



AUTOMATED MONITORING & PROTECTION SYSTEM FOR EXTERNAL FLOATING ROOF STORAGE TANKS

A white paper identifying a solution to the challenges petroleum terminal operators face managing the risk of storm water accumulation on external floating roof storage tanks

Preventing discharges to the environment and the loss of roof buoyancy leading to potential roof failure during heavy rainfall events are two major concerns facing owners and operators of aboveground petroleum storage tanks constructed with external floating roofs. The challenge facing operators is whether to open or close the roof drain during heavy weather events such as tropical storms or hurricanes.

To protect the integrity of the floating roof and prevent a loss of buoyancy from the weight of storm water accumulating on the roof would require opening the roof drain to allow rainwater to discharge into the secondary containment system. While roof integrity is certainly important, wind-related stresses on the roof structure could cause damage to the internal roof drain piping resulting in a loss of product into the secondary containment if the roof drain remains open.

Until recently, there has not been a product that can detect hydrocarbons in the floating roof drain, automatically close the roof drain valve and send an alert to notify terminal personnel. EnviroEye, a patented technology with five years of proven success has been developed to provide terminal owners and operators with a continuous monitoring and protection system that addresses all of these concerns.

Operator Challenges - Storm Water Management

Roof drain lines on External Floating Roofs (EFR) must be constantly monitored by terminal personnel during rain events to prevent over accumulation of storm water on the roof and to ensure that storm water runoff does not contain water contaminated with petroleum hydrocarbons. Storage tank operators with EFRs are also challenged with managing the possibility of roof drain line failures introducing some amount of petroleum products into the discharge or in a worst-case scenario, draining the volume of the entire tank. Managing the release of storm water and preventing a discharge of product are critical terminal operations that require continuous monitoring of the roof drain system.

When preparing for inclement weather and heavy rains, terminal procedures usually require operators to remain onsite after regular hours, to open and close drain valves according to rain fall severity. This poses potential risks to operating personnel responsible for system management. Operators are challenged with whether to leave the roof drain valves open or closed.

If the roof drain valves are closed, excess rainwater can accumulate on the roof, causing a loss of buoyancy and the potential for the roof to sink which may then cause damage to the tank. If roof drains are open during a light or torrential rain event, all water immediately drains from the roof through and out of the tank into the diked area. If the roof drain line fails, stored product would drain through the line discharging petroleum product into the secondary containment system. This can be particularly problematic if the drain line fails during a storm event, as the operator is not likely to detect the problem for a while, which could potentially result in the loss of the entire tanks' contents. Also, sending personnel to examine the roof drain discharge point during a storm could subject the operator to health and safety concerns.

To make matters worse, a loss of product from a drain line failure could result in several negative outcomes for the terminal owner/operator including the potential for:

- Violations of a federal or state environmental permits;
- Unwanted media attention and impacts to Company image & stock price;
- Damage to the storage tank system, resulting in costly repairs, extended down time and loss of revenue; and

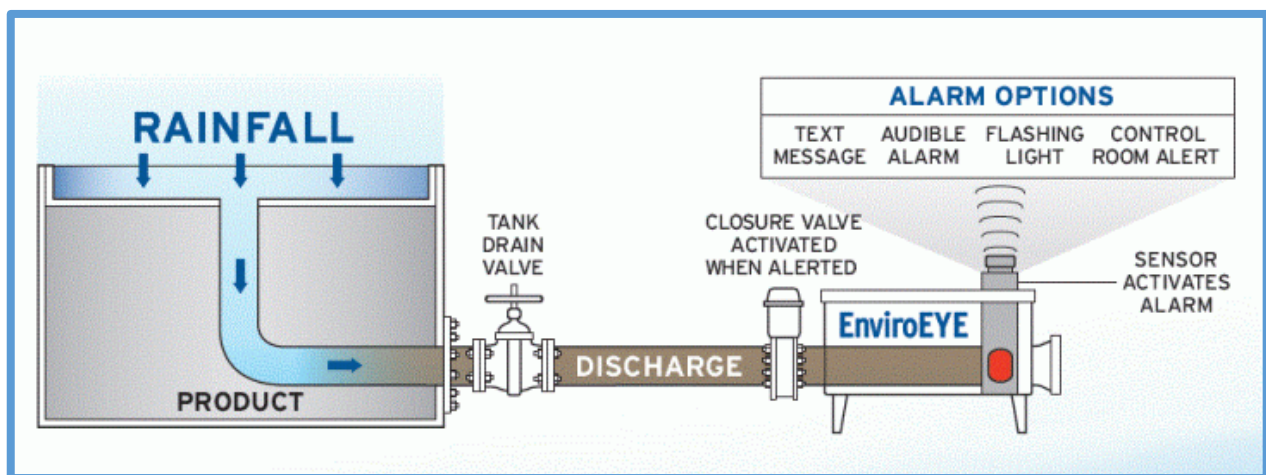
- Significant costs to remediate petroleum contaminated soils and groundwater.

However, the EnviroEye™ Drain Guard System (DGS) as further discussed below empowers operators to avoid these and other potential safety risks by leaving the valve open as the default setting. The EnviroEye™ DGS was created from an owner/operators' need to tackle these important concerns and other potential safety hazards (e.g., trips & falls, lightening, etc.) which can arise at aboveground storage tank facilities.

Operator Solution - Drain Guard System

To address the operator challenges mentioned above, EnviroEye™ has developed the Drain Guard System (DGS) for EFR storage tanks and secondary containment outfalls. This patented technology quickly detects hydrocarbons that may be present in the storm water being released through the roof drain or from a secondary containment system. If hydrocarbons are detected in the roof drain line, the DGS will immediately close the drain line valves and simultaneously send a message via text and/or other alerts that the system has activated. This enhanced capability allows managers and operators to leave roof drain valves open for constant draining during heavy weather, significantly reducing the potential for a EFR failure due to loss of buoyancy from the weight of storm water accumulating on the roof. Figure 1 below presents the component of the Drain Guard System.

Figure 1



The Drain Guard System by EnviroEye™ utilizes a UV-Fluorosensor, manufactured by Slick Sleuth^R to monitor and detect product escaping through the roof drain. This detection sensor is

mounted at the flow chamber discharge. A motor-controlled valve placed at the flow chamber inlet is activated by the sensor when hydrocarbon is detected. The sensor sensitivity configuration creates a detection baseline for closing the roof drain. The sensor works in wet or dry conditions and a baffle system slows the water enough so that entrained product can rise to the surface.

Alerts for notification of system activation may be sent in various ways, such as audio or visual alarms, or even a text message to key personnel. Additional protection may be added using a second motor control valve at the discharge, preventing remaining product in the chamber from escaping. This feature allows the terminal employees to focus on other regular preventive maintenance tasks. In a typical storm, personnel would investigate the situation as soon as possible. However, in the event of a torrential storm, visual examination of these systems might be delayed.

The EnviroEye™ DGS offers additional monitoring features to detect potential failures. Magnets can detect drain line corrosion by capturing scale for analysis. If a line weep is detected, sorbent pads can be installed to trap small amounts of product for examination. This preventative monitoring is an inexpensive way to avoid costly disruptions to tank operation. The DGS improves discovery of potential failures to determine if the tank needs closer inspection or might need to be put into an earlier rotation for its out-of-service API 653 inspection. The drain guard system is designed to activate immediately upon detection of drain line failure. With configurable settings for when to close drain valves and ability (using diapers) to absorb small amounts of hydrocarbon contamination, the DGS helps keep the tank in service until maintenance can be scheduled. These systems are available in standard configurations or may be built to customer specific site requirements.

The Drain Guard System also has applications beyond the monitoring of floating roof drain valves. The DGS can simplify and automate monitoring/control of other areas that must manage rainwater runoff, especially secondary containment outfalls, retention pond and storm water sumps. The DGS becomes the last “eyes” on any runoff before it leaves the facility. With the DGS, operators can be confident that product contaminated water is not exiting their terminal. Terminal owners who weigh the costs of product loss, environmental contamination and

remediation, potential storm damage to tanks, along with associated disruption to revenue stream recognize the benefit of installing the DGS.

Features & Benefits

- DGS is inexpensive compared to the cost of inventory loss and environmental remediation in the event of a discharge of petroleum product
- Minimize environmental exposure
- Demonstrate environmental responsibility
- Reduces the need for in-person oversight
- Real time electronic monitoring
- Customized to client needs
- Five years of proven results including survival of major hurricane
- Manages/reduces facility risk
- May reduce insurance costs
- Addresses important elements of the SPCC Plan regulation
- DGS technology can handle the head pressure of an aboveground storage tank and does not require submerged sensors or equipment to operate.
- The DGS helps avoid downstream fouling. DGS will activate immediately in alarm condition and is not subject to the time lag of other solutions.
- The DGS automates management of open roof floating tank drains and enables early detection of scale in the discharge, helping avoid costly failures.
- The DGS has proven itself, notably at a Florida installation, and has given the operator a return on investment by preventing disruption to operation and product delivery.

Conclusion

The EnviroEye™ Drain Guard System's patented technology automates monitoring and control of floating roof and secondary containment drains to detect and prevent the discharge of petroleum products. Designed to operate within hazardous locations, the DGS reduces maintenance and monitoring costs. The DGS can be installed and configured with no service interruptions. The EnviroEye™ DGS adds a level of insurance for your facility operation, giving

operators and safety managers confidence that the facility is never disrupted by catastrophic drain line failures.