Smart LDAR: October 30, 2002

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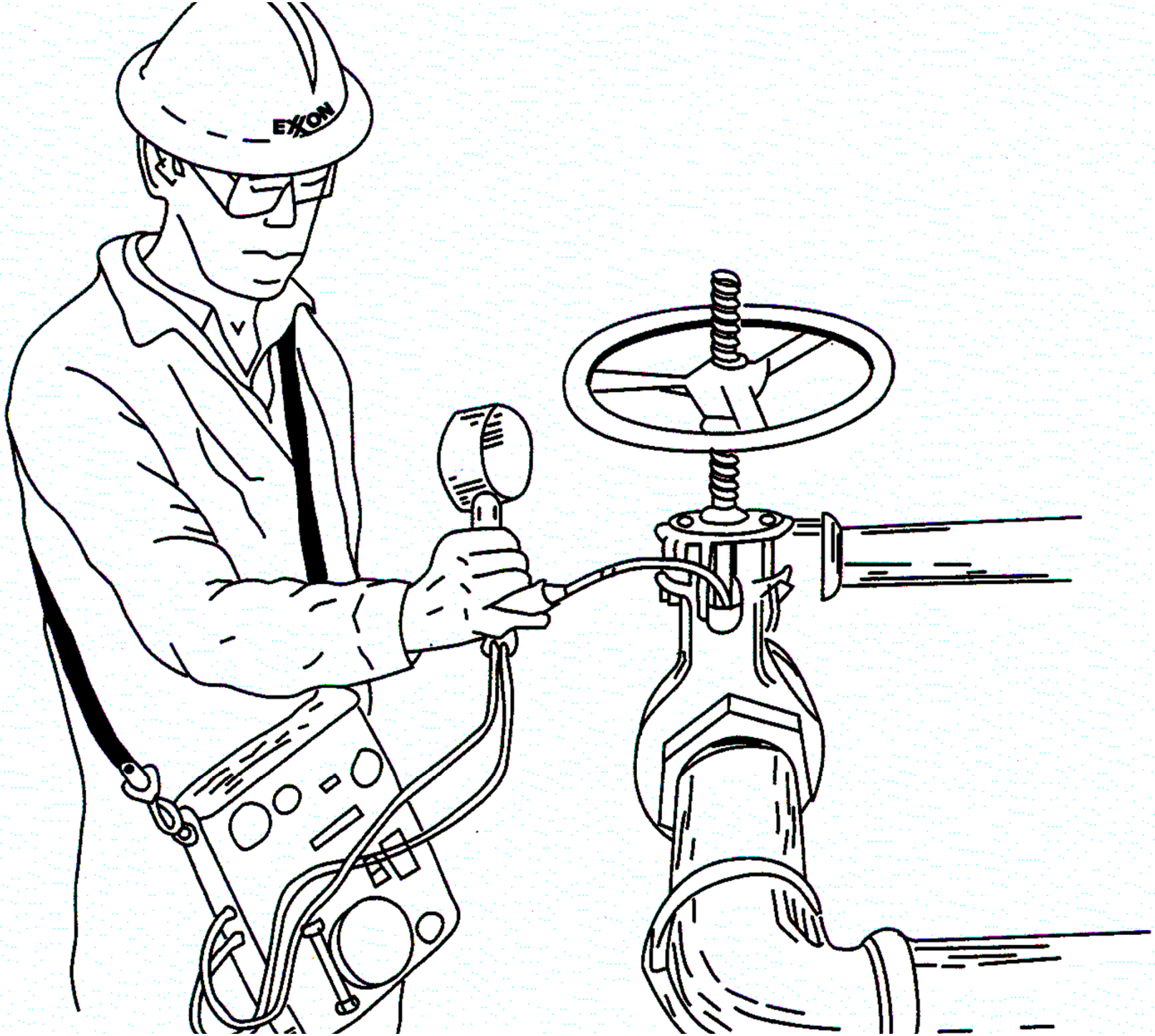
Outline

- Fugitive Emissions & Why We Control Them
- What is Smart LDAR?
- The Smart LDAR Instrument
- Regulatory Issues with Smart LDAR
- Next Steps

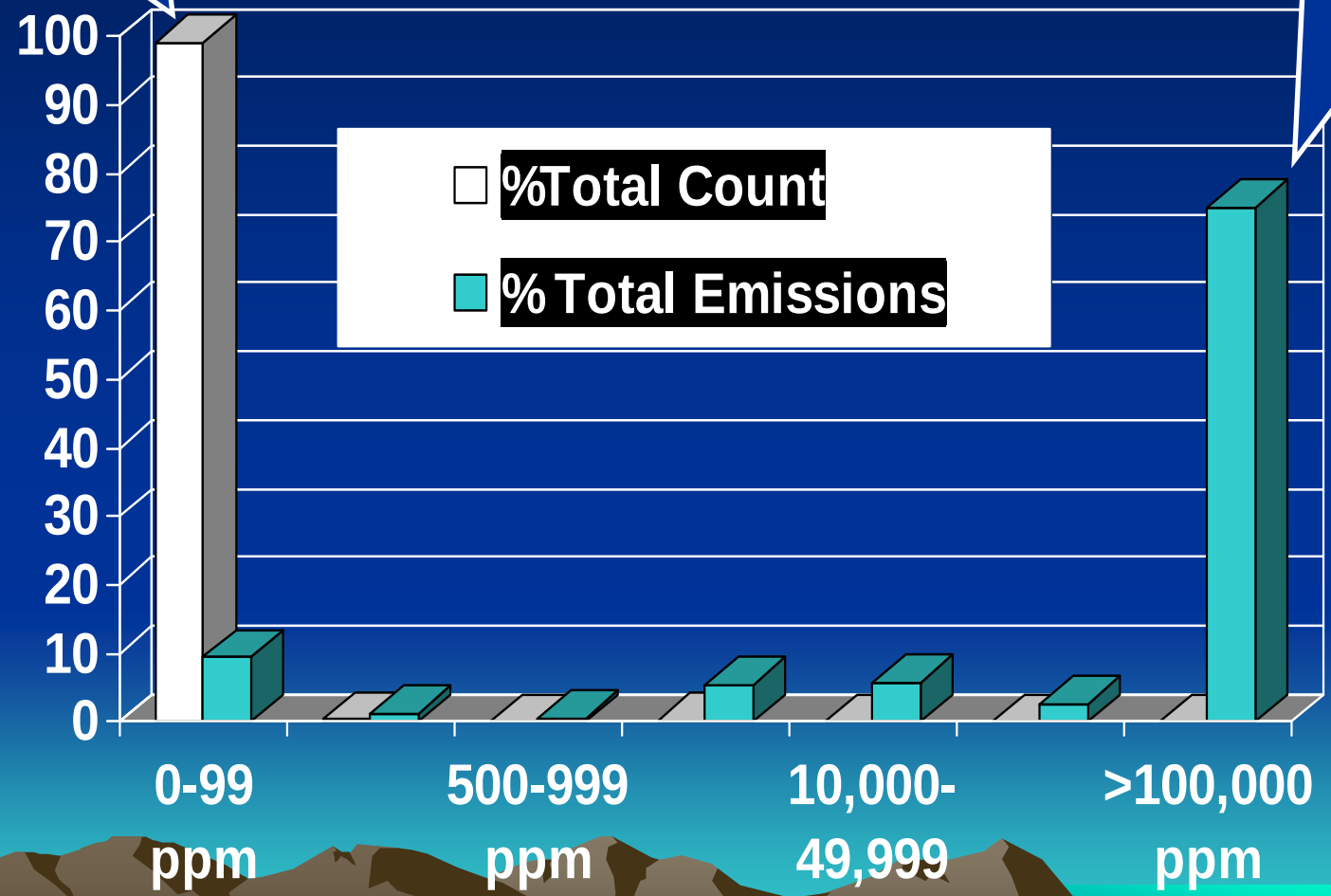
Fugitive Emissions

- Routine leakage from valves, pumps, flanges, connectors, etc.
- Can aggregate to significant tonnage
- Can be hazardous air pollutants with direct health impact
- Can be controlled by equipment design or, more commonly, leak detection & repair programs


EXXON

Most equipment doesn't leak

84% of emissions come from 0.13% of components



Taback et al., 1997, API Publ 310, "Analysis of Refinery Screening Data"

What Is Smart LDAR?

- **Smart Leak Detection And Repair** is nothing more than the efficient locating and repair of the relatively small number of leaky valves, pumps, connectors, etc., in a large population of process equipment.

Smart LDAR Conceptual Framework

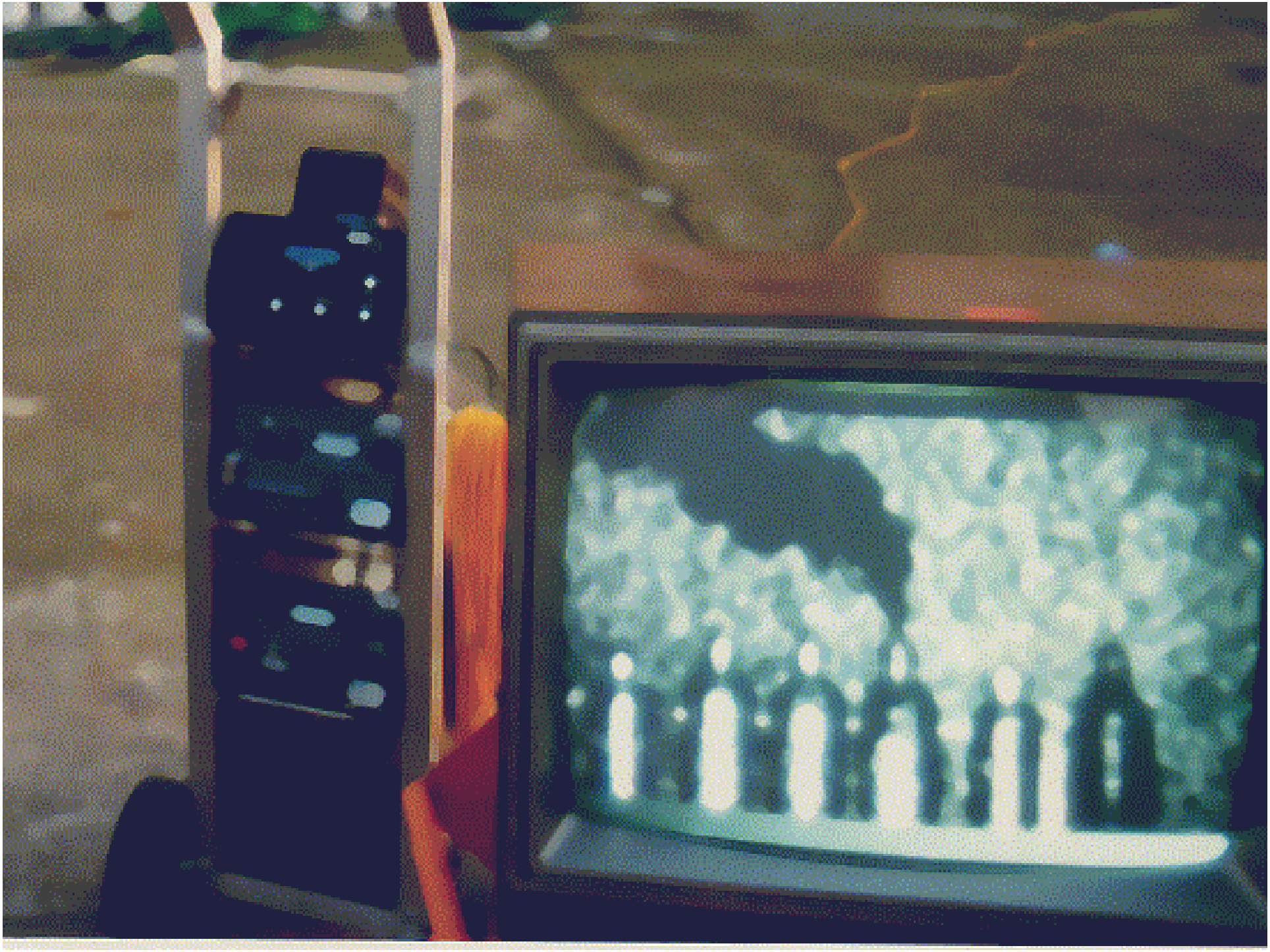
- Use remote sensing technology to quickly & economically identify significant leakers
- Scan often enough to catch significant leakers before emissions accumulate
- Repair (same as existing program)

Smart LDAR Conceptual Framework (cont.)

- Tradeoffs include:
  - More frequent detection scans but fewer repairs
    (don’t repair little leakers)
  - More expensive equipment but less manpower for inspection and less repair cost (?)

Smart LDAR Instrument

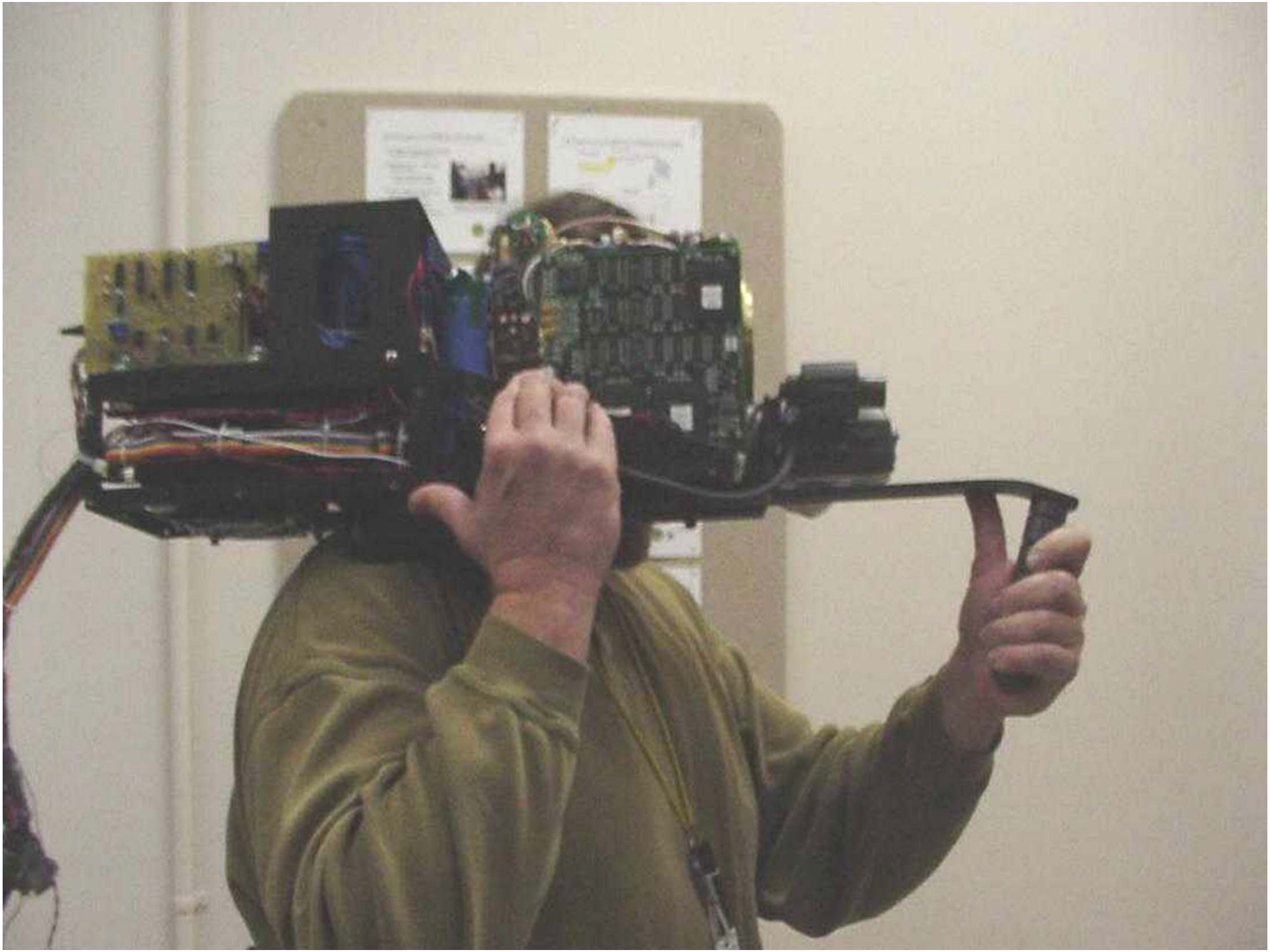
- API helping develop (with DOE & EPA) Backscatter Absorption Gas Imaging (BAGI) by LIS
  - BAGI scans laser over imaged area
  - Reflected laser captured by camera to form image of area
  - Target gas absorbs laser and image appears black



Instrument Development

- Commercial product:
  - GasVue from Laser Imaging Systems
  - Uses CO_2 laser to see SF_6
- Being adapted by Sandia National Labs
  - Changing to PPLN laser to look at H-C bond stretch
    (periodically-polled Lithium Niobate)
  - Making man-portable and intrinsically safe
    - Issues include laser power, battery life, weight
  - Largely paid for by DOE & EPA


Shoulder-mounted camera
Backpack power/control unit



Does Instrument Work?

- 1998 petrochem plant test
- 1999 refinery test
- 2001 laboratory tests
- 2002 refinery test delayed due to instrument problems
  - Various glitches & gremlins in the system
- Fully expect to establish reliable field detection limit

Smart LDAR Regulatory Progress

- 2000 report established “equivalence” criteria between Smart LDAR and Method 21
  - Required sophisticated Monte Carlo analysis
  - Determined relationship between frequency of scan and required reliable detection limit

Open Issues / Next Steps

- Reliability in field use
- Detection limit and subjectivity of interpretation
- Standardized Procedures &Recordkeeping
- Commercial availability of BAGI units
- Alternative technologies development

Summary

- Significant incentives exist to continue developing Smart LDAR technologies & regulations
- Laser BAGI technology poised to achieve field demonstration status for a man-portable unit
- All participants in this multi-stakeholder, multi-disciplinary effort are optimistic of a successful conclusion.