,000, 12,000, 15,000 gallons) indicate industry standardization. Long right tail represents commercial/industrial facilities.]

6.2 Capacity Evolution by Decade

[Description: Distribution of tank capacities across installation decades, showing trends in tank sizing over time.]

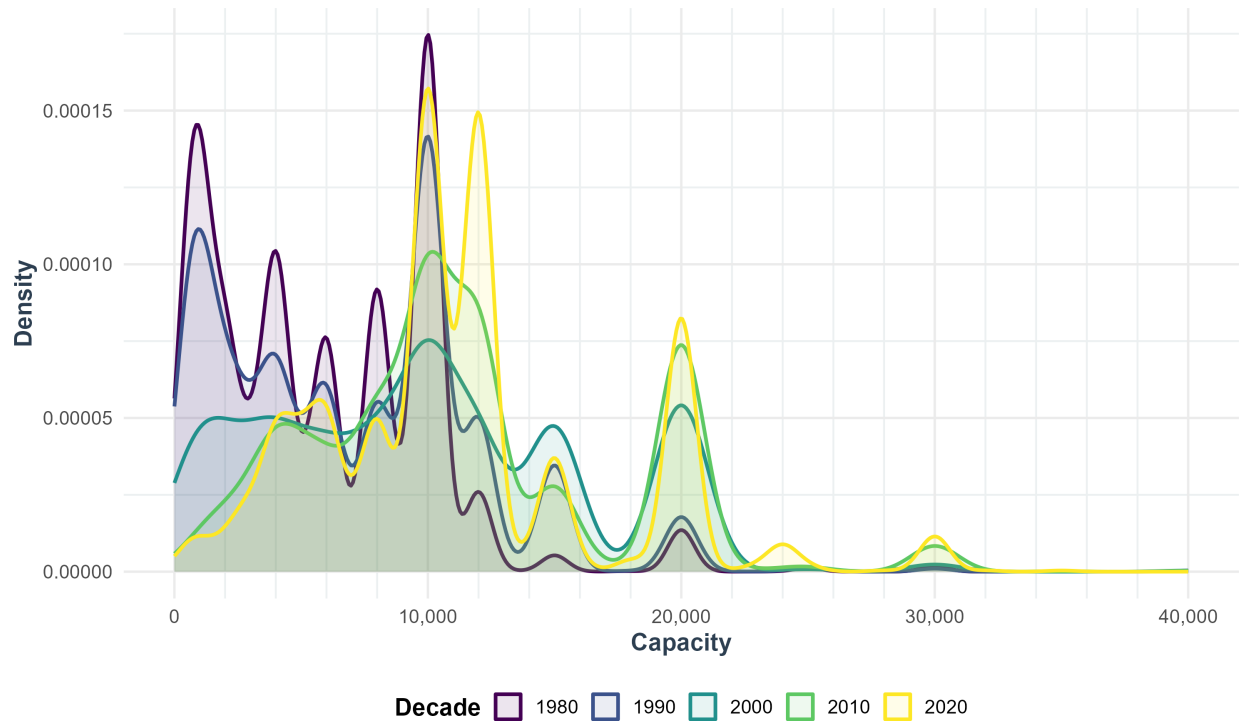


Figure 3: Evolution of Tank Capacity Distribution by Installation Decade

[Figure Note: [Placeholder: Interpretation of capacity trends—have tanks gotten larger over time? Implications for replacement costs and risk assessment.]]

6.3 Fuel Mix Evolution

[Description: Temporal shift in the proportion of gasoline, diesel, and other fuel types in new tank installations.]

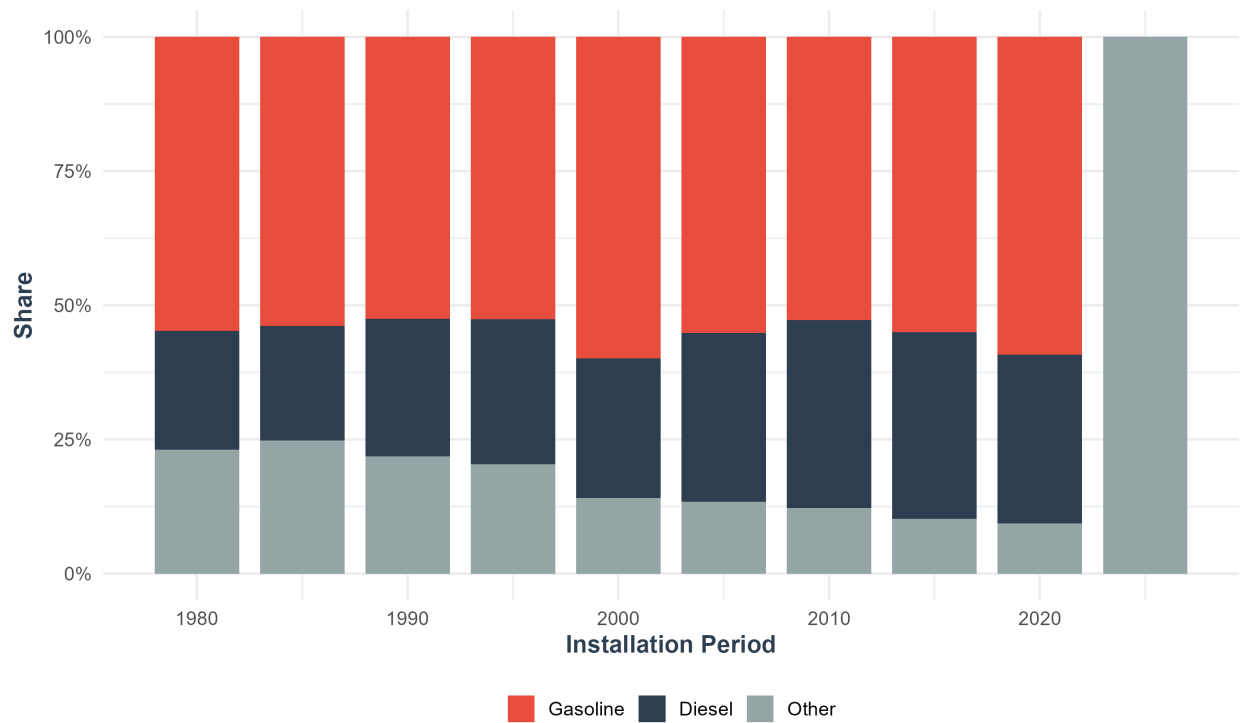


Figure 4: Evolution of Fuel Type Mix in New Installations (5-Year Periods)

[Figure Note: [Placeholder: Analysis of fuel mix shifts—decline in gasoline share? Growth in diesel? Implications for risk profiles and insurance premiums.]]

6.4 Tank Lifespan Distribution

[Description: Distribution of tank ages at closure, showing typical service life and identifying outliers.]

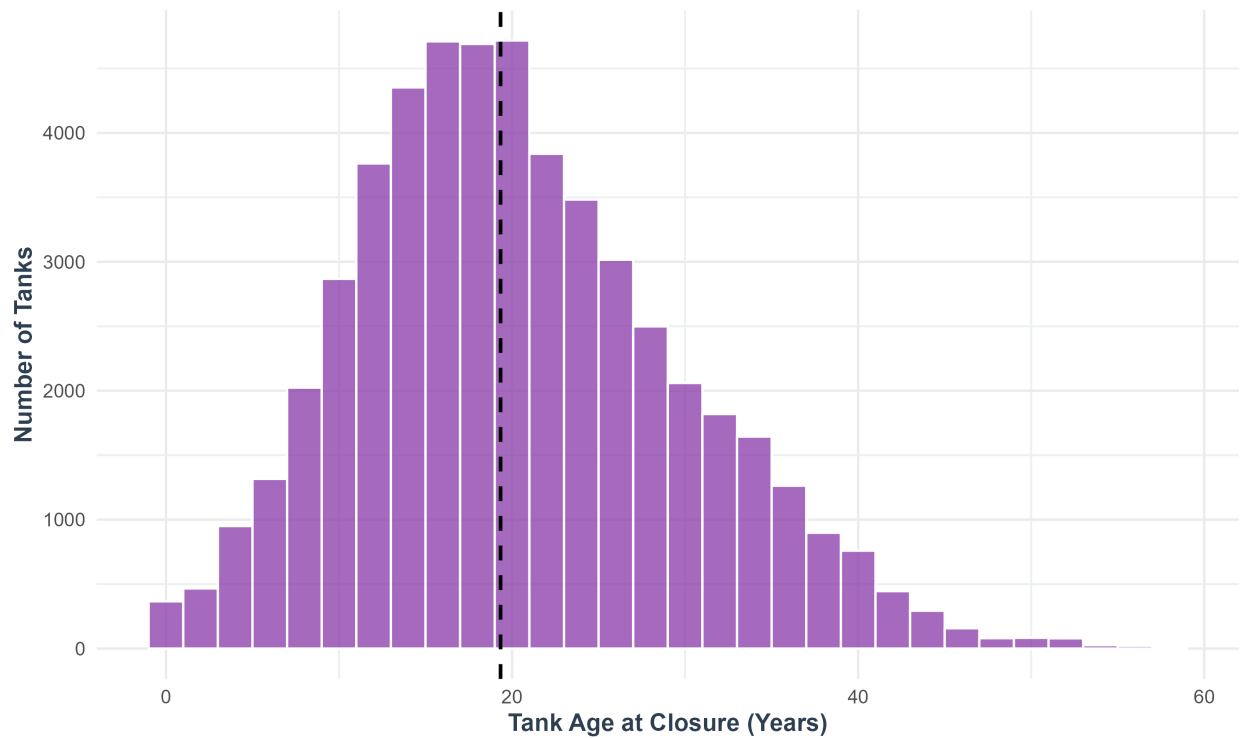


Figure 5: Distribution of Tank Age at Closure

[Figure Note: [Placeholder: Interpretation of lifespan patterns—median age, typical range, and implications for remaining useful life of active tanks.]]

7 Facility-Level Intelligence

This section examines facility-level aggregations, including size distributions, survival patterns, and relationships between facility age and complexity.

7.1 Facility Size Evolution by Decade

[Description: Distribution of facility sizes (number of tanks per facility) across facility vintage decades.]

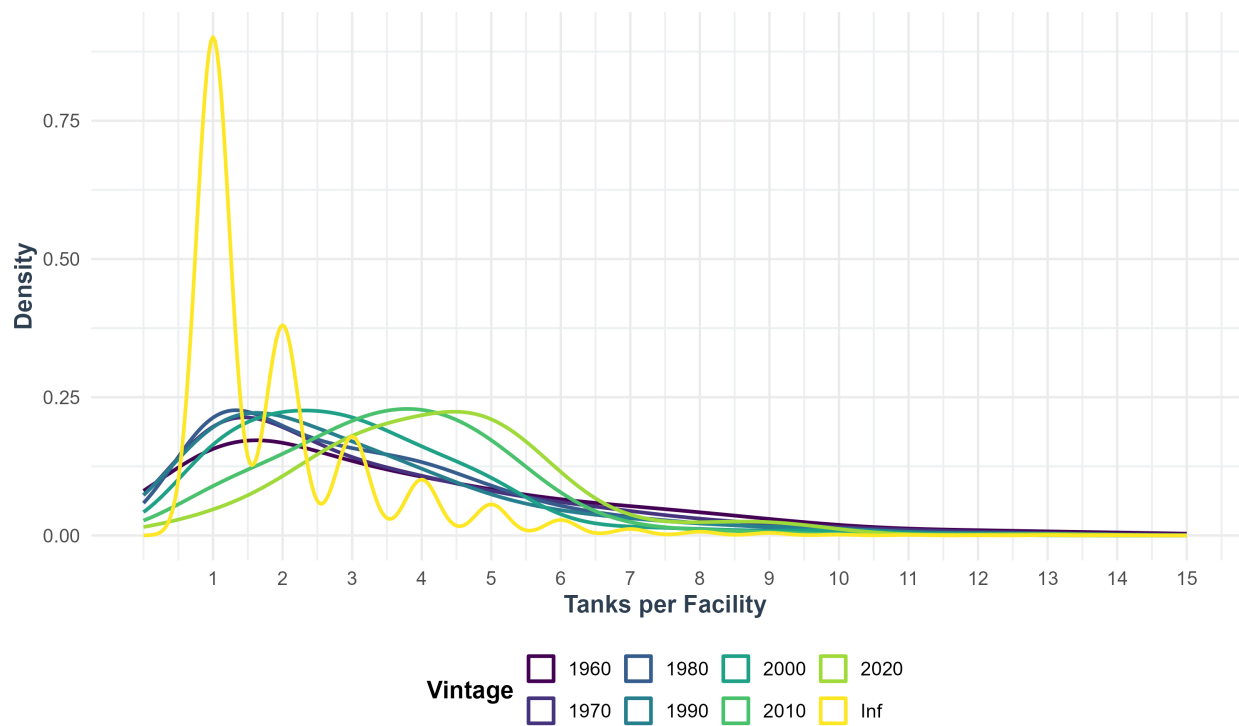


Figure 6: Evolution of Facility Size Distribution by Vintage Decade

[Figure Note: [Placeholder: Interpretation of facility size trends—are newer facilities larger or smaller? Implications for operational complexity and risk concentration.]]

7.2 Facility Status by Vintage

[Description: Proportion of facilities in different status categories (Fully Active, Fully Closed, Mixed Status) by vintage decade.]

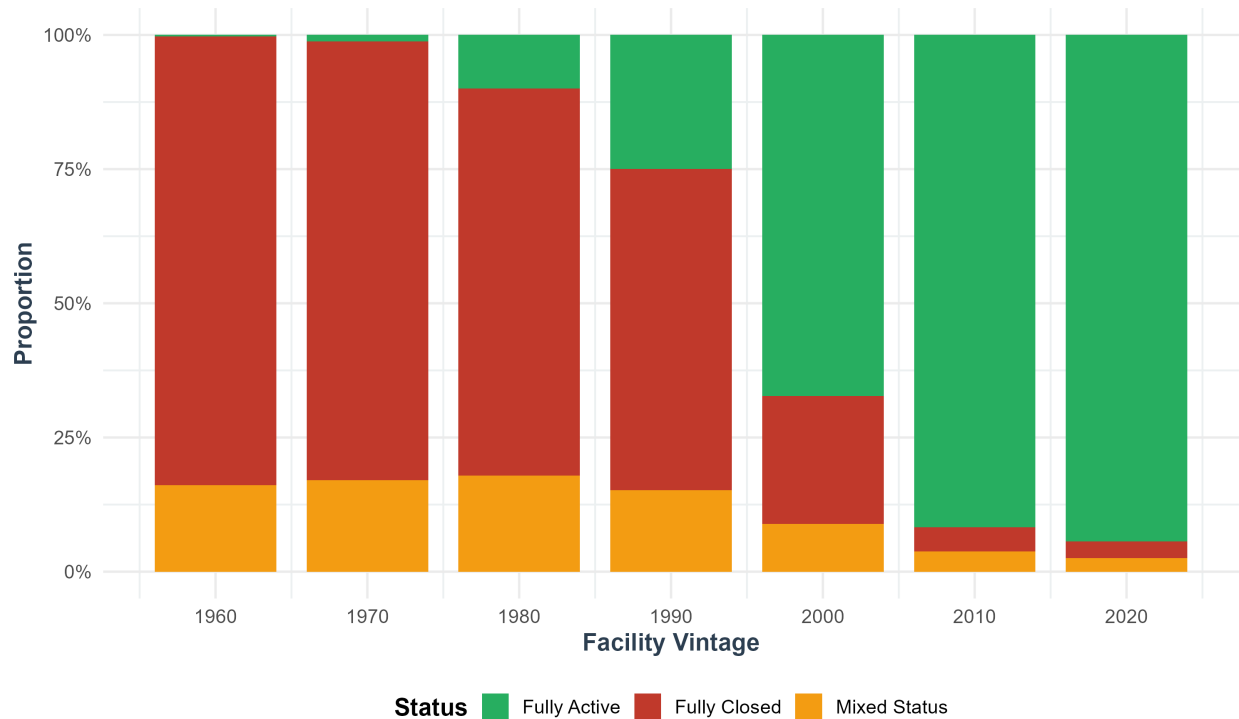


Figure 7: Facility Survival Status by Vintage Decade

[Figure Note: [Placeholder: Analysis of facility survival patterns—do older facilities show higher closure rates? Implications for portfolio risk assessment.]]

7.3 Facility Age vs. Size Relationship

[Description: Scatter plot examining the relationship between facility age and number of tanks, with smoothed trend line.]

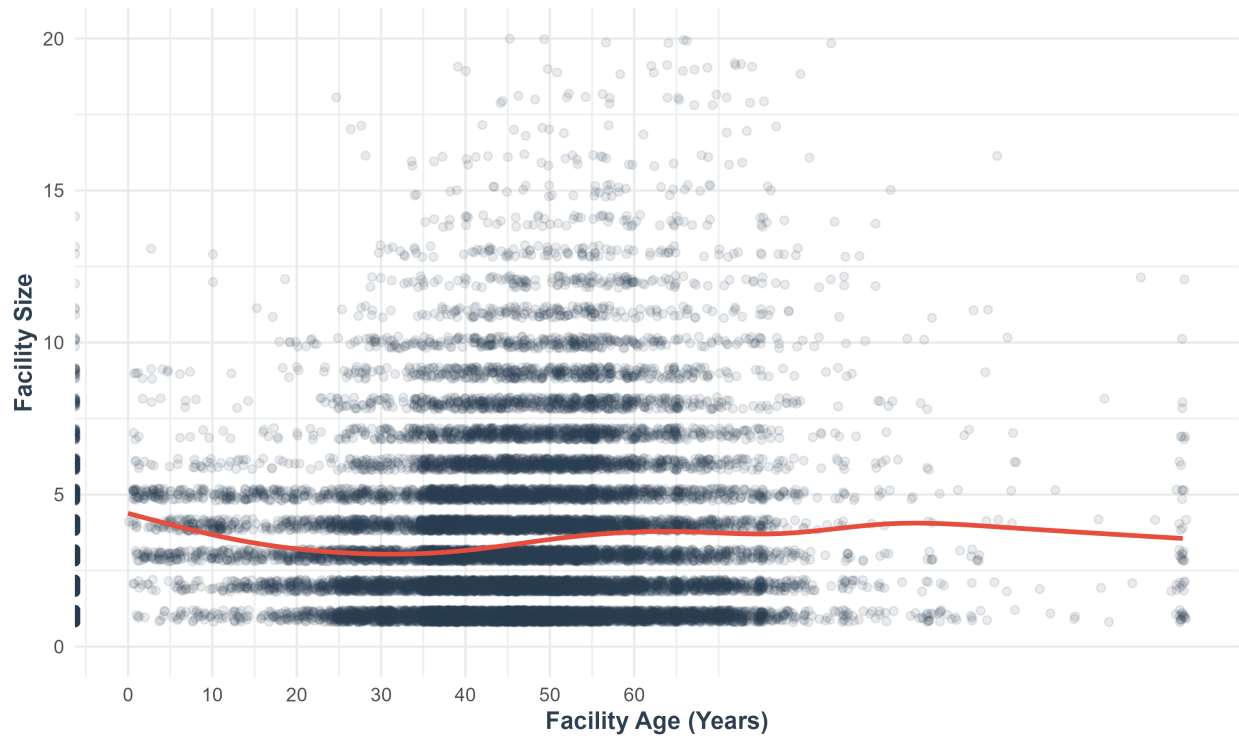


Figure 8: Relationship Between Facility Age and Size

[Figure Note: [Placeholder: Interpretation of age-size relationship—do older facilities tend to be larger? Implications for modernization costs and operational risk.]]

8 Fleet Risk & Infrastructure Analytics

This section examines construction-based risk tiers and capacity standardization trends to characterize infrastructure modernization patterns.

8.1 Fleet Risk Tier Transition

[Description: Temporal evolution of tank construction risk tiers based on wall construction (single vs. double) and material type.]

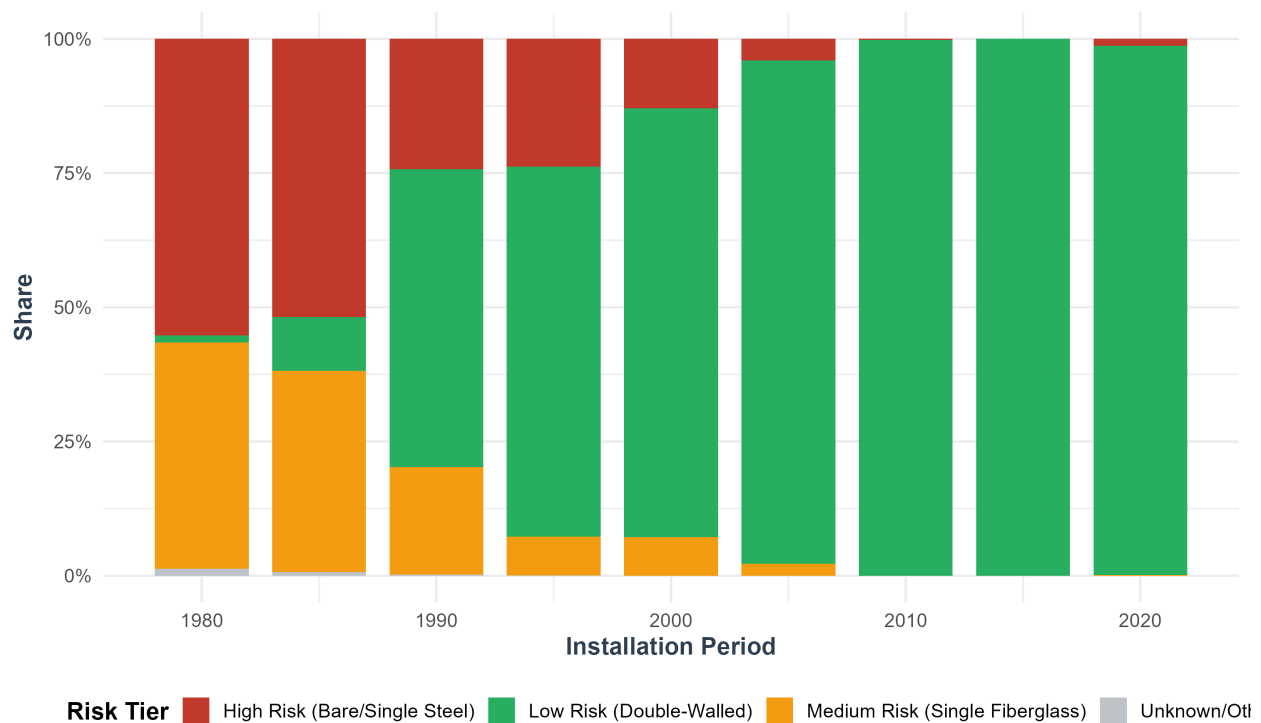


Figure 9: Fleet Risk Tier Transition by Installation Period

[Figure Note: Risk tiers derived from TANK CONSTRUCTION component: “High Risk” = bare/single-wall steel; “Medium Risk” = single-wall fiberglass; “Low Risk” = double-walled or jacketed tanks. Transition toward lower-risk construction reflects regulatory evolution (e.g., 1998 EPA deadline).]

8.2 Capacity Standardization Trends

[Description: Installation frequency of standard tank capacities over time, showing market convergence on common sizes.]

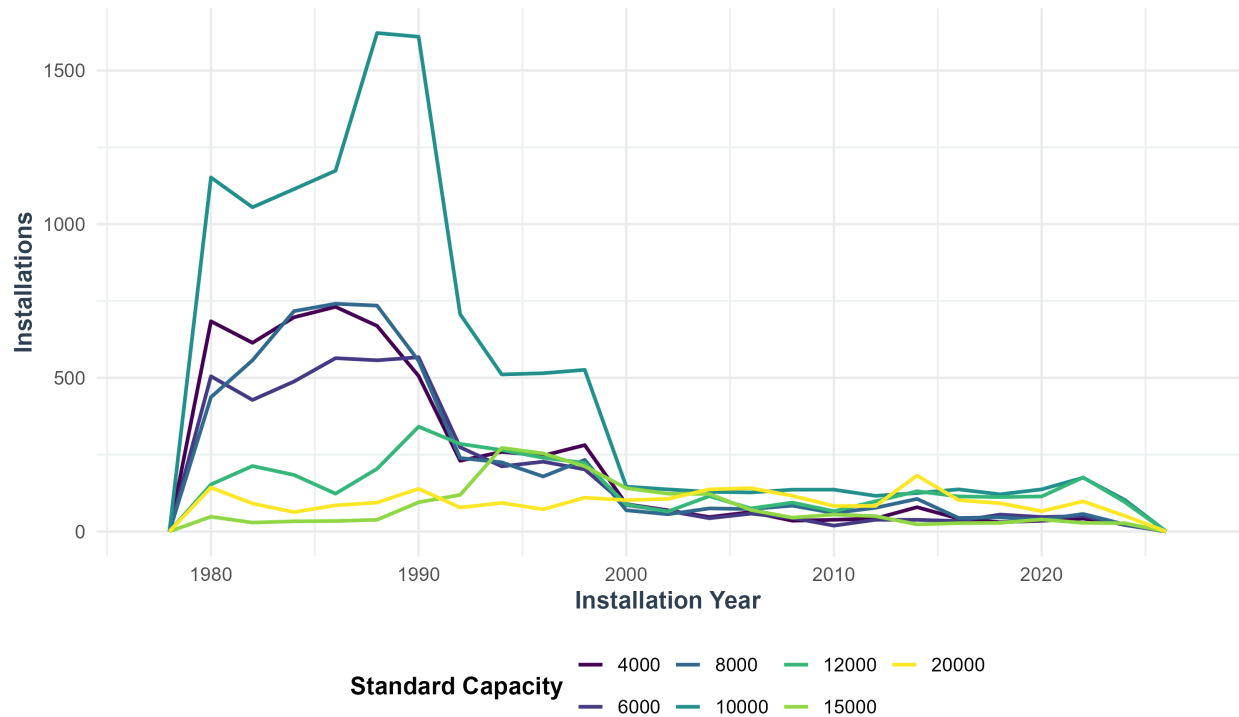


Figure 10: Installation Trends for Standard Tank Capacities (1980+)

[Figure Note: Standard capacities (4000, 6000, 8000, 10000, 12000, 15000, 20000 gallons) shown. Trends indicate market preferences and potential cost efficiencies from standardization.]

9 Owner & Market Structure Analytics

This section presents visualizations of ownership patterns, market concentration, and temporal evolution of business categories.

9.1 Owner Size Distribution

[Description: Distribution of tank counts across owner size classes.]

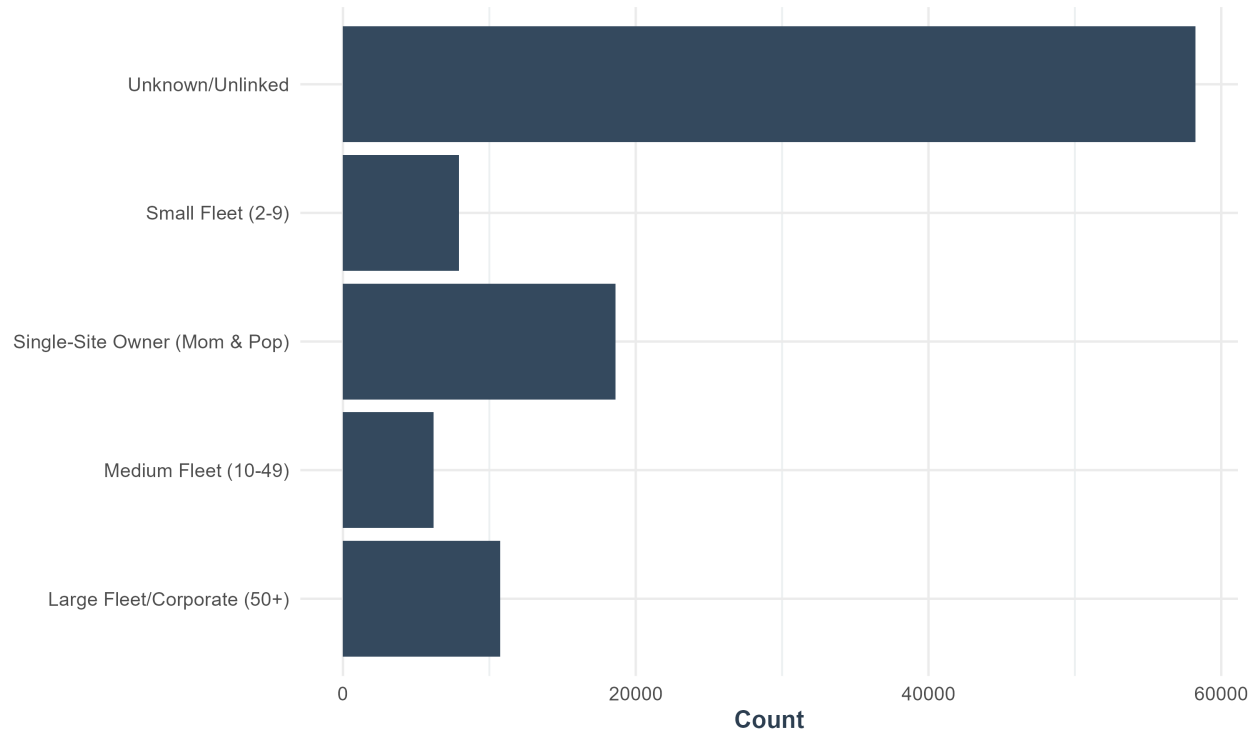


Figure 11: Tank Count Distribution by Owner Size Class

[Figure Note: Horizontal bar chart showing relative market share by owner fleet size. Single-site operators vs. corporate fleet concentration.]

9.2 Mom & Pop Sector Breakdown

[Description: Sector distribution within single-site (“Mom & Pop”) owners, showing business type diversity.]

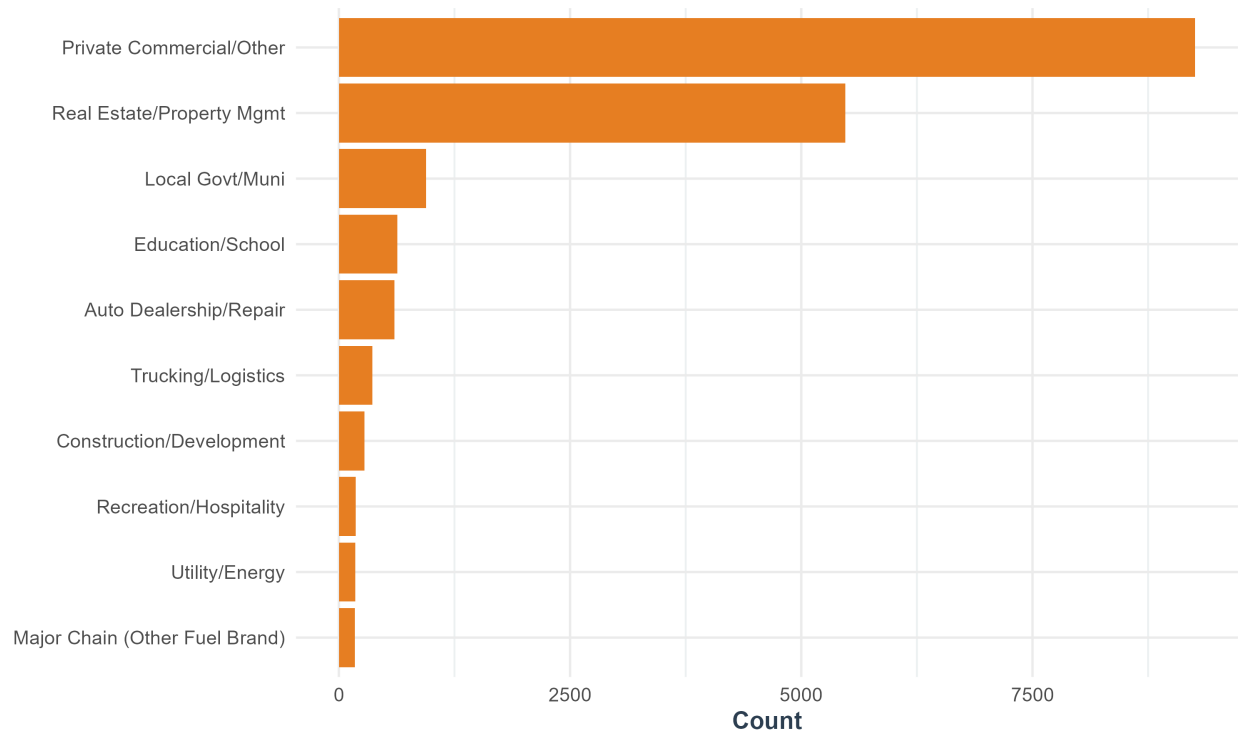


Figure 12: Top 10 Sectors Among Single-Site Owners

[Figure Note: Identifies which business sectors dominate the single-site owner segment—critical for understanding small operator vulnerability to remediation costs.]

9.3 Major Chains Market Share

[Description: Tank counts for major retail chains operating in Pennsylvania.]

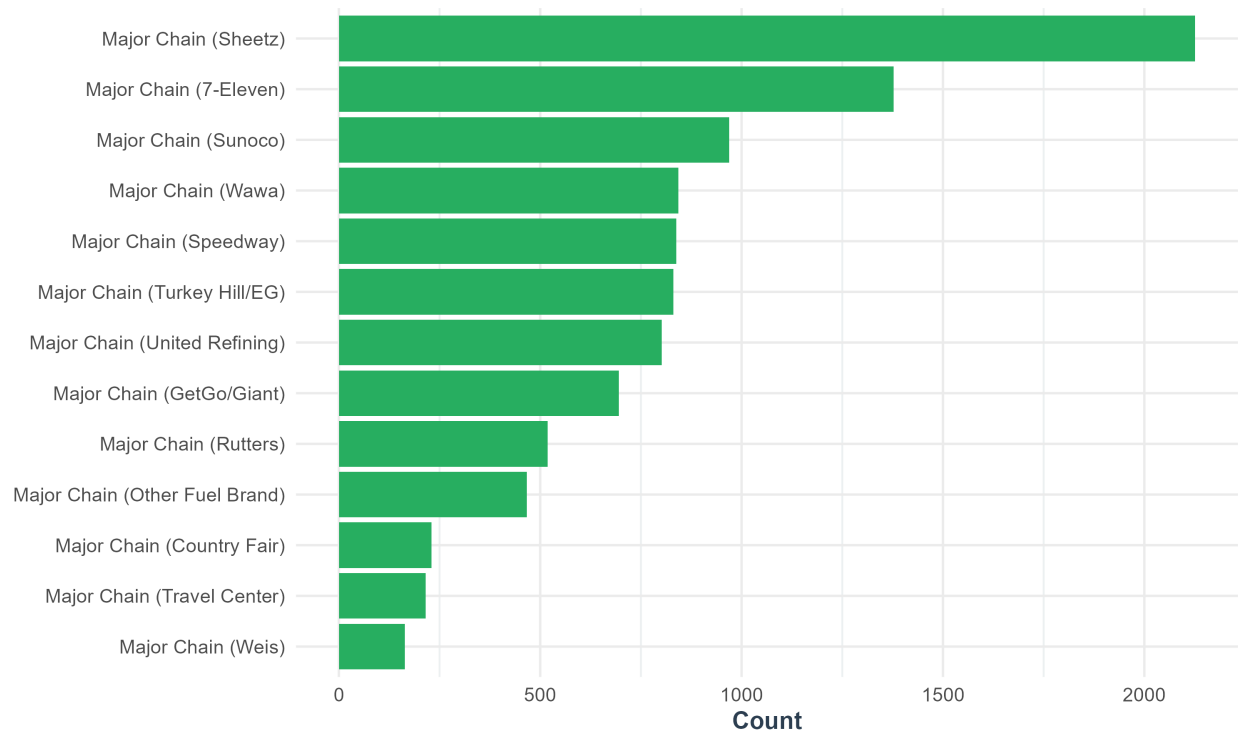


Figure 13: Major Chains Market Share by Tank Count

[Figure Note: Identifies dominant retail fuel chains (Sheetz, Wawa, GetGo, etc.) and their relative infrastructure footprints in Pennsylvania.]

9.4 Owner Size Evolution

[Description: Temporal evolution of installation share by owner size class.]

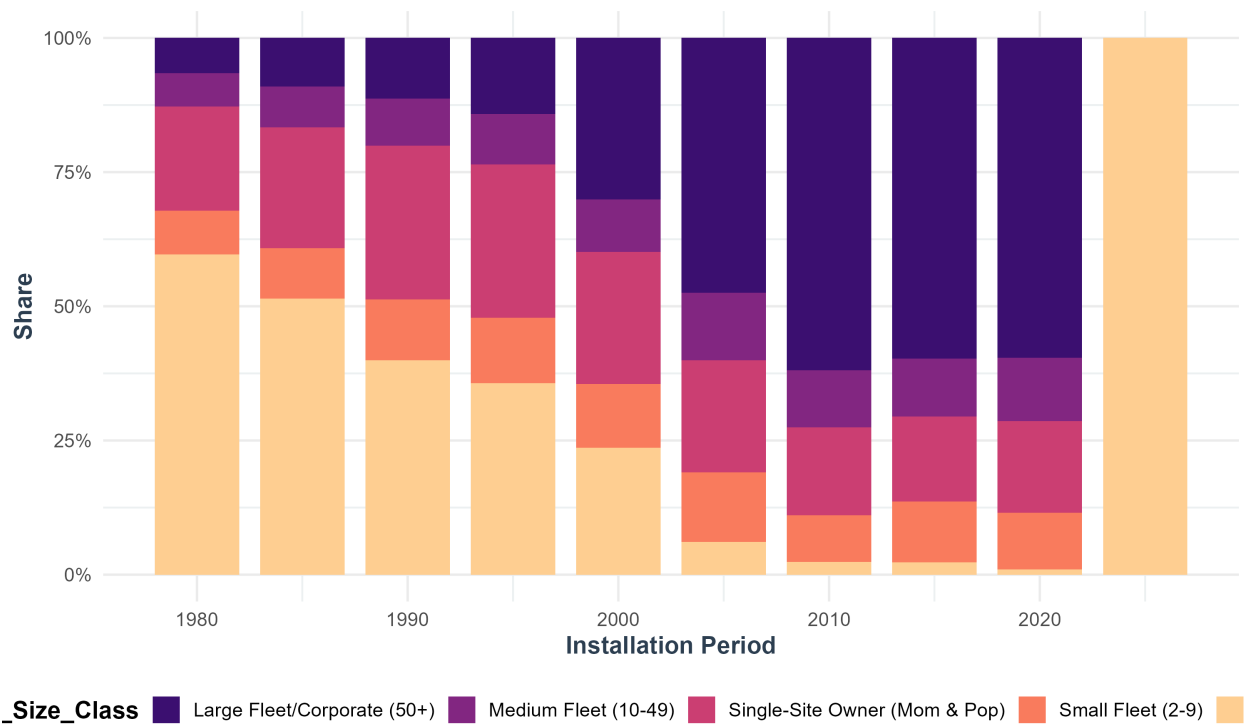


Figure 14: Evolution of Tank Installations by Owner Size Class (5-Year Periods)

[Figure Note: Stacked area showing market consolidation trends—increasing corporate share vs. declining single-site operator share over time.]

9.5 Business Category Evolution

[Description: Temporal evolution of installation share by business category classification.]

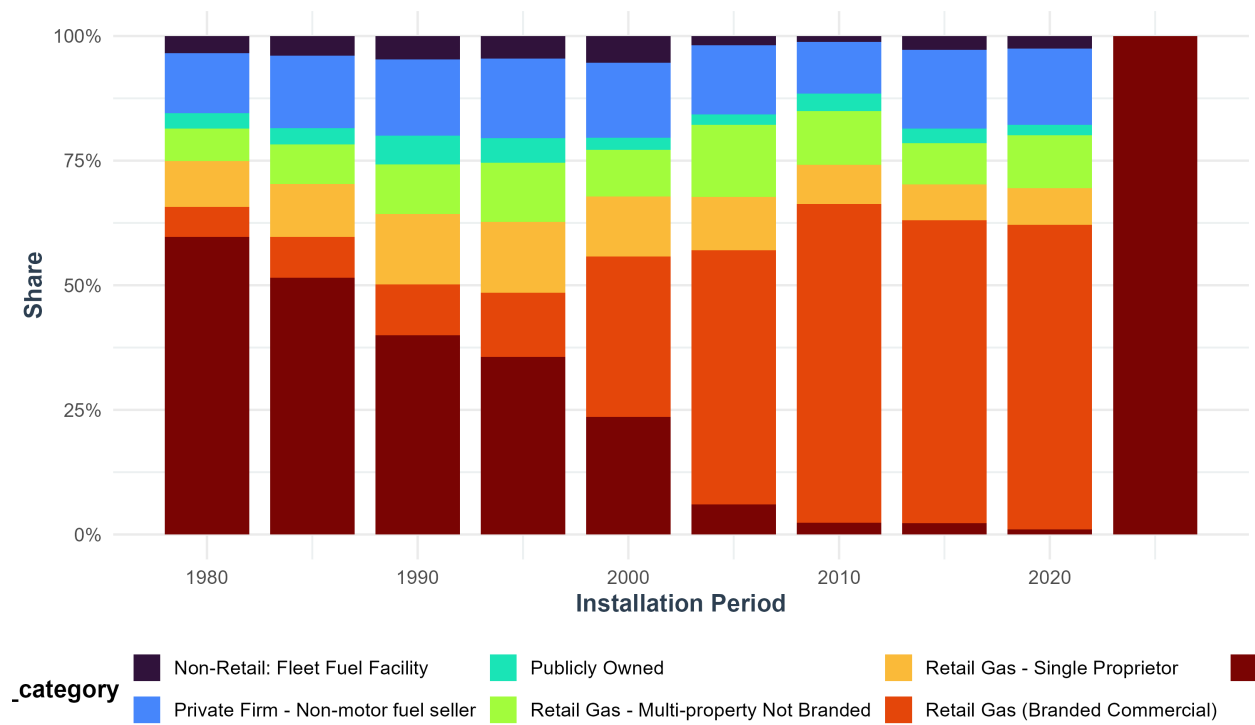


Figure 15: Evolution of Tank Installations by Business Category (5-Year Periods)

[Figure Note: Shows structural shifts in who is installing tanks—retail gas, fleet operations, public sector, etc. Useful for understanding changing composition of USTIF portfolio.]

10 Closure Dynamics

This section examines tank closure patterns over time, stratified by facility type.

10.1 Tank Closures by Facility Type Timeline

[Description: Annual tank closures by business category, showing differential exit/modernization patterns.]

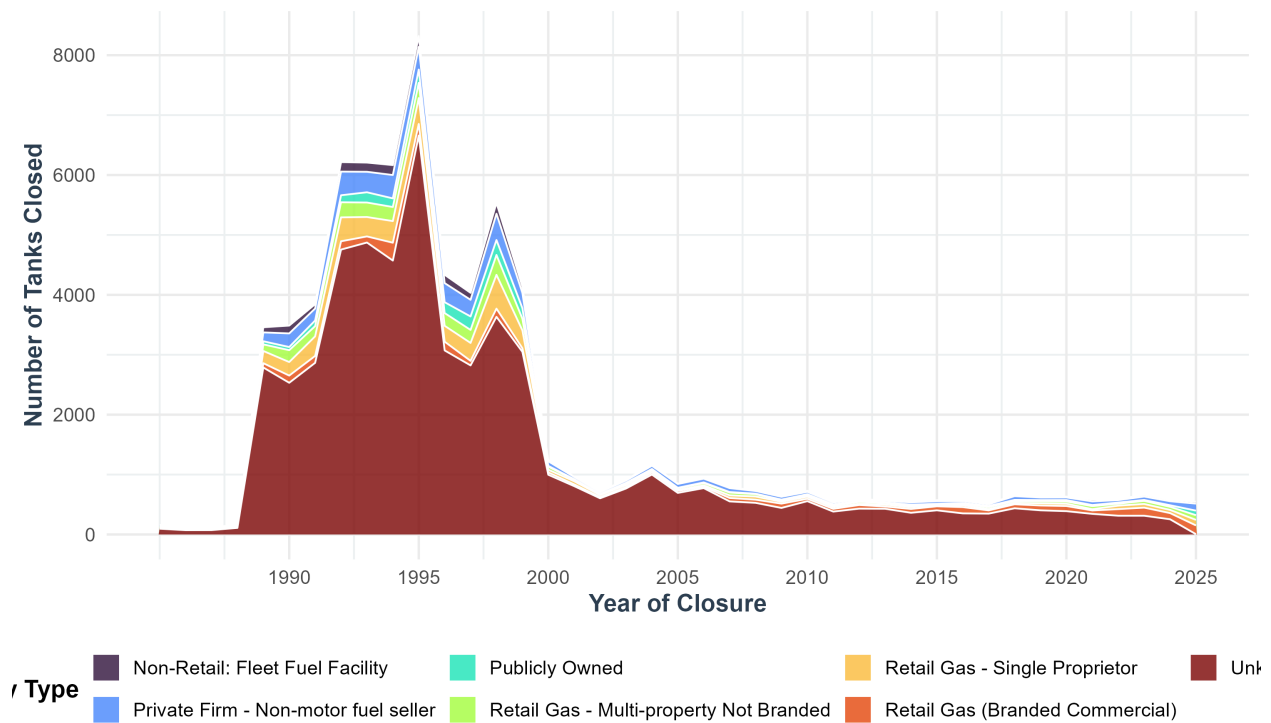


Figure 16: Tank Closures by Facility Type (1985-2025)

[Figure Note: Stacked area chart showing closure volume by business category over time. Peaks may correspond to regulatory deadlines (e.g., 1998 EPA compliance), market consolidation waves, or economic shocks. Useful for understanding historical claim volume drivers.]

11 USTIF Claims & Contracts Analysis

This section provides a summary of the USTIF claims and remediation contracts, adjusted for inflation to **2024 Real Dollars**.

11.1 Claims Overview

[Description: Operational status and financial severity of claims, adjusted for inflation.]

Table 75

Table 76USTIF Claims: Status & Real Costs

| claim_status | Count | Avg_Real_Cost | Total_Real_Paid | Share |
|---------------------------|-------|---------------|-----------------|-------|
| Closed Eligible | 4407 | \$361,543 | \$1,593,320,744 | 56.6% |
| Closed Withdrawn | 1264 | \$1,502 | \$1,898,367 | 16.2% |
| Closed Denied | 1157 | \$5,086 | \$5,884,614 | 14.8% |
| Open Eligible | 627 | \$607,121 | \$380,664,923 | 8.0% |
| Closed Post Remedial Care | 217 | \$748,635 | \$162,453,746 | 2.8% |
| Open Pending | 97 | \$1,058 | \$102,618 | 1.2% |
| Open Post Remedial Care | 18 | \$1,176,190 | \$21,171,415 | 0.2% |
| Open Appealed | 5 | \$16,303 | \$81,516 | 0.1% |

[Table Note: Claims categorized by operational status with real dollar costs adjusted to 2024 base year.]

11.2 Financial Severity

[Description: Distribution of real claim costs (log scale) showing the prevalence of high-severity events.]

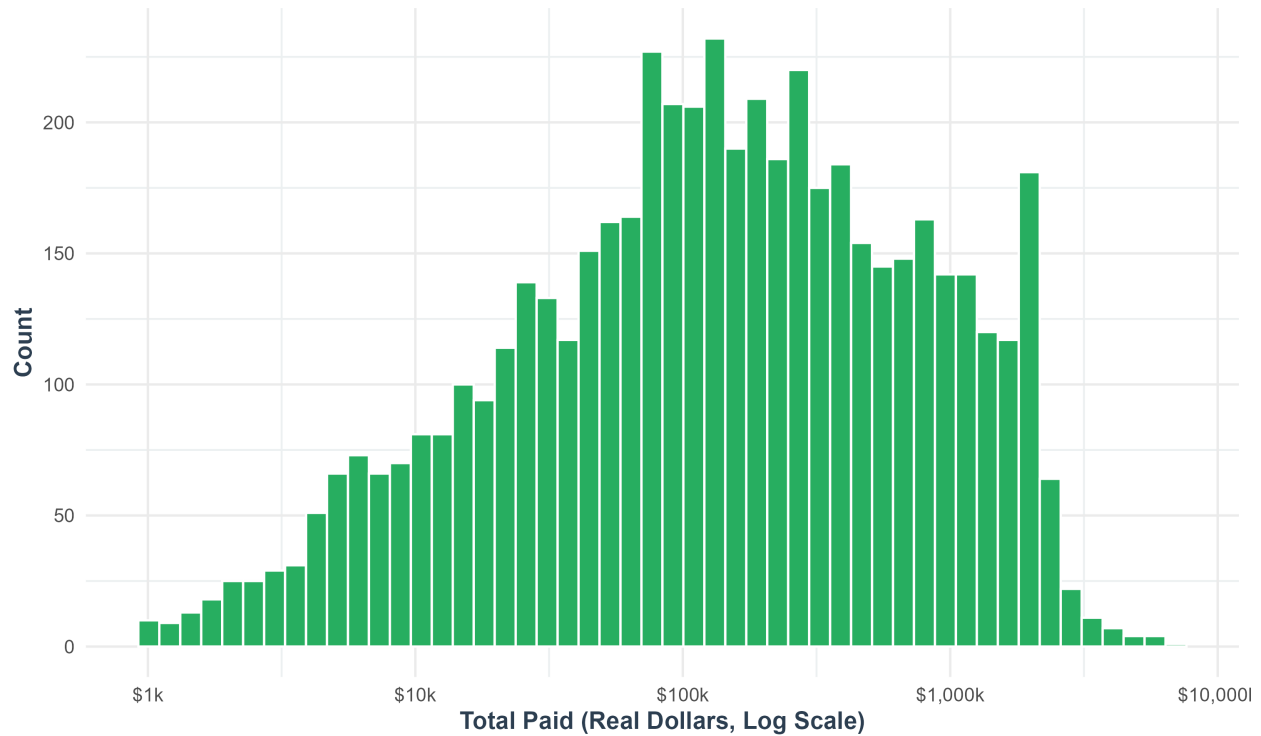


Figure 17: Distribution of Real Claim Severities (2024 Dollars)

[Figure Note: Log-scale distribution reveals long right tail characteristic of environmental remediation costs.]

11.3 Contracts & Auctions

[Description: Analysis of remediation contracts, comparing Bid-to-Result mechanisms against traditional models.]

Table 77

Table 78 Contracts: Real Value by Mechanism

| auction_type | Contracts | Total_Real_Value | Median_Real_Value |
|---------------|-----------|------------------|-------------------|
| Other/Unknown | 398 | \$110,541,797 | \$173,405 |
| Bid-to-Result | 83 | \$42,289,577 | \$438,017 |
| Scope of Work | 177 | \$28,650,874 | \$109,601 |

[Table Note: Contract mechanism breakdown showing PFP auction vs. T&M allocation patterns.]

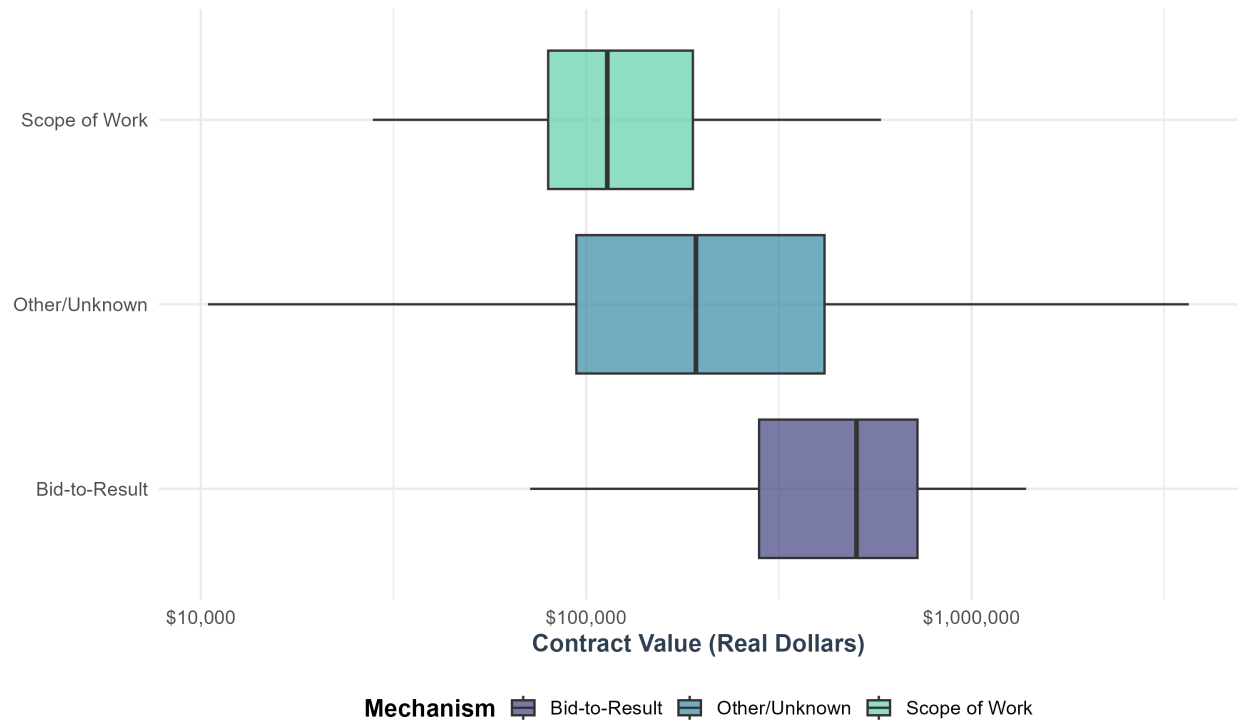


Figure 18: Contract Value Distribution by Mechanism (Real 2024 Dollars)

[Figure Note: Boxplot comparison of contract values by mechanism type. Caution: raw comparisons subject to selection bias per “naive fallacy” identified in research design.]

12 Appendix: Variable Inventory

[Description: Complete frequency dictionary for categorical variables in the Claims and Contracts datasets.]

12.1 Claims Variables

12.1.1 Claim Status

Table 79

Table 80 Variable Inventory: *claim_status* (Claims Data)

| Value | N | Share |
|---------------------------|------|-------|
| Closed Eligible | 4407 | 56.6% |
| Closed Withdrawn | 1264 | 16.2% |
| Closed Denied | 1157 | 14.8% |
| Open Eligible | 627 | 8.0% |
| Closed Post Remedial Care | 217 | 2.8% |
| Open Pending | 97 | 1.2% |
| Open Post Remedial Care | 18 | 0.2% |
| Open Appealed | 5 | 0.1% |

[Table Note: Distribution of claim operational status (open/closed).]

12.1.2 DEP Region

Table 81

Table 82 Variable Inventory: *dep_region* (Claims Data)

| Value | N | Share |
|------------------------------------|------|-------|
| PADEP Southeast Regional Office | 2018 | 25.9% |
| PADEP Southwest Regional Office | 1512 | 19.4% |
| PADEP Southcentral Regional Office | 1433 | 18.4% |
| PADEP Northeast Regional Office | 1333 | 17.1% |
| PADEP Northwest Regional Office | 907 | 11.6% |
| PADEP Northcentral Regional Office | 589 | 7.6% |

[Table Note: Geographic distribution of claims across PA DEP regional offices.]

12.1.3 County

Table 83

Table 84 Variable Inventory: county (Claims Data)

| Value | N | Share |
|----------------|-----|-------|
| Allegheny | 687 | 8.8% |
| Montgomery | 544 | 7.0% |
| Philadelphia | 502 | 6.4% |
| Bucks | 395 | 5.1% |
| Delaware | 303 | 3.9% |
| Luzerne | 285 | 3.7% |
| Chester | 274 | 3.5% |
| Westmoreland | 254 | 3.3% |
| Lancaster | 254 | 3.3% |
| Erie | 218 | 2.8% |
| York | 212 | 2.7% |
| Berks | 190 | 2.4% |
| Lehigh | 188 | 2.4% |
| Dauphin | 186 | 2.4% |
| Northampton | 179 | 2.3% |
| Monroe | 177 | 2.3% |
| Washington | 171 | 2.2% |
| Lackawanna | 161 | 2.1% |
| Schuylkill | 133 | 1.7% |
| Beaver | 113 | 1.5% |
| Mercer | 106 | 1.4% |
| Fayette | 105 | 1.3% |
| Butler | 104 | 1.3% |
| Cumberland | 104 | 1.3% |
| Blair | 100 | 1.3% |
| Lycoming | 95 | 1.2% |
| Clearfield | 81 | 1.0% |
| Cambria | 80 | 1.0% |
| Indiana | 72 | 0.9% |
| Franklin | 72 | 0.9% |
| Lebanon | 70 | 0.9% |
| Adams | 69 | 0.9% |
| Centre | 68 | 0.9% |
| Somerset | 64 | 0.8% |
| Northumberland | 62 | 0.8% |
| Venango | 61 | 0.8% |
| Bedford | 61 | 0.8% |
| Columbia | 58 | 0.7% |
| Armstrong | 57 | 0.7% |
| Carbon | 57 | 0.7% |
| Crawford | 58 | 0.7% |
| Susquehanna | 51 | 0.7% |
| Lawrence | 46 | 0.6% |

[Table Note: County-level claim frequency distribution.]

12.1.4 Location Description

Table 85

Table 86 Variable Inventory: *location_desc* (Claims Data)

| Value | N | Share |
|------------------|------|-------|
| Commercial | 7292 | 93.6% |
| Local Government | 251 | 3.2% |
| Private | 237 | 3.0% |
| State Government | 11 | 0.1% |
| | 1 | 0.0% |

[Table Note: Facility location type classification.]

12.1.5 Products

Table 87

Table 88 Variable Inventory: products (Claims Data)

| Value | N | Share |
|---|------|-------|
| Unleaded Gasoline | 4881 | 62.6% |
| Diesel | 807 | 10.4% |
| Unleaded Gasoline, Diesel | 553 | 7.1% |
| Heating Oil | 329 | 4.2% |
| Unleaded Gasoline, Kerosene, Diesel | 190 | 2.4% |
| Unleaded Gasoline, Other | 175 | 2.2% |
| Unleaded Gasoline, Kerosene | 169 | 2.2% |
| Other | 142 | 1.8% |
| Kerosene | 96 | 1.2% |
| Unleaded Gasoline, Heating Oil, Diesel | 73 | 0.9% |
| Unleaded Gasoline, Other, Diesel | 69 | 0.9% |
| Unleaded Gasoline, Kerosene, Heating Oil, Diesel | 46 | 0.6% |
| Unleaded Gasoline, Heating Oil | 42 | 0.5% |
| Unleaded Gasoline, Other, Heating Oil | 41 | 0.5% |
| Unleaded Gasoline, Other, Heating Oil, Diesel | 33 | 0.4% |
| Unleaded Gasoline, Other, Kerosene, Diesel | 25 | 0.3% |
| Heating Oil, Diesel | 16 | 0.2% |
| Other, Diesel | 16 | 0.2% |
| Unleaded Gasoline, Other, Kerosene | 15 | 0.2% |
| Kerosene, Diesel | 14 | 0.2% |
| Unleaded Gasoline, Other, Kerosene, Heating Oil, Diesel | 11 | 0.1% |
| Unleaded Gasoline, Kerosene, Heating Oil | 9 | 0.1% |
| Other, Heating Oil | 7 | 0.1% |
| Other, Heating Oil, Diesel | 6 | 0.1% |
| Unleaded Gasoline, Undetermined | 5 | 0.1% |
| Unleaded Gasoline, Undetermined, Kerosene, Diesel | 5 | 0.1% |
| Unleaded Gasoline, Other, Kerosene, Heating Oil | 4 | 0.1% |
| Unleaded Gasoline, Undetermined, Other | 3 | 0.0% |
| Kerosene, Heating Oil, Diesel | 2 | 0.0% |
| Unleaded Gasoline, Undetermined, Other, Heating Oil | 2 | 0.0% |
| Kerosene, Heating Oil | 2 | 0.0% |
| Other, Kerosene, Heating Oil | 1 | 0.0% |
| Unleaded Gasoline, Undetermined, Other, Kerosene | 1 | 0.0% |
| Unleaded Gasoline, Undetermined, Diesel | 1 | 0.0% |
| Undetermined, Other, Diesel | 1 | 0.0% |

[Table Note: Substance/product types associated with claims.]

12.1.6 Is Closed

Table 89

Table 90 Variable Inventory: *is_closed* (Claims Data)

| Value | N | Share |
|-------|------|-------|
| TRUE | 7045 | 90.4% |
| FALSE | 747 | 9.6% |

[Table Note: Binary indicator for claim closure status.]

12.1.7 Is Open

Table 91

Table 92 Variable Inventory: *is_open* (Claims Data)

| Value | N | Share |
|-------|------|-------|
| FALSE | 7045 | 90.4% |
| TRUE | 747 | 9.6% |

[Table Note: Binary indicator for claim open status.]

12.2 Contracts Variables

12.2.1 Adjuster

Table 93

Table 94 Variable Inventory: adjuster (Contracts Data)

| Value | N | Share |
|-----------------------|----|-------|
| Marion,Shane | 83 | 12.6% |
| Mackewicz,Bonnie | 81 | 12.3% |
| Aubel,Tracy | 69 | 10.5% |
| Smith,Bethany | 66 | 10.0% |
| Bilder,Jack | 57 | 8.7% |
| Ferro,James | 54 | 8.2% |
| Hawk,Gerald | 48 | 7.3% |
| Headdings,Kyle | 41 | 6.2% |
| Cramer,Jolene | 34 | 5.2% |
| Melvin, CPCU,Linda M. | 33 | 5.0% |
| Bollana,Debra | 29 | 4.4% |
| Goodyear,Jennifer | 23 | 3.5% |
| Condran,Patricia | 14 | 2.1% |
| Moore,Ronald | 12 | 1.8% |
| Kern,Beth | 9 | 1.4% |
| Crabb,Linda | 5 | 0.8% |

[Table Note: ICF Claims Evaluator assignment distribution. Key variable for instrumental variable identification strategy.]

12.2.2 Consultant

Table 95

Table 96 Variable Inventory: consultant (Contracts Data)

| Value | N | Share |
|---|-----|-------|
| Letterle & Associates Inc, | 128 | 19.5% |
| MEA, Inc., | 65 | 9.9% |
| Groundwater & Environmental Services, Inc., | 58 | 8.8% |
| Mountain Research LLC, | 55 | 8.4% |
| Core Environmental Services, Inc., | 43 | 6.5% |
| Kleinfelder Eastern Merger Corporation, | 20 | 3.0% |
| In-Site Group, Inc., | 18 | 2.7% |
| Converse Consultants, | 17 | 2.6% |
| DMS Environmental Services LLC, | 16 | 2.4% |
| B&B Diversified Enterprises Inc, | 15 | 2.3% |
| Environmental Alliance, | 14 | 2.1% |
| Liberty Environmental, Inc., | 14 | 2.1% |
| Austin James Associates, | 13 | 2.0% |
| Environmental Remediation & Recovery, Inc., | 13 | 2.0% |
| Moody & Associates, Inc., | 9 | 1.4% |
| United Environmental Services, Inc., | 9 | 1.4% |
| American Environmental Assoc Inc, | 8 | 1.2% |
| R.A.R. Engineering Group, Inc., | 8 | 1.2% |
| Chambers Environmental Group Inc, | 8 | 1.2% |
| Pennsylvania Tectonics, Inc., | 7 | 1.1% |
| Cribbs & Associates, Inc., | 7 | 1.1% |
| Environmental Consulting, Inc., | 6 | 0.9% |
| Alternative Environmental Solutions Inc, | 6 | 0.9% |
| Flynn Environmental, Inc., | 5 | 0.8% |
| P. Joseph Lehman, Inc., | 5 | 0.8% |
| Monridge Environmental, LLC DBA JK Environmental Services, LLC, | 5 | 0.8% |
| Labella Associates DPC Labella Associates PC, | 5 | 0.8% |
| EnviroTrac, LTD, | 4 | 0.6% |
| Juniata Geosciences LLC, | 4 | 0.6% |
| Alpha Geological Services Inc., | 4 | 0.6% |
| KU Resources Inc., | 3 | 0.5% |
| American Geosciences Inc, | 3 | 0.5% |
| Synergy Environmental, Inc., | 3 | 0.5% |
| Compliance Environmental Services, | 3 | 0.5% |
| Keystone Environmental Health and Safety Services, | 3 | 0.5% |
| Environmental Compliance Services, Inc., | 2 | 0.3% |
| Langan Engineering & Environmental Services, Inc., | 2 | 0.3% |
| ATC Associates, | 2 | 0.3% |
| , | 2 | 0.3% |
| CP Environmental Group, Inc., | 2 | 0.3% |
| Onesky Engineering, Inc., | 2 | 0.3% |
| Storb Environmental, Inc., | 2 | 0.3% |
| ATC Group Services LLC | 2 | 0.3% |

[Table Note: Environmental consulting firm assignment frequency.]

12.2.3 Brings to Closure

Table 97

Table 98 Variable Inventory: *brings_to_closure* (Contracts Data)

| Value | N | Share |
|-------|-----|-------|
| Yes | 394 | 59.9% |
| No | 264 | 40.1% |

[Table Note: Contract scope classification regarding site closure responsibility.]

12.2.4 Contract Category

Table 99

Table 100 Variable Inventory: *contract_category* (Contracts Data)

| Value | N | Share |
|-------------------|-----|-------|
| Sole Source | 409 | 62.2% |
| Competitively Bid | 249 | 37.8% |

[Table Note: High-level contract type categorization.]

12.2.5 Bid Type

Table 101

Table 102 Variable Inventory: *bid_ttype* (Contracts Data)

| Value | N | Share |
|-----------------------|-----|-------|
| | 420 | 63.8% |
| Defined Scope of Work | 177 | 26.9% |
| Bid to Result | 61 | 9.3% |

[Table Note: Procurement mechanism classification (competitive bid vs. negotiated).]

12.2.6 Contract Type Raw

Table 103

Table 104 Variable Inventory: $contract_{type,aw}$ (Contracts Data)

| Value | N | Share |
|---------------------|-----|-------|
| Fixed Price | 620 | 94.2% |
| Pay for Performance | 24 | 3.6% |
| Time and Material | 12 | 1.8% |
| | 2 | 0.3% |

[Table Note: Original contract type codes from source data.]

12.2.7 Auction Type

Table 105

Table 106 Variable Inventory: *auction_ttype* (Contracts Data)

| Value | N | Share |
|---------------|-----|-------|
| Other/Unknown | 398 | 60.5% |
| Scope of Work | 177 | 26.9% |
| Bid-to-Result | 83 | 12.6% |

[Table Note: Auction mechanism subtype for PFP contracts.]

12.2.8 Is Bid to Result

Table 107

Table 108 Variable Inventory: *is_bid_to_result* (Contracts Data)

| Value | N | Share |
|-------|-----|-------|
| FALSE | 575 | 87.4% |
| TRUE | 83 | 12.6% |

[Table Note: Binary indicator for Performance-Fixed-Price (PFP) auction contracts. Primary treatment variable for causal analysis.]

12.2.9 Is Scope of Work

Table 109

Table 110 Variable Inventory: *is_scope_of_work* (Contracts Data)

| Value | N | Share |
|-------|-----|-------|
| FALSE | 481 | 73.1% |
| TRUE | 177 | 26.9% |

[Table Note: Binary indicator for traditional Time-and-Materials (T&M) contracts.]

12.2.10 Brings to Closure Flag

Table 111

Table 112Variable Inventory: *brings_to_closure_flag* (Contracts Data)

| Value | N | Share |
|-------|-----|-------|
| TRUE | 394 | 59.9% |
| FALSE | 264 | 40.1% |

[Table Note: Binary indicator for contracts responsible for achieving site closure.]

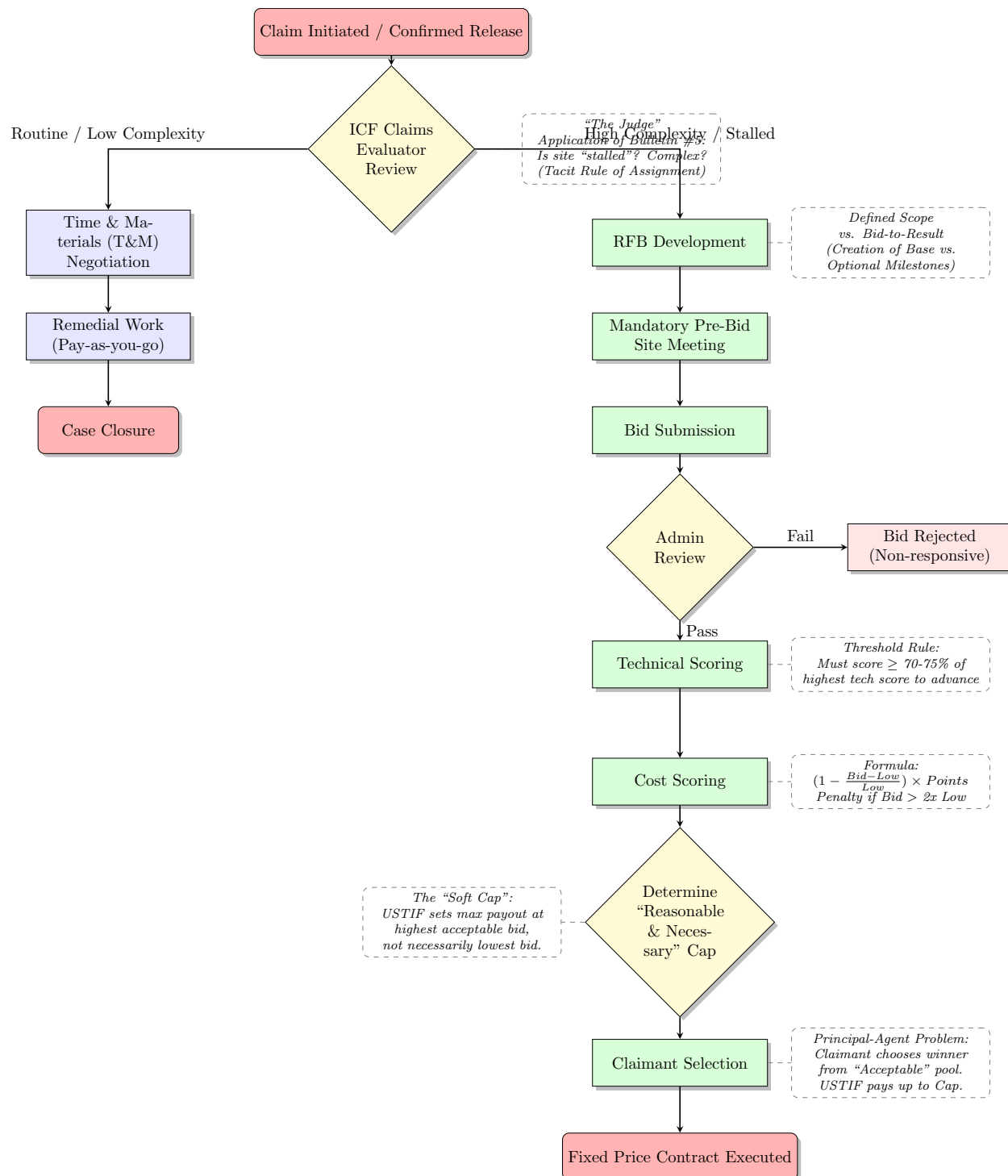


Figure 19: USTIF Claims Assignment and Auction Mechanism