Best Practices for Minimizing Water Intrusion in Secondary Containment Systems





INTRODUCTIONS

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What is Secondary Containment?

Secondary containment is a second layer of liquid-tight containment installed around USTs and piping.





What is Not Secondary Containment?





What is the Purpose of Secondary Containment?

- A. Primary purpose is to contain and collect any fuel spills, releases or overfills within a liquid-tight area until the product release can be recognized, resolved and remedied.
- B. Secondary purpose is to provide access for environmental inspections and equipment maintenance.







A Brief History of Secondary Containment – The Single Wall Past

Late 1980s State and federal policymakers determine that many of the nation's <u>single wall</u> underground fuel storage tanks were leaking and contaminating groundwater supplies.



1989 The Exxon Valdez runs aground off of Alaska, rupturing its <u>single wall</u> hull and spilling millions of gallons of crude oil into the waters and surrounding environment.



These unconnected events in the late 1980s were a huge wake-up call to both regulators and the oil industry and began to change the way crude oil was transported and how fuels were stored underground.



The Rapid Transition to Mandated Secondary Containment in the Petroleum Transportation Industry

Prior to 1989, <u>all</u> crude oil supertankers had single wall hulls with no secondary containment.

1989 The single hull Exxon Valdez strikes a reef in Alaska's Prince William Sound, spilling 11 million gallons of crude oil.

1990 Due to public outcry, Congress quickly passes the Oil Pollution Act requiring double walled hulls on <u>all new crude oil tankers</u> to contain any possible oil spills.

2015 Per the Oil Pollution Act, <u>all crude oil</u> <u>tankers operating in US waters</u> must have secondarily contained, double wall hulls effective 1/1/15.





The Slower Transition to Mandated Secondary Containment in the Retail Fueling Industry (Part 1)

Prior to 1988, <u>most</u> USTs and fuel piping systems were single wall steel. Corrosion of the steel tanks and piping was determined by the EPA to be the primary cause of fuel leaks.

1988 The EPA passes new UST regulations that require all <u>new</u> USTs and piping to have corrosion protection as well as "release detection" systems. All existing UST systems were required to have the same protection installed <u>within</u> <u>10 years</u>. Secondary containment of USTs and piping is mandated at this time only for "hazardous substances" stored underground.





The Slower Transition to Mandated Secondary Containment in the Retail Fueling Industry (Part 2)

1989-90 Xerxes and Owens Corning introduce the first fiberglass double wall USTs with factory installed brine interstitials – the industry's first secondarily contained USTs with interstitial monitoring that provided a quick and effective means of leak detection without a release of product into the environment.

1990s Major oil companies begin to specify double wall USTs at new sites as a general practice because of their added protection against fuel leaks (and financial liability!).





The Slower Transition to Mandated Secondary Containment in the Retail Fueling Industry (Part 3)

2001 Due to concerns about MTBE contamination of drinking water, California issues Senate Bill 989 that <u>mandates</u> "under dispenser containment" at all sites by the end of 2003.

2005 Also in reaction to MTBE concerns, the new Energy Policy Act <u>mandates</u> the installation of secondarily contained tanks and piping at <u>all new</u> <u>or replaced</u> UST systems <u>within 1000 feet</u> of a public water system. Under dispenser containment is also required at <u>all new</u> dispenser systems within 1000 feet of a public water system.

2015 After 27 years, EPA revises its 1988 UST regulations and <u>mandates</u> the installation of secondarily contained USTs and secondary containment for fuel piping at <u>all new or replaced</u> UST systems.



How well do you know EPA's 2015 UST regulations?



New EPA Requirements for Secondary Containment

- Beginning on April 11, 2016, owners and operators <u>must</u> install secondarily contained tanks and piping when installing or replacing tanks and piping. Owners and operators must use interstitial monitoring as release detection for these new or replaced tanks and piping.
- Secondary containment means the tank and piping have an inner and outer barrier with an interstitial space that is monitored for leaks and includes containment sumps when those sumps are used for the interstitial monitoring of the piping.
- As part of the annual walkthrough inspection requirements set forth in 40 CFR 280.36(a), owner operators must inspect containment sumps for visual damage and remove <u>any</u> <u>liquid</u> found in containment. So removing water from secondary containment is now an EPA requirement!

Source: 40 CFR Part 280







The Problem: Secondary Containment Collects Water Too!

A "Typical" Tank Sump



Same Sump With Water Intrusion



Unfortunately, many secondary containment systems installed in the past were poorly designed and acted more as access to piping and equipment then as truly liquid-tight containment. As a result, water intrusion into secondary containment is common and systems that are water "traps" are effectively not working as containment.



Leak Detection Issues Caused by Water Intrusion into Secondary Containment

Water Intrusion Can Create Leak Detection Problems

- Frequent Water Intrusion creates Frequent Sensor Alarms
- Frequent or False Alarms Can Lead to Ignored Leaks
- Raised or Disconnected Sensors Can Lead to Product Releases

Frequent Sensor Alarms Increase Environmental Compliance Costs

• Making operators of fuel stations less financially viable





Spill Containment Problems Caused by Water Intrusion

Secondary Containment Volume is Reduced by Water Intrusion

• E.g. a 5-gallon spill bucket filled with 3 gallons of water cannot contain a 5 gallon overfill during a fuel drop

Water Intrusion makes it Difficult to Inspect Secondary Containment

High Costs of Water Removal from Secondary Containment

- Water in Secondary Containment must be treated as a Hazardous Material due to possible fuel contamination
- Per Site Water Removal Costs can be in the Tens of Thousands – this hurts the operator's financial viability







Corrosion Issues Caused by Water Intrusion

Water Intrusion into Secondary Containment Greatly Increases the Risk of Microbial Induced Corrosion

- Microbial Induced Corrosion Depends on Water mixed with Ethanol Blended Fuels
- No Water = No Microbial Induced Corrosion
- Corrosion Rapidly Destroys Unprotected Equipment (MIC effects can be seen in less than 18 months!)

Water Intrusion into Tanks Increases Corrosion Risk

- Even though tank top manway systems and risers are supposed to be watertight, it is just a matter of time before standing water in a sump or spill bucket can further intrude <u>into the actual tank</u>.
- Microbial corrosion is especially problematic in diesel tanks and numerous UST failures have already occurred.







Bottom Line: Secondary Containment systems filled with water are bad for everyone... except maybe the vac truck companies!









What kind of water gets into Secondary Containment?

- 1. Surface water
- 2. Groundwater
- 3. Condensation





How does surface water get into Secondary Containment?



It's mostly due to gravity (I think!)...

Any water flowing over the tank pad or on the dispenser islands will find its way below ground. Surface water gets past non-watertight manhole covers, gaps, seams and even through the cracks in the concrete pad itself. Water that makes its way below ground will easily enter any tank and dispenser sumps that are not properly sealed.





How does groundwater get into Secondary Containment?

Hydrostatic pressure forces water that is below ground to flow or seep through even small gaps, cracks, pinholes or seams in secondary containment. The deeper the water entry point, the higher the hydrostatic pressure so tank collar joints and piping and conduit entries are especially at risk.

Formula for Hydrostatic Pressure (P)

P = ρ (density of water)*gravity*height

P at 12" = (1,030 kg/m^3)(9.8 m/s^2)(0.3 m) P = 30.28 mbars (0.475 psi)

P at 48" = (1,030 kg/m^3)(9.8 m/s^2)(1.52 m) P = 153.4 mbars (2.225 psi)

∴ the hydrostatic pressure exerted by a 4 ft. column of groundwater is 5x greater than a 1 foot column!





How does condensation get into Secondary Containment?

On a typical Florida day with an ambient air temperature of 80°F and a relative humidity of 75%, any surface with a temperature of 71°F or lower will become covered by the condensation in the air.

To determine the amount of water that would condense on the inner wall of a tank sump, we must first determine the volume of water vapor <u>in the</u> <u>sump</u>. A typical tank sump measures about 48" in diameter and 5 feet in depth. A sump of this size would have a volume of 65 cubic feet. At 80°F and a relative humidity of 75%, approximately 7.5 grams of water will be present i<u>n every cubic foot of air</u>. This means the sump will contain approximately 487 grams or nearly 2 ½ cups of water.

Two and a half cups of water may not sound like a lot but it will add up over time as water collects in the base of the sump and it will certainly contribute to microbial induced corrosion!









So let's try and fix this water intrusion problem together...

- 1. Manufacturers cannot solve this problem on their own if we could, all new UST installations would require "triple wall", vacuum-sealed stainless steel containment!
- 2. State and local regulators, working with industry groups, need to participate in the "solution"...





A Few "Global Best Practices" Regulators Might Consider to Help Minimize Water Intrusion into Secondary Containment

1. Require All Installers to Be Factory Certified (and re-certified every 2 years)

Many States and Jurisdictions Require Certification Already – It's Critical!

2. Enforce New UL Listing Requirements for Secondary Containment

UL 2447 Requires Liquid Tight Containment and Entry Fittings + "Systems"

3. Require Periodic Tightness Testing of all Secondary Containment

At a Minimum, Integrity Testing Per New EPA Requirements



So where does water get into Secondary Containment?

Uhh, pretty much everywhere!





Water Intrusion into Dispenser Sumps

The "Problems"

- 1. Groundwater leaking through sump walls or sump joints;
- 2. Groundwater leaking through pipe entry fittings;
- 3. Groundwater leaking through conduit entry fittings; and
- 4. Surface water leaking through the dispenser housing.





"Best Practices" to Help Minimize Water Intrusion into Dispenser Sumps

The "Fixes"

- 1. Use monolithic 1-piece dispenser sumps (no field assembly or joints);
- 2. Use factory-installed, factory-tested pipe entry fittings (such as the Loop system);
- 3. Use semi-rigid, fuel compatible product entry fittings;
- 4. Route all conduits <u>outside</u> of dispenser sumps;
- 5. For repairs, install "split boot" repair fittings;
- 6. Minimize water entry into dispenser housings use dispenser sumps with "rain lips" and install a watertight seal around the base of the dispenser frame.













Water Intrusion into DW Piping Interstice

The "Problems"

- 1. Groundwater leaking through damaged secondary wall of piping; and
- 2. Water in dispenser sump or tank sump leaking through open pipe entry fittings (test boots).





"Best Practices" for Preventing Water Intrusion into DW Piping Interstice

The "Fixes"

1.

2.









Water Intrusion into Tank Sumps and Multiport Fill Sumps

The "Problems"

- 1. Groundwater leaking through tank collar joints;
- 2. Groundwater leaking through riser entry fittings installed in the base of <u>solid bottom</u> sumps;
- 3. Groundwater leaking through sump walls or tophat joints;
- 4. Groundwater leaking through pipe entry fittings;
- 5. Groundwater leaking through conduit entry fittings;
- 6. Surface and groundwater entering though nonwatertight tank sump or multiport lids; and
- 7. Condensation inside the sump.





"Best Practices" to Help Minimize Water Intrusion into Tank and Fill Sumps

The "Fixes"

- Use "double seals" on the tank collar 3 layers of fiberglass tape on the outer collar and an epoxy poured inner collar;
- 2. Minimize use of solid bottom tank sumps that require riser entry fittings in the base;
- 3. Minimize use of thin wall sumps that can be porous or subject to material "creep";
- 4. Use UL approved semi-rigid, fuel compatible product or vent line entry fittings;
- Minimize need for conduit entries (e.g. see ElectroTite) or use UL approved semi-rigid, fuel compatible conduit entry fittings;
- 6. Encourage use of watertight, twist or cam-locking sump lids or multiport covers (e.g. FibreTite); and
- 7. Consider venting of tank sumps and the use of desiccants to remove moisture from the air.





"Best Practices" to Help Minimize Water Intrusion Through Conduit Entry Fittings into Tank Sumps

The "Fixes"

Use Semi-Rigid or FRP Entry Fittings for <u>all</u> Conduit Entries





ElectroTite System – uses only factory installed conduit entry fittings that are above the hydrostatic "danger zone"





Preventing Water Intrusion at Conduit Entry Points - New ElectroTite Tank Sump



ElectroTite System – allows for up to 6 factory installed and factory tested conduit entry fittings.



"Best Practices" to Help Minimize Water Intrusion Through Sump Lids into Tank Sumps

<u>The "Problem"</u>: The top of the sump tophat reducer is installed below the bottom of manhole skirt and there is no watertight lid on the sump. Surface water that gets past the manhole cover will drain straight into the top of this unsealed sump.



<u>The "Fix"</u>: The bottom of the manhole skirt is installed at least 2" below the bottom of the sump lid. Any water getting past the manhole cover will drain (through the pea gravel) into backfill. In addition, installing a watertight lid prevents any water that doesn't drain into backfill from getting into the sump.





Preventing Water Intrusion in Multiport Fill Sumps – New FibreTite Multiport System

Watertight Gasketed Multiport Cover



Watertight Fill Port Covers

Sealable, watertight fill port covers are available with the FibreTite multiport system.

Double Wall Protection Against Leaks

The P761 spill buckets are safely shrouded off to the watertight fill sump tophat.



Upgrading Leaking Steel Multiport Fill Sumps – FibreTite Retrofit Multiport System

"Typical" Steel Multiport



FibreTite Retrofit Multiport System



Corroded steel, missing bolts and gaskets and no way to keep water out of sump!

Corrosion resistant, easy access for maintenance and completely watertight!







Water Intrusion through Manhole Covers and Multiport Covers

The "Problems"

- 1. Water leaks through open bolt holes in cover;
- 2. Water leaks past outer radius of un-gasketed covers (where manhole cover sits on the frame);
- 3. Water leaks through cracks in damaged covers; and
- 4. Water leaks through cracks in the tank pad (water then seeps into space between manhole skirt and top of tank sump).





"Best Practices" to Help Minimize Water Intrusion past Manhole Covers and Multiport Covers

The "Fixes"

- 1. Use manhole covers that don't require bolts;
- 2. Use gasketed manhole covers to seal out water;
- 3. Install thicker composite covers that can handle deflection when trafficked;
- 4. Repair or seal damaged concrete where surface water drain into the area above the sump lid; and
- Require watertight concrete tank pads if surface water can leak into the pea gravel then fuel can too...



Installing new watertight manhole covers above tank and fill sumps is one of the most costeffective ways of reducing water intrusion in tank top secondary containment!



"Best Practices" – Install Strong Composite Covers Because Thin Composite Covers Will Not Be Watertight for Long!



Thin composite covers will deflect significantly (up to 2") when trafficked eventually causing the fiberglass layers to delaminate.

The end result will be cover failure at its weakest point – allowing for water intrusion and worse!









Water Intrusion into Fuel and Vapor Spill Buckets

The "Problems"

- 1. Surface water leaks past outer radius of un-gasketed covers (where cover sits on the frame);
- 2. Ground water leaks through bellows clamps (where bellows attaches to the frame);
- 3. Ground water leaks through cracks in damaged single wall spill buckets; and
- 4. Water leaks through "slip on" spill buckets.





"Best Practices" for Preventing Water Intrusion into Fuel Spill Buckets

The "Fixes"

- 1. Use watertight spill bucket covers;
- 2. Encourage use of double wall spill buckets to protect the primary containment bucket and allow for easy testing of bucket;
- 3. Discontinue use of "slip-on" spill buckets in favor of "thread-on" spill buckets;
- 4. Discourage temporary spill bucket "fixes" such as liners; and
- 5. Enforce EPA integrity testing of spill buckets.











The Potential Return on Investment of Preventing Water Intrusion into Secondary Containment

Overall Cost Savings to the Industry of Minimizing Water Intrusion into Secondary Containment Could be Over \$100 Million

1. Lowering Water Removal and Hazardous Material Storage and Disposal Costs can save Tens of Millions of \$\$!

- 2. Reducing Maintenance and Environmental Costs can save Tens of Millions of \$\$!
- **3.** Less Time Wasted Handling False Alarms = Improved Efficiency of Employees
- 4. Lower Environmental Inspection and Integrity Testing Costs
- 5. Reduced Corrosion Costs
- 6. Reduced Costs Associated with Contaminated Fuel

Encouraging and Assisting Owner/Operators and Installers to Invest in "Best Practices" and Watertight Secondary Containment is Good for All of Us!



Thank You!

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