Inspectioneering Journal

ASSET INTEGRITY INTELLIGENCE

AN INSPIRED APPROACH TO STORAGE TANK INSPECTION PRACTICES

ELIZABETH BRUECKNER, *Principal at G.K. Hills Consulting Ltd.*

VOLUME 25, ISSUE 4
JULY | AUGUST 2019

AN INSPIRED APPROACH TO STORAGE TANK INSPECTION PRACTICES

BY: ELIZABETH BRUECKNER, *Principal at G.K. Hills Consulting Ltd.*

Client Pain Point Quote: "...the toughest challenge is to convince people that it is absolutely critical for the oil and gas industry to integrate change. It has to move out of a reactive mode into a proactive one, or it will not survive over the long term."

INTRODUCTION

Managing aboveground storage tanks fabricated to API 650 and 12 Series specifications, or atmospheric tanks of other dimensions or specifications, within a large organization can be a complex undertaking. An unfortunate reality is that many upstream oil and gas producers are largely unable to manage the integrity of their small diameter tanks in a timely, cost effective, and responsible manner. Many don't have a thorough and working understanding of best practices and regulatory requirements with regard to these tanks. The most common reasons for inadequate planning and execution of tank inspections include the following: incomplete and inaccurate tank data, poor communications and information sharing across the organization, little or no meaningful analytics applied and or utilized, and the inability to understand and interpret data and ultimately develop an effective action plan for addressing these tanks.

When referring to aboveground storage tank compliance in the upstream petroleum industry, it must address a complex framework of:

- Regulatory Compliance: This requires not only knowing, understanding, and having a working knowledge of them, but also understanding the implications of implementing and maintaining them over the tank's operating life.
- Standards: Determining how standards address and apply to their particular operations. They must address not only the standards, but apply their intent to the full scope of the operation. They must be site specific.
- Corporate: The corporate tank integrity plan must be in alignment with the current corporate policy (i.e., minimize impacts to the environment)

The framework must then be effectively layered and aligned, promoting the ability to demonstrate that the organization has enacted all reasonable measures to meet or exceed compliance requirements and their application(s) to routine site-specific operations.

This can be an overwhelming and somewhat frustrating experience. No matter what perspective or role an individual has, we have common frustrations that all center around "the tank."

The most effective and workable solution is a tank inspection process that is:

- Systemized and standardized using fully integrated technology
- Easy to follow and easy to use (i.e., meets compliance by design)
- Leverages data as a powerful and very useful tool

REGULATORY ENVIRONMENT

As a means of providing context, we must acknowledge and clearly understand the regulatory environment that applies directly to the storage tank systems. The intent of Alberta Energy Regulator's (AER) Directive 055 Storage Requirements for the Upstream Petroleum Industry is to prevent soil, groundwater, and surface water contamination at upstream petroleum sites. The implementation of effective storage practices should reduce the long-term costs associated with decontamination activities and enhance the capability for upstream petroleum sites to be reclaimed to conditions suitable for its next intended land use without having to pay for reclamation costs.

Current AER Directive 055 inspection and reporting requirements include the following:

- All tanks require a monthly visual examination
- Pre-1996 installations: mechanical integrity must be verified every 5 years
- Regulations address:
  - Primary and secondary containment devices
  - Leak detection systems and weather protection
  - Operating procedures, maintenance practices, and inspection programs to maintain the containment systems, as well as associated documentation and record retention requirements

This is where most of the efforts are focused—on compliance. The boxes are getting checked, the monthly visual examinations are complete, and mechanical integrity has been verified. But is it really getting done? The same recommendations are often showing up in inspection reports as they did five years previously and they are largely related to how the tank is being operated and maintained.

The regulator's own data tells us most releases are related to how the tank is operated and maintained. Most releases are a result of overfilling, leaks and drips from valves and fittings, and spillage from inventory management and/or during fluid transfers, and generally, not as a result of corrosion related, catastrophic tank failures.

PROBLEMS ASSOCIATED WITH STORAGE TANK MANAGEMENT

Regulation has had unintended consequences; the intent has gotten lost.

The tank owner may believe they are compliant, but they are still having spills and feeling the pain of regulatory implications through administrative penalties and enforcement. So, what is happening?

Tank owners typically have the same frustrations, which often include:

- Not really understanding why they're required to do what they're required to do
- Having an inaccurate and incomplete inventory
- Over inspecting / under inspecting practices
- Non-rigorous inspection
- Duplication of work
- Lack of integration with tank integrity management programs

Field examples collected over the past few years illustrate the complexity and how far reaching the problem actually is.

Inaccurate and Incomplete Inventory

The problem starts with the inventory-- the data used to describe the tank and associated system. Examples of this include missing static data, materials of construction, tank function, configuration, and inconsistent units of measurement.

Diversity in Tanks and Associated Systems

The characteristics of tanks vary considerably, as do their associated regulations and maintenance requirements, even when they are utilized for essentially the same purpose.

Even when the tanks are of similar design, the characteristics can vary considerably (e.g., double wall). Containment systems can range from a lined steel dike to a secondary tank to a dike constructed of soil, with a liner installed.

Over Inspecting / Under Inspecting

In one example, a storage system installed pre-1996 would originally have fallen under the requirements to verify integrity every 5 years.

- The 12 foot diameter, 400 BBL single wall storage tank was subsequently replaced and elevated six inches off the ground on a skid and timbers.
- The tank was inspected for mechanical integrity in 2012, but no inspection record was maintained on file.
- The tank was inspected again in 2013; with the visual external inspection noting a leaking bullplug.
- The tank was inspected for mechanical integrity again in 2017 (5 years after 2012). The inspection consisted of a visual external, visual internal, ultrasonic thickness inspection, and a floor scan. The inspection report contained a photo of the bullplug, which has been leaking since 2013.
- The monthly visual examination records did not identify the leaking bullplug.

Figure 1. 12' Diameter 400 Bbl

At some point prior to 2013, the secondary containment was upgraded. Monthly visual examinations were enough to address the regulatory requirements (verification of integrity on a 5-year frequency was no longer required); however, the tank owner still had the tank on a 5-year inspection frequency.

The tank was elevated off the ground to reduce the risk of bottom side corrosion; however, a floor scan was performed in 2017.

The leaking bullplug still had not been repaired.

Non-rigorous Monthly Visual Examinations

In some cases, routine monthly visual examinations satisfy the regulatory requirements and the mechanical integrity of the tank does not have to be verified every 5 years. In one example, vegetation (moss) growth along the base of the tank was identified during the review of inventory data (as documented in Figure 2). Results of the monthly visual examinations were reviewed and noted a history of fluid in the secondary containment. The vegetation growth along the base of the tank was never noted.

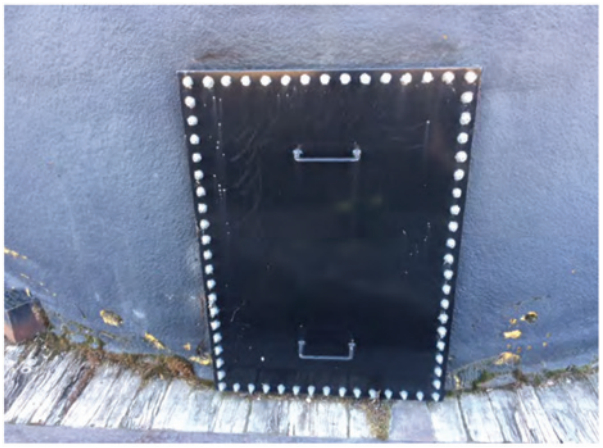


Figure 2. 15'3" Diameter 1000 Bbl Sales Oil

The vegetation growth and history of fluid in the secondary containment both present potential threats to the integrity of the tank floor and along the base of the insulated shell (See Figure 3). The monthly visual examination performed by owner/operator personnel did not identify the risk even though it was clearly visible, and the potential costs associated with the loss of the sales oil tank were significant. The observations were never documented for follow-up action.

Figure 3. Lined steel dike (secondary containment)

The tank was subsequently inspected and repairs to the tank floor were required. The monthly visual examinations function as an early warning system. Ultimately, it all could have been avoided.

This list is just a sampling; as a result, the issue feels overwhelmingly complex. It is a complex system of problems, especially when multiplied by hundreds or even thousands of tanks.

On so many levels, there is both a need and an opportunity for improvement.

THE INSPIRED APPROACH

The frustrations experienced across the industry were the inspiration to take a closer look at current practices, identify what we are trying to achieve, and what could be done to reduce soil, groundwater, and surface water contamination, and reduce operating costs, while managing hundreds of tanks at a time.

OVERVIEW OF THE TANK INSPECTION PROCESS

The inspection process and lifecycle of the tank are inherently linked through the initial design, system data, routine monthly visual examinations, mechanical integrity inspections, planned maintenance and repair, and a focus on continuous improvement. Instant access to meaningful data must be available to the various functional teams in a way that makes it easy for them to clearly understand, prioritize, and execute the required work.

Inventory and Data Verification

A critical component is to have an accurate inventory, as well as the ability to readily review and analyze historical data from various sources.

Data collection is focused on gathering the information we need to do the "job" for every function that is involved with the lifecycle of the tank. This means a complete record of each tank is maintained and readily available to both the inspector and the operator at any given time for reference and planning purposes.

Data is used to categorize the tanks by their characteristics/site-specific conditions (i.e., vertical, where the manway is located etc.)

Business rules (examination & strategy), as defined in the regulations are applied to the data. This supports consistent standardized and repeatable examinations and inspections.

When the inventory is properly accounted for, the data becomes extremely useful and powerful.

Monthly Visual Examinations

Tank data should drive the required monthly visual examination plan. Examiners, using mobile technology, should be presented with questions only relevant to the particular tank and associated system they are examining. Observations should be collected about the condition of the tank and associated system each month (comprised of observations and photos), and when the examination is completed, the tank data record should be updated. The tank examination should be user, GPS, date & time-stamped for transparency and due diligence, demonstrating reasonable precautions have been taken to prevent a release.

Maintenance and Repair Tasks, Documentation, and Tracking

Next, a Reviewer (subject matter expert) completes the monthly examination reviews and generates a tank exam report containing the observations, photos and recommendations that have been assigned a degree of severity (i.e., Severity 1: Immediate - mandatory repair or change required). This report can be attached to a service request to provide additional detail for the individuals assigned the task.

Focus on Making Continuous Improvements – Tank and System Design

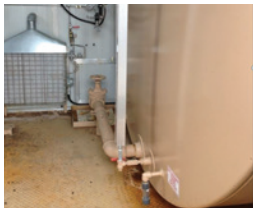
Modern technology can automate routine activities and reduce human error.

Tank integrity, maintenance, operations, compliance and management functions can be integrated. Sharing data and working together to improve the outcome will most likely reduce costs and improve operations. Opportunities for improvement also become more easily identifiable (e.g., operator awareness training, improvements to the type of overfill protection methods, etc.).

CONCLUSION

Tank inspection to achieve regulatory compliance has often been viewed as an expense. An inspired approach to tank integrity takes the opposite view. This proactive approach seeks to recognize threats and respond to them rather than to the spills or failures.



Data collected during the process supports the following outcomes:

- Assignment of correct inspection techniques to determine tank integrity
- More accurate budgeting, based on specific inspection type and routine maintenance tasks
- Ability to reduce costs by assigning appropriate resource skill and organization of similar tasks
- Targeted monthly visual examinations and inspections
- Improved regulatory and audit performance
- Understanding of tank degradation mechanisms
- Statistics that provide the ability to repair/address tanks degradation mechanisms at the root cause
- Knowledge and understanding of full tank inventory
- Ability to assign appropriate maintenance tasks to the tanks and associated system
- Reduction in duplication of effort
- Reduction in ad-hoc and rush jobs
- Reduction in inspection costs. Costs can be reduced by performing the most appropriate inspection and/or examination and extending the frequency of inspections
- Business logic is applied which coaches behavior that is consistent with applicable regulatory requirements
- Environmental leadership through reduction in environmental events and long-term cost associated with contamination related issues

Is your approach inspired? ■

For more information on this subject or the author, please email us at inquiries@inspectioneering.com.

The images above illustrate the diversity of tanks and secondary containment.

CONTRIBUTING AUTHOR

ELIZABETH BRUECKNER

Throughout her career, Elizabeth (Beth) Brueckner has worn many hats when it comes to dealing with the life cycle of tanks. From field level inspection, to API certified, to business owner and consultant, Beth has felt first-hand the many frustrations that exist in industry. Combining tanks and technology, Beth is the founder and thought leader behind G.K. Hills Consulting Ltd and its innovative Tank Management System with real-time field applications that are transforming the way tank data is collected and managed. G.K. Hills' focus on environment and sustainable operations delivers unprecedented value to the Clients and communities that it serves.