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2-1658 Digital Valve Inspections: Automating Acoustic Leak Detection for Faster Insights

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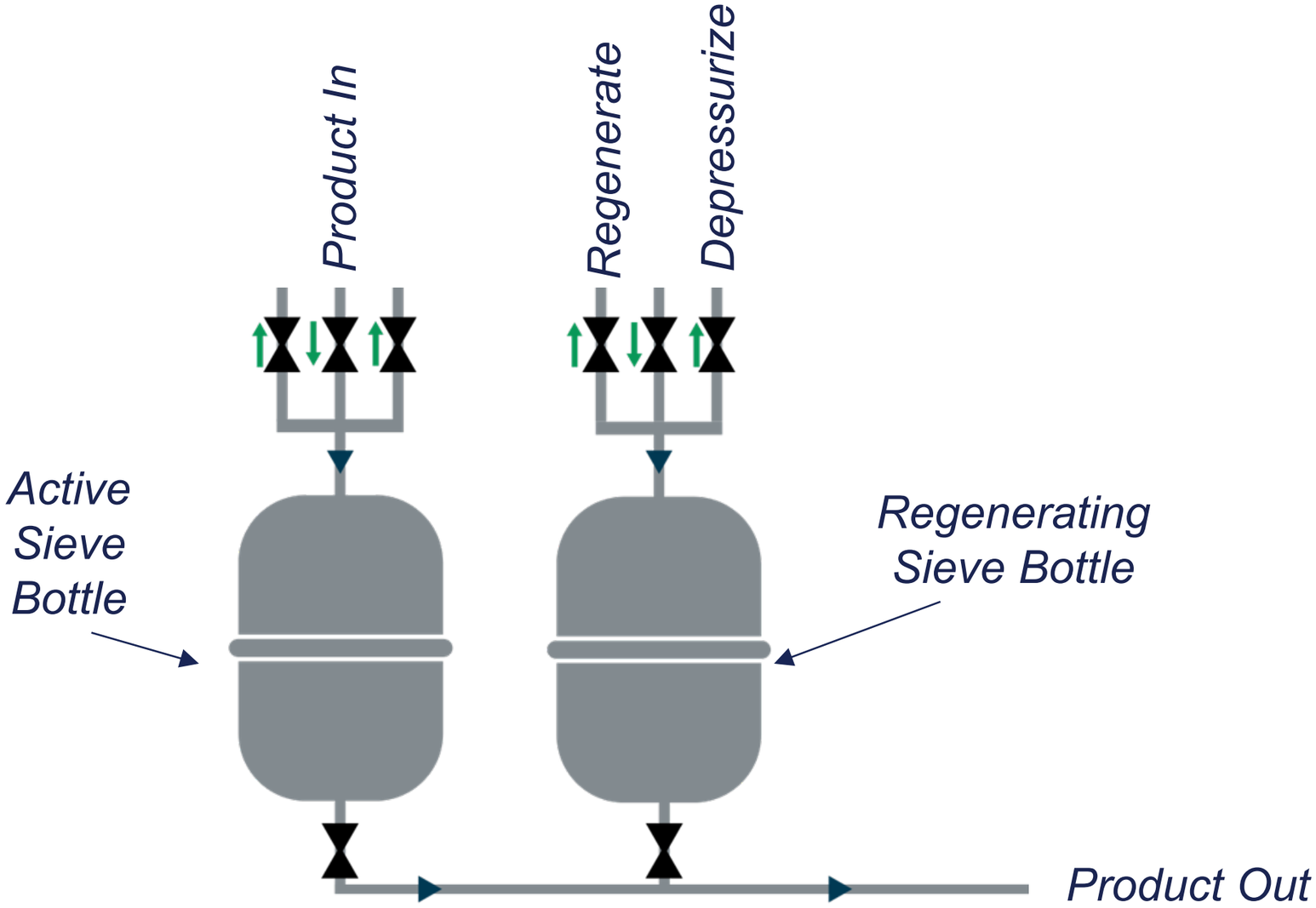
Case Study: Valve Leak Detection for Molecular Sieve Systems Common to Ethanol Plants

Molecular Sieve Basics

- Desiccant beads in a molecular sieve bottle act like a sponge on a molecular level
- The water molecules get stuck inside the sponge as they try to pass through
- Ethanol molecules are too large and pass around the sponge
- Vessels alternate between production and regeneration through operation of valves

Molecular Sieve Basics

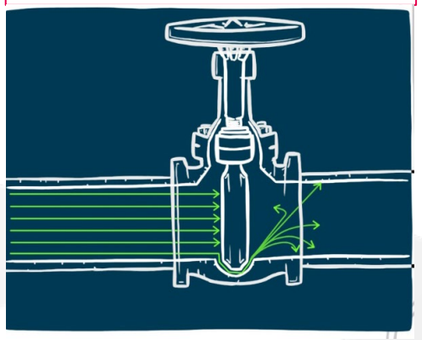


- *Molecular Sieve: Removal of moisture from the product stream*
- *Results in higher quality product*
- *Leaking valves lead to inefficiency, lost revenue, and an unreliable system*
- *Will show an example of saving a customer $3.5 million/year*
- *Leak Detection and Valve Repair scope yielded an ROI of 2-3 weeks!*

Leaking sieve valves

- Lower efficiency
- Recycle effect
  - Can blend unfinished product into completed stream
- Less throughput
- Unwanted pressure swings causing bead destruction
  - Bead replacement is very costly
- Increased operational costs
  - Additional energy consumption to process again

Various studies show that *at least* 5-10% of industrial valves leak…..



Best valve options

Harsh environment (bead dust)

- Vanessa 30,000 series
- Bubble tight
- Metal seat
- High Cycle

Normal Operations

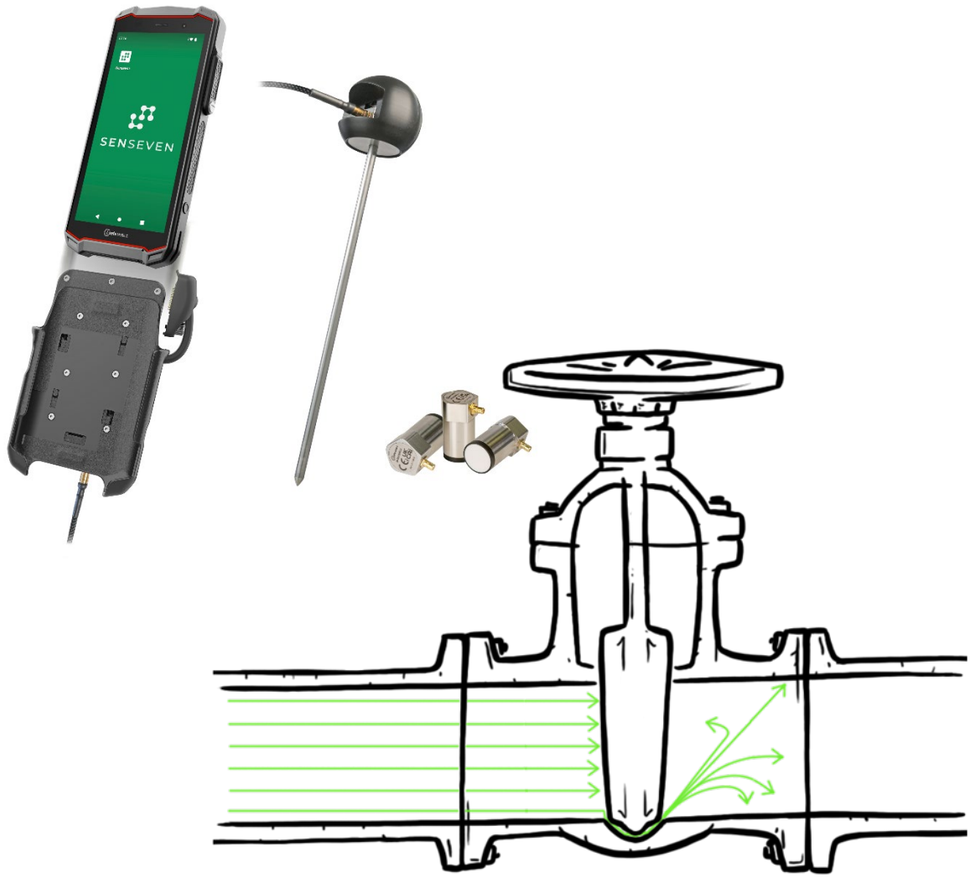
- Fisher 8580
- Class 6 shutoff
- High cycle
- Easy to maintain and highly rebuildable

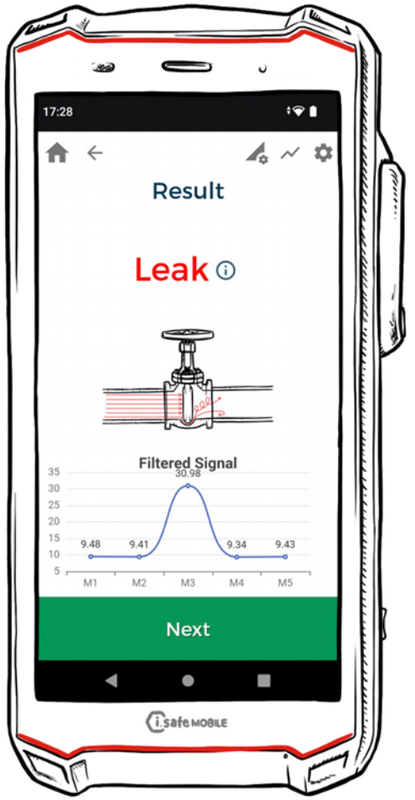
Approaches to Identifying Leaking Valves……

- Guessing which valve is leaking with antiquated technique; *often inaccurate*
- Blind replacement of the valve & hoping for the best; *inefficient*
- Causing upsets in the process due to incorrect assessments; *impacts production*
- Increasing downtime to find the cause using manual inspections; lower availability

- Or……Acoustic Leak Detection using mobile, cloud-based technology.
  - Quick measurements
  - Automated analysis
  - Proven results

Acoustic Valve Leak Detection





BENEFITS:

- *Handheld, mobile technology*
- *Ex-Proof, Class 1, Div 1*
- *100% non-invasive*
- *Simple, intuitive interface*
- *Automated Analysis*
- *Proven Results*
- *Uses Mature Technology*
  - *Acoustic Emission*

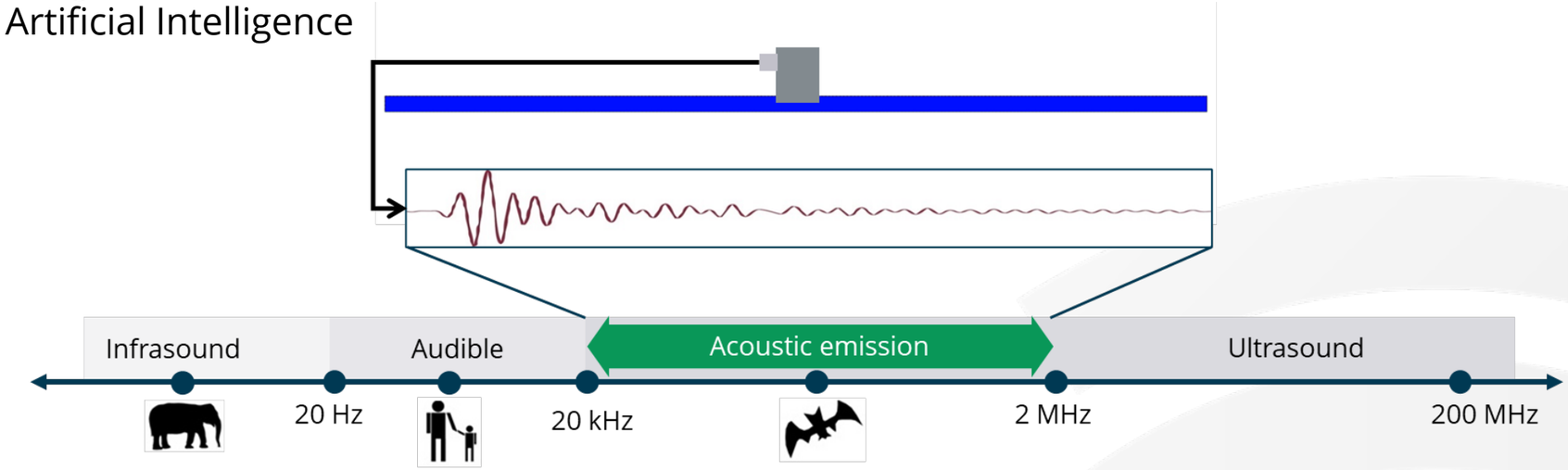
Underlying Technology: Acoustic Emission (AE)

What is Acoustic Emission?

- High frequency, structure borne sound waves
- For Valve Leakage ~100kHz to 500kHz
- Traditionally very cumbersome and expensive
- Technology has allowed it to go Mobile
    - Cloud Computing
    - Rules based Artificial Intelligence

Applications of AE

- Structural Monitoring
- Tank Leakage
- Pressure Vessel Integrity
- Much more….

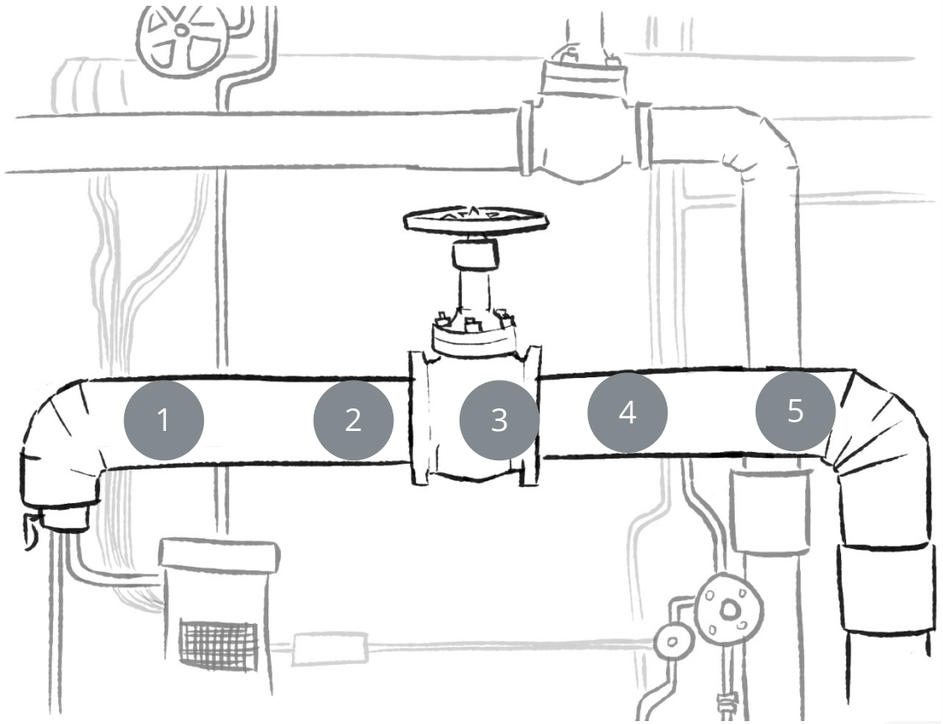


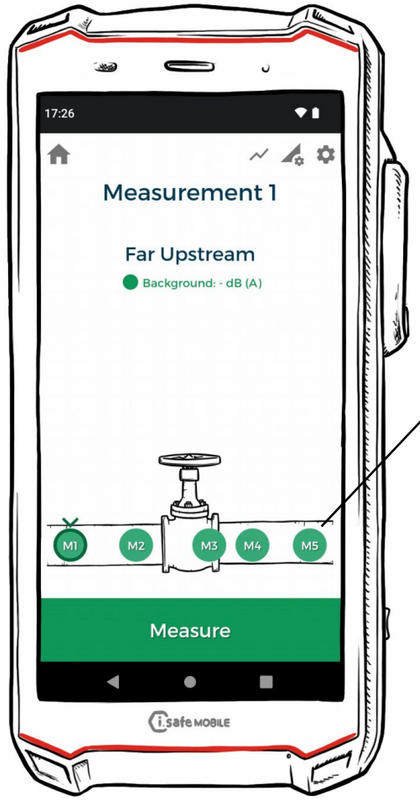
AE has been applied to Valve Leak Detection for decades.

Acoustic Valve Leak Detection

Requirements:

- *Valve is closed*
- *Pressure drop across the valve*
  - *Normal or Assisted*
- *Physical Access to Valve and Adjacent Piping*
  - *Insulation, etc*
- *Some Meta-data*

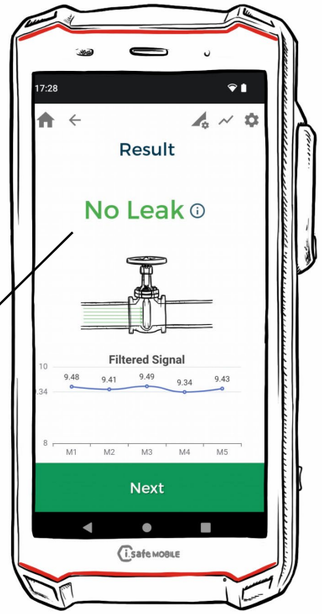




Software-guided step by step inspection process

Simple to use, Powerful insight to your process

Immediate Results



SENSEVEN

Cloud-based data storage and analysis

infor

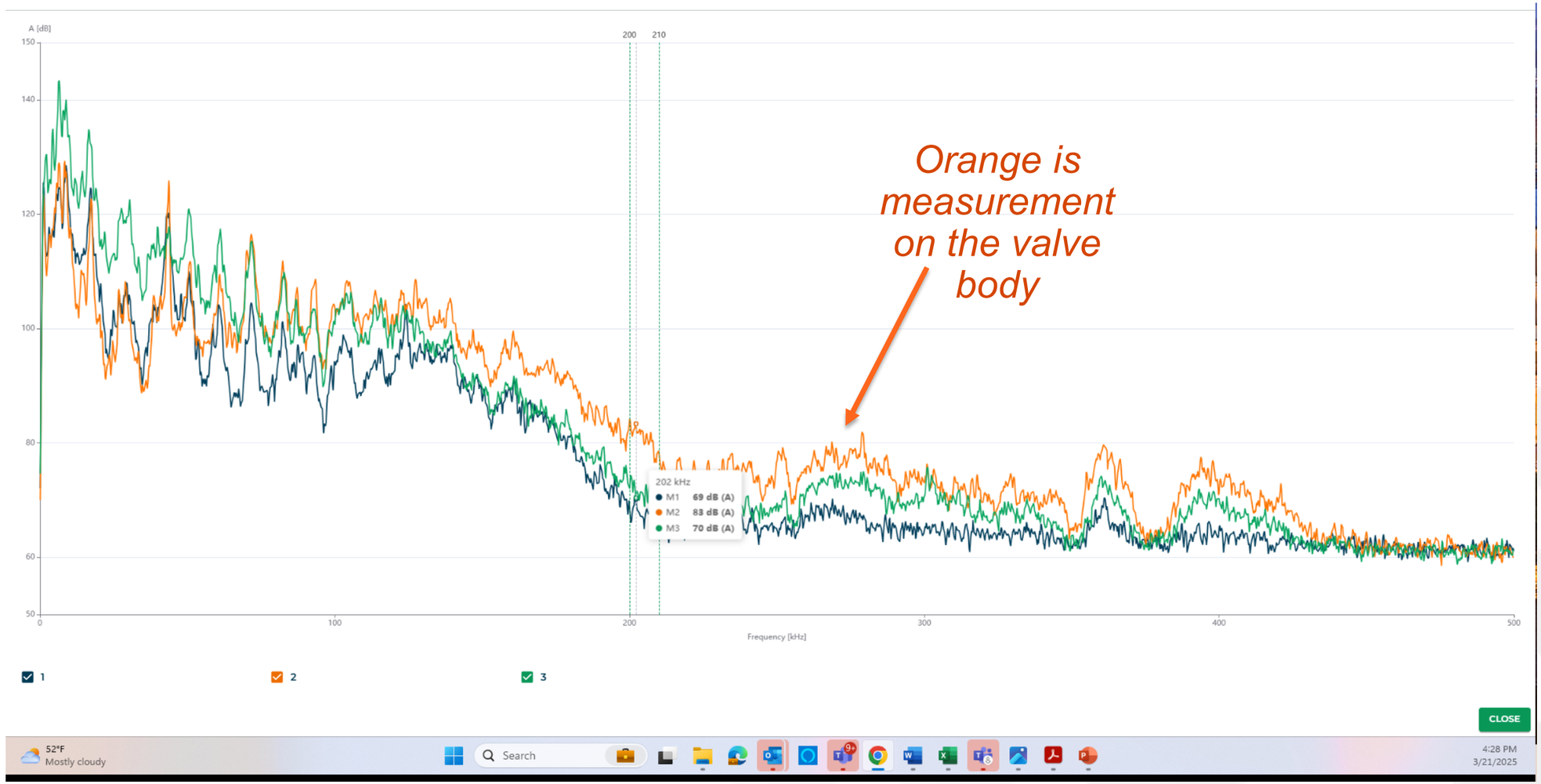
IBM

SAP

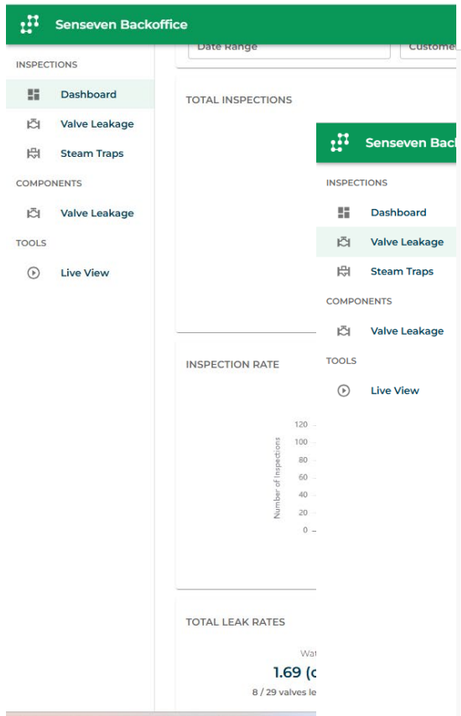
Export actions to maintenance software

Creates reports based on ISO 18081 and action plans to schedule your maintenance activities accordingly

Amplitude vs. Frequency of a Leaking Valve



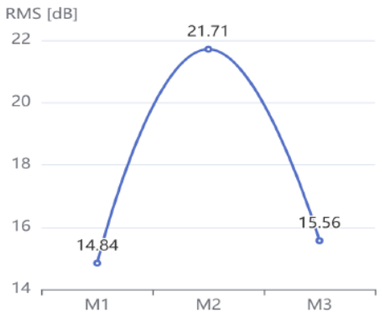
Insightful Dashboards & Simple Reports

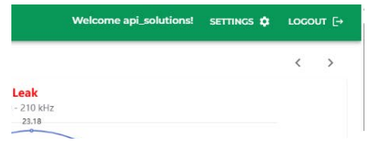


Find text or tools

Valve Report - Internal Leakage #1

Date:	02/25/25, 09:31 AM
Tag #:	EV5609
Medium:	Gas (Gaseous)
Valve Type:	Butterfly
Valve Size:	10 in.
Pressure Upstream:	50 PSI
Pressure Downstream:	-
Result:	Leak
Leak Rate:	15.41 - 26.04 scf/m (Fail)
Leakage class:	EN 60534-4 - VI - 0.0004 scf/m





Pressure Downstream	Result	Leak Rate
-	Leak	15.41 - 26.04 scf/m (Fail)
-	Leak	2.11 - 3.56 scf/m (Fail)
-	Leak	170.88 - 288.79 scf/m (Fail)
-	Leak	15.59 - 26.34 scf/m (Fail)
-	No Leak	0 scf/m
-	No Leak	0 scf/m
-	No Leak	0 scf/m
-	No Leak	0 scf/m
-	No Leak	0 scf/m
-	No Leak	0 scf/m
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-	No Leak	0 scf/m

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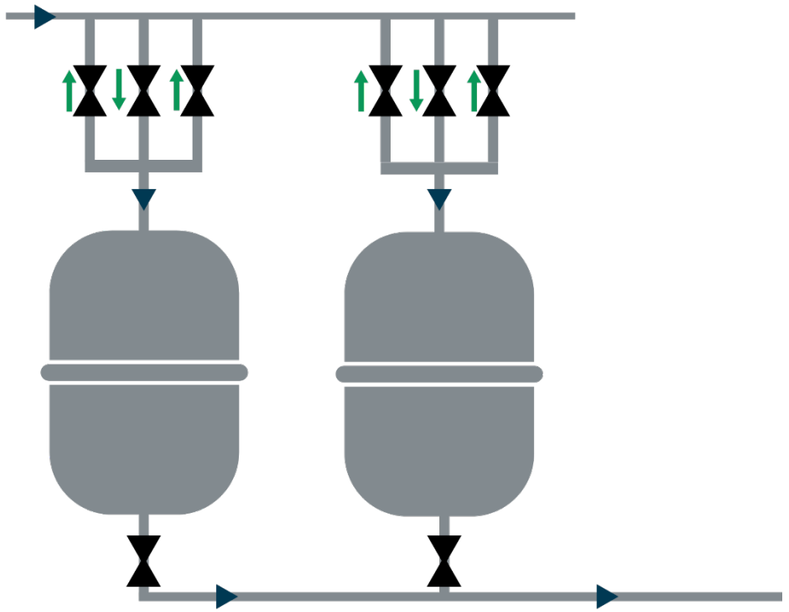
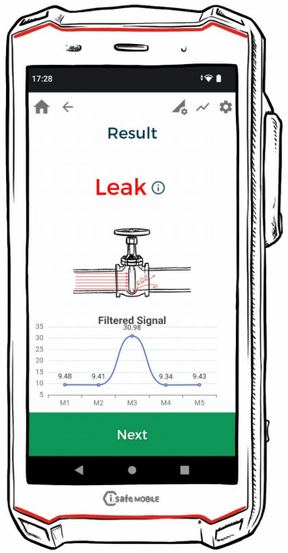
Summary of Software & Storage Features

- Data is accessible by mobile device or laptop
- Trend over time for each asset
- Compare estimated leak rate vs. expected leak rate when new
- Photo of the valve for positive ID
- RFID compatible for meta-data
- More complex features for power users

Example: Result from the Field





Facts about the plant:

- Ethanol Plant in Iowa
- Plant capacity of ~100 million gallons per year
- Inspected 16 valves on the Molecular Sieve
- **3 through-valve leaks were identified**

Results:

- Leaking valves had a negative impact on efficiency, difficulty in achieving desired vacuum
- Molecular sieve unit performance was negatively impacted, risking product quality
- Capacity reduction by up to 5%
- Without taking action, the economic impact of product loss amounts up to > USD 3.5 mn/year

Recommended Use & Summary

- Simple and Insightful Technology to Identify Valves Leaking Internally
- Regular PMs or Pre-Outage
  - Provides time to order parts or plan replacements
  - Schedule downtime and work force to repair/replace
- Most effective on valves with design shutoff greater than ANSI CLIV
- Fixing small leaks can’t prevent further erosion/damage to valve bodies and trim
  - Often less expensive to fix leaks before they further damage the valve
  - Improved reliability and availability
- Proven application in various industries
  - Ethanol
  - Power
  - Refining
  - Any other that needs to identify leaking valves

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Find More Information

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Thank You