Chevron / OSPR
Oil Spill Response Technology Workshop

February 25, 2015 ~ Alameda, California

Risk Reduction
Early Warning Detection of Oil Leaks & Spills

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Slick Sleuth™

Oil Spill Sensor & Alarm

- **Real-Time Spill Detection**
- **Reduces Risk of Discharge**
- **Best Management Practice**
- **Ounce of Prevention**

…Pound of Cure!

Who Uses Slick Sleuth?

Power Generators
Power Plants (Coal, Fuel, Nat. Gas)
Hydro-Electric & Nuclear Power
Compressor Stations
Remote Substations

Heavy Industry
Steel & Aluminum
Pulp & Paper
Food Oils & Ethanol
Manufacturing Factories

Offshore Industry
Offshore Platforms
Manned & Unmanned Rigs
Marine Terminals
Loading/Transfer Buoys

Environmental
Stormwater Monitoring
Inland Waterways
Aquaculture & Fish Farms
Sensitive Habitats

Transportation
Ports & Harbors
Fuel Docks & Shipyards
Airports
Railways

Oil & Petrochem
Refineries
Terminals
Oil Production Sites
Mid-Stream – Pipelines &Storage

Water Quality
Desalination
Intake Protection
Wastewater Treatment
Municipalities

What Constitutes an Oil Spill ?

"…any quantity of discharged oil that violates state water quality standards, causes a film or sheen on the water's surface, or leaves sludge or emulsion beneath the surface. For this reason, the Discharge of Oil regulation is commonly known as the 'sheen' rule… Under this regulation, reporting oil discharges does not depend on the specific amount of oil discharged, but instead can be triggered by the presence of a visible sheen created by the discharged oil…"

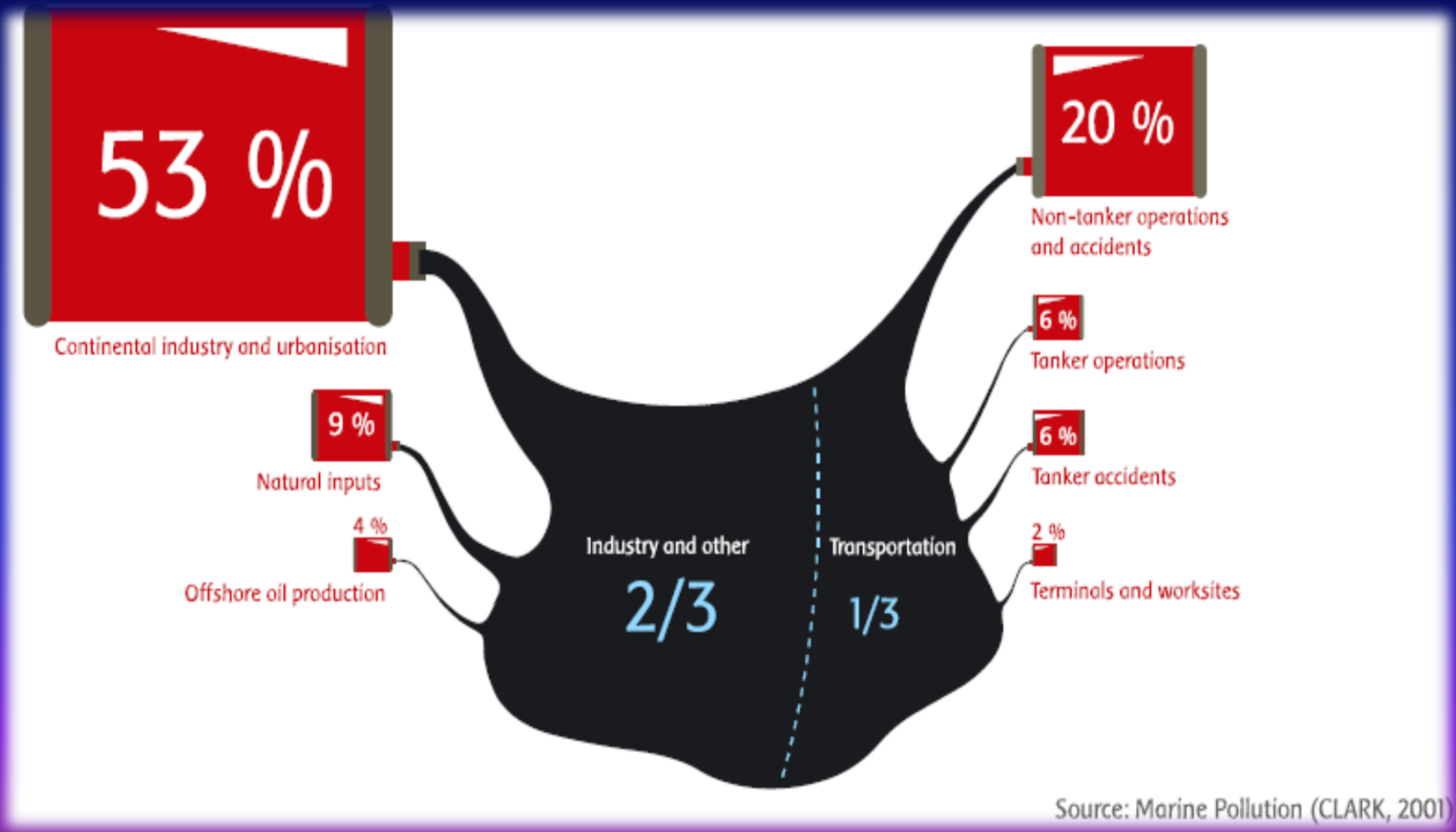
$C_5 H_{12}$ ↕ $C_{18} H_{38}$

US EPA ~ Ref. 40 CFR part 110, Discharge of Oil regulation, and 40 CFR part 112, Oil Pollution Prevention regulation

In-Shore Spills Are A BIG Issue

Approximately:

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



** Texas Water Resources Institute*

Key Drivers

- **Reduced Risk of Oil Discharge = Cost Benefits**
- **Minimize Clean-Up Expense & Inventory Loss**
- **Protect Corporate Image (stay out of the news!)**
- **Improve CSR & Environmental Stewardship**
- **Compliance w/ Pollution Regs & Best Practices**



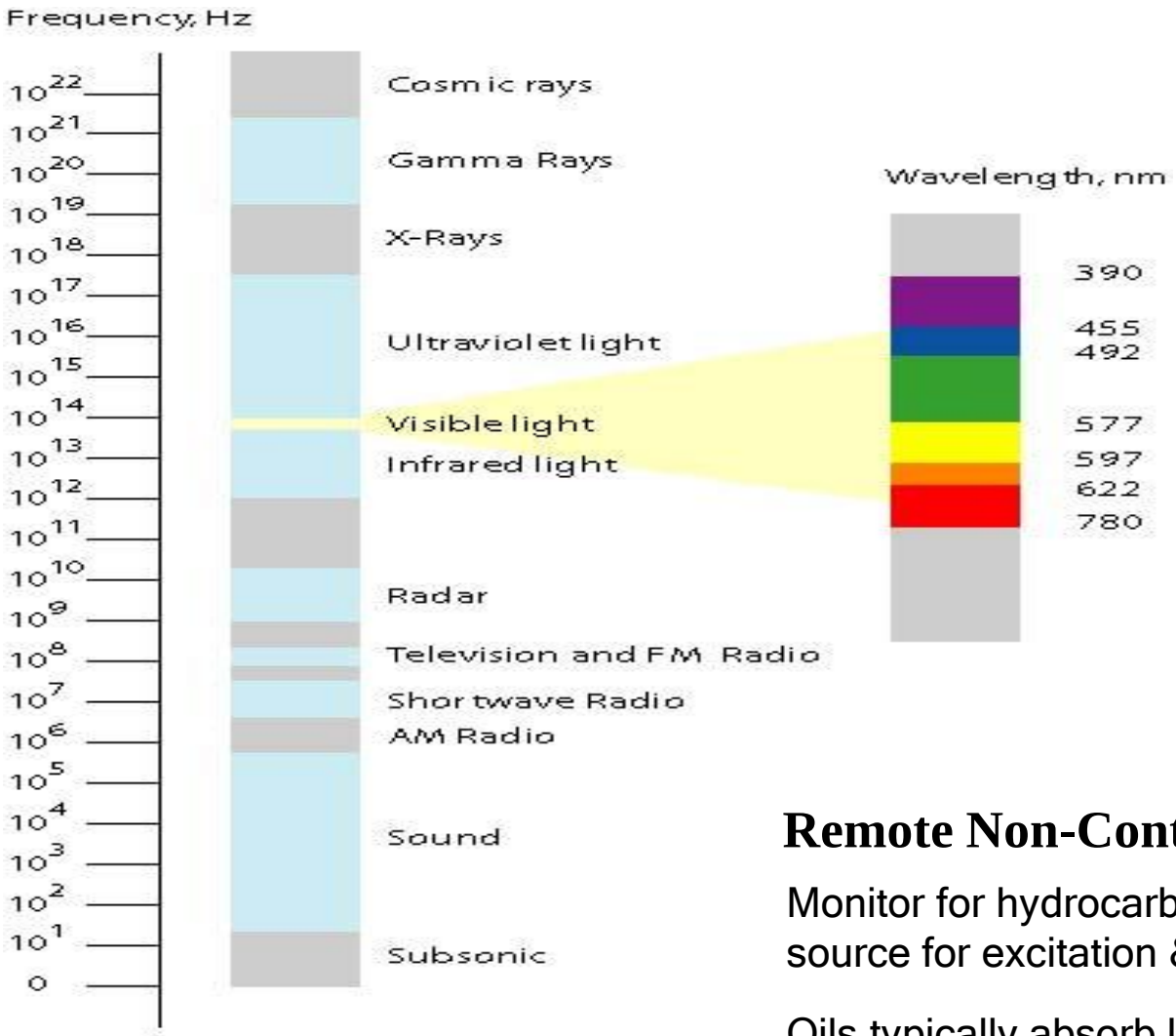

Remote Oil Spill Detection

- **Optical (Non-Contact) Oil Detection Sensor**
- **Early Detection = Early Response & Containment**
- **Detects Oil Sheens & Slicks on Water and on Ground**

SS300 / 320

SS100 (*new*)

Theory of Operation

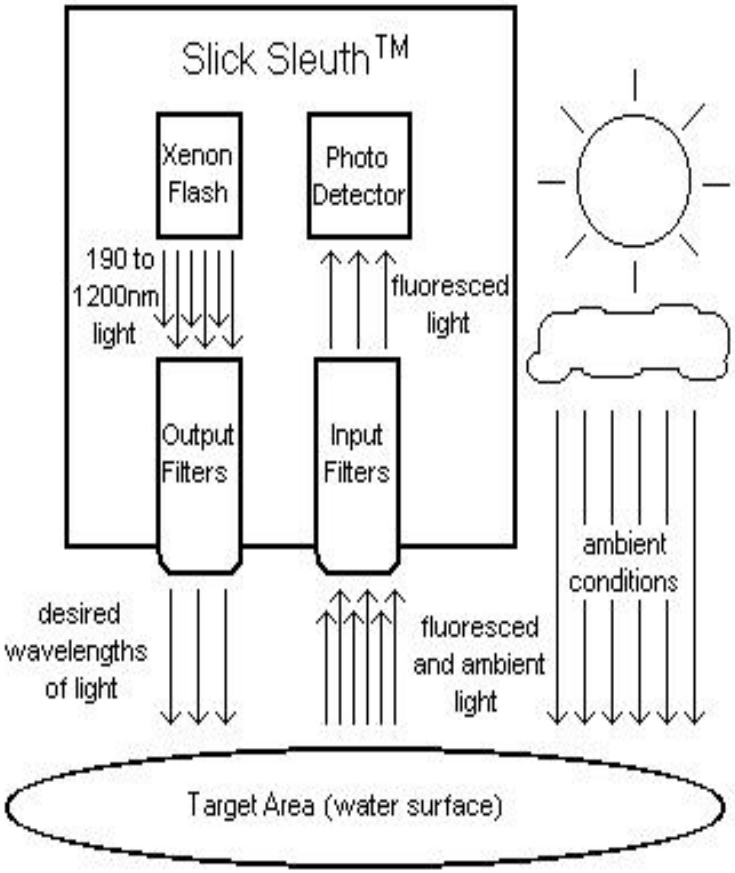


Remote Non-Contact Sheen Detection

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

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

Theory of Operation



Basic Operation
Non-Contact UV Filter-Fluorometer

- ***Immune to Ambient Conditions***
  - ***Sunlight/Darkness, All Weather, Waves, etc.***
- ***Highly Sensitive***
  - ***Detects Oil Sheens Down to One* (µm)*Micron***
  - ***User Adjustable Sensitivity***
- ***Proven Technology***
  - ***Same principle as used in lab analyzers but simplified & made robust for field deployment***

Slick Sleuth Technology Strengths

photo courtesy of Occidental E & P

Non-Contact Sensor !!

- Optical Sensor (***No*** In-Water Probe)
- Low Maintenance, Non Fouling
- Simple to Install & Operate
- **A Proactive Tool !**

Early Detection, Alert & Containment

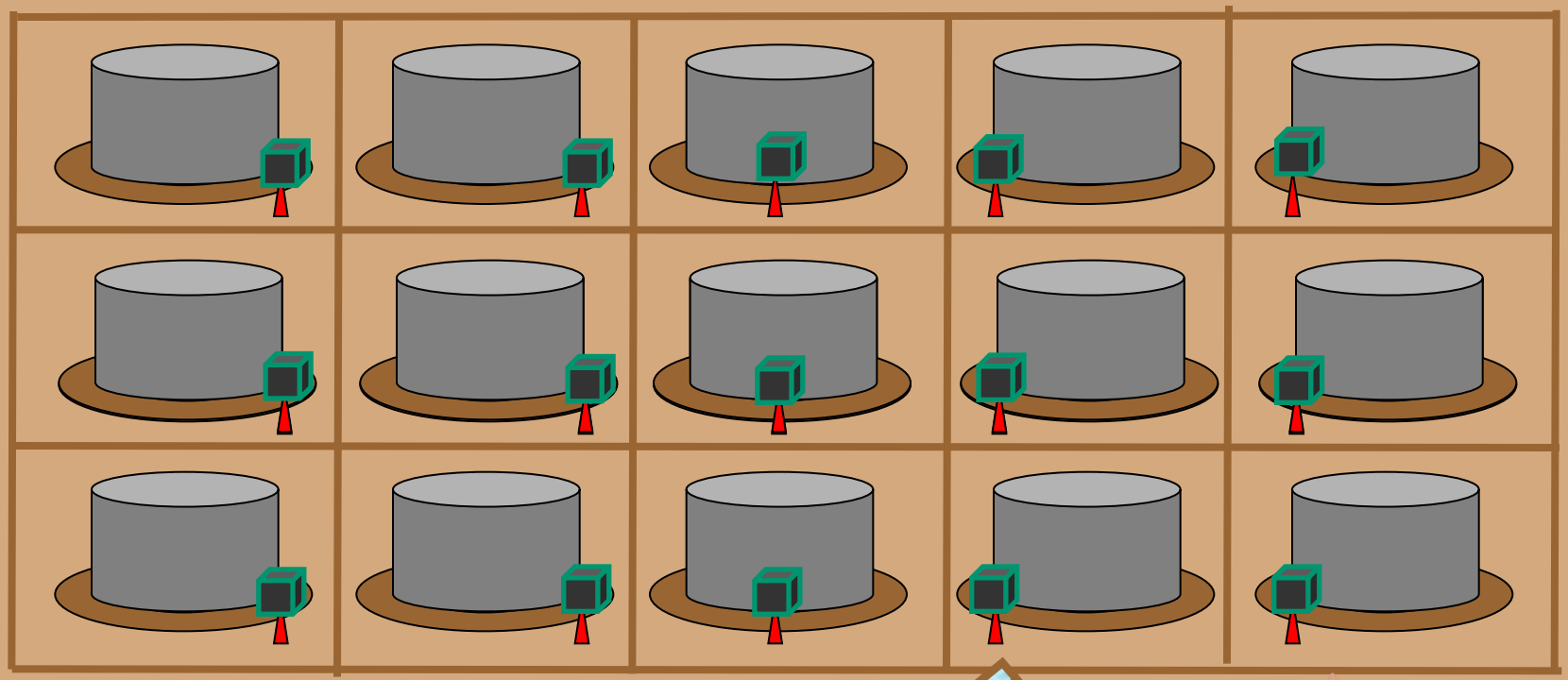
- Like a “Smoke Alarm” for Oil Spills
- Highly-Sensitive Sheen Detection
- Crude Oil, Fuel Oil, Diesel, Jet, More
- **~1,000 Systems Installed in 8-Yrs.**

Slick Sleuth - Product Designations

	MODEL	RANGE*	APPLICATION
	SS 100	1 Meter	AST Facilities
	SS 300	5 Meters	Industrial Facilities
	SS 320	8 Meters	Terminal Piers

** Range = Vertical Distance from Sensor to Surface*

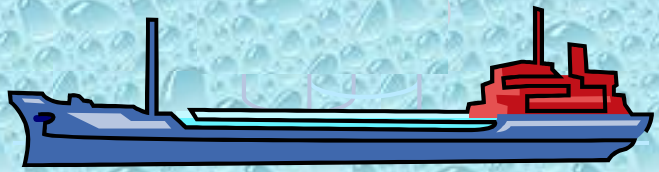
Strategic Monitoring is Key



Tank Dike Alarms
(Model SS 100 x15)

Outfall/Failsafe Alarm
(Model SS300)

Drainage from
Tank Farm

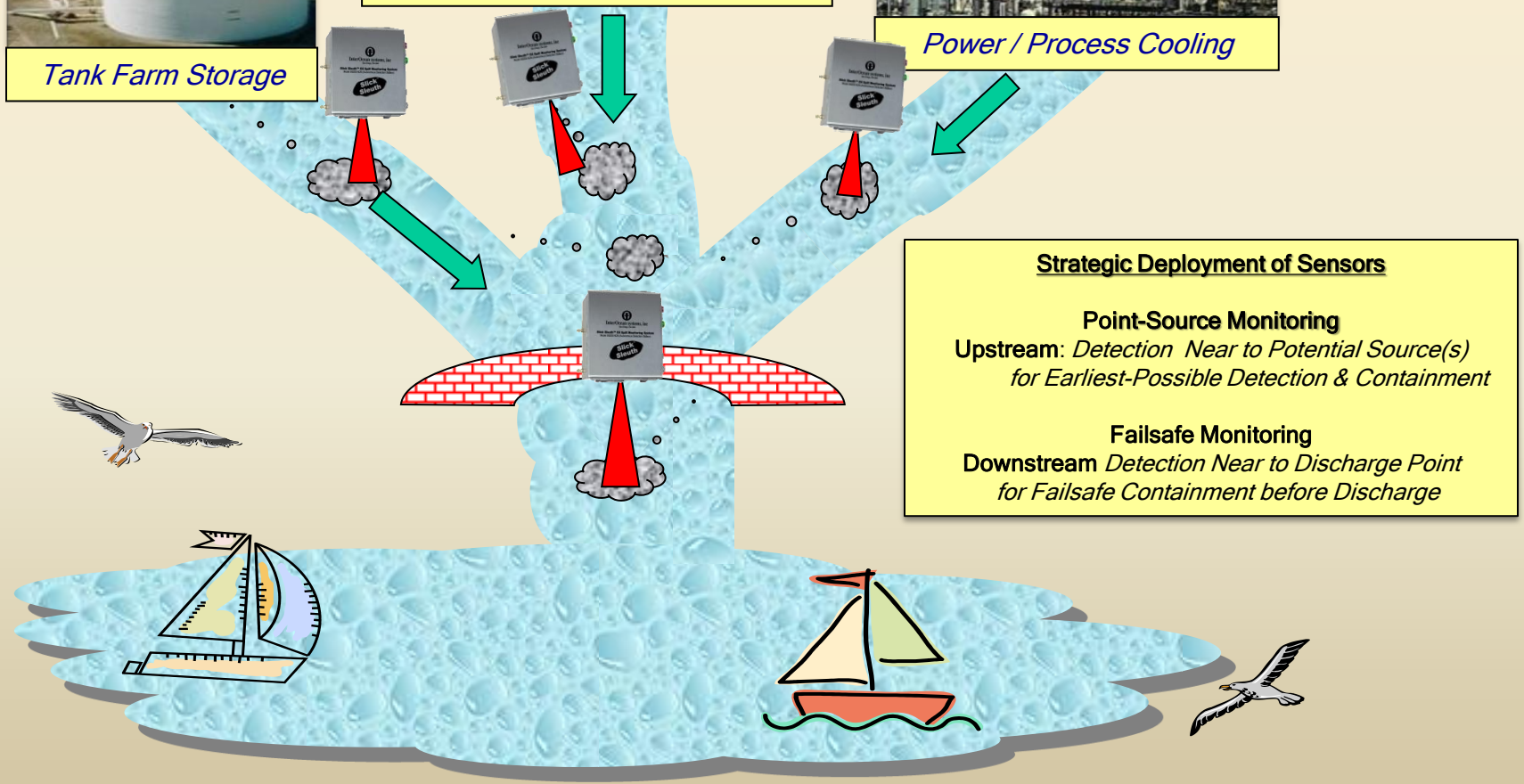


Industrial 'Spillway' Safety Strategy

Tank Farm Storage

Heat Exchanger

Power / Process Cooling

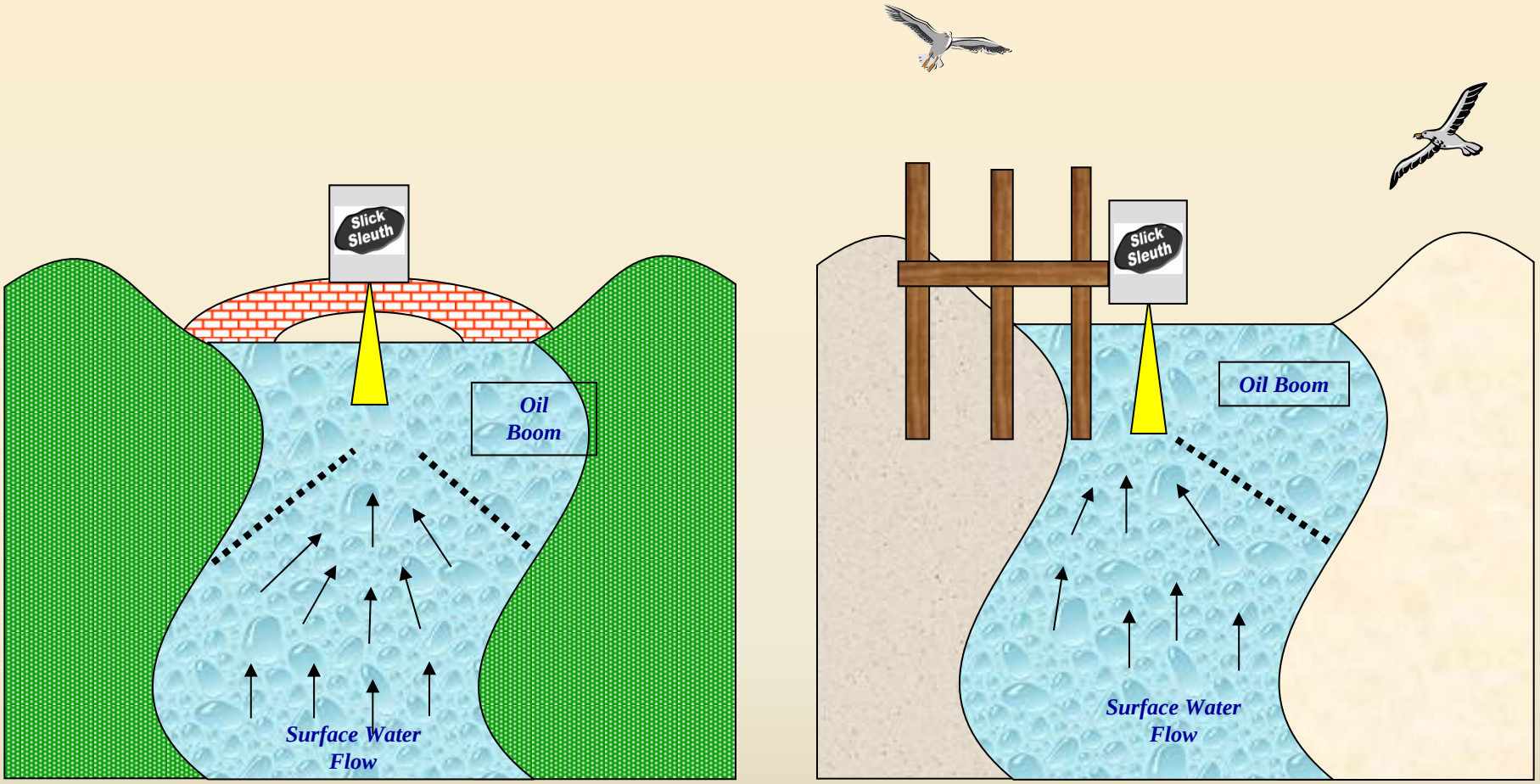


Strategic Deployment of Sensors

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*

Wide-Channel Monitoring Strategy



Example of Simple, Low-Cost, Surface Flow Control

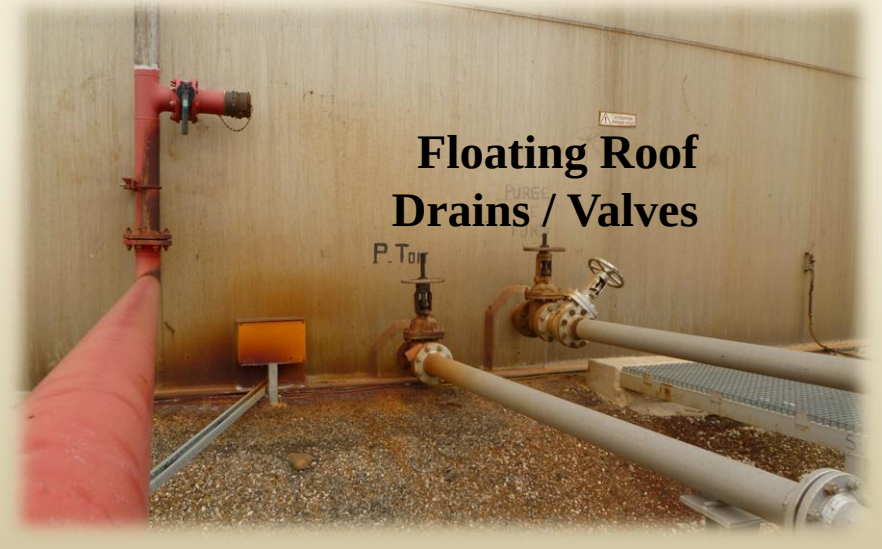
A Useful Approach for Covering 'Wide Area' Applications with a Single Point Sensor

Wide Area Monitoring w/a System Array

Monitoring Points @ Storage Terminal

Inside (Interstitial) & Under Tanks

Inside Tank Dikes & Secondary Containment



Floating Roof Drains / Valves

Outflows From Tank Dikes

Monitoring Points @ Storage Terminal

Equipment & Mixing Pads

Sumps, Drainages, Outfalls

Oil/Water Separators

Monitoring Points @ Terminal / AST Facility

Monitoring for Leaks/Spill within Secondary Containment at an Above Ground Storage Tank (AST) Facility

photos courtesy
Magellan Pipeline

Discharge Monitoring ~ Airport

Airport Installations

Discharge Monitoring ~ Airport

Real Time Leak/Spill Monitoring at FedEx Terminal (Memphis, TN)

photos courtesy of Buckeye Pipeline

Discharge Monitoring ~ Airport

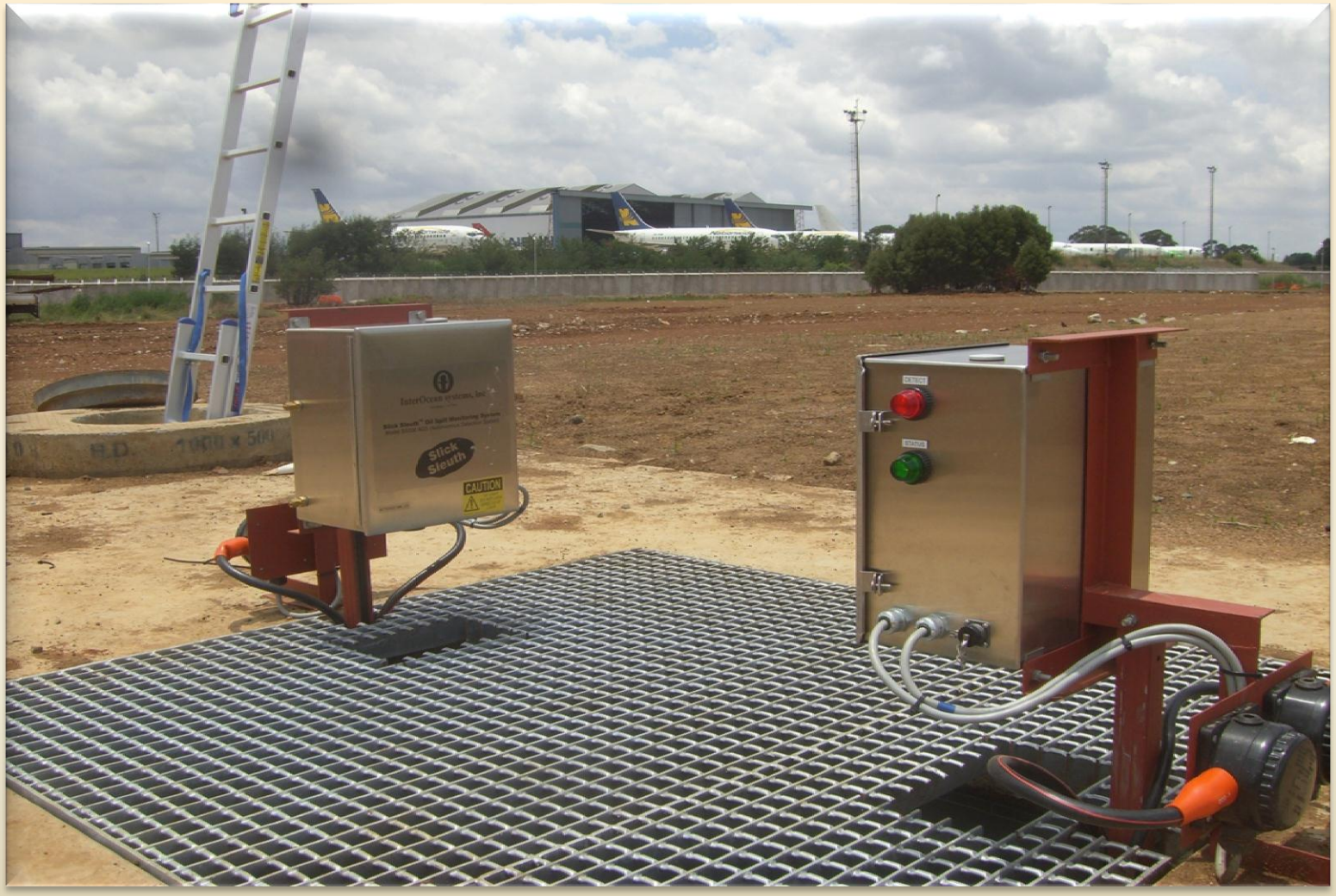


photo courtesy
WSP Engineering Group
South Africa

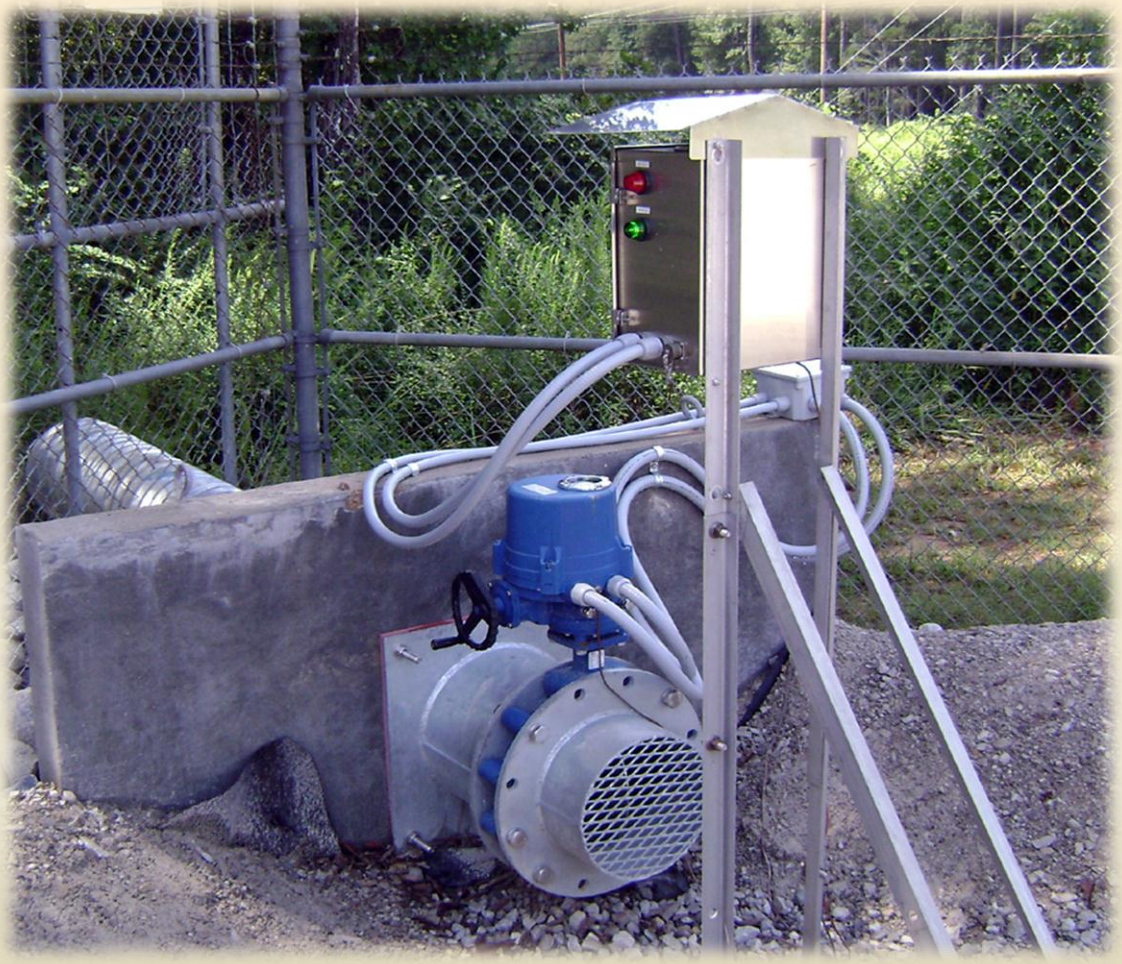
Real Time Leak/Spill Monitoring at Airport

Automated Detection & Containment of Jet Fuel, Diesel

Automated Containment Example

***Slick Sleuth* Automated Detection & Containment (with *Bay Saver*)**
***Oliver Tambo* Intl Airport**
photo courtesy of ACSA

Automated Containment Example



Autonomous Spill Detection Sensor @ Electrical Substation
Detection Shuts-Off Pump plus Real Time Alarm to Control Center

photo courtesy
Cleco Power

Automated Containment Example

Autonomous Spill Detection Sensor

w/ Actuator Valve Control & Real Time Alarm to Central Control

photo courtesy
Dominion

Automated Containment Example

Control Point for Monitoring & Automated Capture of Oil at Marine Terminal

(Photo Courtesy Transpetro)

Discharge Monitoring ~ Refinery

Autonomous Spill & Leak Detection Sensor
Monitoring for Oily Discharge in Industrial Storm Water Sewer
(photo courtesy SK Energy)

Discharge Monitoring ~ Refinery

Detectors in Marine Terminal – Used to Contain Accidental Discharge from Tank Farm Areas

(photos courtesy SK Energy)

Discharge Monitoring ~ Refinery

Spill & Leak Detection Sensor ~ Refinery Installation
(Six Detectors Installed at this Facility)

photo courtesy Shell Oil

Discharge Monitoring ~ Power Plant

Spill Monitor & Alarm
Sump Application

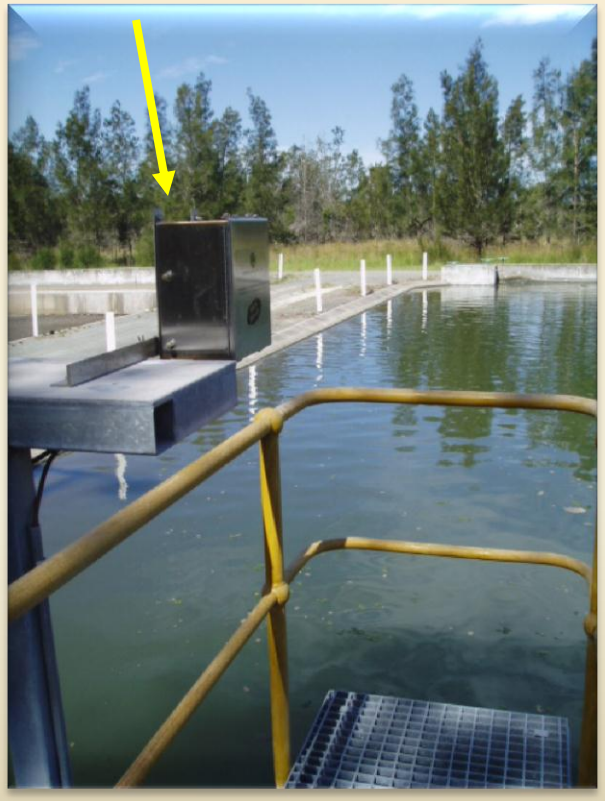
(photo courtesy Pennsylvania Power & Light)

Spill Discharge Alarm
Outflow Application

(photo courtesy Endesa)

Discharge Monitoring ~ Power Plant

Spill Monitor Installed at Separator / Discharge Control Point



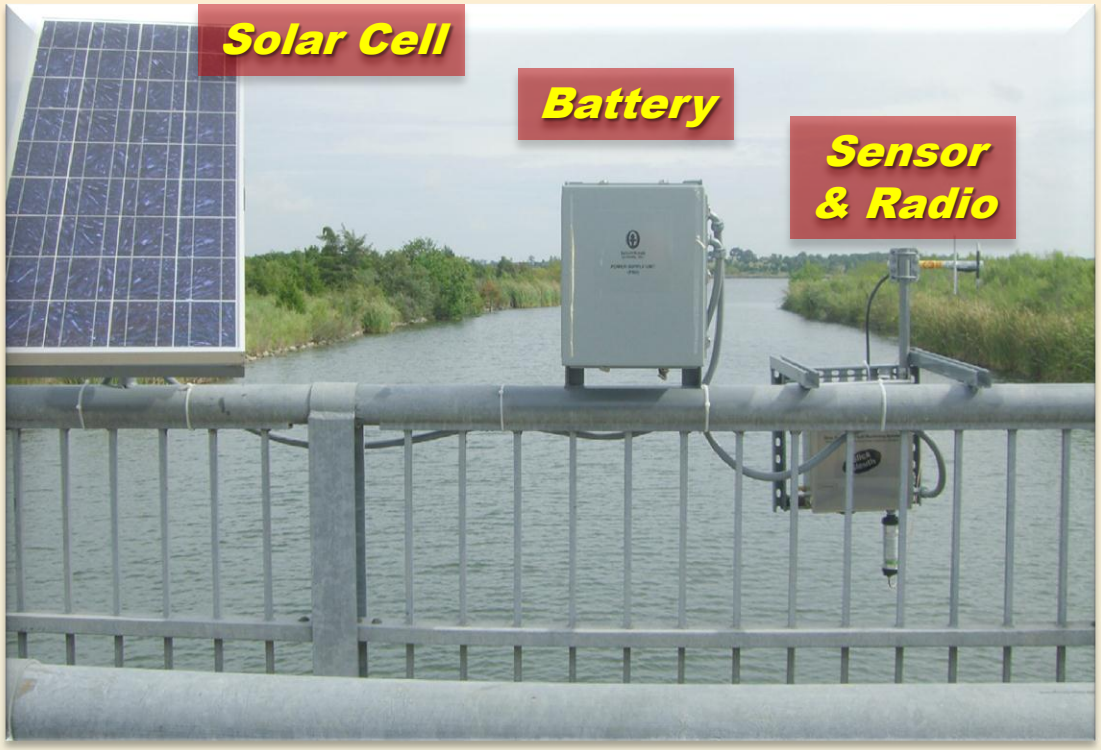
photos courtesy Delta

Discharge Monitoring ~ Power Plant

Power Plant – Cooling Water Discharge / Outfall
(note positioning of oil containment boom below sensor)

photos courtesy ATCO

Discharge Monitoring ~ Power Plant



Real Time Monitoring for Fuel Oil, Turbine Oil, Lube Oil.
Solar Powered. Alarm via 900MHz Radio Transceiver.
Sensor mounted approx. 4-meters Above Discharge to River

photos courtesy of
Austin Energy

Discharge Monitoring ~ Municipality

Real Time Remote Monitoring
at Municipal Lift (Pump) Stations
5-Unit System in Northwestern USA

photos courtesy
U.S. Army Corps of Engineers

Discharge Monitoring ~ Navy Fuel Depot

U.S. Navy
Manchester
Fuel Depot

Leak & Spill Monitoring ~ Navy Pier

Fuel Pier Installation
Sensor w/ GSM Wireless Alert

Leak, Spill, Overfill Protection

Royal Australian Navy
(RAN)

Leak & Spill Monitoring ~ Navy Pier

Navy Fuel Pier Installation

photo courtesy of RAN

Leak & Spill Monitoring ~ Cruise Ship Terminal

Autonomous Spill Detection Sensor (Model SS100)
Canaveral Cruise Ship Terminal – Detection of #6 FueL Oil & Diesel

photos courtesy
Seaport Canaveral

Leak & Spill Monitoring ~ Port Application

Autonomous Spill Monitoring Array
Commercial Port & Oil Terminal

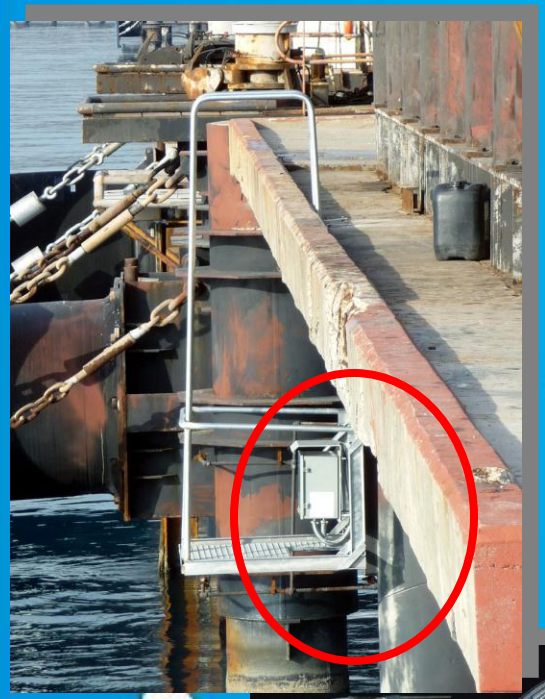
(photo courtesy Port of Koper, Slovenia)

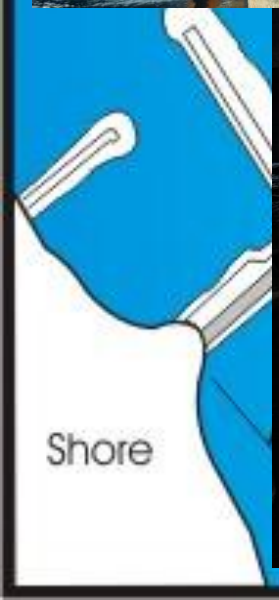
Leak & Spill Monitoring ~ Marine Terminal

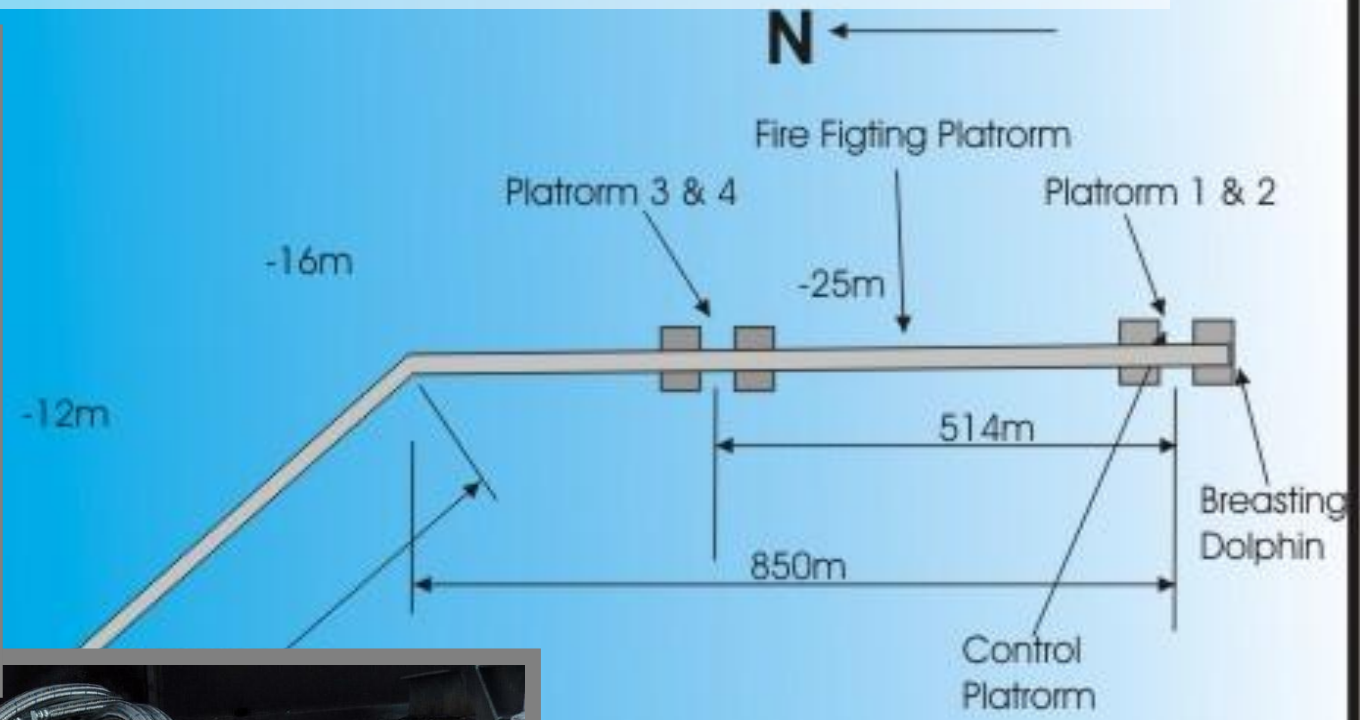
Marine (Oil) Terminal Application

(photo courtesy of SK Energy)

Leak & Spill Monitoring ~ Marine Terminal

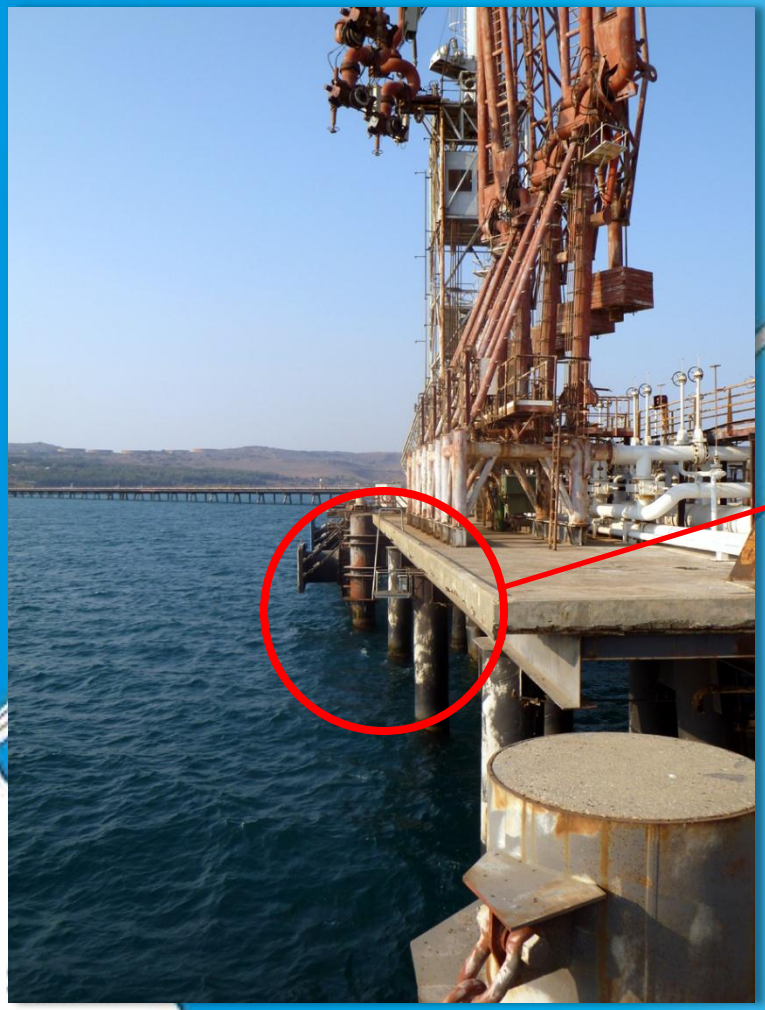






BOTAŞ
CEYHAN
TANKER TERMINAL

Leak & Spill Monitoring ~ Marine Terminal



Loading Pier Application Example

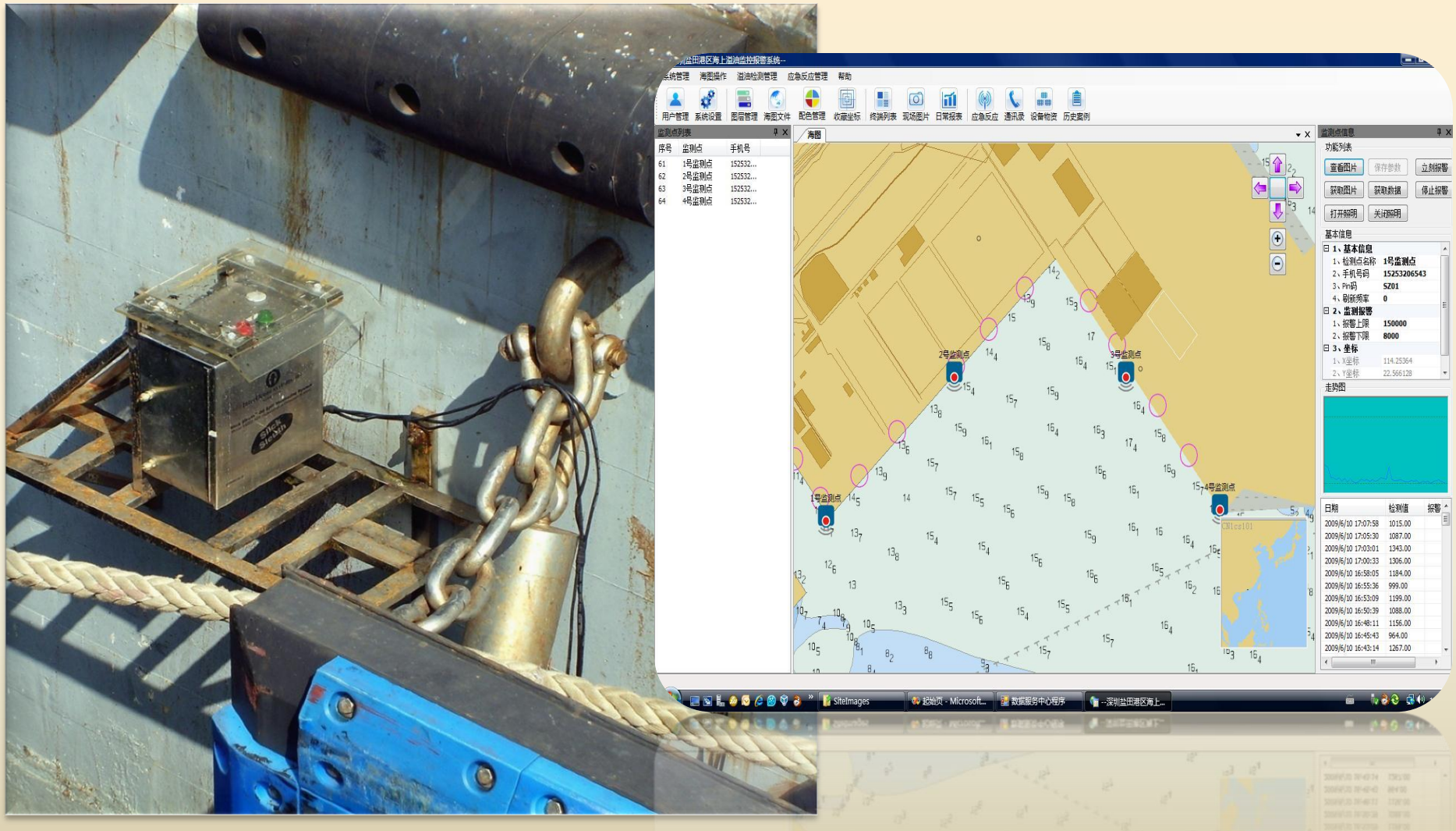
Typical Mounting Platform for Harbor and Terminal Pier Applications

Leak & Spill Monitoring ~ Marine Terminal

Marine Terminal Application (China)

(photo courtesy of MSA & SunicOcean)

Leak & Spill Monitoring ~ Marine Terminal



Yantian Port Installation, Shenzhen, China

screen capture & photo courtesy of MSA & SunicOcean

Leak & Spill Monitoring ~ Marine Terminal

Terminal Application - Real-Time Spill Monitoring System

(photo courtesy of Transpetro)

Leak & Spill Monitoring ~ Marine Terminal

Oil Spill Monitoring Center, China

Multiple Ports & Terminal Facilities Monitored in Real-Time by Government Approved 3rd Party

client prefers not to be identified

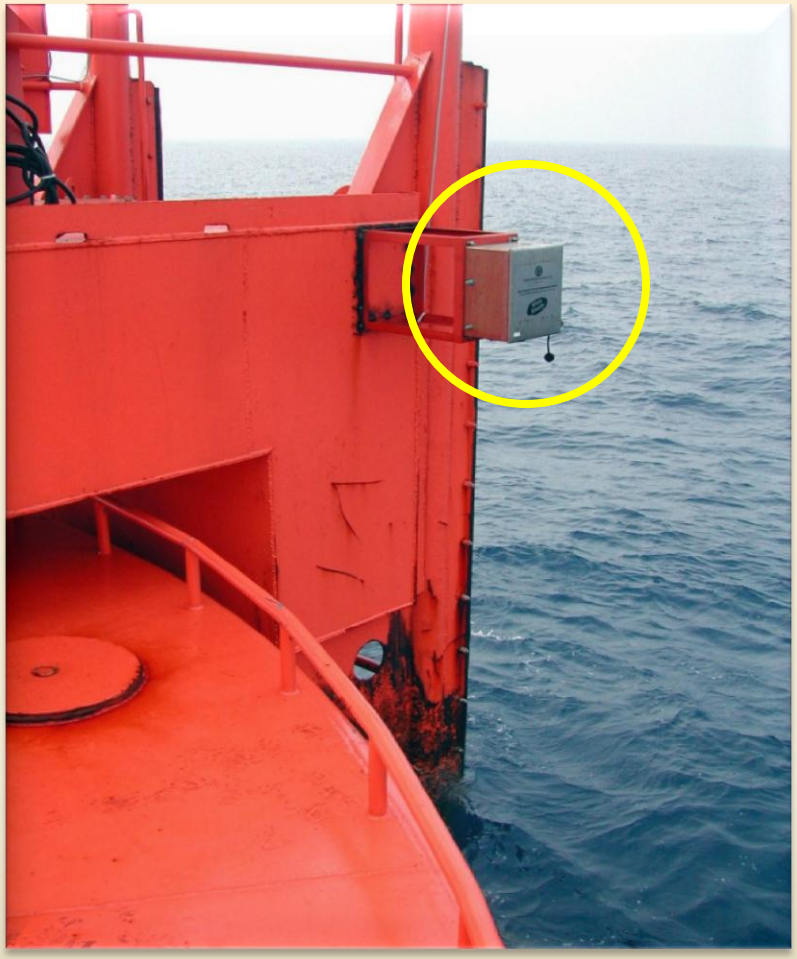
Leak & Spill Monitoring ~ Offshore Terminal

Installation on SBM Offshore Loading Buoy

6 Slick Sleuth Sensors on total of 3 buoys.
with Solar Power, Radio Telemetry, & Base Station Command/Control

photo courtesy of Chinese Petroleum Corp. (CPC)

Leak & Spill Monitoring ~ Offshore Terminal



Installation on SBM Offshore Loading Buoy

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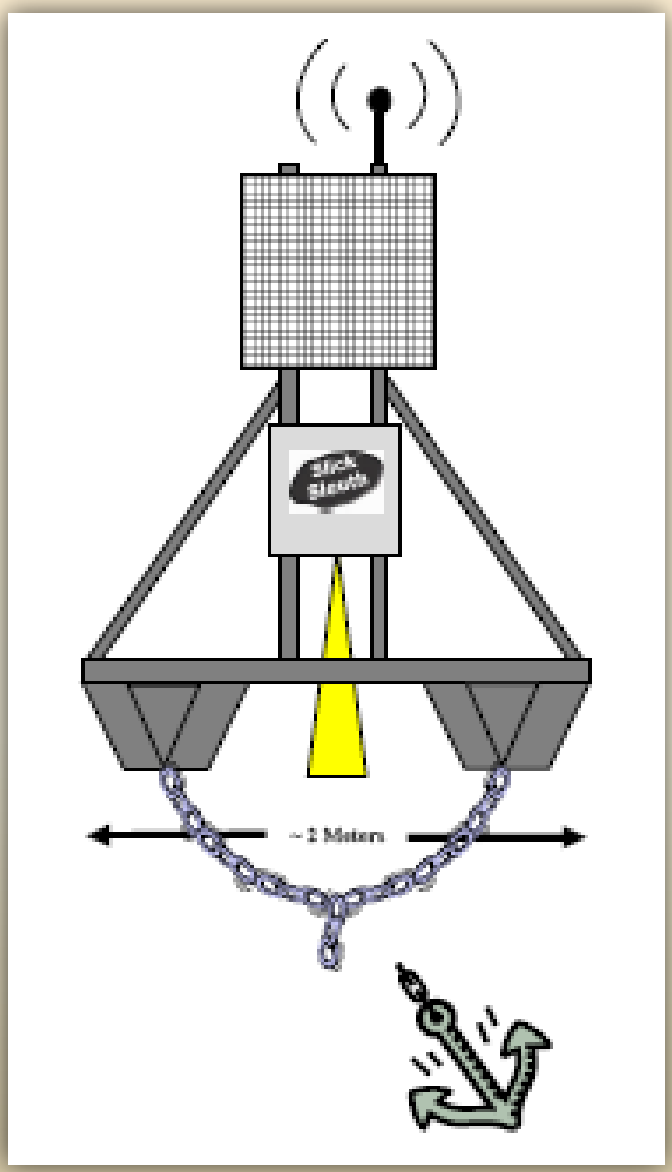
photo courtesy of Chinese Petroleum Corp. (CPC)

Spill Monitoring Buoy ~ Near-shore/Offshore Applications



"Slick Guard" Environmental Monitoring Platform for Offshore, Coastal, Ports & Harbor Applications

Spill Monitoring Buoy – DeSalination Plant

“Slick Guard” Environmental Monitoring Platform
for PROTECTION of Seawater Intakes

photo courtesy of TAPCO

Introducing...

SS360 Rig Guard™

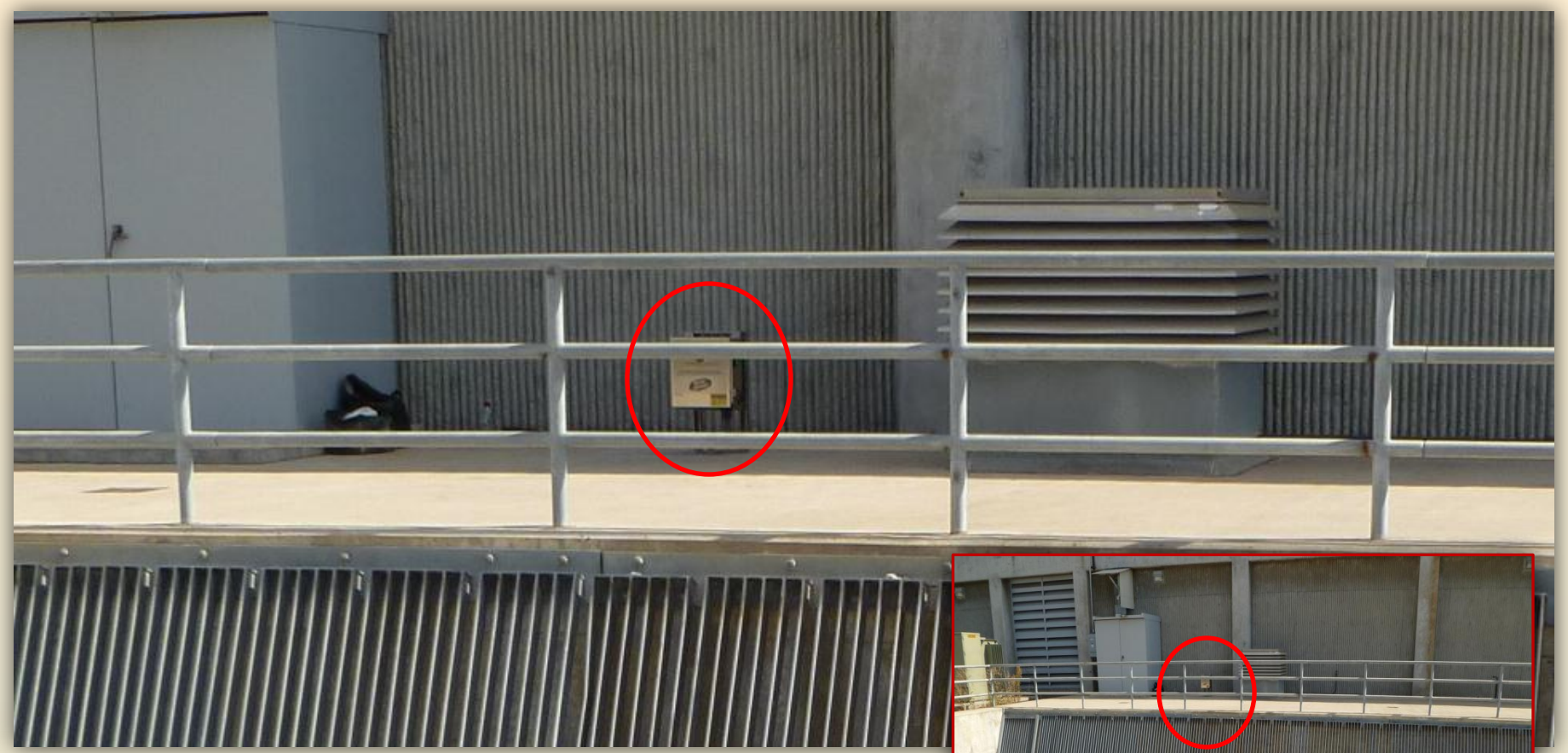
Slick Sleuth™

- 20 Meter Range (sensor to water)
- Detection of Crude, “Slops” & Diesel
- Real-time Protection for Manned & Un-Manned Platforms

California ~ Refinery Discharge

*photo courtesy Conoco Phillips – **Bay Area***
(now Phillips 66)

California ~ Watershed / Port Discharge



Stormwater Monitoring / Collection Sumps

SoCal Watershed Drains into Long Beach Terminal prior to Discharge into Port of Long Beach / Los Angeles / San Pedro Harbor.

photos courtesy Port of Long Beach

California ~ Rincon-Grubb OilField Discharge

Image Courtesy of Santa Barbara Channelkeeper / Lighthawk

California ~ Tidal Wetlands

photo courtesy
Aera Energy
(now Oxy/CRC)

Real Time Remote Monitoring for Accidental Discharges at Wetlands Tidal Gate Control Point – Oil Production Site

California ~ Tidal Wetlands

photo courtesy
Aera Energy
(now Oxy/CRC)

Real Time Remote Monitoring
at Wetlands Tidal Gate – Oil Production Site

California ~ Tidal Wetlands

photo courtesy
Aera Energy
(now Oxy/CRC)

Example of Mounting Sensor on
Swinging Adjustable Deployment Arm

California ~ Tidal Wetlands

photo courtesy
Aera Energy
(now Oxy/CRC)

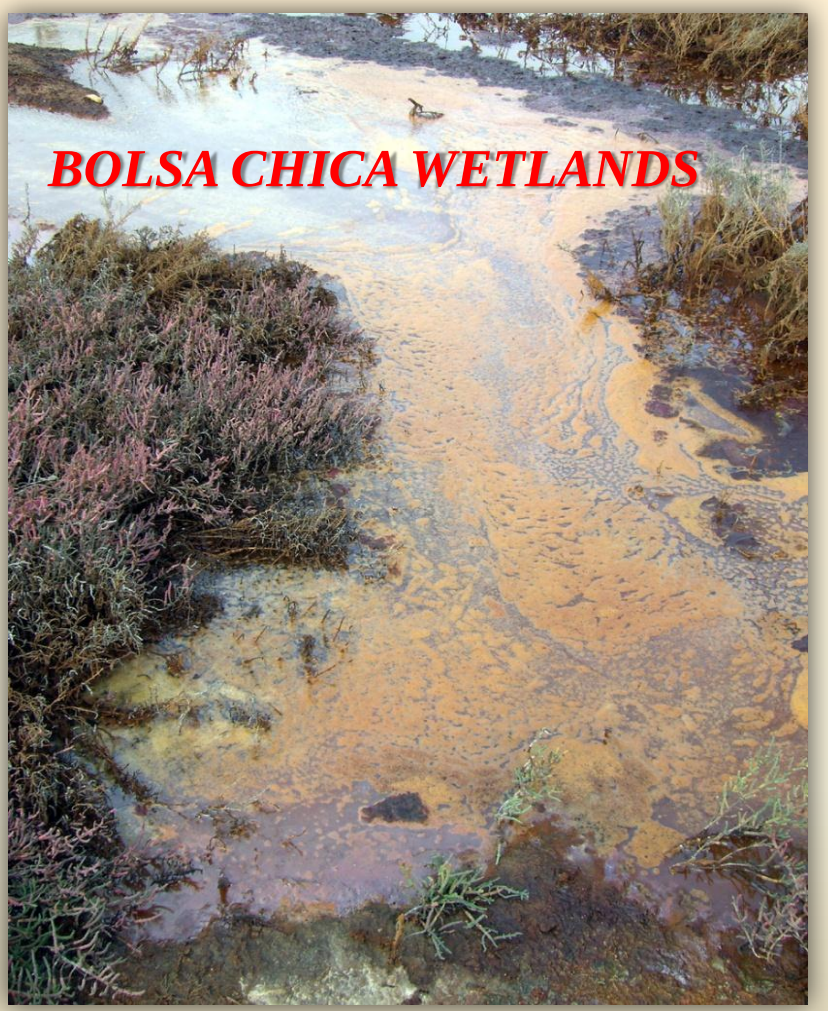
Real Time Remote Monitoring
at Wetlands Tidal Gate – Oil Production Site

California ~ Tidal Wetlands

Real Time Remote Monitoring
at Wetlands Tidal Gate – Oil Production Site

photo courtesy
Aera Energy
(now Oxy/CRC)

California ~ Tidal Wetlands



Several Points Within the Wetlands Have Either Natural Crude Seepage or "Bio-Sheen" – Not Sure Which?

photo courtesy
Aera Energy (now Oxy/CRC)

Questions?

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