

**i<sup>2</sup> Solutions** - Innovative Solutions for Environmental Compliance

## Compliance Solutions for Field Erected ASTs

“Real World Experiences”

Presented by Michael Crabb

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mac@i2-Solutions.com

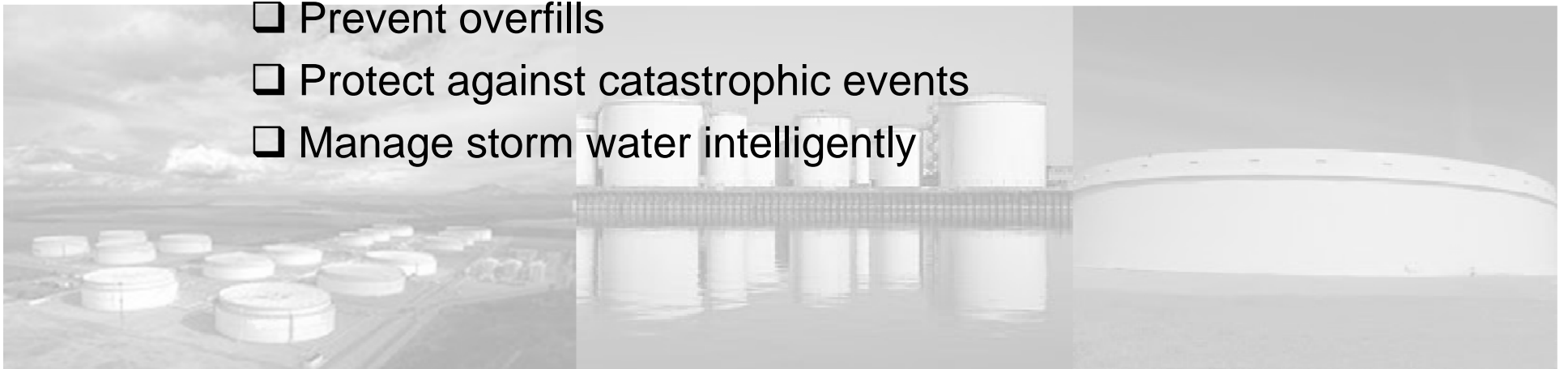
Engineers and contractors with experience in solving  
Environmental Compliance Challenges



## Compliance Solutions for Field Erected ASTs

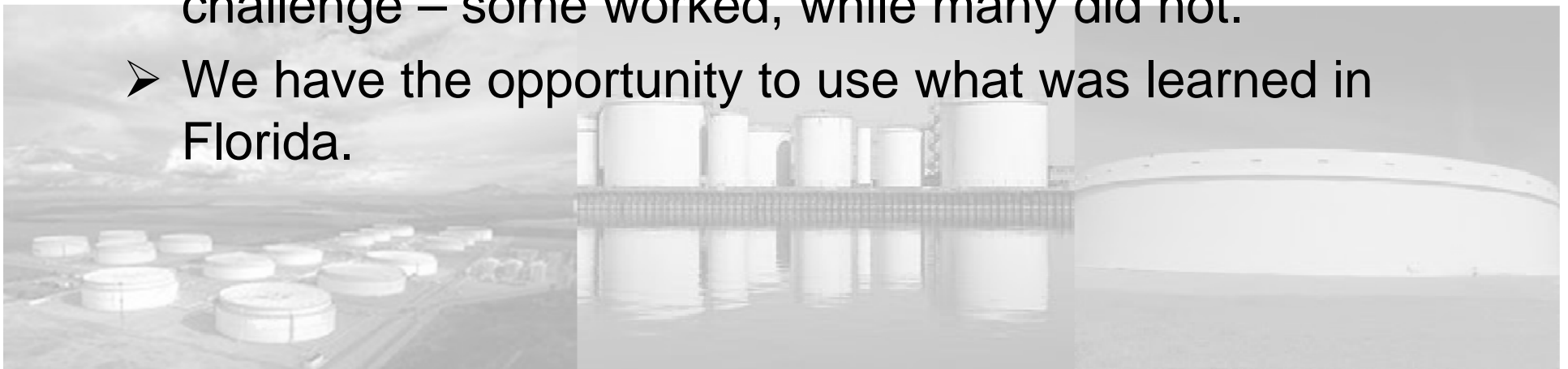
Today's topics of discussion:

- Existing “single bottom” field erected tanks (ASTs)
- Un-lined Dike Fields & Overfill Protection
- Hydrocarbon Detection
  - ❑ Detection of leaks in pipes and tank bottoms
  - ❑ Prevent overfills
  - ❑ Protect against catastrophic events
  - ❑ Manage storm water intelligently



## Florida regulations – a wealth of experience

- In the 1990's Florida implemented a number of rules that forced tank owners to do major upgrades to facilities.
  - ❑ As of Jan 1, 2010 - **All** single bottom storage tanks must be upgraded with secondary containment. (i.e. double bottom)
  - ❑ Rule requires periodic monitoring of containment for leaks.
  - ❑ First state mandating that all EXISTING tanks be upgraded without exception.
- This drove a number of different ideas to solve the challenge – some worked, while many did not.
- We have the opportunity to use what was learned in Florida.

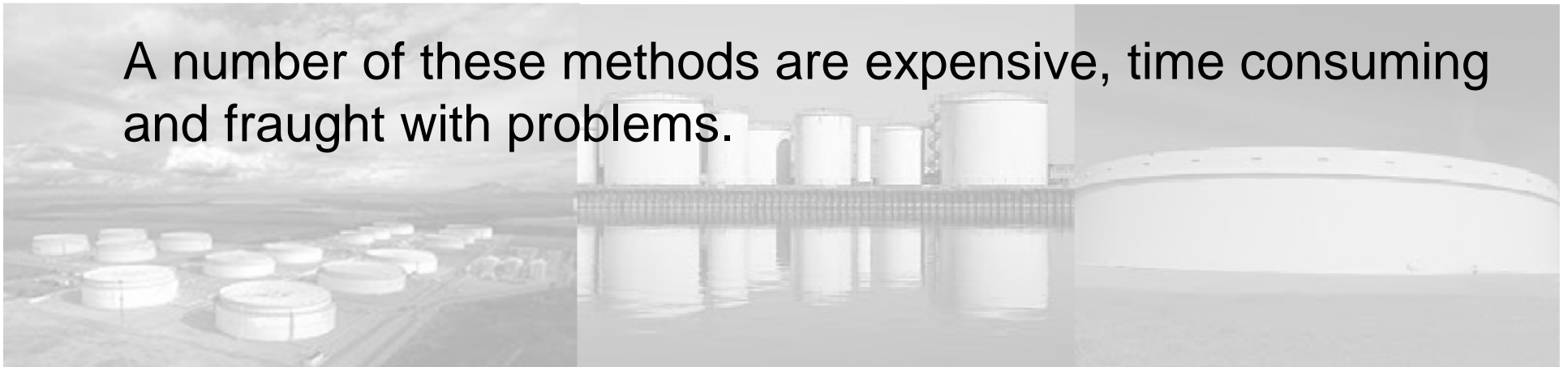


## Single Bottom Tank Solutions

There are a number of methods that can be used to meet under-tank secondary containment.

- Lift and Line
- Slotted Shell double bottom (including “El Segundo”)
- Internal Liners
  - ❑ Variations of composite materials (Delta liner, etc)
  - ❑ Steel liners

A number of these methods are expensive, time consuming and fraught with problems.



## “Lift and Line”

Literally – lift the tank up and place a liner under the tank.

- Specialized work – few can do correctly.
- Tank foundation can be reworked in the process
- Hydro test is a must prior to return to service.
- No continuous integrity test of the liner post install.



## “Slotted” Shell Double Bottom

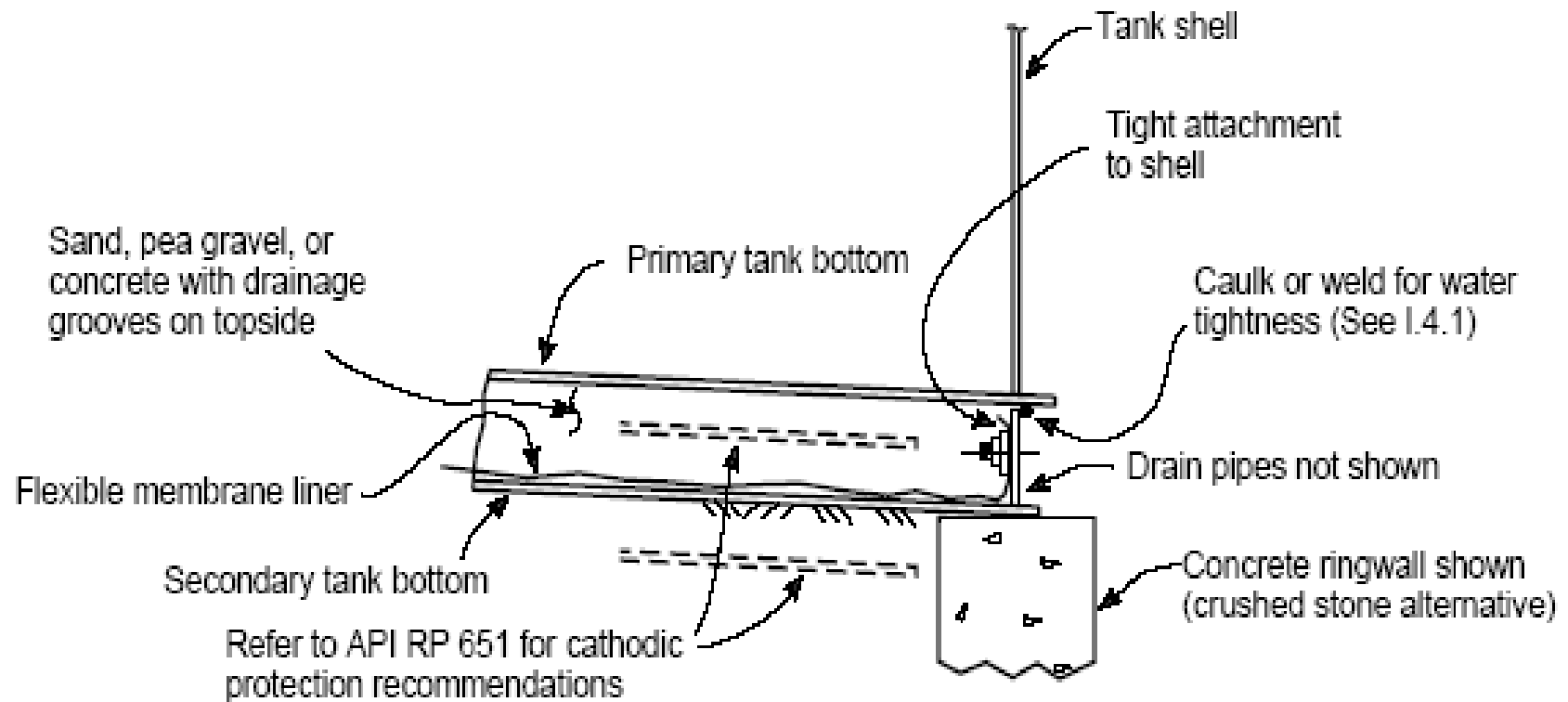
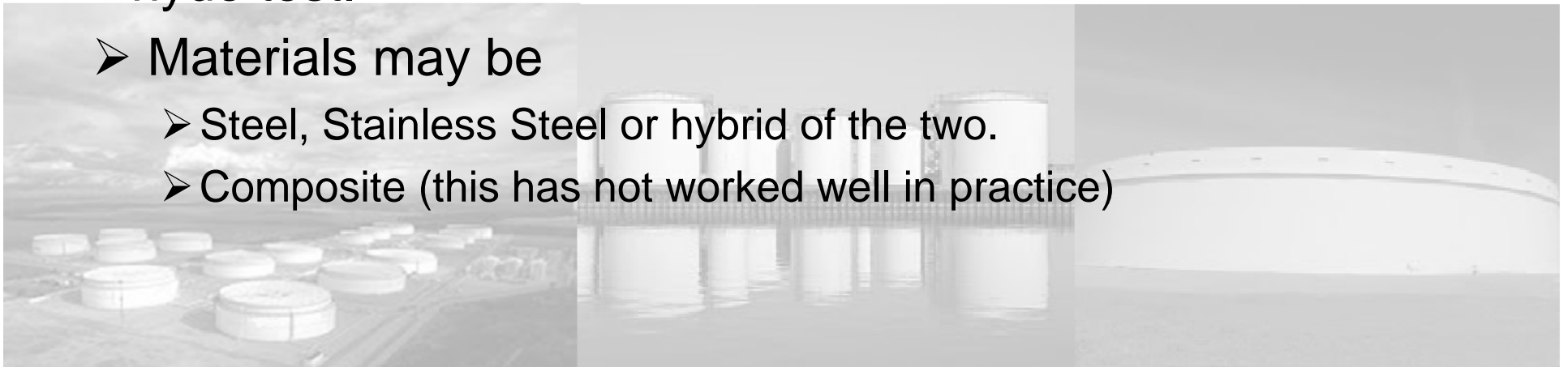


Figure I-4—Double Steel Bottom with Leak Detection at the Tank Perimeter (Typical Arrangement)

## Internal Liners (Release Prevention Barriers)

- Internal liners form an interstice between the product and the structural bottom.
- The liner is attached to the tank shell.
- The height of attachment can be adjusted for the most advantageous positioning to solve other issues.
- Liners typically eliminate issues with additional cathodic protection, nozzle relocation, loss of product volume and hydro test.
- Materials may be
  - Steel, Stainless Steel or hybrid of the two.
  - Composite (this has not worked well in practice)



## API 653 – SECTION 4

4.4.5 If a tank bottom is to be (substantially repaired) or replaced, consideration should be given to installing a leak detection (tell-tale) system that will channel any leak in the bottom to a location where it can be readily observed from the outside of the tank.<sup>5</sup>

<sup>5</sup> For existing tanks, API supports the use of a Release Prevention System (RPS). The term RPS refers to the suite of API standards that are designed to maintain above ground storage tank integrity and thus protect the environment. These are: the frequency of internal inspections; lining the bottom of the tank interior; fitting the tank with Release Prevention Barriers (RPBs); installing cathodic protection; or some combination of these measures, depending on operating environment and service of the tank.

If a decision is made to replace an existing bottom, API supports the evaluation of installing an RPB ... An RPB includes steel bottoms, synthetic materials, clay liners, and all other barriers or combination of barriers placed in the bottom of or under an above ground storage tank, which have the functions of: 1) preventing the escape of contaminated material; and 2) containing or channeling released material for leak detection (covered in detail in appendix I of API Std 650).

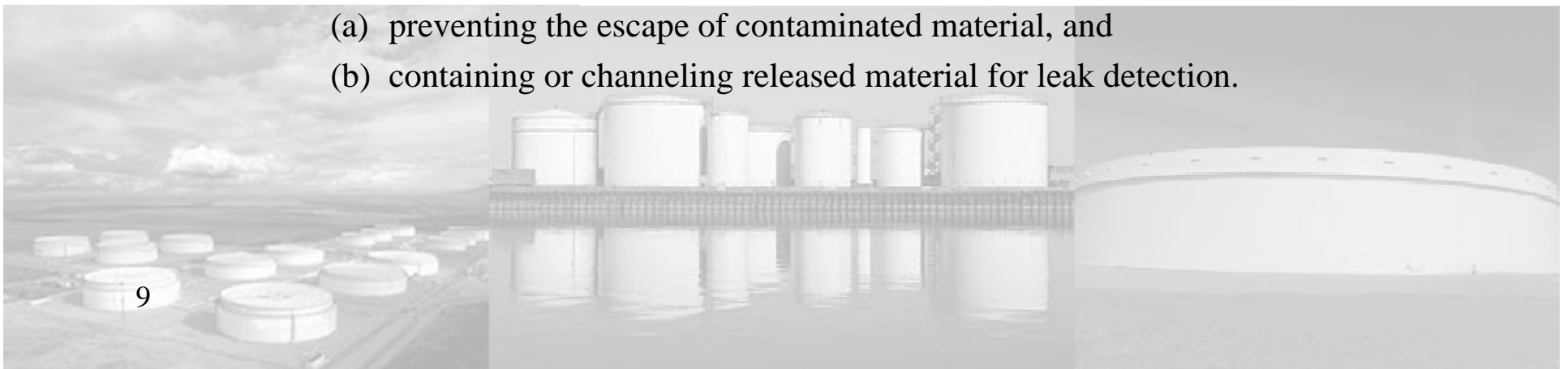


## API 650 – APPENDIX I

I.1.1 This appendix provides acceptable construction details for the detection of product leaks through the bottoms of aboveground storage tanks ...

Note: API supports a general position of installation of a Release Prevention Barrier ... An RPB includes steel bottoms, ..., and all other barriers or combination of barriers placed in the bottom of or under an aboveground storage tank, which have the following functions:

- (a) preventing the escape of contaminated material, and
- (b) containing or channeling released material for leak detection.

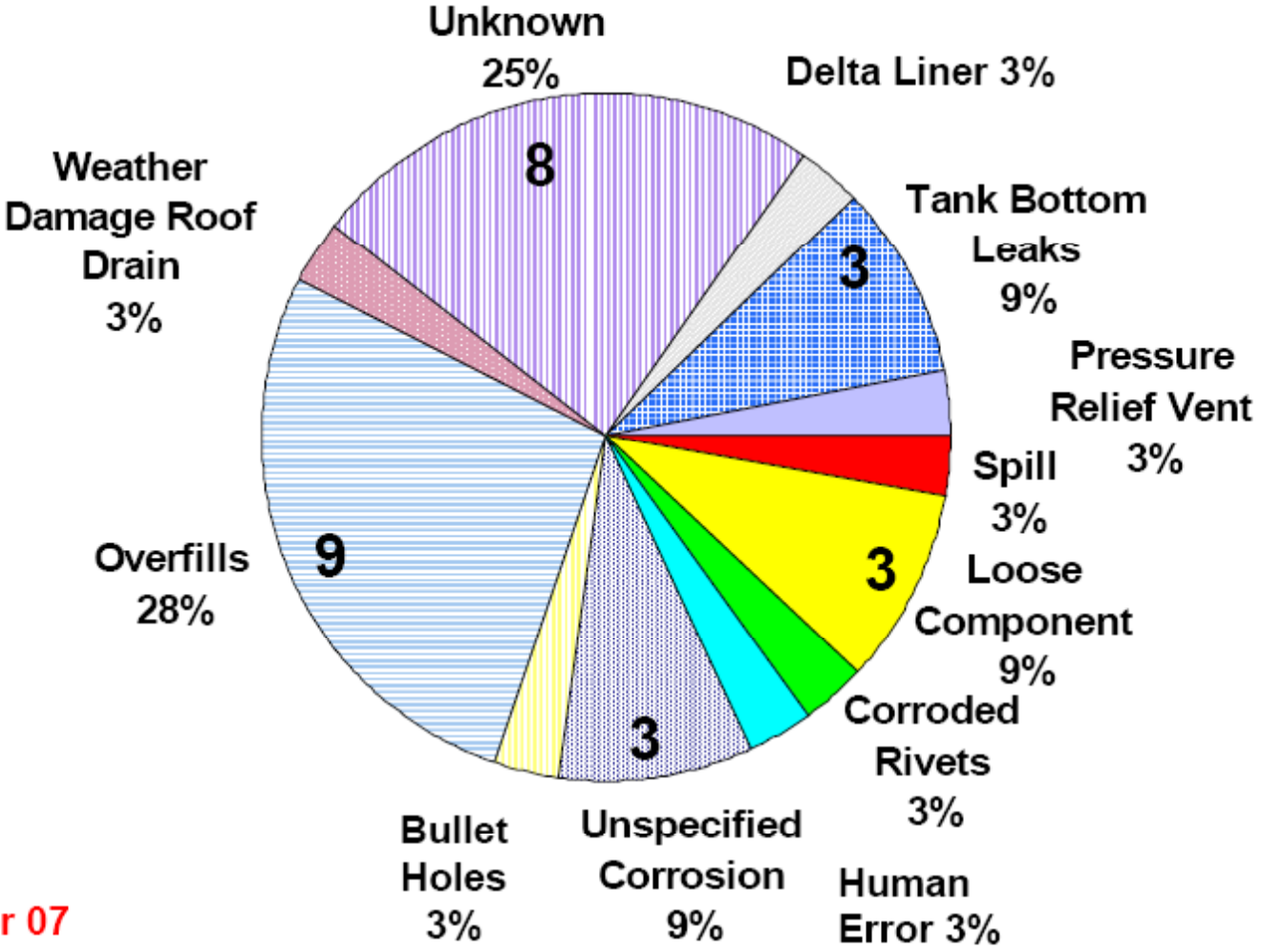


## Internal Liners - Benefits

- **24-7 monitoring** of the tank bottom
- **Safe, secondary containment**
- **No contamination** of soil or waters, **no expenses for removal**
- Constant monitoring allows for a **flexible and fast reaction to the event**
- **Leak can be identified** quickly
- The **repair effort** will be **reduced tremendously**
- **Rapid** and cost effective implementation
- **No Hydro test**



# Causes of Discharge from Field Erected AST Systems



Apr 07



**OVERFILL EXAMPLES**



## Solutions for Dike Field Containment

There are a number of methods that can be used to meet overfill and dike area secondary containment.

- HDPE Liners
- Concrete (typically will require coating at some point)
- Clay Liners (gaining success in Europe – self healing)
- Alternative Solutions / Overfill Protection



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# Overfill Protection / Dike Field Containment

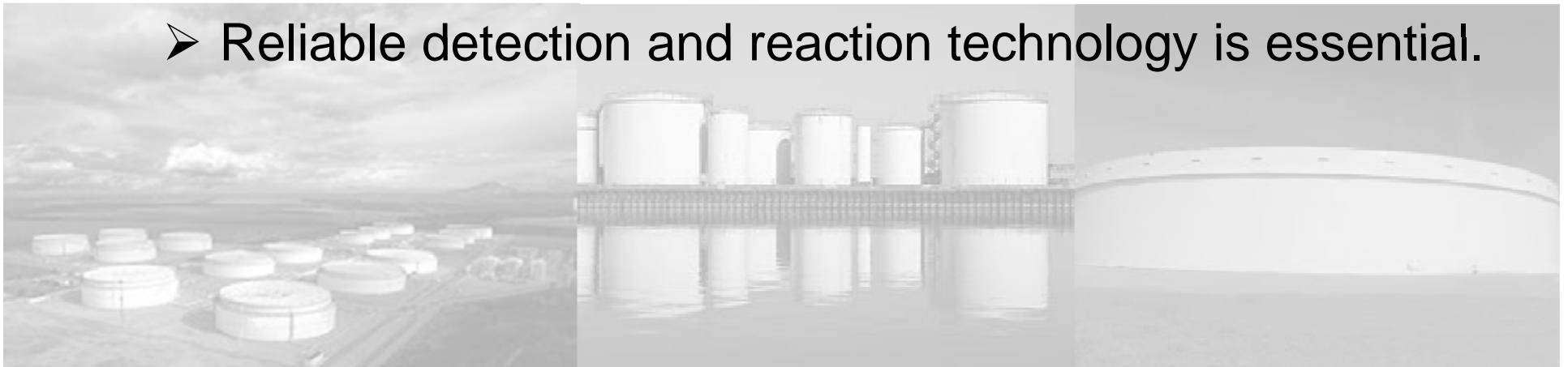
## ALTERNATIVE METHODS AND SOLUTIONS



## Alternative Solutions / Overfill Protection

Key concepts of alternative overfill protection solution:

- Provide a means to capture an overfill long enough to detect and react before a release.
- Allow (non contaminated) storm water to flow to pervious area – rather than contain and process.
- Limit the size of the containment area – reduces both the installation and on-going maintenance costs.
- Reliable detection and reaction technology is essential.



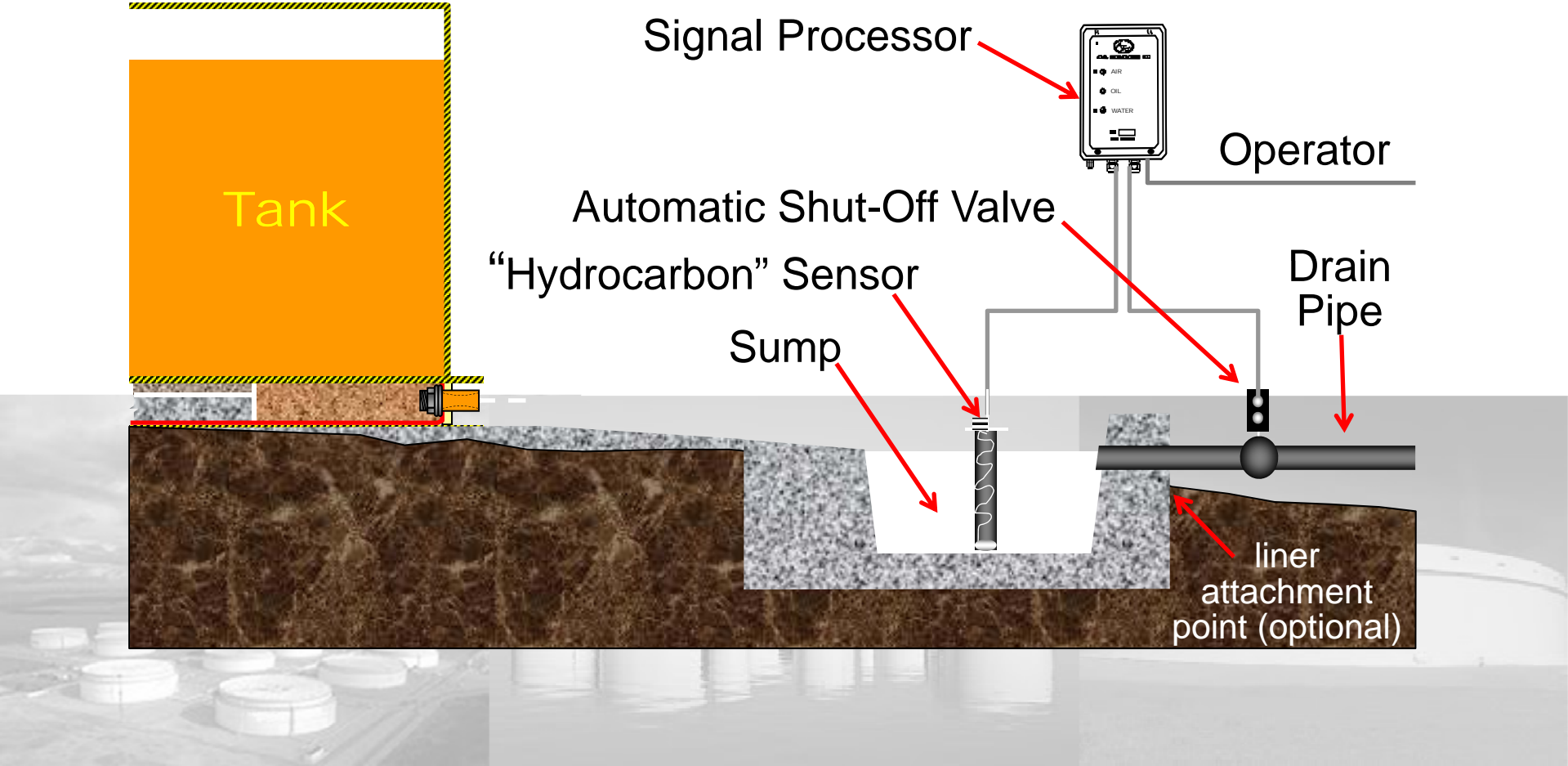
## DIKE AREA ISSUES

- **High cost** to maintain an imperious dike area.
- **Expenses** to analyze, treat and recycle contaminated storm water.
- Flooded dike areas can cause **accelerated corrosion** due to moisture penetration into the tank foundation.





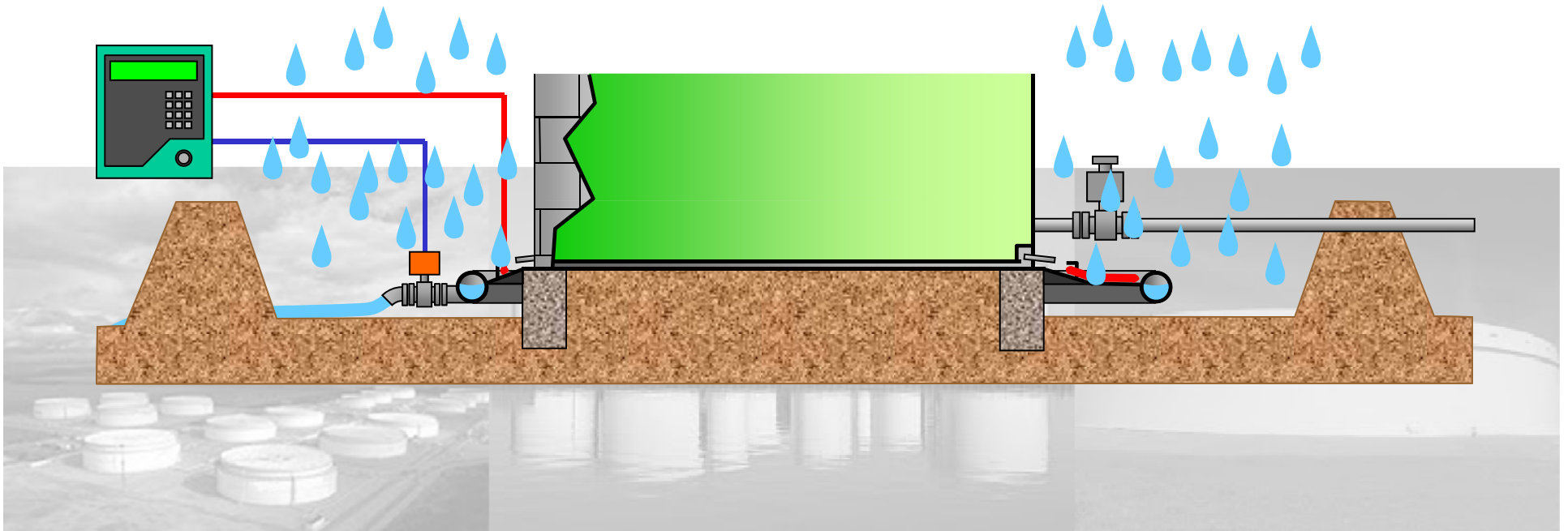
# Concept of Alternative Overfill Protection



## Operation

- **Normal Operation**

Rainwater will pass through the automatic shut-off valve (normally open) and drain into the soil. The water will not be detected.

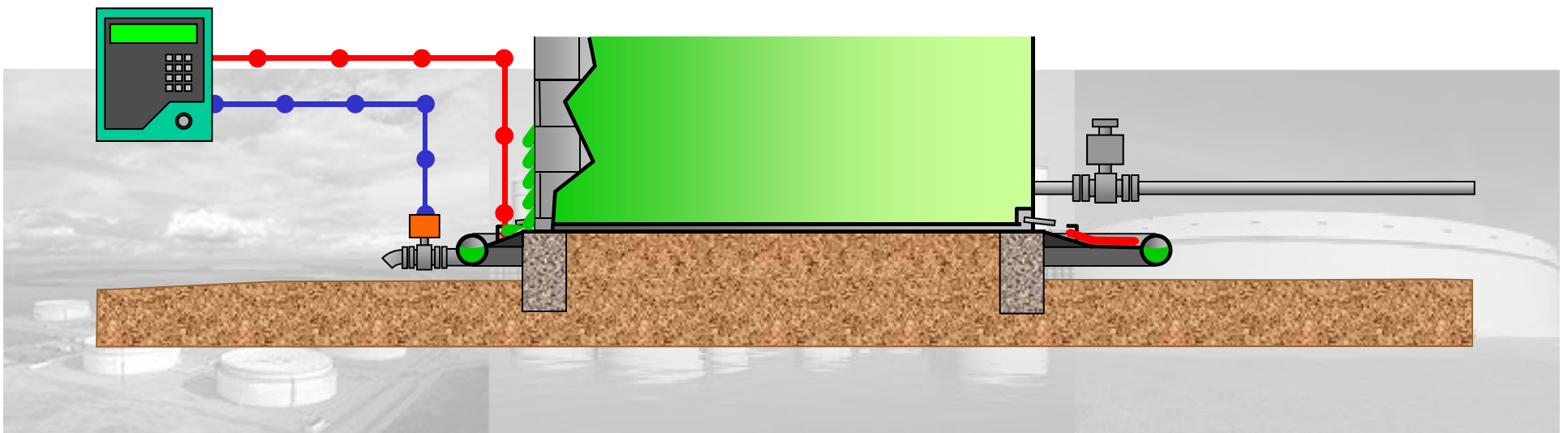


## Operation

- **Operation with presence of a leak**

Any leakage around the tank will penetrate the sensor cable and trigger an alarm.

A relay will immediately close the automatic shut-off valve.

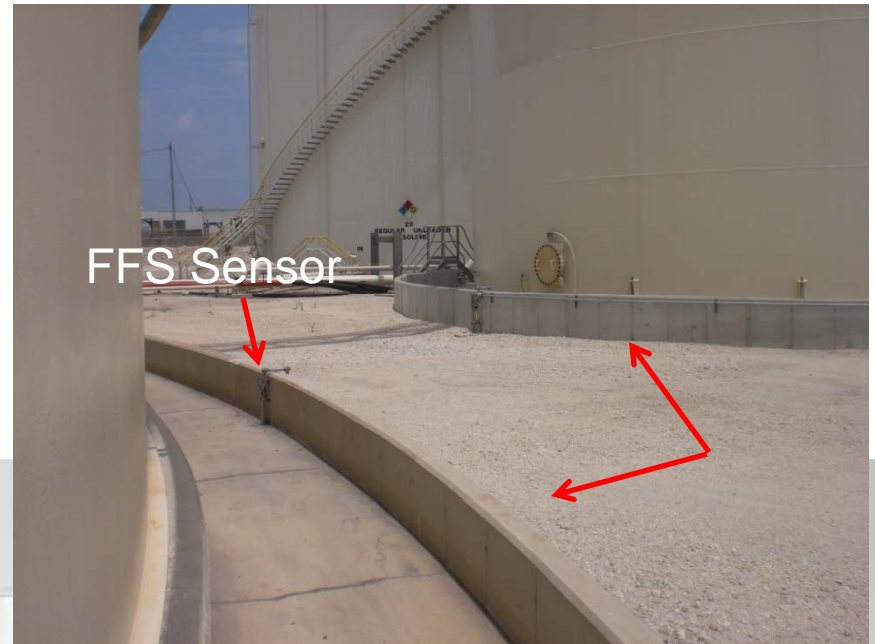


# Installations

## Alternative Adapted to large unlined dike field for new tank construction



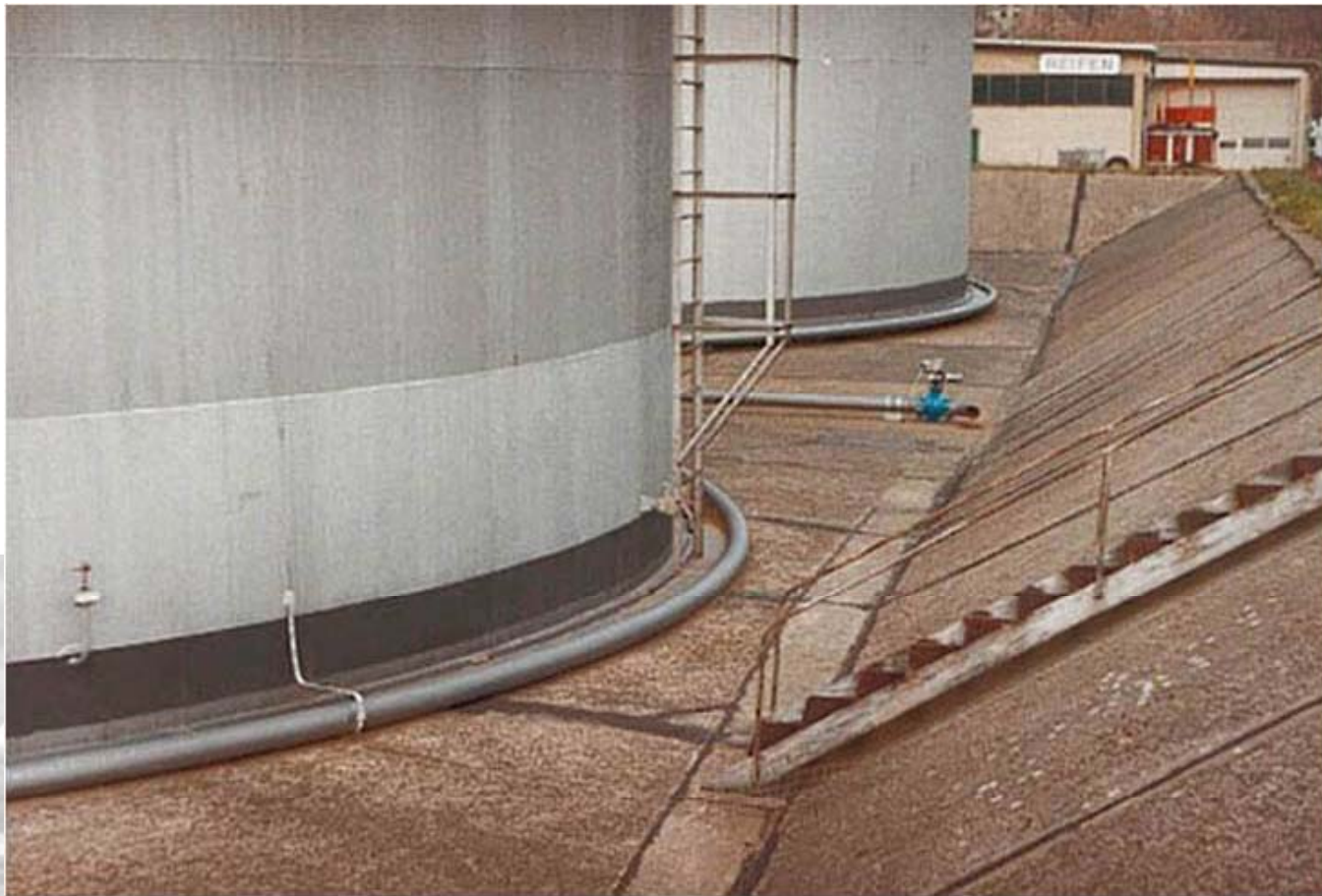
Wall height dictated by tank fill rate



Exterior of wall may be used to anchor liner – should operator choose to line the entire dike

# Installations

## Existing Concrete lined dike retro fitted with Alternative Solution



**HYDROCARBON DETECTION – (LEAK DETECTION)**

# HYDROCARBON DETECTION

## WHY DO I CARE?



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**DETECTORS COULD HAVE PREVENTED THIS**



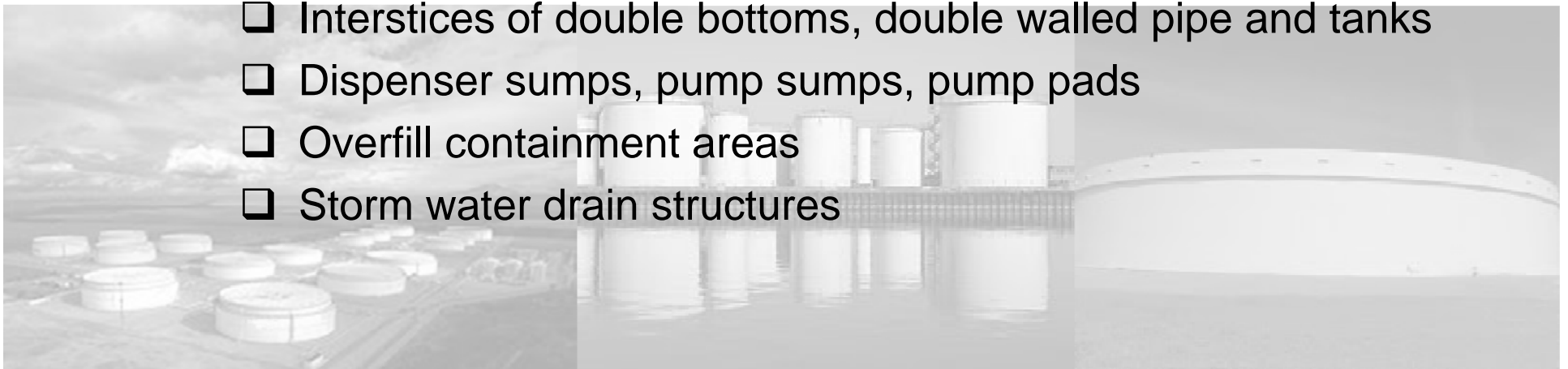
## Hydrocarbon Detection

Accurate hydrocarbon detection devices should be used in any containment structure to:

- Prevent Catastrophic events
- Prevent Releases
- Provide early detection for reaction and remediation.

The following are all candidates for detection monitors

- Interstices of double bottoms, double walled pipe and tanks
- Dispenser sumps, pump sumps, pump pads
- Overfill containment areas
- Storm water drain structures

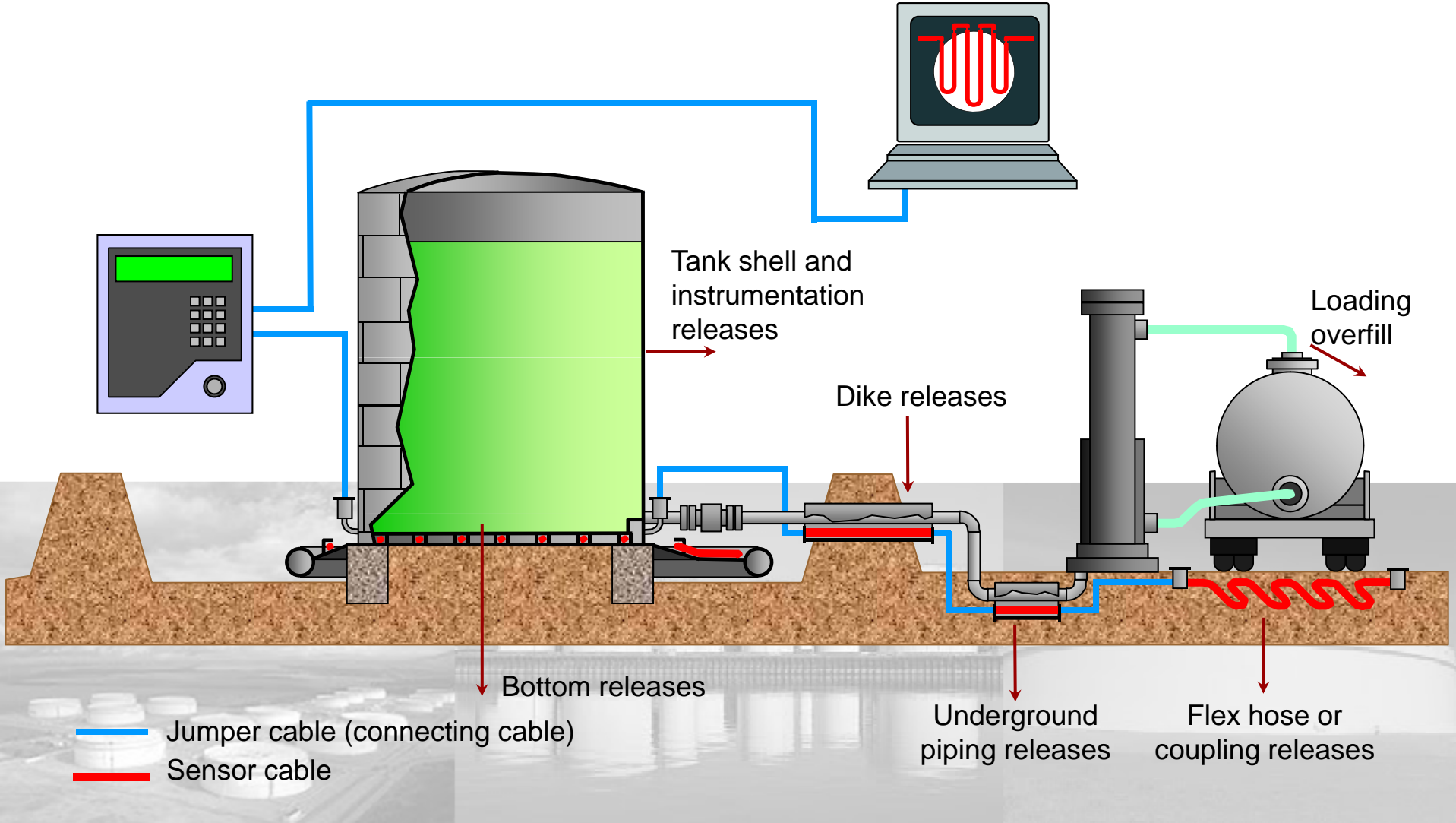




## Other Example Implementations



# THE COMPLETE MONITORING SOLUTION

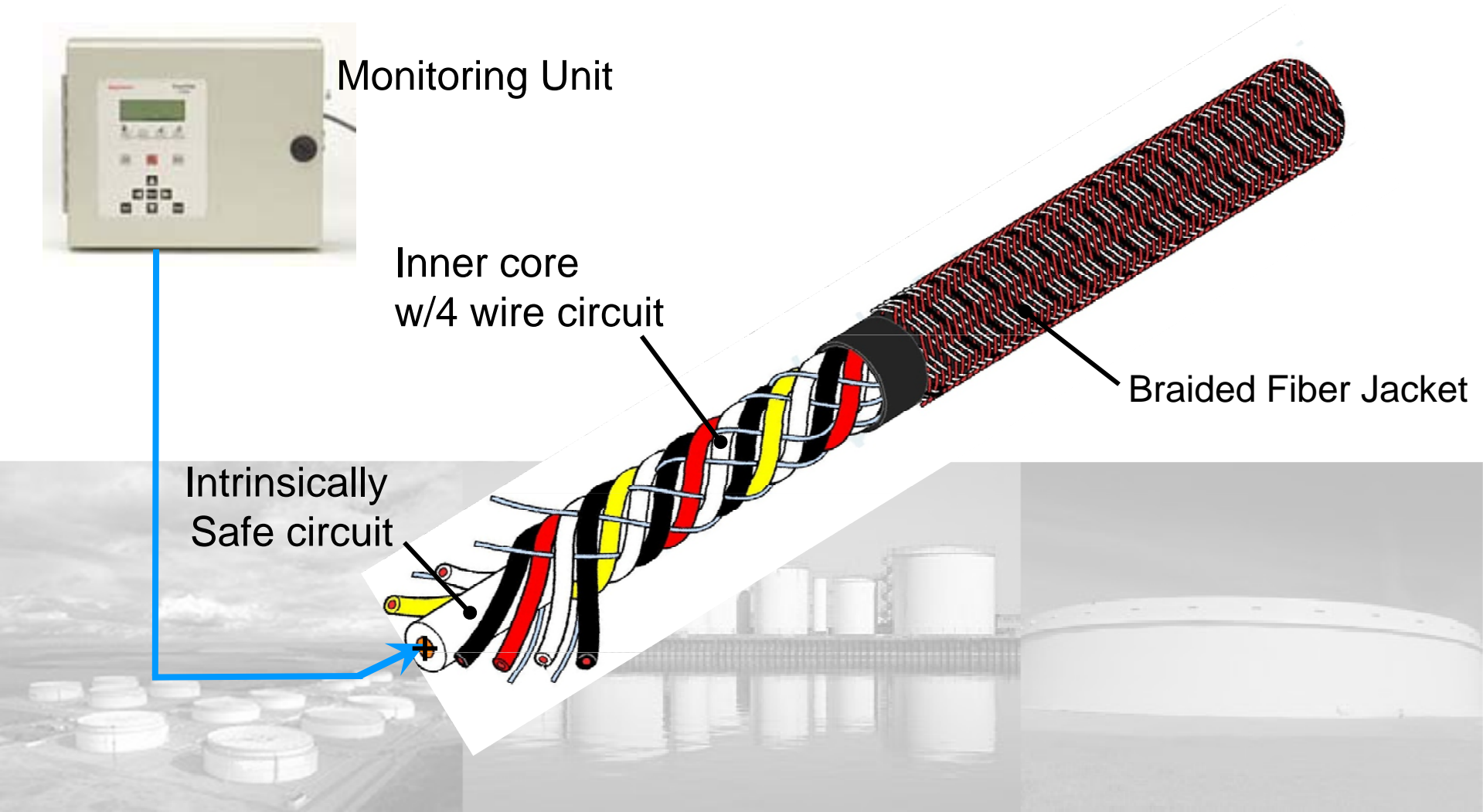


## MONITORING SYSTEM



- **Multiple** channels with ~ **5000 ft sensor length per channel**
- **Display** of the events with **Date, Time** and **location** of the event
- **Data logging** of all events and alarms
- **Automatic restart** after power loss
- **Password protection** at all operation levels

**PRINCIPLE OF CABLE OPERATION**



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**CONTACT INFORMATION**

**MICHAEL CRABB**

**i2 SOLUTIONS, LLC**

**T: 954-439-2775**

**E: [MAC@i2-SOLUTIONS.COM](mailto:MAC@i2-SOLUTIONS.COM)**

**THANK YOU**

