

New Regulations on Above-Ground Storage Tanks and Vessels in Texas

*The Texas Aboveground Storage
Vessel Safety Program*

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1. INTRODUCTION AND OVERVIEW

Texas is home to over 35,000 Aboveground Storage Tanks (ASTs). These form a critical backbone of the state's petrochemical, petroleum refining, and bulk storage industries. These facilities, concentrated along the Gulf Coast, support one of the largest industrial complexes in the United States. Their integrity and operational safety, however, have been repeatedly tested by natural disasters and industrial accidents, revealing profound vulnerabilities with significant environmental and public health consequences. [1]

In direct response to those vulnerabilities, the Texas Legislature unanimously enacted Senate Bill 900 (SB 900), signed into law on June 8, 2021, and effective September 1, 2021. This legislation established the Aboveground Storage Vessel Safety (ASVS) Program under the authority of the Texas Commission on Environmental Quality (TCEQ), creating the first comprehensive state-level safety framework specifically targeting large-capacity ASTs storing regulated substances at petrochemical plants, petroleum refineries, and bulk storage terminals. [2, 17]

This paper provides a structured analysis of the ASVS Program's origins, regulatory framework, technical mandates, compliance obligations, and industry impact. It is organized into the following sections: (1) Introduction and Overview; (2) Gap Assessment and Problem Statement; (3) Topic Discussion; (4) Way Forward; and (5) Appendix A: References.

1.1 Program Purpose and Goals

The Texas Commission on Environmental Quality (TCEQ) is tasked with developing and implementing the ASVS Program under SB 900's mandate. The program's core objectives directly address lessons learned from past incidents: [1]

- Protecting groundwater and surface water in the event of an accident or natural disaster.
- Identifying and incorporating new safety elements into the program.
- Clearly define which entities and vessels are regulated under the new framework.
- Promoting the overall safety of storage vessels by adopting stringent requirements for their design, construction, operation, and maintenance.

The implementing regulations were codified under 30 Texas Administrative Code (TAC) Chapter 338, which became effective August 24, 2023. The program integrates critical safety elements from federal statutes (40 CFR Parts 68, 112, and 264) and national consensus standards (API 653, API 2350, API 650, NFPA 30, and API RP 2001),

mandating technical measures that include remote shut-off valves, overfill prevention systems, and fire suppression systems. [3, 13]

This paper covers ASTs regulated under the ASVS Program, which has a capacity of 21,000 gallons or more, are constructed of non-earthen materials, storing regulated substances, and located at or forming an integral part of a petrochemical plant, petroleum refinery, or bulk storage terminal. The analysis addresses the program's regulatory architecture, its technical and operational requirements for owner-operators, and the broader compliance landscape, including the convergence of physical and cyber-physical security obligations. [1, 3]

2. GAP ASSESSMENT AND PROBLEM STATEMENT

Before SB 900, the regulatory landscape governing ASTs in Texas consisted primarily of federal spill response mandates and general environmental rules. These frameworks addressed cleanup and containment after releases but did not impose specific proactive engineering standards to prevent AST failures during extreme weather events or operational emergencies. The cumulative effect of two catastrophic incidents made this gap untenable. [6, 18]

2.1 Hurricane Harvey (2017): Exposing Structural Vulnerabilities

Hurricane Harvey in August 2017 caused widespread flooding that led to the failure of numerous ASTs across Texas. Failures were attributed to flotation due to floodwaters, inadequate containment, and loss of power. These failures resulted in extensive environmental contamination. At least 145,000 gallons of fuel were spilled, and toxic pollutants were released into the air. Approximately one-third of the 4,500 storage tanks along the Houston Ship Channel were in areas highly susceptible to flooding. [5, 6]

The unprecedented rainfall also revealed a previously underappreciated vulnerability: the roofs of some floating-roof tanks sank under the weight of accumulated water, allowing chemicals to escape. At the time, federal and state rules focused on spill preparedness but lacked any specific mandate for securing ASTs against such extreme weather events. The regulatory framework had no proactive engineering requirements to address structural resilience, flood resistance, or remote isolation capabilities. [5]

2.2 The Deer Park Tank Farm Fire (2019): Industrial Catastrophe

The Deer Park Tank Farm Fire in March 2019 at the Intercontinental Terminals Company (ITC) facility compounded the urgency for legislative reform. Multiple tanks caught fire and burned for days. The resulting spills forced the shutdown of the Houston Ship Channel. The incident caused harmful air pollution, extensive ground and surface water contamination, and generated millions of gallons of hazardous waste. A catastrophic breach released an estimated 470,000 to 523,000 barrels of a mixture of firewater, firefighting foam, and oil products directly into the environment, impacting approximately 136 miles of shoreline and various sensitive habitats. [9, 10, 11]

The fire caused severe air quality concerns in surrounding areas, prompting road and school closures and necessitating shelter-in-place orders. The U.S. Department of Justice later reached a proposed settlement of approximately \$6.65 million to compensate for natural resource injuries. The incident underscored the absence of mandatory fire suppression standards, overfill prevention requirements, and remote shut-off capabilities in existing regulations. [9, 10, 12]

2.3 The Regulatory Gap

Prior to SB 900, the core regulatory gap was clear: Texas had no state-level framework that proactively mandated specific engineering controls, structural safety standards, or operational protocols for large-capacity ASTs at high-risk industrial facilities. Existing federal rules under 40 CFR Parts 68, 112, and 264 addressed emergency response planning, spill prevention, and hazardous waste management, but they did not require: [6, 18]

- Remote shut-off valves for emergency isolation of tanks.
- Specific overfill prevention systems beyond general good practice.
- Mandatory fire suppression infrastructure for tank farms.
- Structural standards designed to withstand extreme weather events.
- A state registration and certification system to track AST compliance status.

Moreover, the cybersecurity of operational technology (OT) systems that increasingly control and monitor ASTs was unaddressed. As AST operations became more digitized, vulnerabilities in IT/OT systems created new risk vectors not captured by any existing framework.

The unanimity with which the Texas Legislature passed SB 900 reflected a broad political consensus that the existing regulatory framework was insufficient and that a more robust,

proactive approach was imperative. The program's explicit focus on "protecting groundwater and surface water" is a direct legislative response to the widespread environmental contamination documented in both incidents. [2, 17]

2.4 Historical Context: Texas Tank Farm Development

Understanding the scale of the challenge requires historical context. Texas's chemical tank farm infrastructure grew rapidly after World War II, with the Houston vicinity (including Freeport, Bay City, and Texas City) becoming the heaviest concentration of chemical plants and tank farms in the nation. Other major coastal centers included Beaumont-Port Arthur-Orange, Brownsville, Corpus Christi, Victoria, and Seadrift.

Companies such as Dow Chemical, Union Carbide, and major oil producers have all established extensive tank farm facilities. By the 1950s, the chemical industry in Texas surpassed all other manufacturing in value added, and by 1989 Texas led global ethylene production. Many of these facilities were strategically sited near waterways for transport, often adjacent to residential areas due to historical zoning practices. This legacy infrastructure, much of it aging, presented the compliance challenges that SB 900's phased implementation timeline was designed to accommodate.

3. TOPIC DISCUSSION

3.1 Regulatory Framework

3.1.1 Applicability: Criteria for Regulated Aboveground Storage Vessels

The ASVS Program applies to ASVs that meet all of the following criteria: [1, 3]

- **Material of Construction:** The vessel must be constructed with non-earthen materials such as concrete, steel, or plastic.
- **Capacity Threshold:** The vessel must have a capacity of 21,000 gallons (equivalent to 500 barrels) or more.
- **Substance Stored:** The vessel must store a regulated substance as defined by Texas Water Code Section 26.343, including substances listed under CERCLA Section 101(14), petroleum and its liquid fractions at standard conditions, and any other substance designated by TCEQ.
- **Location and Facility Type:** The vessel must be located at, or be an integral part of, a petrochemical plant, a petroleum refinery, or a bulk storage terminal (including end-of-line pipeline storage terminals, refinery storage terminals, for-hire storage

terminals, and rail and barge storage terminals). This risk-based applicability framework concentrates oversight on facilities and substances directly implicated in past catastrophic incidents, optimizing regulatory resources while minimizing burden on lower-risk operations. [1, 3]

3.1.2 Exemptions

To prevent redundant regulation, the ASVS Program explicitly exempts: [3]

- Oil and gas production or gathering tanks.
- Stormwater or wastewater collection system tanks.
- Flow-through process tanks, including pressure vessels, process vessels, and oil/water separators.
- Mobile intermediate bulk containers designed to be moved within a facility.
- Tanks regulated under the Surface Mining Control and Reclamation Act, the Federal Food, Drug, and Cosmetic Act, or DOT PHMSA.
- Tanks managing leachate, methane gas, or methane gas condensate (unless storing a regulated substance); tanks storing liquefied petroleum gas.
- Heated tanks (externally heated by steam, electric heating elements, or hot oil) and tanks operating above 0.5 PSIG.

It is critical to note that these exemptions do not relieve facilities from applicable state and federal air, water, and waste regulations. The ASVS Program is an additional layer of safety standards, not a replacement for existing federal oversight. [3]

3.1.3 Governance: Role of the Texas Commission on Environmental Quality

TCEQ is the central state agency responsible for the comprehensive oversight and implementation of the ASVS Program. Its mandate encompasses: [1, 3]

- Program Establishment and Enforcement: Developing and enforcing safety requirements under 30 TAC Chapter 338.
- Inspections: Conducting on-site inspections of registered ASVs at least once every five years.
- Guidance and Training: Developing guidance documents and offering training to help owner-operators navigate registration and compliance.
- Fee Administration: Establishing and collecting fees sufficient to recover reasonable costs of program implementation.

The fee-based funding mechanism ensures the program’s long-term financial sustainability, allowing TCEQ to build and maintain the necessary expertise and resources for effective oversight. [3]

3.1.4 Key Program Timelines

The ASVS Program follows a structured timeline with staggered deadlines designed to provide owner-operators sufficient time to achieve compliance. The decade-long window for existing ASVs reflects TCEQ’s recognition of the substantial financial and logistical challenges involved in upgrading approximately 36,000 existing tanks across Texas. [3, 13, 15]

Table 1. Key Program Timelines: Effective Dates, Registration, and Certification Deadlines

Date	Milestone	Description
June 8, 2021	SB 900 passed	Texas Legislature unanimously passes SB 900; signed by the Governor, effective Sept 1, 2021.
Aug 24, 2023	Program rules effective	30 TAC Chapter 338 rules establishing the ASVS Program become effective.
Sept 1, 2025 (target)	Registration opens	TCEQ targets this date for electronic registration of ASVs via STEERS.
Sept 1, 2027	Registration deadline / new ASV certification	All existing ASVs (built before 9/1/2027) must be registered. New ASVs must register and certify within 30 days of the operation's start.
By Sept 1, 2037	Full compliance deadline	Existing ASVs must achieve and certify compliance at the next scheduled out-of-service maintenance event after 9/1/2027 or by this date, whichever comes first.
Ongoing	Recertification	All ASVs must recertify compliance with safety standards every 10 years.

3.2 Mandated Safety Standards and Technical Requirements

The ASVS Program's technical strength lies in its comprehensive integration of established federal statutes and national consensus standards. The program aims to apply "all and only those critical safety elements that are applicable to a storage vessel," ensuring the correct requirements are matched to the correct types of vessels. [3]

3.2.1 Integration of Federal Regulations

- 40 CFR Part 68 (Chemical Accident Prevention Provisions / Risk Management Plan): Requires facilities using certain hazardous substances above threshold quantities to develop and implement a risk management program. The ASVS Program incorporates provisions related to emergency response (Subpart E), risk management plans (Subpart G), and other general requirements (Subpart H). Notably, TCEQ uses its own definition of regulated substances from 30 TAC 338.2, and the 40 CFR §68.10 threshold quantity does not apply; instead, the 21,000-gallon capacity threshold governs applicability.
- 40 CFR Part 112 (Oil Pollution Prevention / SPCC / Facility Response Plan): Mandates prevention and response measures for facilities that could discharge oil into navigable waters. Requirements cover facility drainage, secondary containment for bulk storage containers, integrity testing, and overfill prevention.
- 40 CFR Part 264 (Resource Conservation and Recovery Act): Standards for owners and operators of hazardous waste treatment, storage, and disposal facilities (Subparts A–E), addressing facility security, general inspection requirements, personnel training, and the safe management of ignitable, reactive, or incompatible wastes.

Facilities already compliant with these federal mandates will have a significant advantage in meeting ASVS requirements, but the Texas-specific nuances mean federal compliance alone does not ensure full ASVS compliance. Owner-operators must carefully cross-reference existing federal compliance programs with the specific requirements of 30 TAC Chapter 338. [3]

3.2.2 Incorporation of National Consensus Standards

"Consensus Standards" are standards agreed upon by a group of experts to address safety or quality issues in various fields. The standards are published by groups such as the American National Standard Institute (ANSI), the American Petroleum Institute (API) or the National Fire Protection Association (NFPA). If adopted by governments, consensus standards have the force of law.

Following are some of the standards regulating Aboveground Storage Tanks.

- API Standard 653 (Tank Inspection, Repairs, Alteration, and Reconstruction): Applicable to existing ASVs. Specifies requirements for evaluating tank shells, bottoms, and foundations; determining inspection frequencies; and providing design considerations for reconstructed tanks.
- API Standard 2350 (Overfill Prevention for Storage Tanks in Petroleum Facilities): Applicable to storage vessels with internal design pressure not exceeding 2.5 psig containing NFPA Class I or Class II liquids. Sections 4 and 5 are directly incorporated to prevent tank overfills — a vulnerability highlighted during Hurricane Harvey.
- NFPA 30, Section 22.8 (Fire Protection for Aboveground Storage Tanks): Applies to atmospheric storage vessels of 50,000 gallons or more containing Class I liquids in congested areas with unusual exposure hazards. For new ASVs constructed after September 1, 2027, Section 22.4 (location requirements) is also mandated.
- API Recommended Practice 2001 (Fire Protection in Refineries): For vessels not requiring a full fire suppression system under NFPA 30, provides guidance on fire considerations design, general approaches for fire control and extinguishment, operating practices, maintenance, emergency response organization, training, and pre-fire incident planning (Sections 5–11).
- API Standard 650 (Welded Tanks for Oil Storage): Required for new ASVs constructed after September 1, 2027. Sets minimum requirements for material, design, fabrication, erection, and inspection of vertical, cylindrical, aboveground, welded storage vessels.

3.2.3 Specific Safety Measures Mandated

- Remote Shut-off Valves: Essential for quickly isolating tanks in emergency situations, preventing further release of hazardous substances or the spread of fires.
- Overfill Prevention Systems: Critical for preventing spills caused by tanks filled beyond capacity. The program mandates adherence to API Standard 2350, which provides detailed system requirements.
- Fire Suppression Systems: Mandated to control and extinguish fires, directly addressing the large-scale conflagrations experienced at Deer Park. Requirements align with NFPA 30 and API RP 2001.

These specific engineering controls are not arbitrary; they are direct technical solutions to the types of failures experienced in documented incidents, demonstrating a clear cause-and-effect relationship between past failures and newly mandated controls. [3]

Table 2 - Summary of Key Safety Standards Incorporated by the Texas ASVS Program

Standard / Regulation	Type	Key Focus Area(s)	Applicability
40 CFR Part 68 (CAPP/RMP)	Federal Regulation	Chemical Accident Prevention, Risk Management Plans, Emergency Response	All ASVs
40 CFR Part 112 (OPP/SPCC/FRP)	Federal Regulation	Oil Pollution Prevention, Spill Prevention/Control/Countermeasure, Facility Response Plans	All ASVs
40 CFR Part 264 (RCRA)	Federal Regulation	Hazardous Waste Treatment/Storage/Disposal, Security, Inspections, Training	All ASVs
API Standard 653	National Consensus Standard	Tank Inspection, Repairs, Alteration, Reconstruction	Existing ASVs
API Standard 2350	National Consensus Standard	Overfill Prevention Systems	All ASVs (specific conditions apply)
NFPA 30, Section 22.8	National Consensus Standard	Fire Protection for Aboveground Storage Tanks	All ASVs (specific conditions apply)
API Recommended Practice 2001	National Consensus Standard	Fire Protection in Refineries (alternative to NFPA 30)	All ASVs (specific conditions apply)
API Standard 650	National Consensus Standard	Welded Tanks for Oil Storage (Construction)	New ASVs (constructed after Sept 1, 2027)
NFPA 30, Section 22.4	National Consensus Standard	Location of Aboveground Storage Tanks	New ASVs (constructed after Sept 1, 2027)

3.3 Operational and Compliance Requirements for Owner-Operators

3.3.1 Registration Process

All applicable ASVs must be registered electronically through the State of Texas Environmental Electronic Reporting System (STEERS). Key requirements include: [1, 3, 15]

- Existing ASVs (in service on or before September 1, 2027) must be registered by September 1, 2027.
- New ASVs (placed into service on or after September 1, 2027) must be registered within 30 days of operation start.
- Each facility will be linked to a Regulated Entity Number (RN), and each vessel will receive a unique identifying number within STEERS.
- Owner-operators retain ultimate responsibility for compliance even if an authorized representative submits on their behalf.
- Any changes to registered information (operational status, substance stored, ownership, compliance status, records location) must be updated within 30 days.

3.3.2 Self-Certification and Recertification

A core component of the ASVS Program is the self-certification requirement, which places significant due diligence directly on regulated entities: [3]

- Initial Certification (Existing ASVS): At the time of registration, existing ASVS must certify their compliance status as “compliant” or “non-compliant.” Non-compliant vessels must specify the date of the next scheduled out-of-service maintenance.
- Compliance Deadline: Full compliance for existing ASVS must be achieved during the next scheduled out-of-service maintenance after September 1, 2027, or by September 1, 2037, whichever comes first.
- New ASVS: Must certify compliance within 30 days of operation start.
- Recertification: All ASVS must re-certify compliance every 10 years.
- Modifications: Must ideally occur during out-of-service maintenance periods. If infeasible, a documented demonstration of infeasibility must be recorded.

3.3.3 Recordkeeping and Documentation

The ASVS Program places strong emphasis on comprehensive recordkeeping: [3]

- **Scope:** Owner-operators must develop and maintain all records required by the program, including those mandated by incorporated federal and national consensus standards, plus copies of original and amended registration and certification documents.
- **Retention:** Records must be kept at the facility premises or at a readily accessible alternate site and maintained for the entire operational life of the ASV.

The requirement to maintain records for the full operational life of the vessel necessitates robust digital document management systems. While administratively burdensome, comprehensive documentation provides a critical legal defense, the ability to demonstrate due diligence through meticulous recordkeeping can mitigate penalties and serve as evidence of a compliant program in enforcement actions. [3]

3.3.4 TCEQ Inspections and Enforcement

TCEQ maintains a robust inspection and enforcement framework: [3, 1]

- **Periodic Inspections:** At least once every five years for registered ASVs.
- **Access Requirements:** Owner-operators must allow TCEQ personnel entry at reasonable times and furnish requested information on the vessel, equipment, contents, and all relevant records.
- **Sampling and Monitoring:** TCEQ may obtain samples of regulated substances and conduct monitoring or testing of the vessel, equipment, contents, or surrounding environment.
- **Directed Monitoring:** If TCEQ has reasonable cause to suspect a release has occurred, it may require owner-operators to conduct additional monitoring and testing.
- **Enforcement Powers:** TCEQ has explicit authority to enforce compliance, with fees established to cover enforcement activity costs.

3.3.5 Annual Fees and Financial Obligations

TCEQ is authorized to establish and collect annual fees from owner-operators: [3]

- **Fee Structure:** Maximum total fee of \$2,000 per ASV per year. The proposed preliminary fee schedule includes a flat fee of \$200 per vessel, plus \$0.0024 per barrel of capacity for vessels exceeding 20,000 barrels.
- **Purpose:** Fees recover reasonable costs incurred by TCEQ for registration review, certification review, inspections, and enforcement.

- **Payment Timing:** Due upon initial registration and annually thereafter. Failure to register does not exempt one from fee assessment. New owners are liable for outstanding fees and penalties.

While annual fees are capped at \$2,000 per ASV, the true financial burden extends far beyond these payments. Significant capital expenditures for engineering design, equipment procurement, and installation of required safety systems represent the larger compliance cost, alongside administrative overhead for recordkeeping and reporting. [3]

3.4 Industry Impact: Challenges, Costs, and Benefits

3.4.1 Compliance Costs and Financial Implications

- **Direct Fees:** Annual fees capped at \$2,000 per ASV contribute to TCEQ's administration costs. For facilities with numerous large tanks, cumulative fees represent a notable recurring expense. [7, 8]
- **Capital Expenditures:** The most significant financial impact stems from necessary infrastructure upgrades, including installation of remote shut-off valves, advanced overfill prevention systems (API 2350), and comprehensive fire suppression systems (NFPA 30, API RP 2001). For new construction, adherence to API 650 standards adds to initial capital outlays. These modifications, particularly for older infrastructure, require substantial upfront engineering, procurement, and construction investment.
- **Operational and Administrative Overhead:** Companies face increased costs from enhanced recordkeeping and documentation systems, internal auditing processes, and compliance reporting, including investment in digital document management and potentially additional compliance personnel.
- **Litigation and Penalty Avoidance:** Proactive investment in safety mitigates much larger potential financial losses from incidents. Environmental incidents and data breaches can lead to significant civil penalties and class-action lawsuits, underscoring that the cost of non-compliance far outweighs preventative investment.

3.4.2 Operational Adjustments and Infrastructure Modernization

- **Process Re-engineering:** New safety measures require revisions to existing operational procedures and integration with current control systems, including updated standard operating procedures and emergency response plans. [7, 8]
- **Maintenance Scheduling:** The mandate to perform modifications during next regularly scheduled out-of-service maintenance periods will influence long-term maintenance planning and resource allocation.
- **Technology Integration:** Adoption of new technologies for improved monitoring, control, and data management, including advanced sensors, automated controls, and digital compliance management systems.

- **Personnel Training:** Comprehensive workforce training on new systems, updated procedures, remote shut-off valve operations, overfill prevention alarms, and fire suppression protocols.

3.4.3 Challenges in Achieving and Maintaining Compliance

- **Regulatory Complexity:** The volume and detail of 30 TAC Chapter 338, combined with the need to harmonize with existing federal regulations and other state air, water, and waste rules, creates a complex compliance environment. [7, 8]
- **Vessel Identification and Applicability:** Accurately determining which specific ASVs fall under the regulations, given detailed applicability criteria and numerous exemptions, can be time-consuming and complex.
- **Technical Feasibility of Retrofits:** Achieving compliance for older tanks may present significant engineering challenges, potentially requiring custom solutions or extensive overhauls.
- **Workforce Readiness:** Ensuring all personnel are adequately trained on new safety measures, procedures, and recordkeeping requirements is a substantial and ongoing undertaking.
- **Evolving Threat Landscape:** The broader cybersecurity landscape is dynamic and continuously evolving. New threats, such as sophisticated ransomware attacks targeting critical infrastructure and AI-driven exploits, lead to new legislative responses (e.g., the Texas Cyber Command and the Texas Responsible AI Governance Act). Compliance is not a static target but an ongoing adaptive process.

3.4.4 Enhanced Safety and Environmental Protection Benefits

- **Reduced Spill Risk and Environmental Contamination:** Enhanced protection of ground and surface water by mandating overfill prevention systems and improved containment directly addresses the types of contamination observed after Hurricane Harvey. [1, 3]
- **Mitigated Catastrophic Incidents:** Remote shut-off valves and comprehensive fire suppression systems aim to significantly minimize the severity and frequency of catastrophic incidents like the Deer Park fire. [1, 3]
- **Improved Emergency Response:** Incorporation of 40 CFR Part 68 (RMP) and Part 112 (FRP) mandates robust emergency planning and response capabilities, leading to better preparedness and faster containment. [1, 3]
- **Increased Public Trust and Social License to Operate:** Proactive compliance demonstrates commitment to safety and environmental protection, rebuilding public trust and fostering better community relations. [7, 16]

3.4.5 Legal and Liability Considerations

The ASVS Program operates within a broader legal and regulatory landscape with significant liability implications:

- **Reduced Punitive Damages (Texas Safe Harbor Law):** Texas SB 2610, effective September 1, 2025, establishes a cybersecurity safe harbor for small businesses (fewer than 250 employees) that implement and maintain a cybersecurity program aligned with a recognized framework (e.g., NIST Cybersecurity Framework, HITRUST CSF), shielding them from exemplary (punitive) damages in data breach lawsuits. For ASTs, compliance with stringent API and NFPA standards could similarly be argued as “reasonable measures” to protect against physical incidents, potentially reducing damages in the aftermath of unforeseen events.
- **Broader Legal Ramifications:** Violations of environmental or data privacy laws can lead to significant consequences. The Texas Attorney General may seek injunctive relief, civil penalties (up to \$7,500 per violation under TDPSA; up to \$50,000 per violation under ITEPA for breach notification failures), attorney’s fees, and investigative costs. Data breaches can also trigger costly class action lawsuits and severe reputational damage.

3.4.6 Convergence of Physical and Cyber-Physical Security

Modern AST operations rely heavily on operational technology (OT) and information technology (IT) systems for monitoring, control, and data management. This convergence creates a compliance environment that extends beyond physical tank safety to encompass Texas’s evolving cybersecurity and data privacy laws:

- **Texas Data Privacy and Security Act (TDPSA):** Effective July 1, 2024, mandates “reasonable administrative, technical, and physical data security practices” for businesses processing personal data of Texas residents. AST operators managing employee safety training records, access control logs, or customer data must ensure compliance to avoid civil penalties of up to \$7,500 per violation.
- **Texas Identity Theft Enforcement and Protection Act (ITEPA):** Requires businesses to implement “reasonable safeguards” to protect sensitive personal information (SPI) from unlawful use or disclosure. Mandates data breach reporting to the Attorney General within 30 days for breaches affecting 250 or more Texans, and notification to affected individuals within 60 days.
- **Texas Administrative Code 202:** Establishes baseline information security standards for state agencies and higher education institutions based on NIST SP 800-53. While not directly binding on private-sector operators, alignment with TAC 202 demonstrates a proactive security posture.
- **Texas House Bill 3834:** Mandates annual cybersecurity awareness training for state agency employees, local government personnel, and contractors with access to

state computer systems. AST operators with state contracts must ensure their employees complete this certified training.

Failure to secure the digital infrastructure supporting ASTs could lead to data breaches, operational disruptions, and significant legal penalties under privacy laws, even if the physical tank itself is compliant with SB 900. This necessitates a holistic security strategy that bridges traditional physical safety with robust cybersecurity measures.

Table 3 - Operational and Financial Impacts for AST Owner-Operators

Impact Category	Specific Impact / Requirement	Regulatory Driver(s)	Notes / Implications
Capital Expenditures	Installation of remote shut-off valves, upgraded overfill prevention systems, fire suppression systems, and adherence to new construction standards for new tanks.	SB 900, 30 TAC 338 (API 2350, NFPA 30, API RP 2001, API 650)	Represents significant upfront investment, often phased over scheduled out-of-service maintenance cycles.
Operational Changes	Revision of operating procedures, integration of new safety technologies into existing workflows, enhanced maintenance protocols, and adjustments to maintenance schedules.	SB 900, 30 TAC 338 (API 653, 2350, NFPA 30, API RP 2001)	Requires re-training of operational and maintenance staff; potential for brief downtimes during retrofits.
Administrative Burden	Electronic registration of all ASVs, self-certification and 10-year recertification processes, and extensive recordkeeping for the operational life of each vessel.	SB 900, 30 TAC 338	Increased need for dedicated compliance personnel, robust digital document management systems, and internal audit capabilities.
Ongoing Fees	Annual fees to TCEQ, with a maximum of \$2,000 per ASV (comprising a \$200	SB 900, 30 TAC 338	A direct recurring cost designed to fund TCEQ program administration,

	flat fee plus a per-barrel fee for larger tanks).		inspections, and enforcement.
Workforce Training	Mandatory and ongoing training for employees on new safety measures, updated operational procedures, and cybersecurity best practices.	SB 900, HB 3834 (if applicable to state contractors)	Essential for effective implementation of new controls and mitigation of human error, enhancing overall safety culture.
Legal & Liability Risk	Exposure to civil penalties for non-compliance under various Texas laws, potential for class action lawsuits for data breaches, and injunctive relief.	TDPSA, ITEPA, Texas Data Breach Act	Proactive compliance with cybersecurity laws can offer a "safe harbor" from punitive damages for SMBs (SB 2610).
Cyber-Physical Security Integration	Necessity to secure IT/OT systems that control or monitor ASTs, and to manage sensitive data generated by these operations in compliance with privacy laws.	TDPSA, ITEPA, TAC 202, HB 3834	Requires a holistic security strategy that extends beyond physical tank integrity to include digital asset protection.

4. WAY FORWARD

4.1 Summary of Key Impacts and Future Outlook

Senate Bill 900 and the ASVS Program represent a pivotal and necessary evolution in Texas's environmental and industrial safety regulations. These were directly catalyzed by the severe vulnerabilities and extensive damage exposed during Hurricane Harvey and the Deer Park tank farm fire. The program's core strength lies in its comprehensive integration of established federal statutes and national consensus standards, promoting a harmonized, effective, and globally recognized safety framework for ASTs.

The implementation of the ASVS Program will profoundly impact AST owner-operators. Financially, it mandates substantial capital expenditures for infrastructure upgrades, particularly for older tanks requiring retrofits to meet modern API and NFPA standards. These costs are strategically phased over a decade to align with existing maintenance cycles, demonstrating a pragmatic regulatory approach. Operationally, companies must undertake significant process reengineering, integrate new safety technologies, and enhance recordkeeping practices. The compliance environment is further complicated by the need to navigate multiple layers of state and federal regulations, requiring specialized expertise and continuous vigilance.

However, these challenges are balanced by substantial benefits. The program is designed to significantly reduce the risk of future spills and catastrophic incidents, protecting Texas's vital ground and surface water resources and enhancing public safety. The emphasis on robust compliance, particularly in the converging domain of physical and cyber-physical security, can also mitigate legal liabilities.

The future outlook for AST operations in Texas points toward a more resilient, secure, and environmentally responsible industry. The ASVS Program is not merely a compliance checklist but a framework for continuous improvement in industrial safety and environmental stewardship.

4.2 Strategic Recommendations for Owner-Operators

To effectively navigate the new regulatory landscape and leverage the benefits of the ASVS Program, AST owner-operators should consider the following strategic recommendations:

Develop a Comprehensive Compliance Roadmap

Establish a detailed, multi-year plan that meticulously maps all ASVS requirements, including specific deadlines for registration, initial certification, and 10-year recertifications. This roadmap should integrate necessary infrastructure upgrades (remote shut-off valves, overfill prevention systems, fire suppression) with scheduled out-of-service maintenance periods, allowing for optimized capital expenditure and minimized operational disruption.

Conduct a Thorough Regulatory Applicability Assessment

Immediately undertake a comprehensive audit of all storage vessels to determine which are subject to the ASVS Program. This includes cross-referencing existing federal compliance programs (SPCC, RMP, RCRA) with the specific requirements of 30 TAC Chapter 338 to identify compliance gaps, using TCEQ's published guidance materials. Consult with qualified environmental engineers and legal counsel to navigate complex applicability questions.

Integrate Physical and Cyber-Physical Security Strategies

Recognize that the safety and integrity of ASTs are increasingly dependent on the security of their underlying digital systems. Implement robust cybersecurity measures for OT and IT systems that control, monitor, or manage ASTs, including adherence to recognized frameworks such as the NIST Cybersecurity Framework or HITRUST CSF. For qualifying small and medium-sized businesses, the Texas Safe Harbor Law (SB 2610) provides crucial protection against punitive damages in data breach lawsuits, reinforcing the value of a holistic security posture.

Invest in Technology and Workforce Training

Prioritize strategic investments in modern safety technologies aligned with mandated API and NFPA standards, including advanced sensors, automated controls, and robust fire suppression infrastructure. Simultaneously, invest in digital tools for efficient compliance management, such as electronic recordkeeping systems capable of maintaining documentation for the operational life of the ASV. Implement comprehensive and ongoing training programs for all personnel involved in AST operations, maintenance, and compliance, covering both physical safety protocols and the evolving cybersecurity landscape, including requirements under Texas HB 3834 for state contractors.

Proactive Engagement with TCEQ and Industry Associations

Actively monitor TCEQ's official communications, guidance documents, and training opportunities related to the ASVS Program. Engage proactively with TCEQ to seek clarifications on complex requirements or unique operational scenarios. Participate in industry associations and peer groups to share best practices, discuss common

challenges, and collectively advocate for practical and effective regulatory implementations. [1, 15]

Implement Continuous Monitoring and Adaptation

Establish internal processes for continuous monitoring of compliance status and regular risk assessments. The regulatory landscape in Texas is dynamic, with new threats and legislative responses constantly emerging. A robust internal audit program, coupled with ongoing threat intelligence monitoring, will enable owner-operators to proactively identify potential vulnerabilities and adapt safety and security measures. Compliance must be understood not as a one-time achievement but as an ongoing commitment to a resilient and secure operational environment.

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6. Author Biography

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He has extensive experience in research, engineering, project management, technical training, and industrial collaboration, working with industry, academia, and government organizations. He has contributed to peer-reviewed publications and technical conferences and serves as a reviewer and guest editor for professional journals.

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