Early Detection of Hydrocarbon Contamination in Petroleum Terminal Stormwater Systems

Continuous Monitoring of Roof Drains, Containment Outfalls, Sumps, and Facility Discharge Points

Petroleum terminals and hydrocarbon handling facilities must continuously manage the movement of water through their operations. Rainfall, wash water, and contact water move through drainage systems designed to protect equipment and maintain safe operations.

Across a typical terminal, numerous discharge points exist where water exits operational systems, including floating roof tank drains, containment dike outfalls, loading rack sumps, dock containment areas, contact water tanks, and treated water discharge systems. Each of these locations represents a potential pathway for hydrocarbon contamination if a leak, equipment failure, or operational upset occurs.

Historically, many of these discharge points have relied on periodic manual inspection or operational procedures to identify abnormal conditions. While these methods remain important, continuous monitoring technologies can provide earlier detection and improved operational awareness.

The EnviroEye™ Drain Guard System was developed to provide automated monitoring of stormwater discharge and contact water streams, allowing operators to detect hydrocarbon contamination and isolate discharge pathways when necessary.

Stormwater Risk Points in Hydrocarbon Facilities

Common discharge locations within terminal facilities include:

- External floating roof tank drain systems
- Secondary containment dike outfalls
- Contact water collection tanks
- Railcar and truck rack loading sump systems
- Dock line containment sumps and transfer areas
- Well head and production area drainage systems
- Post-treatment discharge from oil-water separators or treatment units

• Final stormwater outfalls leaving the facility

While these systems are necessary for safe operation, they also represent potential pathways for hydrocarbon release if contamination enters the drainage stream.

Many discharge points operate intermittently, depending on rainfall events or operational activities. Because of this intermittent flow, monitoring conditions at these locations can be challenging. Small releases may go unnoticed during routine inspection intervals, and may only become apparent after contamination has spread within containment areas or stormwater systems.

For this reason, early detection at discharge points is an important tool in reducing the risk of environmental releases.

External floating roof (EFR) storage tanks present one of the most well-known stormwater management challenges within petroleum facilities.

Rainwater accumulates on the floating roof surface and must be drained to prevent excessive loading that could threaten roof buoyancy. Roof drains allow this water to pass through the tank and ultimately discharge into secondary containment areas.

Operators must balance two operational risks:

• Leaving roof drain valves closed, which may allow water accumulation that could affect roof buoyancy during heavy rainfall.

• Leaving roof drain valves open, which allows drainage but creates a potential pathway for hydrocarbon release if the roof drain line fails.

Drain line failures may occur due to corrosion, mechanical wear, gasket failure, or damage resulting from roof movement. In such cases, stored product may enter the drain line and discharge into containment systems.

While extreme weather procedures may require operators to leave roof drains open to protect tank integrity, many failures develop gradually during normal operations as small leaks or seepage events. Detecting these early warning conditions can prevent larger releases.

Automated Monitoring of Stormwater Discharge

Continuous monitoring technologies provide a practical way to detect hydrocarbon contamination within discharge streams before contamination spreads through containment systems or leaves the facility. One approach to implementing this monitoring strategy is the use of automated hydrocarbon detection systems installed directly within stormwater discharge lines.

The EnviroEye™ Drain Guard System provides automated monitoring of stormwater and contact water discharge streams using a UV fluorosensor manufactured by Slick Sleuth®. The

sensor detects the presence of hydrocarbons in the water passing through a monitoring chamber installed within the discharge line.

When hydrocarbons are detected above a configured threshold, the system initiates an automated response:

• A motor-actuated valve upstream of the monitoring chamber closes to isolate the discharge pathway.

• Alarm notifications are transmitted to designated personnel through visual, audible, or electronic alerts.

• Operators can then investigate the source of contamination and determine appropriate corrective action.

The monitoring chamber incorporates internal baffling that slows the water flow, allowing entrained hydrocarbons to separate and accumulate near the surface where the sensor can detect them.

Because the system operates within the discharge stream rather than inside the tank or sump itself, sensors are not exposed to submerged operating conditions and can function during both wet and dry periods.

Early Detection During Routine Operations

Many hydrocarbon releases begin as small leaks or developing equipment failures that occur during normal operating conditions rather than during severe weather events.

These early-stage releases may produce only trace contamination in discharge streams and may not be immediately visible during periodic inspections. Continuous monitoring systems can identify these conditions early, allowing operators to respond before the situation escalates.

In addition to hydrocarbon detection, monitoring chambers may incorporate supplemental features that help identify developing maintenance issues. For example, magnetic collectors can capture corrosion scale or debris from drain lines, providing an early indication of internal pipe degradation. Sorbent pads can also be used to capture trace hydrocarbons for visual inspection.

By identifying abnormal conditions early, facilities can schedule maintenance and corrective actions before failures lead to significant product loss or environmental impact.

Applications Across Terminal Infrastructure

While the system was initially developed for floating roof drain monitoring, the same monitoring concept can be applied across many areas of petroleum terminal infrastructure.

In these applications, the system acts as a final safeguard, providing automated detection before contaminated water exits the facility.

Operational Benefits

Automated monitoring of discharge streams provides several operational advantages:

• continuous monitoring of hydrocarbon contamination in water streams

• early detection of leaks or equipment failures

• reduced reliance on manual inspection during adverse weather conditions

• improved environmental risk management

• support for facility spill prevention and control procedures

• reduced potential for product loss and remediation costs

Because the system can be installed on existing piping and drainage systems, it can often be integrated into facility infrastructure without requiring major operational disruption.

Continuous monitoring technologies provide an additional layer of protection by detecting hydrocarbon contamination early and allowing operators to isolate affected discharge pathways before significant releases occur.

The EnviroEye™ Drain Guard System extends this capability to critical stormwater and contact water discharge points throughout terminal infrastructure. By monitoring roof drains, containment outfalls, sumps, and treated water discharge locations, facilities can improve environmental protection, reduce operational risk, and maintain safer stormwater management practices.