



Safety and Environmental Risk Minimization

Automatic tank gauges

Why Do ATGs Miss Leaks?

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Why Do ATGs Miss Leaks?



SYSTEMS

- Traditional wisdom viewed the Automatic Tank Gauge as nothing more than a bunch of components
 - *You buy the system of components known as an ATG*
 - *You have it installed, then set it up, turn it on, and*
 - *SHAZAM! - It works!*
 - *The ATG does its job - Really???*



Why Do ATGs Miss Leaks?

SYSTEMS

- Traditional wisdom was wrong!
 - *UST systems continued to leak*
 - **Even when equipped with ATGs!**
- *ATGs and UST systems are sub-systems within a larger system - Retail Gasoline Outlet (RGO)*
 - ***Inside C-Store sales (Twinkies, Coffee, Tobacco, Chips, Pizza, Coke, etc.)***
 - ***Car Wash***
 - ***Auto-repair***
- *RGOs are themselves part of a much larger system - Fuel Distribution Network (refinery, pipeline, terminal, carrier...)*
 - ***End-of-the-Line: NO CONTROL over fuel quality***

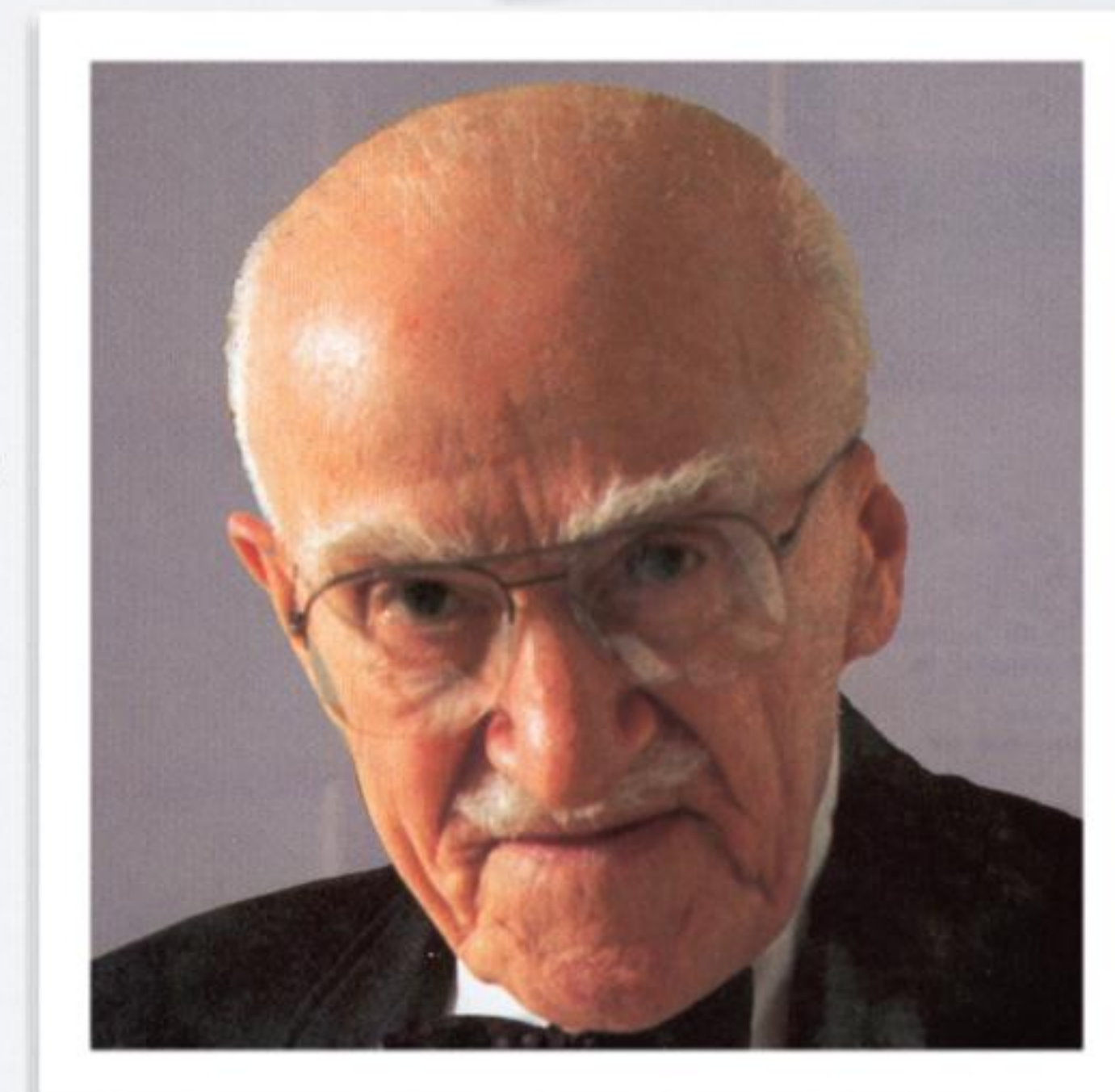
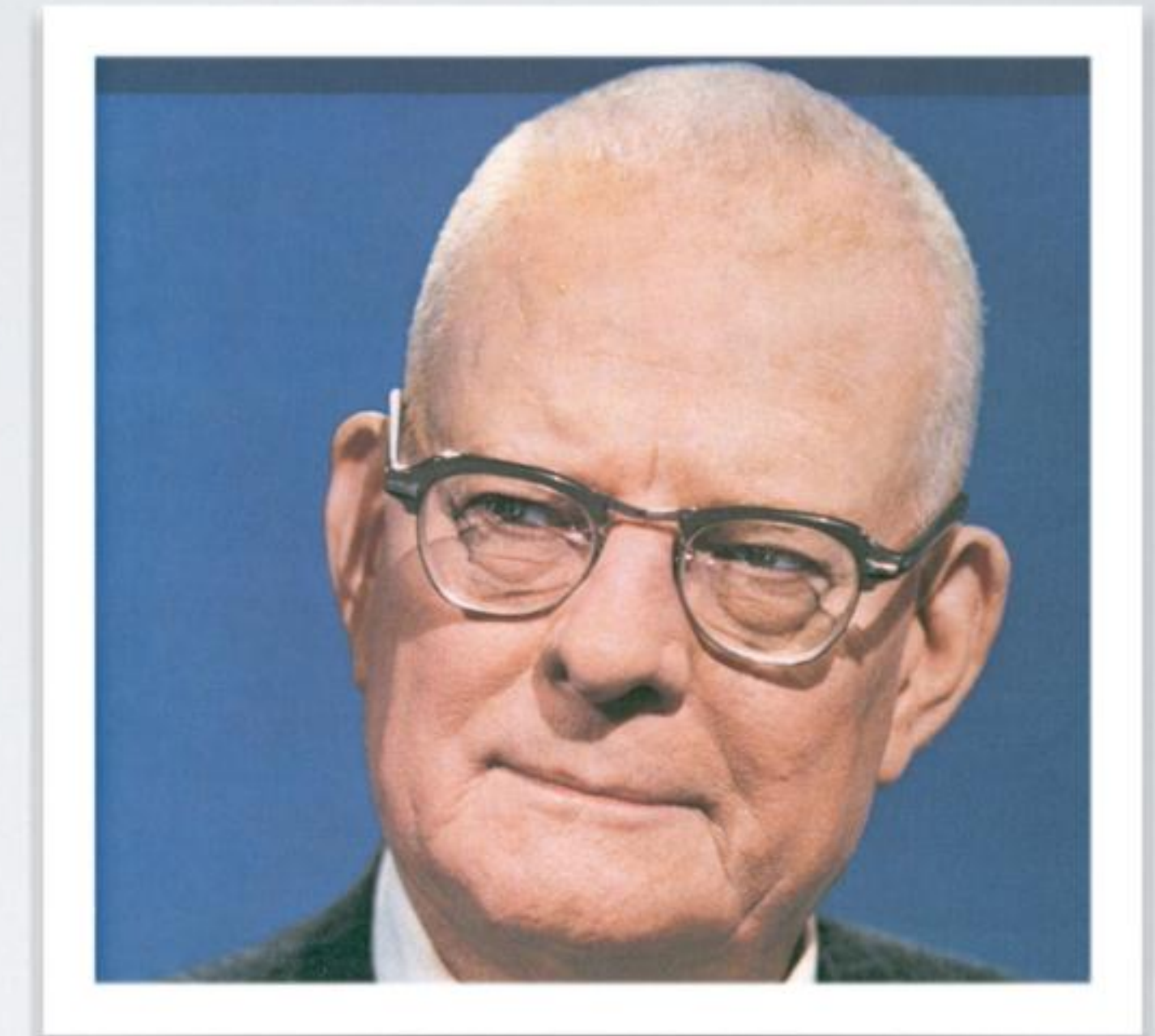


Why Do ATGs Miss Leaks?



CAUSES

- The root-causes behind leaks that have been missed by ATGs can be attributed to two general sources.
 - *People (92% - 98%) - A component of a system*
 - *Engineering / Design (2% - 8%) - (Material, Equipment, Environment, Process)/People*
- “Prophets of Doom” or “Prophets of Enlightenment”
 - *W Edwards Deming & Joseph M. Juran*
 - *U.S. Navy*
 - *Motorola*
 - *Toyota*



Why Do ATGs Miss Leaks?



CAUSES

- “Field Evaluation Study of Automatic Tank Gauging Systems, Electronic Line Leak Detection Systems, and Mechanical Line Leak Detectors” – Ken Wilcox Associates

- *Supports industry findings from investigations of accidents & incidents*

Field Evaluation Study of
Automatic Tank Gauging Systems, Electronic Line Leak Detection
Systems, and Mechanical Line Leak Detectors

June 18, 2007

Prepared by Ken Wilcox Associates
for the
State Water Resources Control Board
Underground Storage Tank Program
P.O. Box 2231
Sacramento, CA 95812
<http://www.waterboards.ca.gov/ust/>

State Water Board Contract # 00-240-550-0

Why Do ATGs Miss Leaks?



People (92% - 98%)

- Categories
 - *Poor Workmanship (Manufacturing / Installation)*
 - *Improper Programming & Setup*
 - *Improper Application*
 - *Improper Operation*
 - *Improper / Inadequate Maintenance / Repair*
 - *Inadequate Inspection and/or Testing*
 - *Tampering & Vandalism*
 - *Inadequate Response*

The vast majority of missed leaks are due to inadequate, wrong, or no actions taken by people and not to the ATGs!



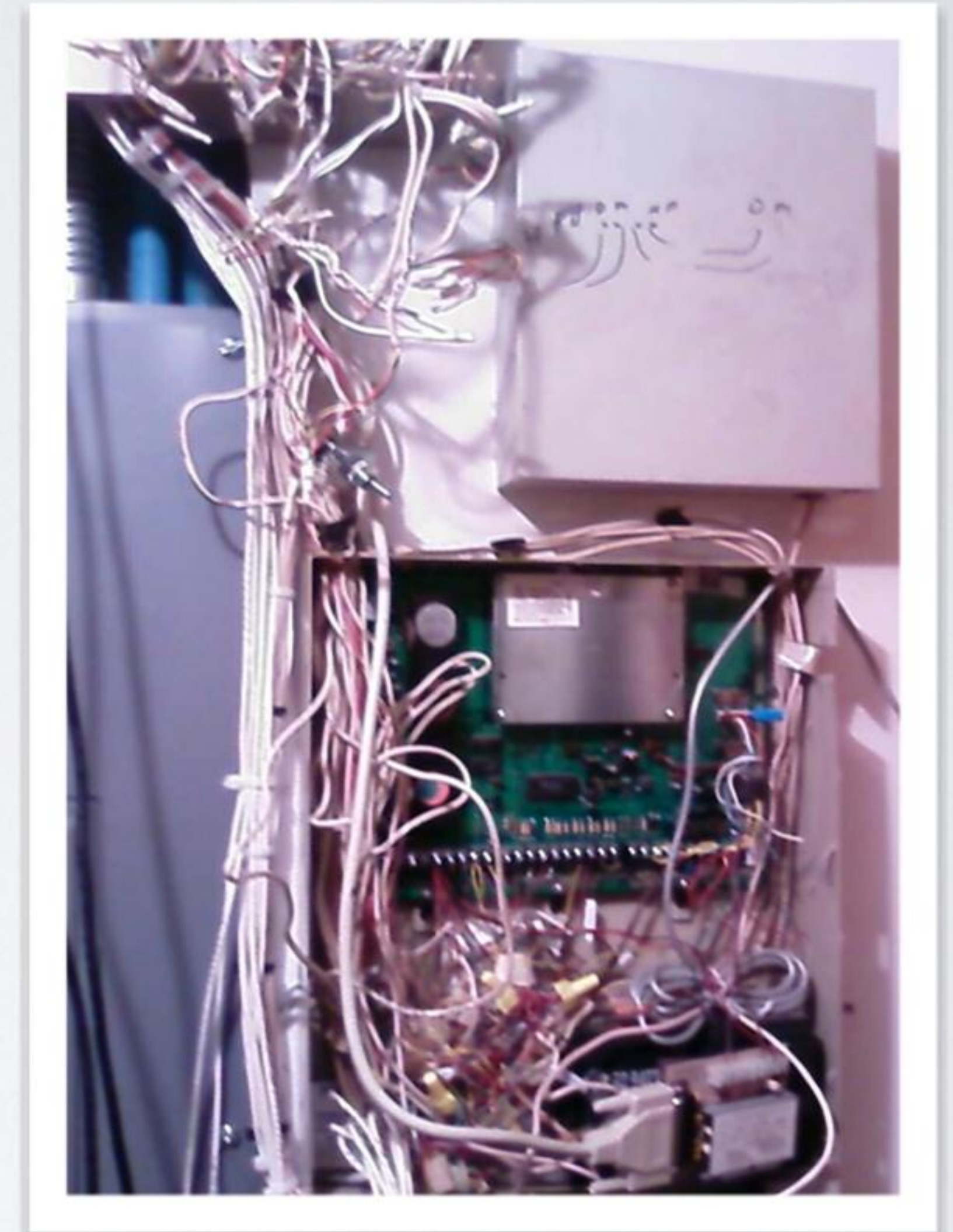
Why Do ATGs Miss Leaks?



PEOPLE

• *Poor Workmanship*

- *Assembly mistakes not caught during manufacturing*
 - Cold solder joints
 - Wrong or Sub-grade materials
 - Improper cure times, tightening torques, etc.
 - Missing parts, components, etc.
- *Damaged wiring during installation*
 - Cuts, nicks, abrasions
- *Wiring not per code*
 - Wrong type conduit, improper seal offs, etc.
- *Improper grounding*
 - More is NOT necessarily better
- *Intrinsically safe wiring compromised*



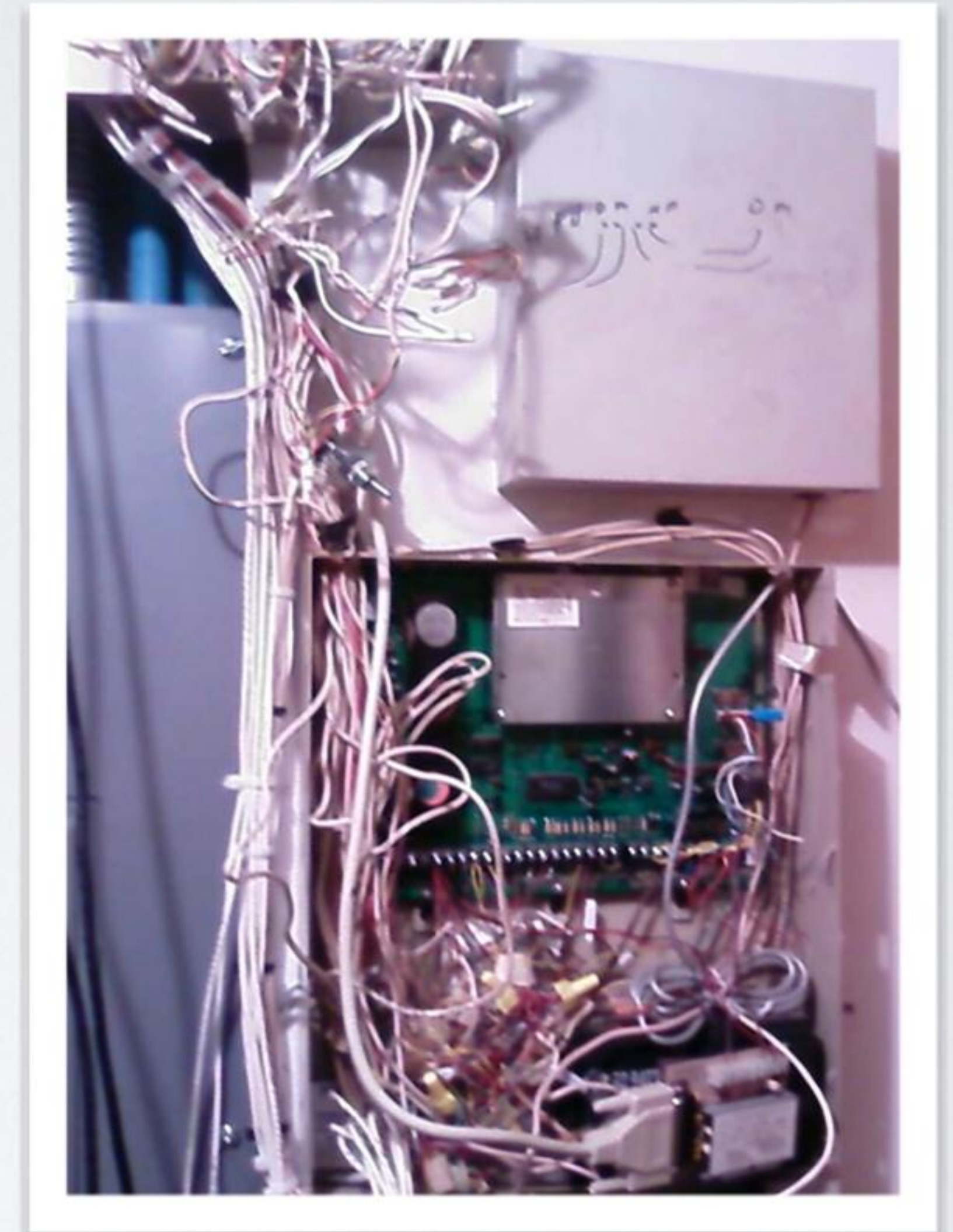
Why Do ATGs Miss Leaks?



PEOPLE

• *Poor Workmanship*

- *Wiring not per manufacturer's requirements*
 - **Wrong gauge**
 - **Wrong wire material & type**
 - **Wrong insulation type**
 - **Too long wiring runs**
- *Incorrect piping materials*
- *Piping not assembled per manufacturer's requirements*
 - **Not enough adhesive / wrong cutback depths**
 - **Improper curing temperature & times**
 - **Micro-voids in materials**
 - **Cross-threading of fittings**



Why Do ATGs Miss Leaks?



PEOPLE

- *Improper Programming & Setup*
 - *STPs wired to stay on continuously*
 - *Sensors not mounted properly*
 - *Piping programmed too long or too short*
 - *Wrong piping material or diameter*
 - *Wrong product assigned to tanks*
 - *Sensors / Probes mislabeled*
 - *Alarm thresholds incorrect*
 - *Leak detection notifications disabled*
 - *Line leak tests disabled*
 - *Wrong programmed tank type or size*

**OCT 14, 2005 10:09 PM
SETUP DATA WARNING**

Why Do ATGs Miss Leaks?



PEOPLE

- *Improper Application*
 - *Tank too large for ATG leak test certification limitations*
 - *Too many tanks manifolded together*
 - *Piping length exceeds ELLD leak test certification limitations*
 - *ELLD not certified for piping material, type or diameter*
 - *Multiple piping types / materials used in system*
 - *Multiple ELLDs used on manifolded piping system*



Why Do ATGs Miss Leaks?



PEOPLE

- *Improper Operation*
 - *Ignoring alarm and warning messages*
 - *Not conducting daily inspections to determine whether the ATG system is functioning normally*
 - *Power to the ATG console?*
 - *System or Function status - Normal?*
 - *Display on?*
 - *Audible alarm working?*
 - *Visual alarm indicators working?*
 - *Sensors properly mounted?*
 - *No nicked or cut sensor / probe / ELLD wiring?*
- *Maintain a daily log of ATG inspection results and any actions taken to correct potential / real problems with ATG system*

**NOV 21, 2005 10:49 PM
Q2: GROSS LINE FAIL**

**JUN 23, 2006 06:11 AM
L7: SENSOR OUT ALARM**

**MAR 22, 2003 10:21 AM
AUTODIAL FAILURE**

**FEB 01, 2007 10:15 PM
T2: HIGH WATER ALARM**

Why Do ATGs Miss Leaks?



PEOPLE

• Improper / Inadequate Maintenance and/or Repair

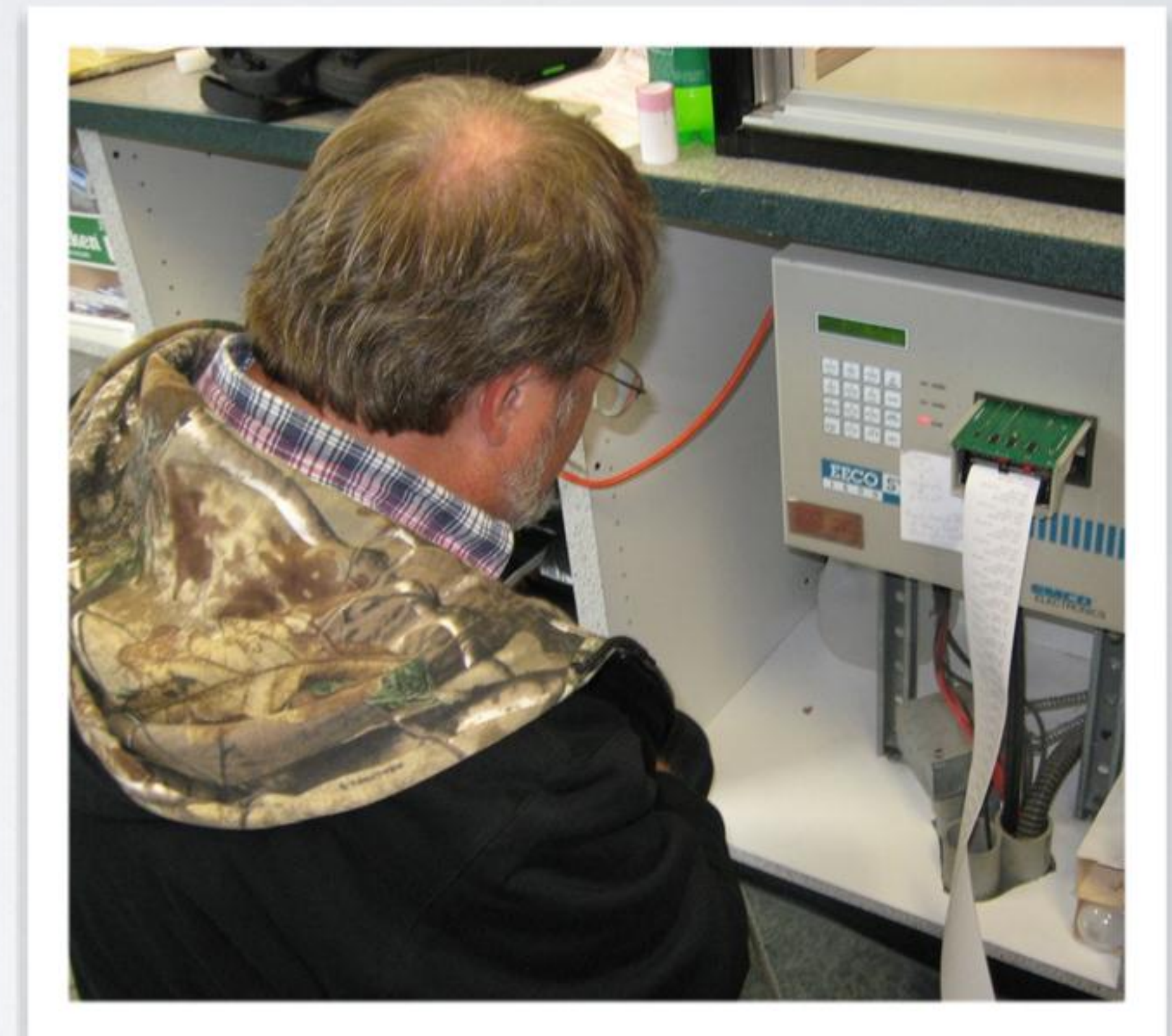
- Technician repairs or replaces the wrong ATG component*
- Technician fails to resolve the problem with the ATG*
- Technician damages other ATG components during maintenance or repair activities either to the ATG or to other equipment*
- Owner does not follow the ATG manufacturer's guidelines for periodic maintenance and inspection*
- Owner fails to have malfunctioning ATG components repaired or replaced*



Why ATGs Miss Leaks?

PEOPLE

- *Inadequate Inspection and/or Testing*
 - *Damaged or worn components of the ATG system are not identified during inspection*
 - *One or more components (e.g. sensors, probes, etc.) of the ATG system are missed during functional testing or inspection*
 - *Diagnostic reports are not pulled from the ATG console and analyzed to evaluate the functionality of various ATG sensors*
 - *Alarm history reports are not pulled and reviewed to assess whether there are potential problems with the UST or ATG systems*



Why ATGs Miss Leaks?



PEOPLE

- *Tampering and Vandalism*
 - *Deliberate disabling of leak detection functions*
 - *Deliberate disabling of audible / visual alarms*
 - *Unplugging or not connecting the ATG to power*
 - *Deliberate damage to the ATG console, components or sensors*



Why ATGs Miss Leaks?



Engineering / Design (2% - 8%)

- Software
- Hardware
- Interference
- Will not cover in this presentation

the quadratic eq
 $b = -(r_1 + r_2)$ and
these expressions are identical to (f)
(e) $r_1 = y^3$ (m) $r_2 = z^3$ wh
(n) $k^2 + Rk - \frac{Q^3}{27} = 0$
solving (m) we obtain to solve
(o) $k_1 = -\frac{R}{2} + \sqrt{\left(\frac{R^2}{4} + \frac{Q^3}{27}\right)}$ and
arbitrarily assigning $k_1 \equiv y^3$ and $k_2 =$
(p) $k_2 \equiv z^3$ and $k_2 \equiv A$

