Alternative Release Detection Methods In Lieu of Line Leak Detectors

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Water Boards

Road Map

- USTs Before 2015
- Federal Regulatory Change in 2015
- Line Leak Detectors (LLDs)
- Automated Interstitial Monitoring (AIM) Pipeline Monitoring Capabilities
- Strengths/Weaknesses of Different AIM Systems

UST Monitoring in CA Before 2015 Federal Update

- ***Generally:*** California requires *VPH (vacuum, pressure, or hydrostatic monitoring)* and LLD on buried pressurized piping
  - Emergency Power Generator USTs (EPGs):
    - Federally Deferred
    - **Old CA EPG tanks:** Sump sensors for piping
    - **New CA EPG tanks:** VPH for piping

2015 Update to Federal Regulations

- **<u>EPGs:</u>** No longer deferred from release detection requirements. CA was given 3 years to retrofit:
- Line leak detectors (LLDs) on buried pressurized piping and either:
  - Annual line tightness test, or
  - Monthly monitoring

2022 USEPA releases AIM document for EPGs:

- Automated Interstitial Monitoring (AIM)
  - Type 1 AIM: Interstitial space monitored by vacuum or pressure
  - Type 2 AIM: Interstitial space monitored by hydrostatic liquid
  - Type 3 AIM: Interstitial space monitored by liquid/product sensors (either test sumps triennially or double-walled containment sumps)

- *<u>CA 2026: Type 1 or 2 AIM system = LLD</u>*

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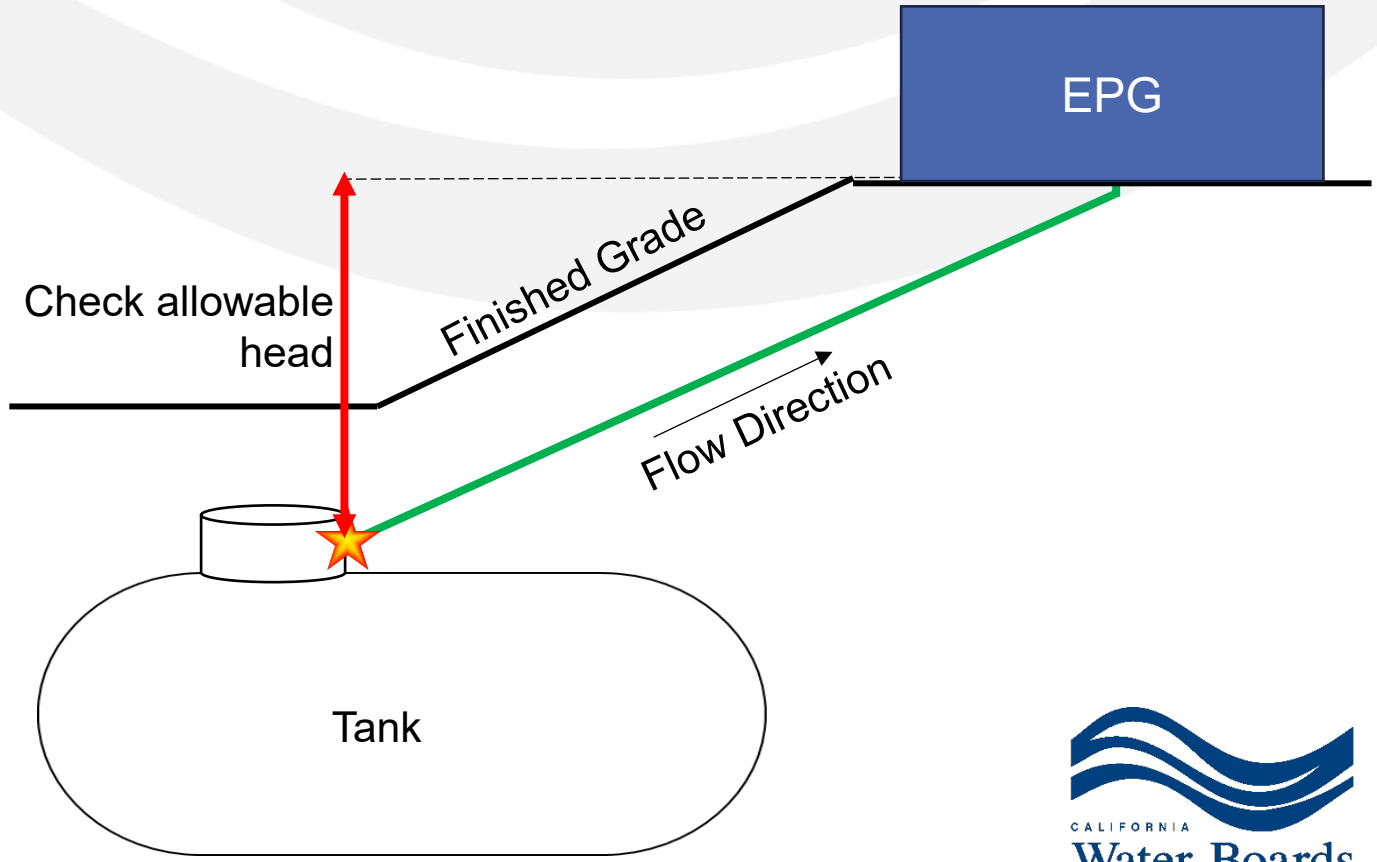
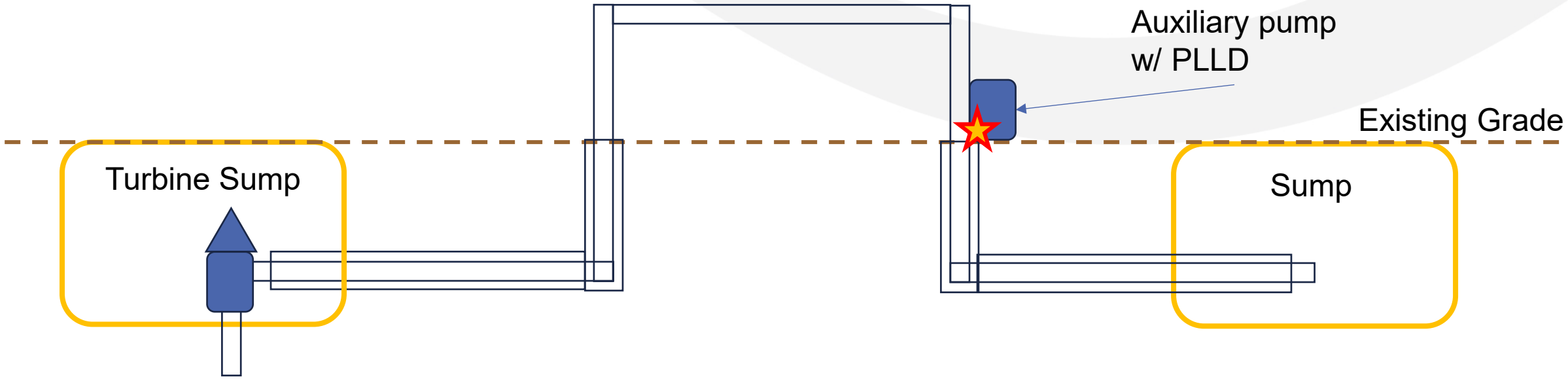
Elevation Head

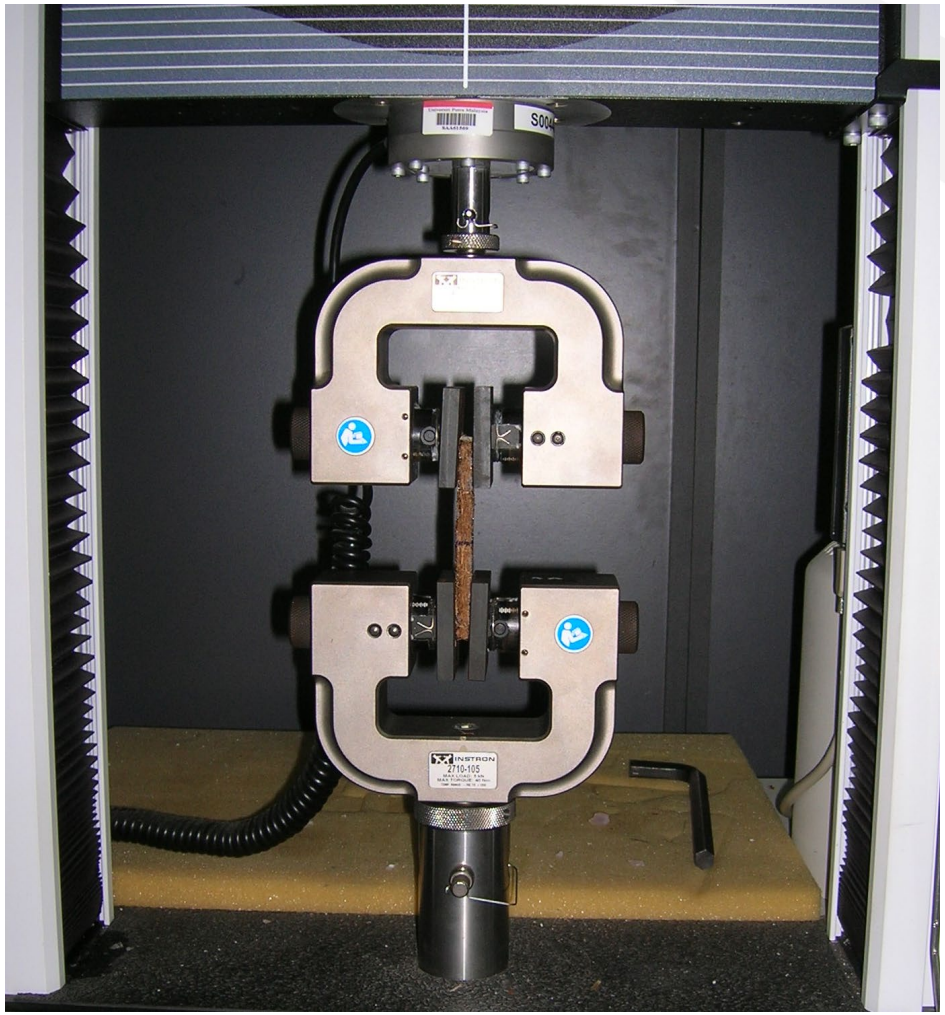
- LLDs are typically installed on the turbine head
- Standing product in pipeline exerts pressure on LLD, masking a leak



LLD Monitoring: Aboveground Piping

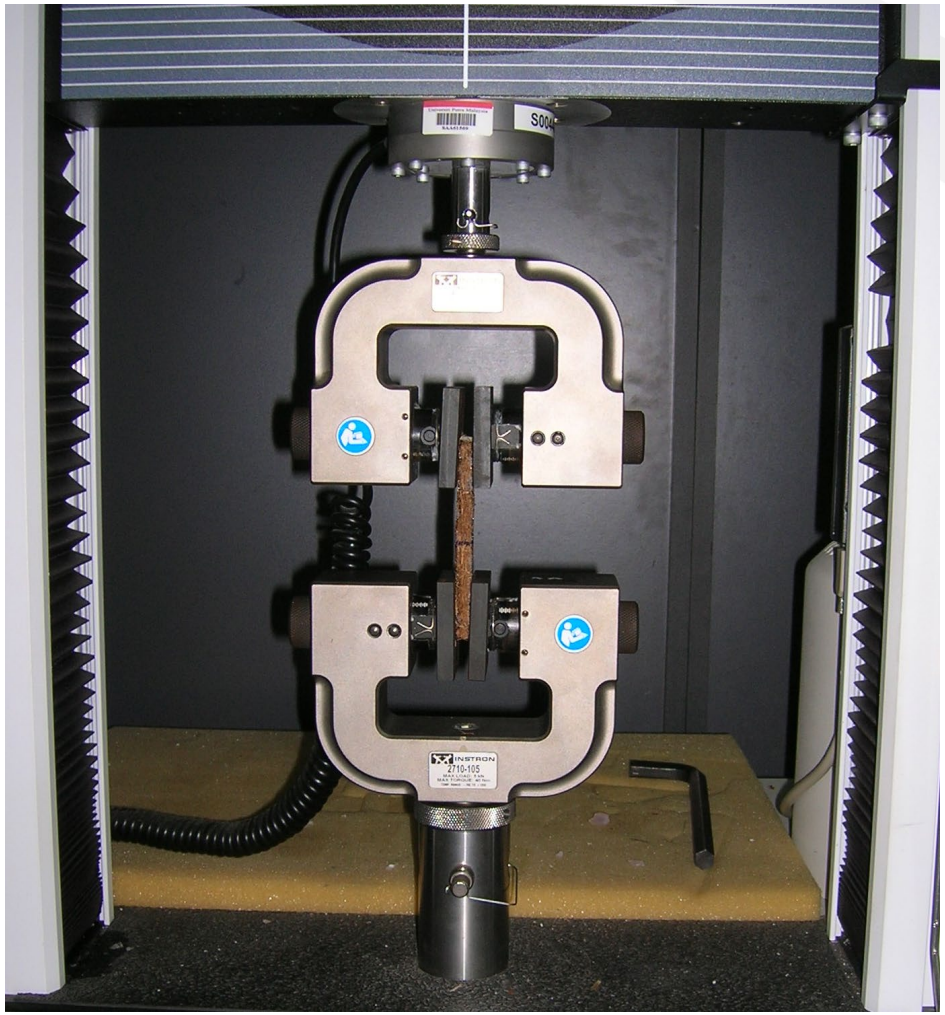


LLDs with Rigid vs Flexible Piping



- Stiffer material = longer LLD monitoring
  - Steel piping
  - Fiberglass piping
- More flexible material = shorter LLD monitoring
  - Flex line

Type 1 and 2 AIM with Rigid vs Flexible Piping



- Rigid piping sold in sticks:
  - More joints/fittings (increased risk for small leaks)
  - Larger interstitial space (shorter monitored distance)
- Flex lines sold in rolls
  - Joints/fittings only at beginning and end of run (decreased risk for small leaks)
  - Smaller interstitial space (longer monitored distance)

Rigid vs Flexible Piping

Fittings are common locations for release

Large interstitial space reduces AIM monitored distance

Rigid vs Flexible Piping

Fewer connections mean fewer opportunity for leaks

Space monitored by AIM

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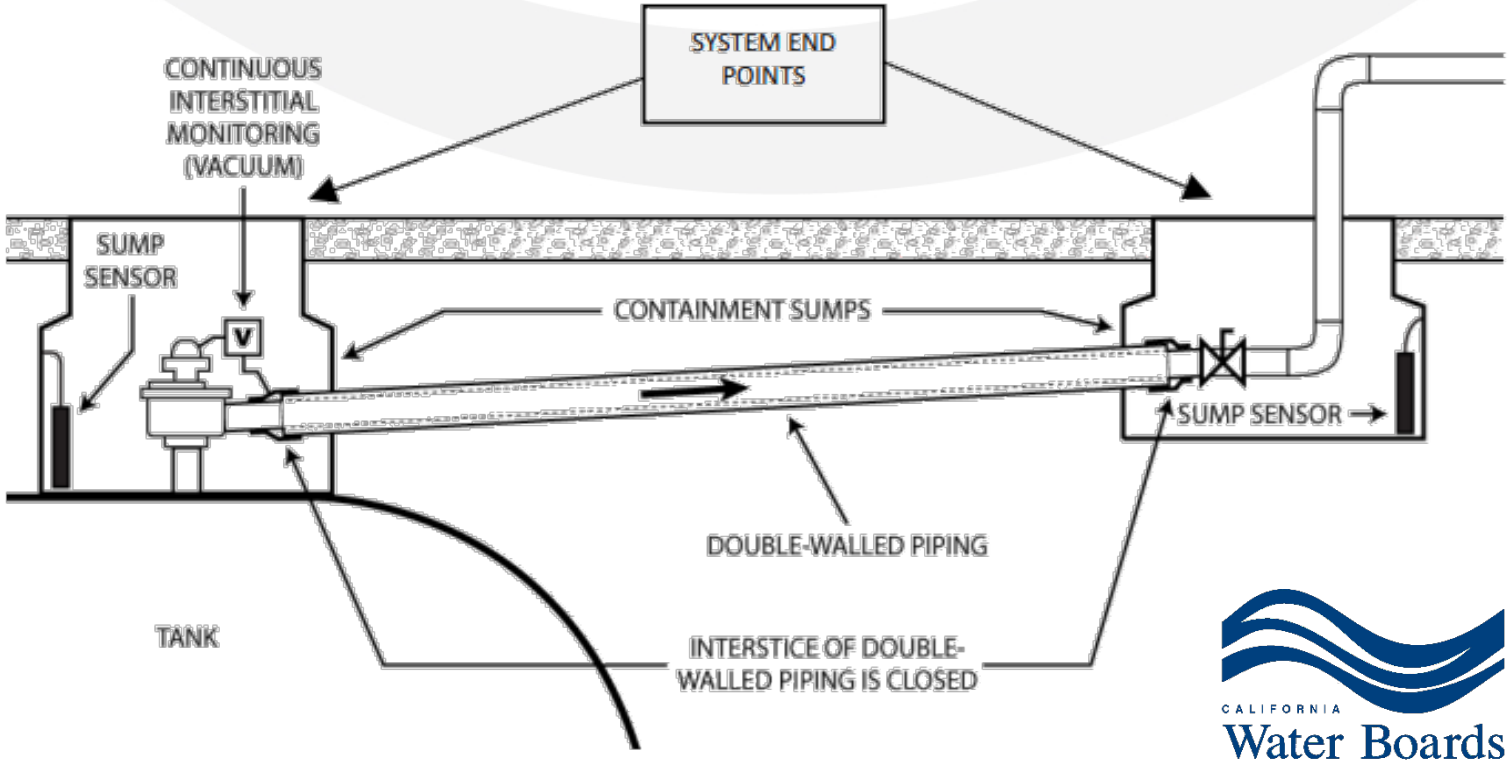
Type 1 and 2 AIM Systems

- Continuously monitor primary and secondary
- Handle longer pipelines
- Pipeline pressure is a non-issue
- Product compatibility is a non-issue
- Elevation head is a non-issue

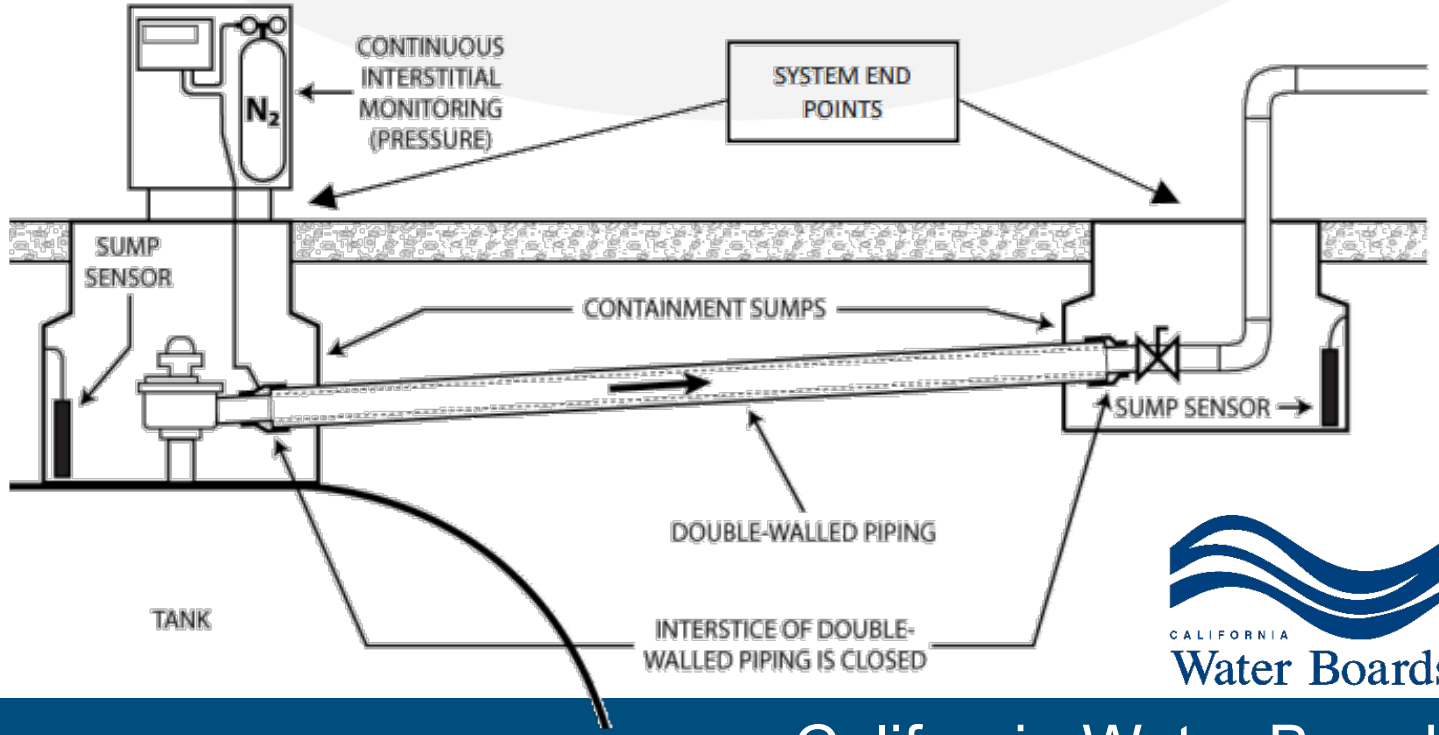
Vacuum

- “Type 1 AIM System”
- Very common for piping interstice
- Vacuum generated by tank turbine
- Change in vacuum indicates a breach in the interstice and generates an alarm condition
- Can monitor 5,000 feet of piping (compared to ~1,000 feet for LLD)

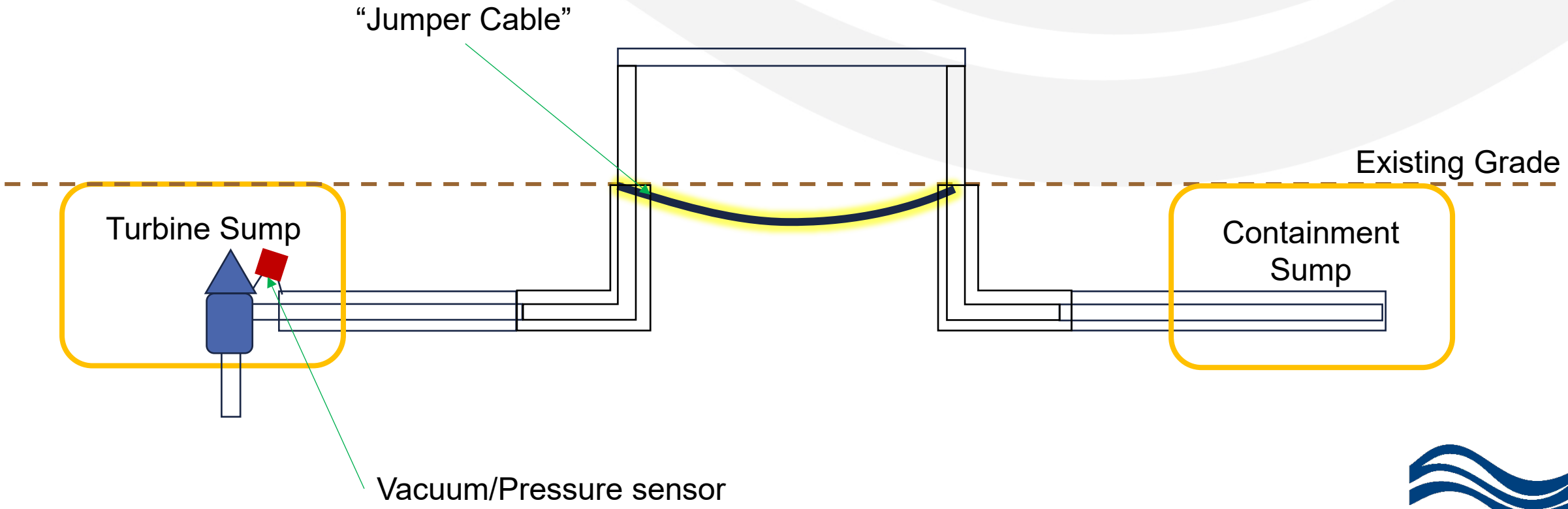


Pressure

- “Type 1 AIM System”
- Least common – only one model is used in CA
- Nitrogen gas supplied to overpressure piping interstice
- Decrease in pressure indicates a release and generates an alarm condition
- Can monitor up to 2,000 feet of piping (compared to 1,000 feet for LLD)

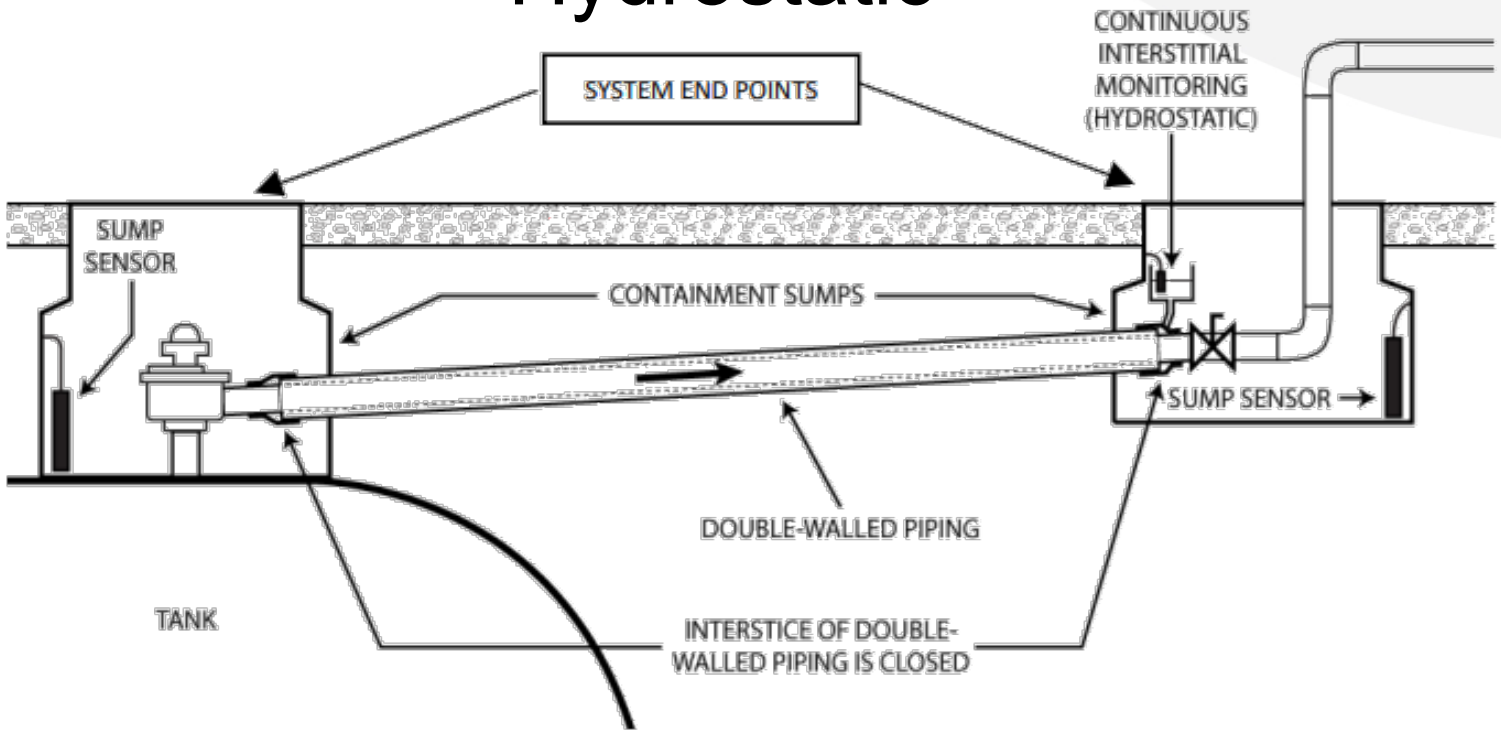


Type 1 AIM System: Aboveground Piping

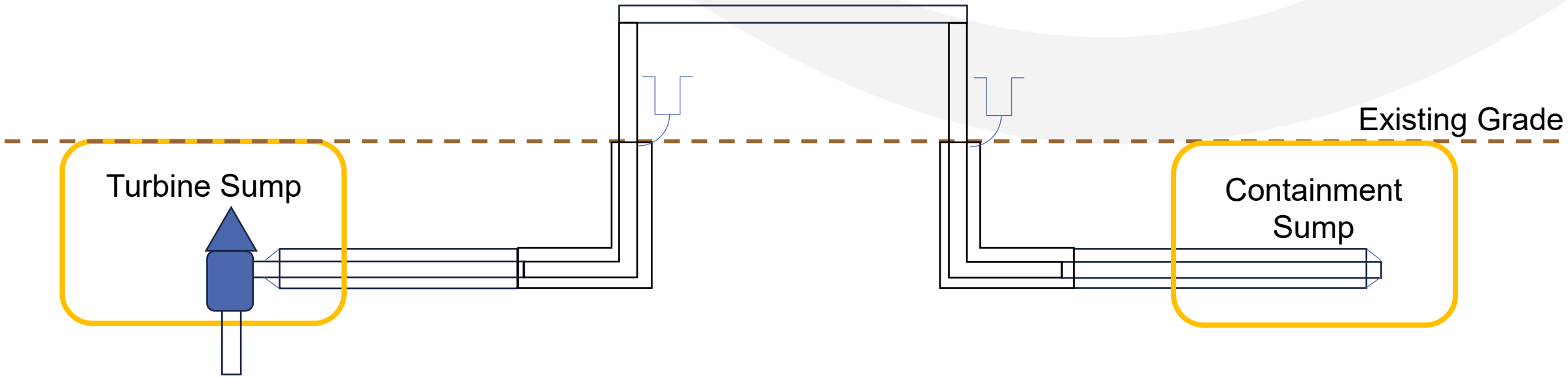


Hydrostatic

- "Type 2 AIM System"
- Common application for tanks
- Dual float sensor: detects both increases ***and*** decreases in brine level
- Decrease in brine: breach from secondary to environment
- Increase in brine: breach from primary to secondary



Type 2 AIM System: Aboveground Piping



Type 3 AIM Systems

- Continuously monitors primary and secondary containment
- Handle longer pipelines, but require periodic monitoring sumps
- Pipeline pressure is a non-issue
- Elevation head is a non-issue

Type 1 AIM System: Long Piping

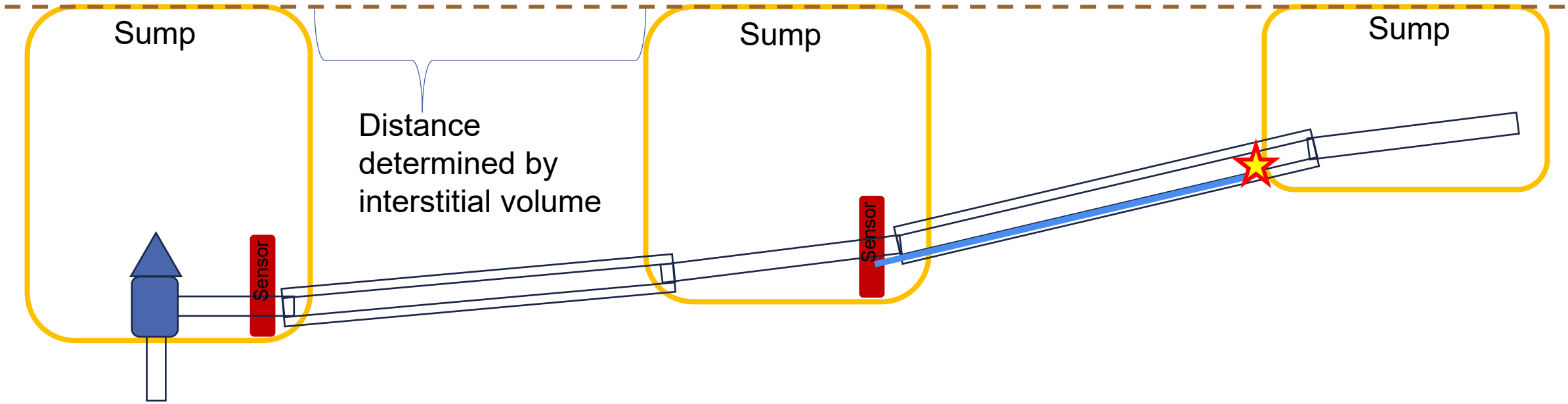
Type 2 AIM System: Long Piping

Type 3 AIM and Rigid vs Flexible Piping

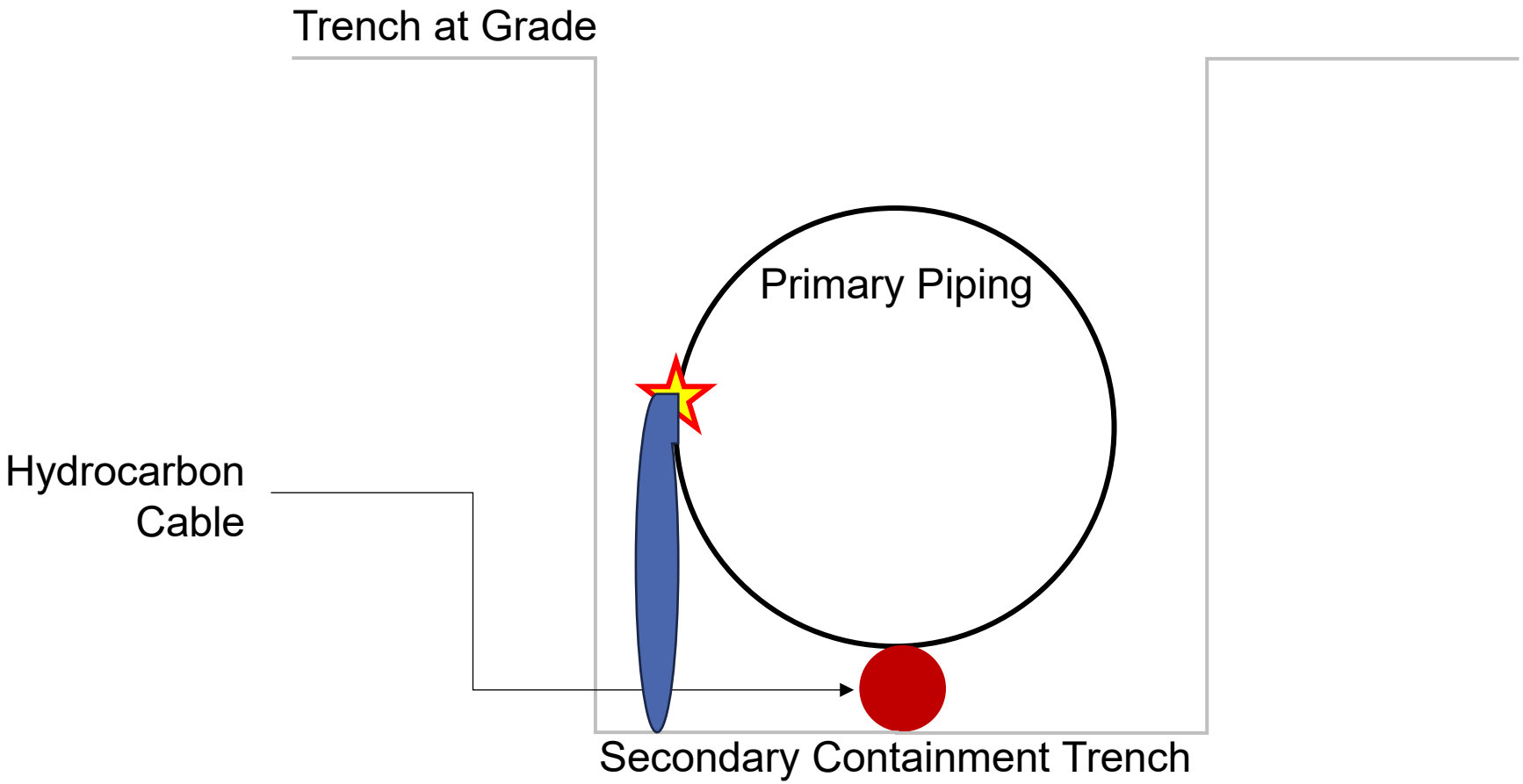
Line Pressure (psi)	3.0 gal/hr Equivalent Vol (mL/min)	Equivalent Leak Rate Vol (gph)	Rigid Piping			Flexible Piping					
			0.2186	0.2652	0.8398	0.0133	0.0196	0.0252	0.0031	0.0042	0.0119
			Maximum Piping Length (ft) Between Sensors								
10	189	3.0	13.7	11.3	3.6	225.3	152.9	118.9	966.5	713.3	251.8
15	232	3.7	16.8	13.9	4.4	276.5	187.6	145.9	1186.3	875.6	309.0
18	254	4.0	18.4	15.2	4.8	302.7	205.4	159.8	1298.8	958.7	338.4
19	261	4.1	18.9	15.6	4.9	311.1	211.1	164.2	1334.6	985.1	347.7
20	268	4.2	19.4	16.0	5.1	319.4	216.8	168.6	1370.4	1011.5	357.0
21	274	4.3	19.9	16.4	5.2	326.6	221.6	172.4	1401.1	1034.2	365.0
22	281	4.5	20.4	16.8	5.3	334.9	227.3	176.8	1436.9	1060.6	374.3
23	287	4.5	20.8	17.2	5.4	342.1	232.1	180.5	1467.6	1083.2	382.3
24	293	4.6	21.2	17.5	5.5	349.2	237.0	184.3	1498.3	1105.9	390.3
25	299	4.7	21.7	17.9	5.6	356.4	241.8	188.1	1529.0	1128.5	398.3
26	305	4.8	22.1	18.2	5.8	363.5	246.7	191.9	1559.6	1151.2	406.3
27	311	4.9	22.6	18.6	5.9	370.7	251.5	195.6	1590.3	1173.8	414.3
28	317	5.0	23.0	18.9	6.0	377.8	256.4	199.4	1621.0	1196.5	422.3
29	322	5.1	23.4	19.2	6.1	383.8	260.4	202.6	1646.6	1215.3	428.9
30	328	5.2	23.8	19.6	6.2	390.9	265.3	206.3	1677.2	1238.0	436.9

https://www.epa.gov/system/files/documents/2022-05/aim-systems-in-depth-discussion.pdf

Type 3 AIM Systems: Long Piping



Type 3 AIM Systems: Long Piping



	Unleaded Gasoline		
	1/3 MER	2/3 MER	MER
TFH Hydrocarbon Sensor Cable**	1368 ft.	2685 ft.	4046 ft.
Response time (min)	3.40	7.48	16.21
Product activation height (cm)	0.65	1.33	3.53
Detection length (cm)	27.7	56.8	150.4
Lower detection limits (cm)			
Product activation height	N/D	N/D	3
Detection length	N/D	N/D	152.9

*See glossary.

** California regulations require sensors to be tested annually to verify proper operation. The detector is not reusable and must be replaced after contact with hydrocarbons.

Specificity Results (in addition to above)

Activated: synthetic gasoline, diesel, heating oil #2, water (AGW Sensor Cable only).

Matrix of ***Nonmetallic*** Pipe Monitoring Applications
Gravity Flow, Vacuum (V), Pressure (P), and Interstitial Liquid Level Monitoring (ILLM)
(Enclosure to State Water Board letter dated February 29, 2008; Matrix Updated April 25, 2014)

Nonmetallic Pipe Manufacturer		**UL 971 pipe date stamped on or after July 1, 2005**		
Brand	**Secondary Containment Type and Size** (Coaxial reported as ID of PS; SOS reported as OD of SC)	**Fuels**[6]	**Open** (min. 5 psi rating on SC per UL) **Gravity Flow or Ambient ILLM**	**Closed** (min. 50 psi rating on SC per UL) **Vacuum, Pressure, or Pressurized ILLM**
Advantage Earth Products, Inc.				
Electr-O-Fuze	Flexible; Coaxial (coil); Black 1½", 2", 3", 4"	MV,CT,HB,AM	Gravity Flow	V,P
	Flexible; Coaxial (sticks); Black 1½", 2", 3", 4"	MV,CT,HB,AM	Gravity Flow	V,P
Franklin Fueling/APT				
XP-150-SC	Flexible; Coaxial (coil); 1½"	MV,CT,HB,AM	Gravity Flow	V
XP-100, 175, 200	Flexible; Coaxial (coil); 1", 1¾", 2"	MV,CT,HB,AM	Gravity Flow	None
UPP	Flexible; Coaxial (coil); 1½", 2"	MV,CT,HB,AM	Gravity Flow	V, P
	Flexible; Coaxial (sticks); 1½", 2", 3", 4"	MV,CT,HB,AM	Gravity Flow	V, P
NOV Fiber Glass Systems				
Dualoy 3000/L	Rigid; SOS; 3", 4"	MV,CT,HB,AM	Gravity Flow	V, P
(Ameron)	Rigid; SOS; 6"	MV,CT,HB,AM	Gravity Flow	None
Dualoy 3000/LCX	Rigid; Coaxial (sticks); 2", 3"	MV,CT,HB,AM	Gravity Flow, AILLM[1]	V, P, PILLM[1]
(Ameron)	Rigid; Coaxial (sticks); 4"	MV,CT,HB,AM	Gravity Flow, AILLM[1]	None
Red Thread IIA	Rigid; SOS; 3", 4"	MV,CT,HB,AM	Gravity Flow	V, P
(Smith Fiberglass)	Rigid; SOS; 6"	MV,CT,HB,AM	Gravity Flow	None
NUPI				
Smartflex	Flexible; Coaxial (coil); 1¼", 1½", 2"	MV,CT,HB,AM	Gravity Flow	V, P
	Flexible; Coaxial (sticks); 1½", 2"	MV,CT,HB,AM	Gravity Flow	V, P
	Rigid over Flexible; Coaxial (sticks); 3", 4"	MV,CT,HB,AM	Gravity Flow	V, P
OPW-FCS				
C15, C20, C30	Flexible; Coaxial (coil); 1½", 2", 3"	MV,AM	Gravity Flow	None
C75, C10[4]	Flexible; Coaxial (coil); ¾", 1"	MV,AM	Gravity Flow	V, P
PGFC-2150[5]	Flexible; Coaxial (coil); 1½"	MV,AM	Gravity Flow	V, P
Western Fiberglass				
Co-Flex	Flexible; Coaxial (coil); 1½", 2", 3"	MV,AM	Gravity Flow, AILLM[2]	None
Co-Flex[4]	Flexible; Coaxial (coil); ¾", 1"	MV,AM	Gravity Flow, AILLM[2]	V, P, PILLM[2]
Co-Flex[3]	Flexible; Coaxial (coil); 1½"	MV,AM	Gravity Flow, AILLM[2]	V, P, PILLM[2]

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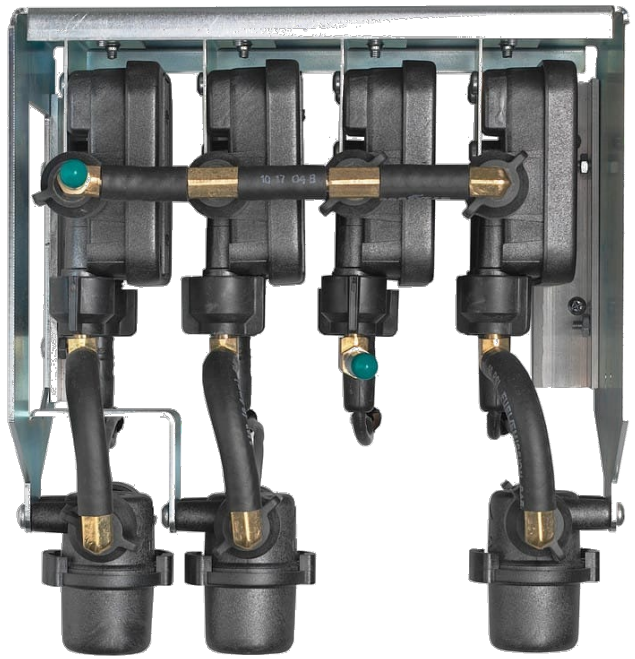
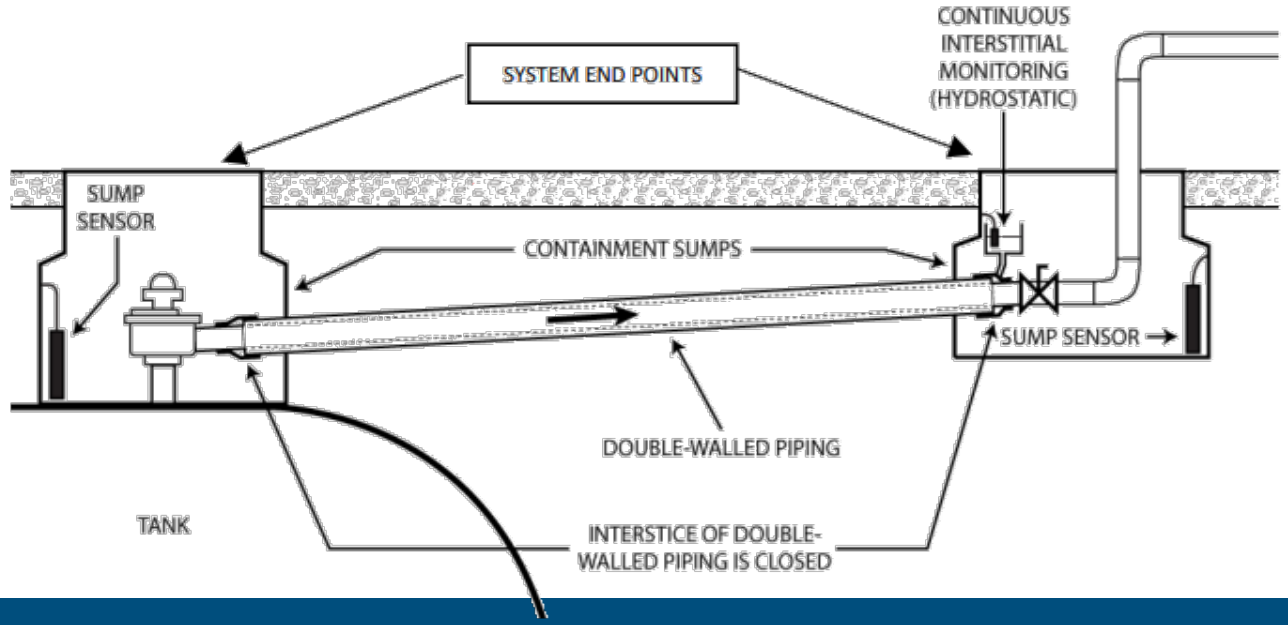
VPH (Type 1 and 2 AIM) Strengths



- Monitors primary and secondary containment
- Continuous monitoring
- High precision monitoring
- Ability to monitor larger pipelines compared to LLDs
- Elevation head is non-issue

VPH (Type 1 and 2 AIM) Drawbacks



- Temperature swings aboveground: swelling/shrinking fluid/gasses cause false alarms (LLDs have this issue as well)
- Catches *everything*, especially hydrostatic monitoring.
- Piping that hadn't been an issue in the past may fail this higher standard.

Resources/Contact Information

UST Leak Prevention Web Site

- https://www.waterboards.ca.gov/ust/

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