



2017 Conference and Exhibition

Accidents Need Not Happen

Novel Approaches to Automated Spill Detection and Containment for Tanks & Terminals

Chris R. Chase
Environmental Systems Manager
InterOcean Systems / San Diego, CA
chrisc@interoceansystems.com

Mark Rauch
Owner / Operator / CEO
Pipeline & Terminal Management Corp / Houston, TX
markr@ptmc.us



Benefits of Early Warning Detection

- Risk Mitigation
- Minimize Costs for Response & Clean-Up
- Protect Corporate Image
- Social Responsibility (CSR)
 - Be a Part of the Solution
- Environmental Compliance

Key Points • Early-Warning Spill Detection



- Multiple Benefits Associated with Proactive Spill Monitoring & Automated Containment
- Use Risk Assessment Tools & Define Strategic Approach
- Smart Technology Trend Empowers Users
- An Ounce of Prevention is Worth a Pound of Cure

Risk Management • Heat Mapping Strategy

Medium

High

Critical

Low

Medium

High

Low

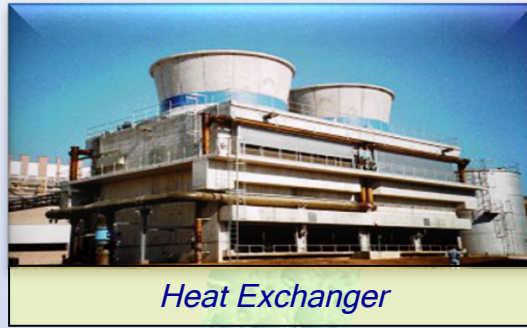
Low

Medium

Strategic Early Warning & Containment



Tank Farm Storage



Heat Exchanger



Power / Process / Cooling

Point-Source:



Failsafe:



Strategic Deployment of Sensors

Point-Source Monitoring

Upstream: Detection Near to Potential Source(s)
for Earliest-Possible Detection & Containment

Failsafe Monitoring

Downstream Detection Near to Discharge Point
for Failsafe Containment before Discharge

Strategic Early Warning & Containment



Left: May 21, 2015

Right: June 23, 2015

Images of Drainage Culvert North of HWY 101

The *Rufugio* Oil Spill in Santa Barbara CA

Could Have Been Prevented !

Strategic Early Warning & Containment

***Tanker Spills and Offshore Rig-based Failures Are NOT
the Largest Source of Oil Releases***

Approximately:

- 12,000 – 15,000 Oil Spills are Reported Annually in USA
- Over 50% of Reported Spills Occur at Inland Facilities



Current Technologies



Capacitance Probe



**Risk of
Doing Nothing!**



UV-Optical



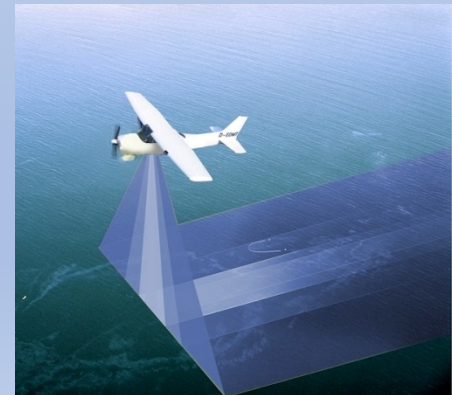
**Flow Through
(UV) Analyzer**



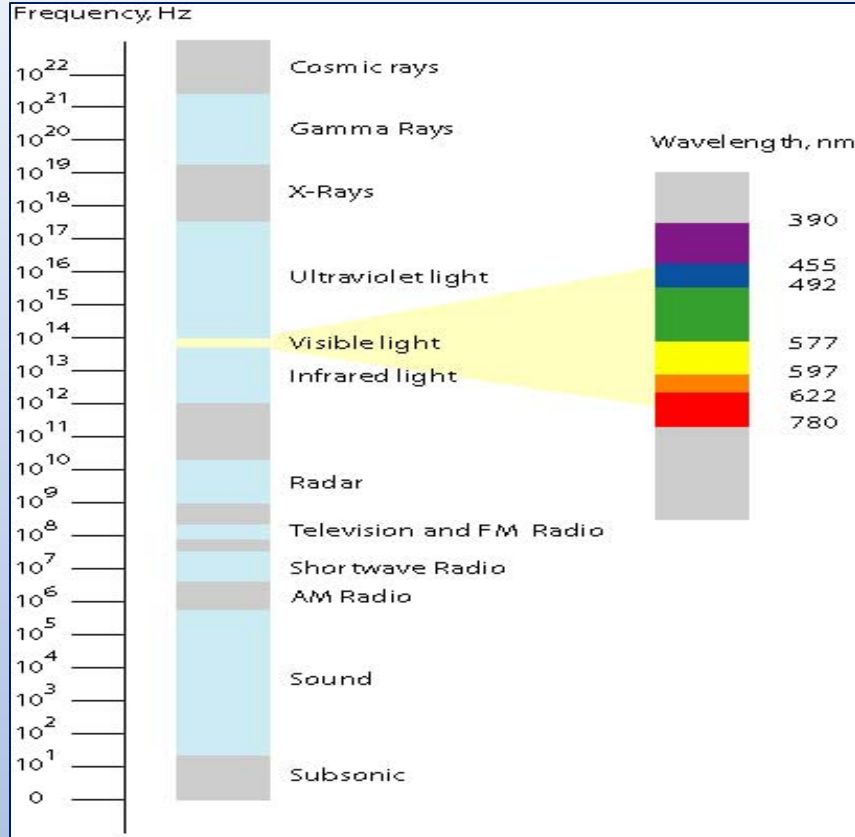
Conductivity Probes / Cable



Remote / Airborne



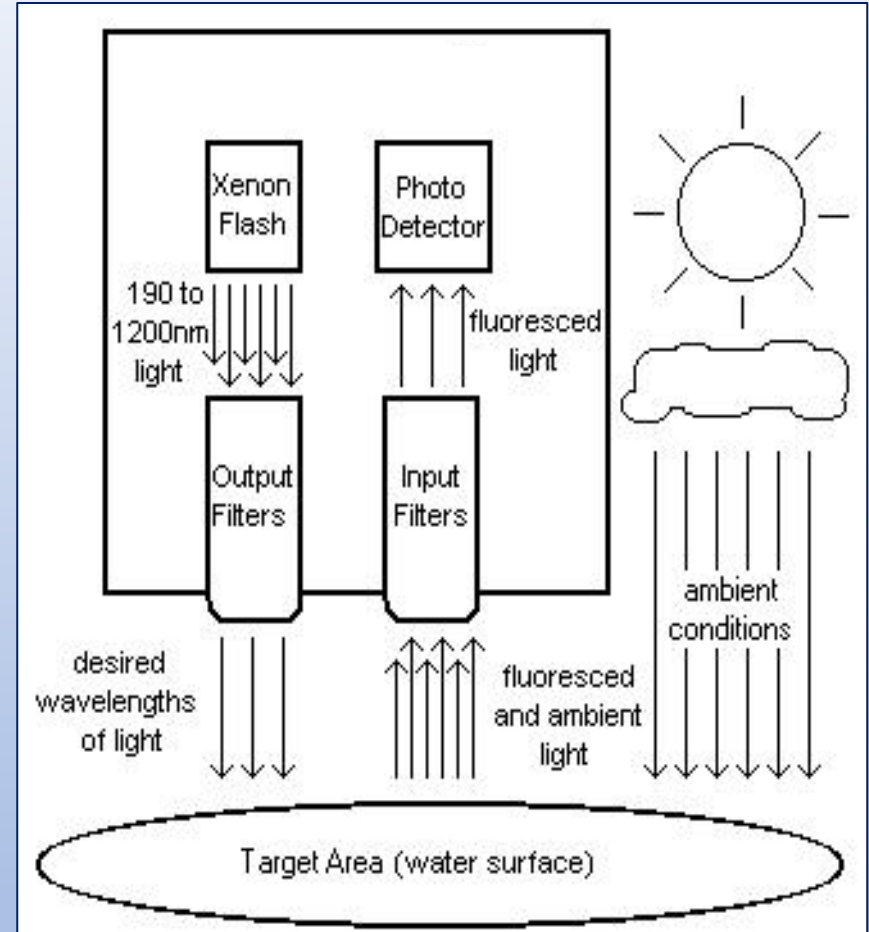
UV-Based Sensor • Theory of Operation



Remote Non-Contact Sheen Detection

Monitors for hydrocarbons using Ultraviolet (UV) source for excitation & detection of fluorescence

Oils typically absorb light between 300 - 400nm, then emit light in the longer 450 to 650nm range



- **Extremely Sensitive**
- **No Probe, No Fouling**
- **Immune to Ambient Conditions**

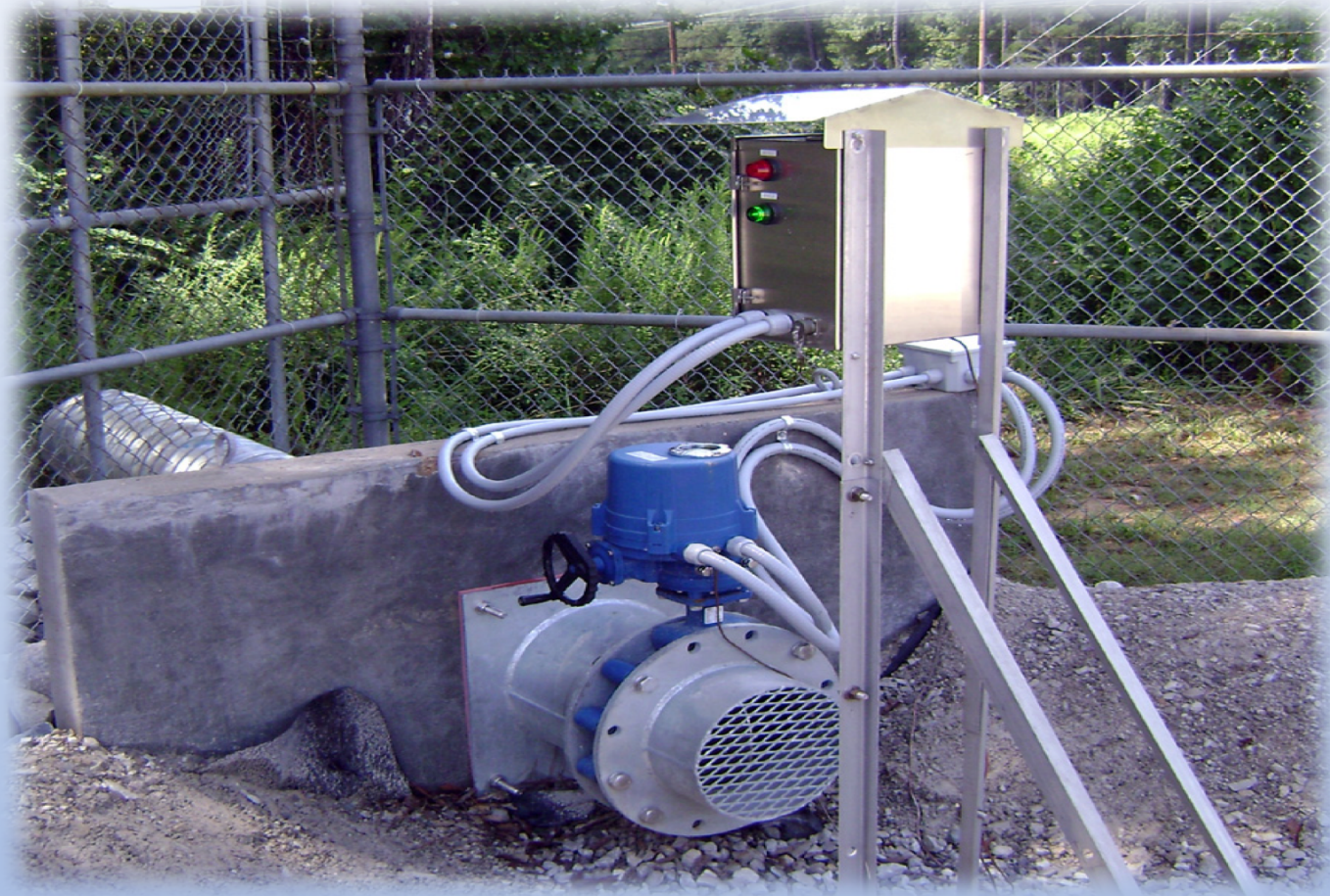
UV-Based Sensor • Theory of Operation



Patented Slick Sleuth Remote Oil Spill Detection & Alert System

- 24/7 Real Time Monitoring for Leaks & Spills
- Proven, Optical, Non-Contact System

Installation Example • Remote Inland Applications



Autonomous Monitoring & Control System

- Detection, Containment, & Remote Alert
- Designed to PREVENT Accidental Releases (to surrounding sensitive habitat!)

Installation Example • Marine Terminals



● *Oil Sheen Monitors*

Installation Example • Marine Terminal



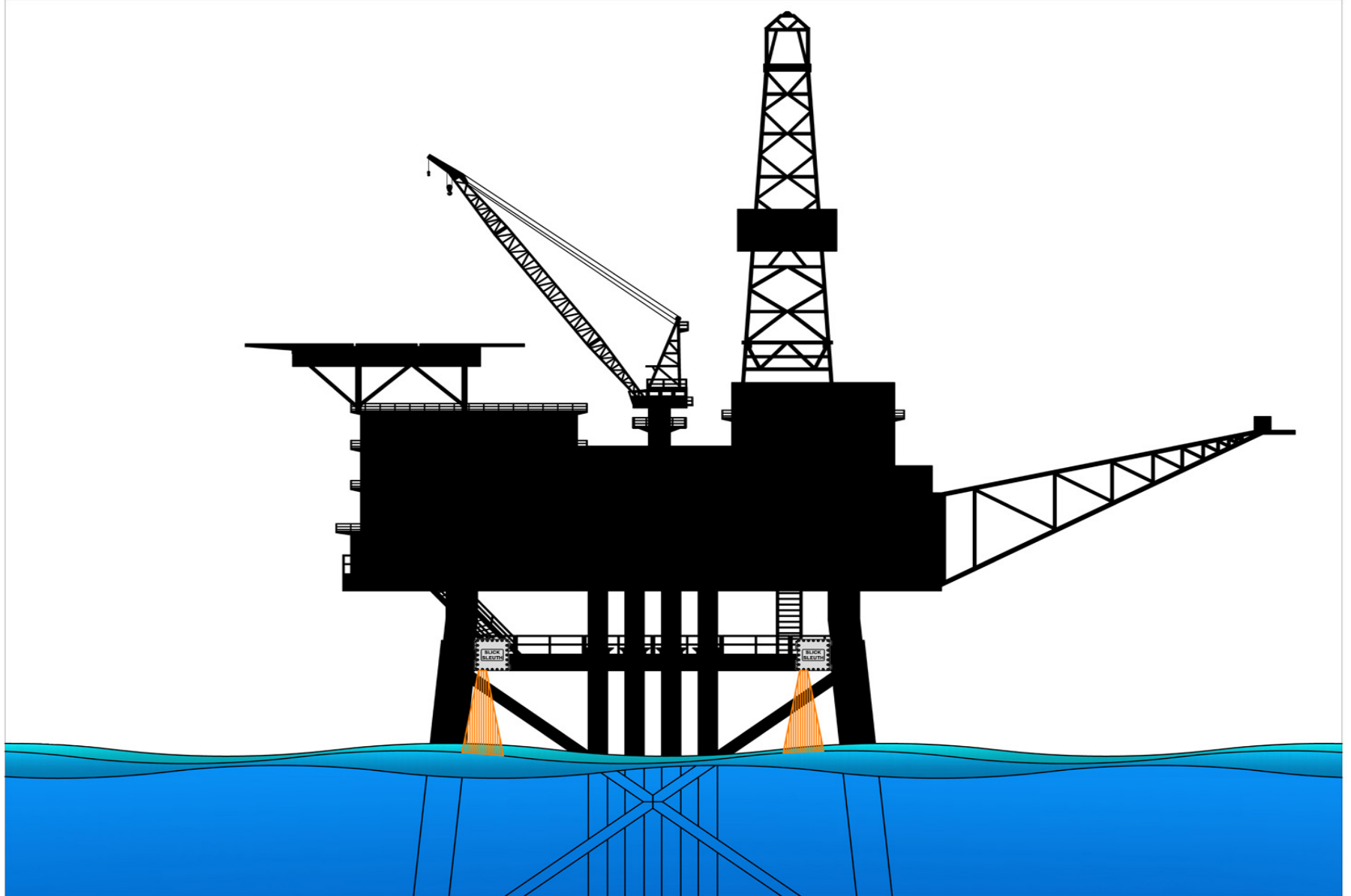
Installation Example • Commercial Terminal



Installation Example • Offshore Loading Buoy



Installation Example • Offshore Platforms



Installation Example • Offshore Platforms

Crowne Plaza Houston River slick-sleuth


https://slicksleuth. 67% Search

Slick Sleuth

Chris Chase

Dashboard

Map Satellite



Google

Map data ©2017 Imagery ©2017 Terms of Use

Stations

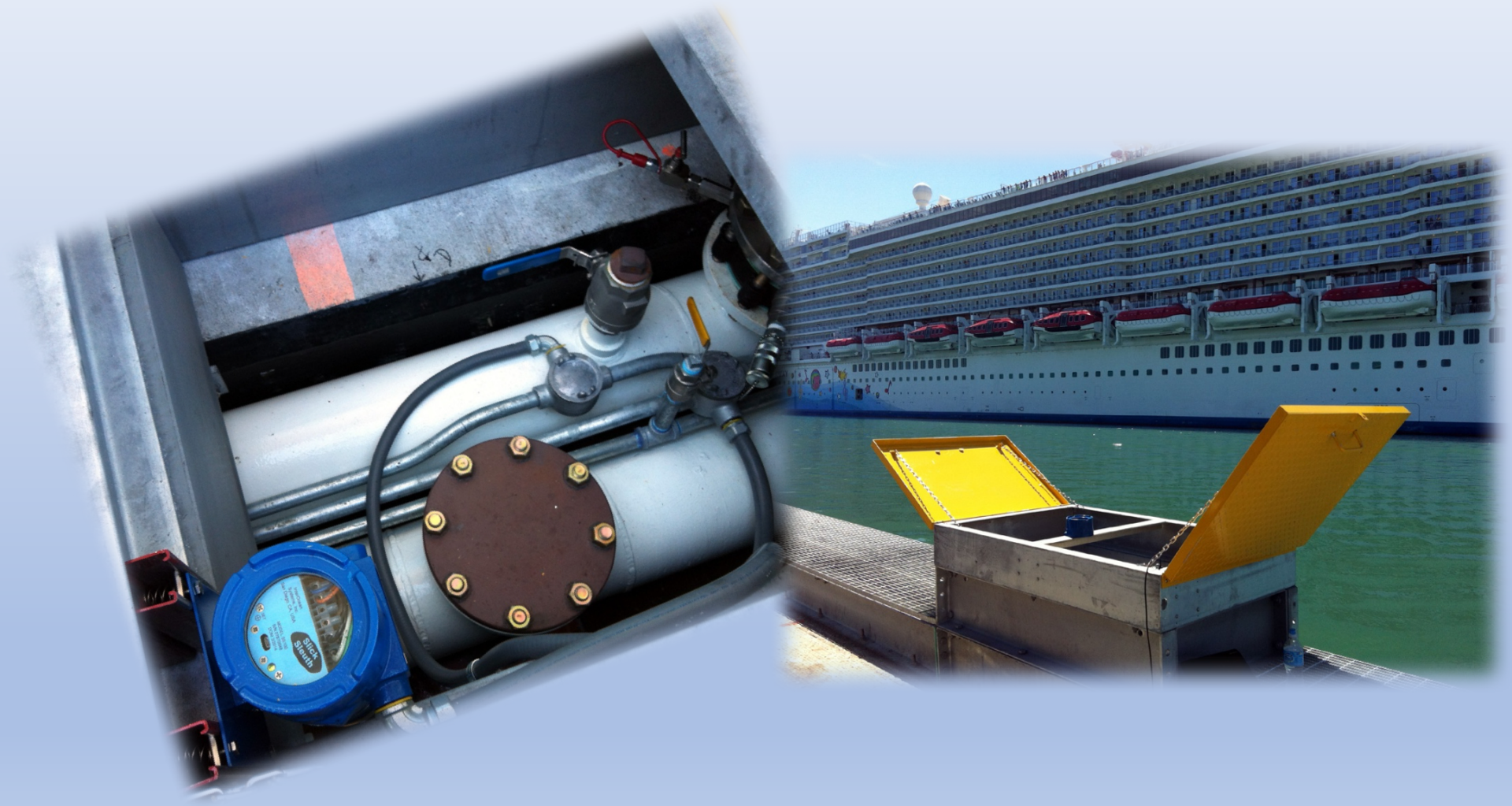
OTC Remote (09)	Platform 01 North (02)	Platform 01 West (03)
Spill <input checked="" type="checkbox"/>	Spill <input checked="" type="checkbox"/>	Spill <input checked="" type="checkbox"/>
Station <input checked="" type="checkbox"/>	Station <input checked="" type="checkbox"/>	Station <input checked="" type="checkbox"/>
Connection <input checked="" type="checkbox"/>	Connection <input checked="" type="checkbox"/>	Connection <input checked="" type="checkbox"/>
05/01/17, 5:07:37 am	05/01/17, 5:07:39 am	05/01/17, 5:07:08 am

Platform 01 South (04)	Platform 01 East (01)
Spill <input checked="" type="checkbox"/>	Spill <input checked="" type="checkbox"/>
Station <input checked="" type="checkbox"/>	Station <input checked="" type="checkbox"/>
Connection <input checked="" type="checkbox"/>	Connection <input checked="" type="checkbox"/>
05/01/17, 5:03:04 am	05/01/17, 5:07:43 am

Installation Examples • Spill Containment Booms



Installation Example • Cruise Ship Terminal



Installation Examples • Tanks & Terminals



Accidents Need Not Happen, Cont.

Novel Approaches to Automated Spill Detection
and Containment for Tanks & Terminals

CASE STUDY: Monitoring Floating-Roof Tank Drains

The Tank Roof Drain Puzzle

Open or Closed ??

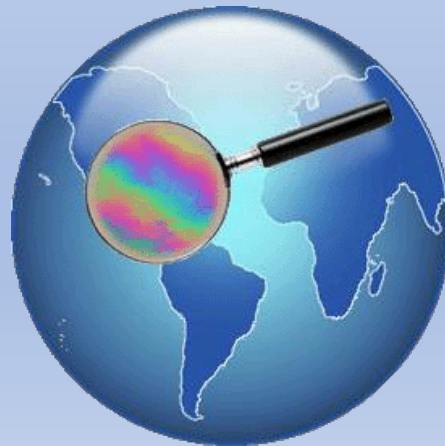
Available Solutions

Field Experience

Lessons Learned During Super Storms

Key Points • Tank Roof-Drain Monitoring

- Estimated 3 million Aboveground Storage (ASTs) Tanks Worldwide (~700k in USA)
- There's No One-Size Fits All Solution
- Pros and Cons for all Types of Tanks
- Inherent Risks Associated with all Storage Tanks
(...and *Super Storms Magnify Risk Profile*)
- Value of Automated Monitoring & Control
New Technology is Being Proven to Lower Risk



Key Points • Tank Roof-Drain Monitoring



- **Fixed Roof**

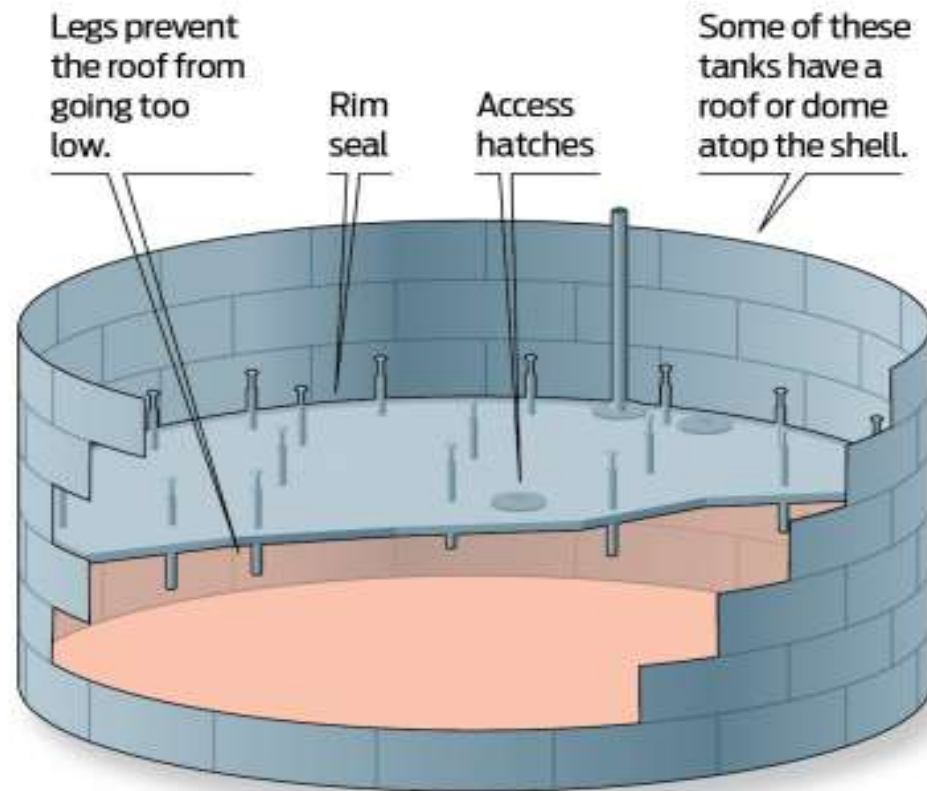
- Domes
- Cones
- Internal Floaters

- **External Floaters**

External Floating-Roof Above Ground Storage Tanks (ASTs)

A floating-roof tank

A floating-roof liquid storage tank is one in which the top of the tank floats on the liquid itself — oil, fuels and other volatile liquids. The point is to prevent the accumulation of vapor between the liquid and the roof. Such vapors can be flammable.



Source: EPA

Houston Chronicle

Above Ground Storage Tank (AST) with Floating Roof

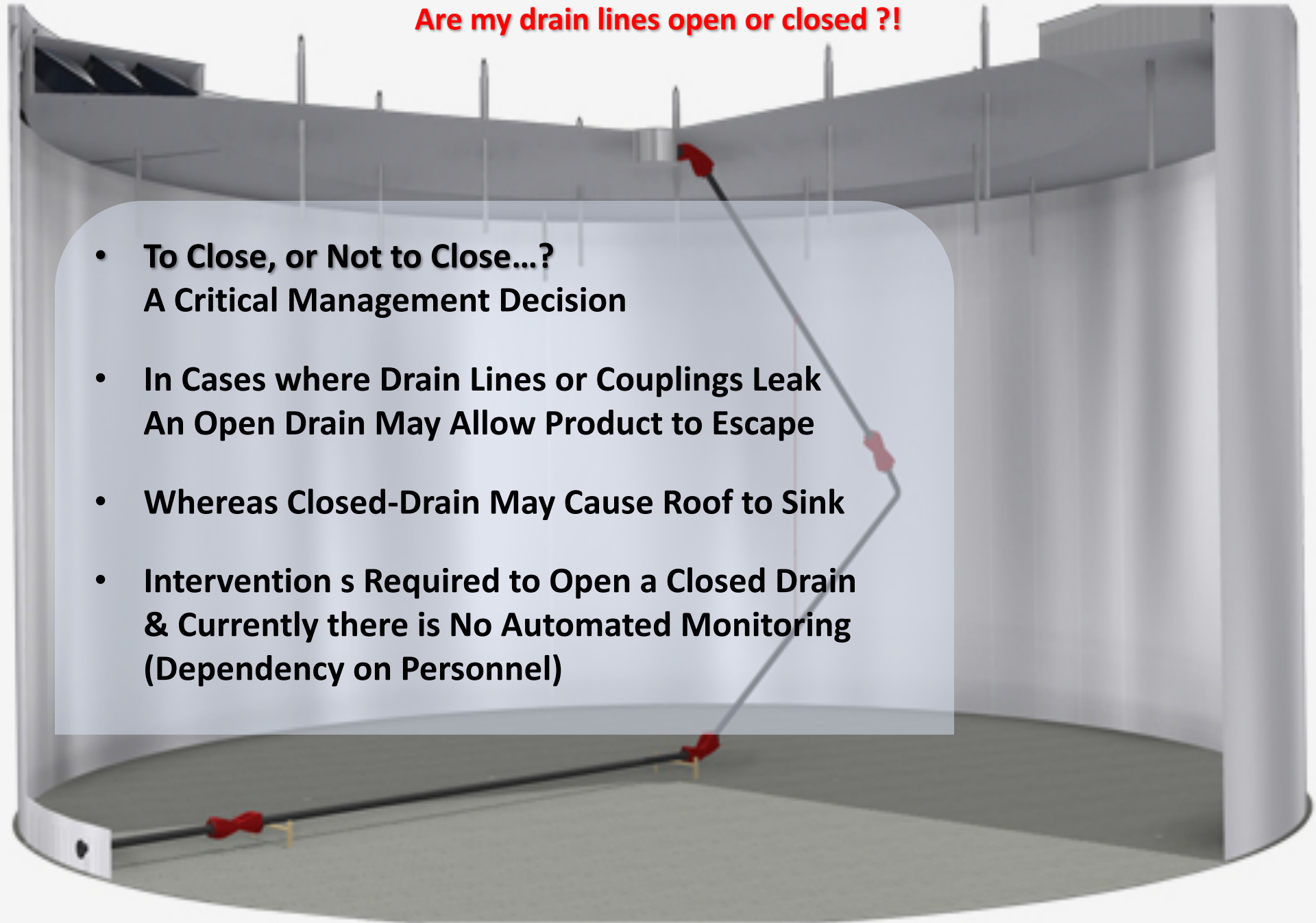
- External “Floater” where Storm-water Collects *if* Roof Drain is Closed
- *The Operator’s Dilemma...*
– *Drains Open or Drains Closed ?*
- The Preferred Position is Always-Open, Allowing Water to be Discharged
- But, There Are Tradeoffs...



The Operator's Conundrum

Are my drain lines open or closed ?!

- **To Close, or Not to Close...?
A Critical Management Decision**
- **In Cases where Drain Lines or Couplings Leak
An Open Drain May Allow Product to Escape**
- **Whereas Closed-Drain May Cause Roof to Sink**
- **Intervention s Required to Open a Closed Drain
& Currently there is No Automated Monitoring
(Dependency on Personnel)**

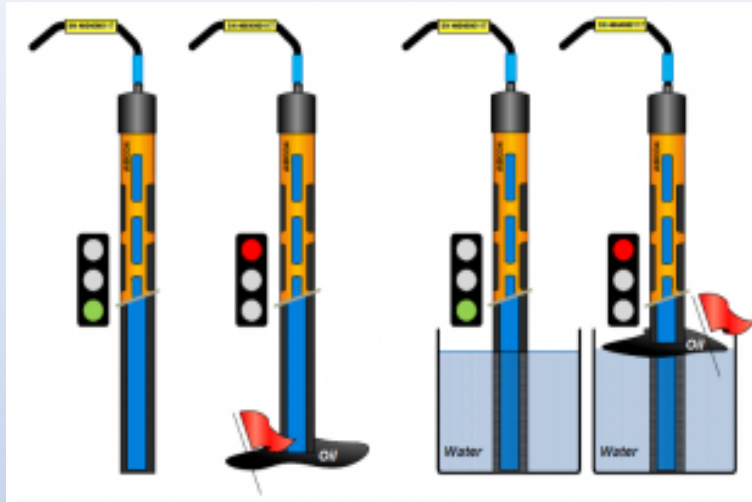


Strategies / Procedures Employed by AST Operators

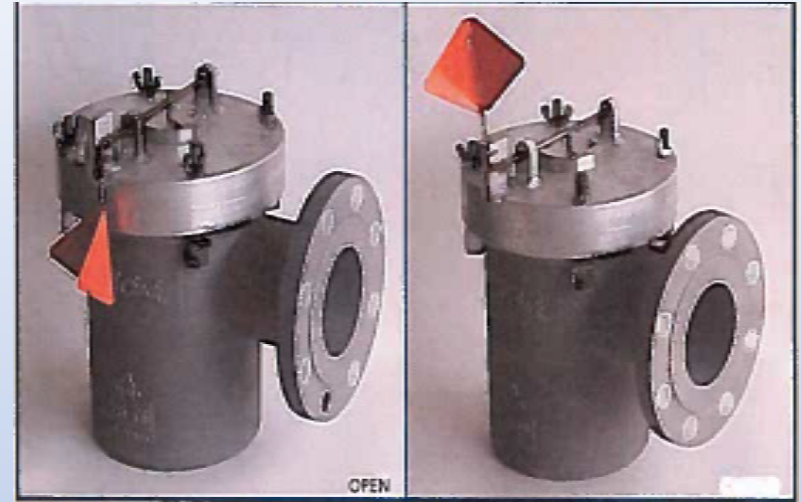
- **Planning:** Establish Open/Closed Drain Protocols, Responsibility/Reporting, and Personnel Training
- **Operating:** Ensure AST Roof Drains are Open/Closed as Appropriate for Current/Forecast Weather Conditions
- **Contingency:** Do Protocols Change During Extreme Weather?
- **Tools:** What Monitoring / Automation / Control Tools Exist?



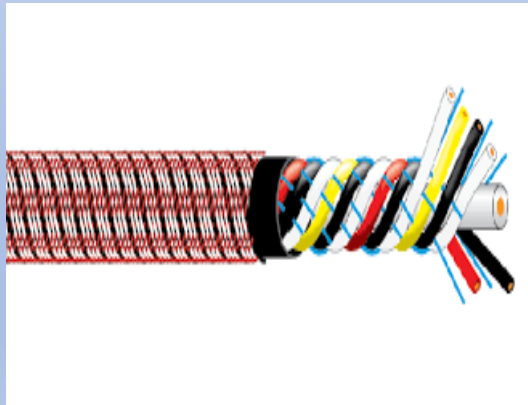
Leak Detection Technologies for ASTs



Fuel Sensing Cable



Styrofoam Ball-Valve



Fuel Sensing Cable

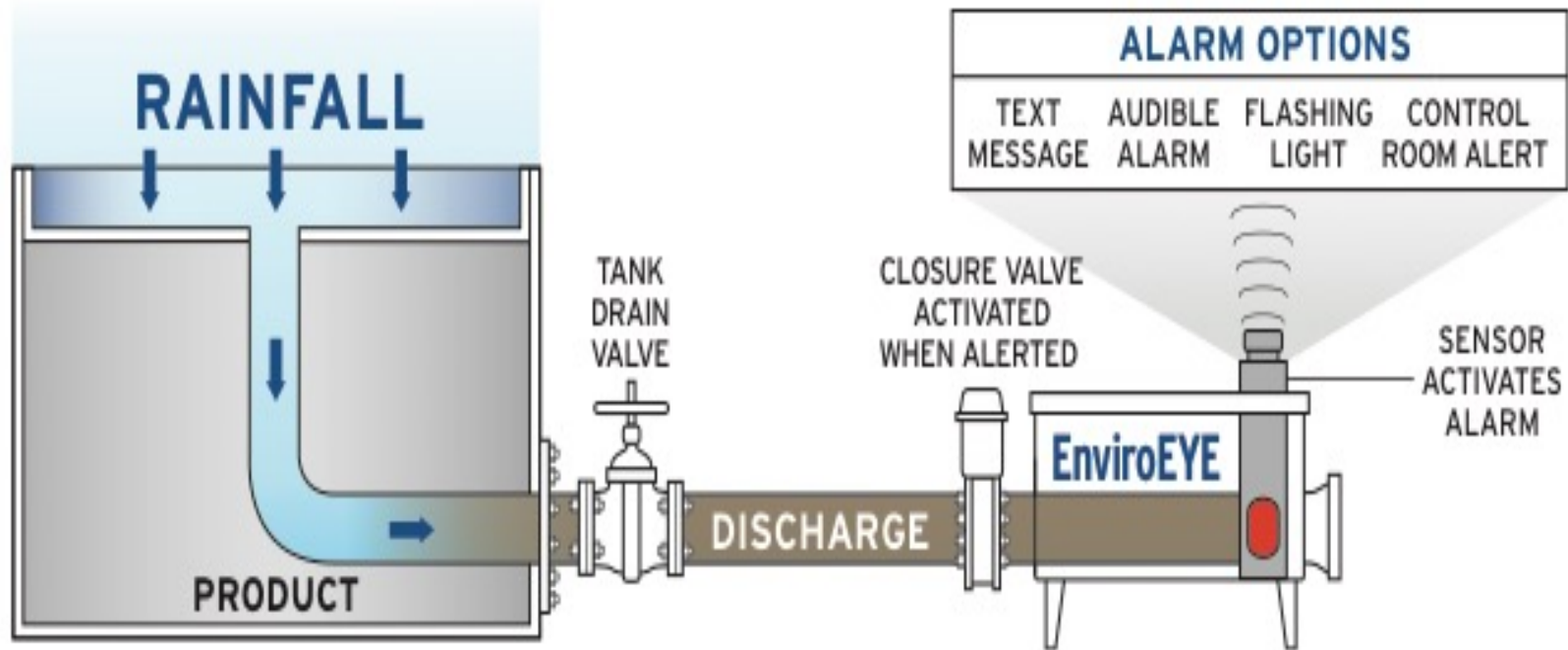


Optical Sensor System



Conductivity Probe

Leak Detection Technologies for ASTs



Recently Patented “EnviroEye” Roof-Drain Monitoring & Discharge Control System

- Automated Detection & Containment
- 24/7 Real Time Monitoring for Leaks
- Eliminates PPE Issues and Reliance on Human Intervention

Leak Detection Technologies for ASTs

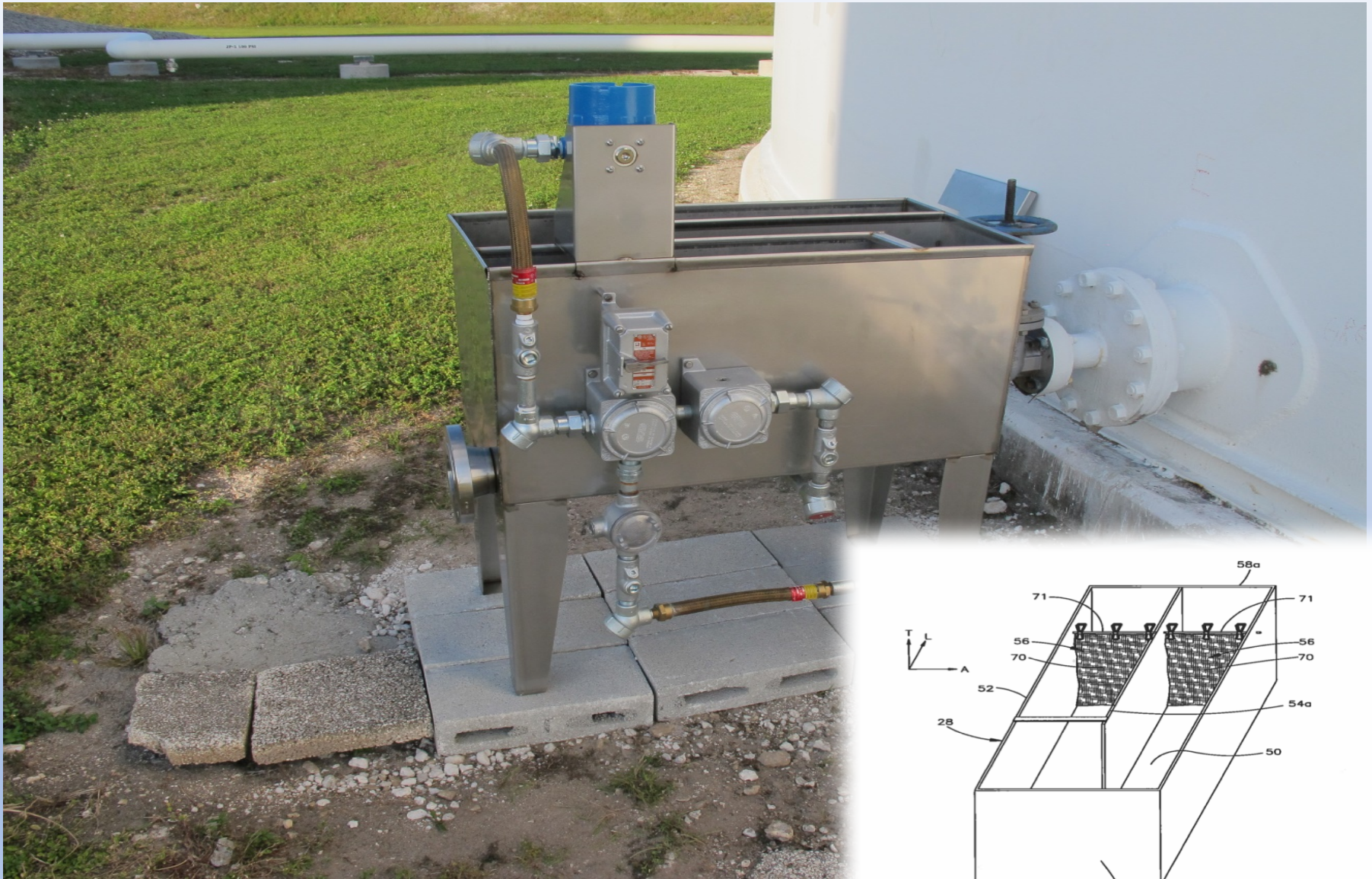


Bird's Eye View



Unit Installed & Operating on AST Floater in Key West
24/7 Monitoring Resulted in Detection of 'Weeping' Drain Line

Leak Detection Technologies for ASTs



Unit Installed on AST Floater in Key West

Flow Chamber Slows Discharge, Provides Control Point for Automated Containment, and Houses Absorbents & Magnets

In the Wake of The Storms...



Post Harvey ~ Houston Chronicle 11/11/17

Lessons Learned & Final Comments



- **Alignment of Valves for a Storm**
- **Equalize Tanks when Possible**
- **Ride Out Crew**
- **Communications - Satellite Phone**
- **Maybe No Access – and For How Long?**
- **Debris, Hazards - Safety PPE**
- **Unforeseen Damage and Danger**
- **Tie Downs and Stow Loose Gear/Equipment**
- ***If* Facility Must Be Abandoned (Inaccessible)**
Override and Bypass Automated Systems...

Post Harvey ~ NOAA, Aerial Download
Image Captured via: <https://storms.ngs.noaa.gov/>

Questions?



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