

A Risk-Based To Onsite Regulations

2016 Southwest Onsite ~~Wastewater~~ Resource
Water Conference

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Out of Sight, Out of Mind

Methods of Sewage Disposal

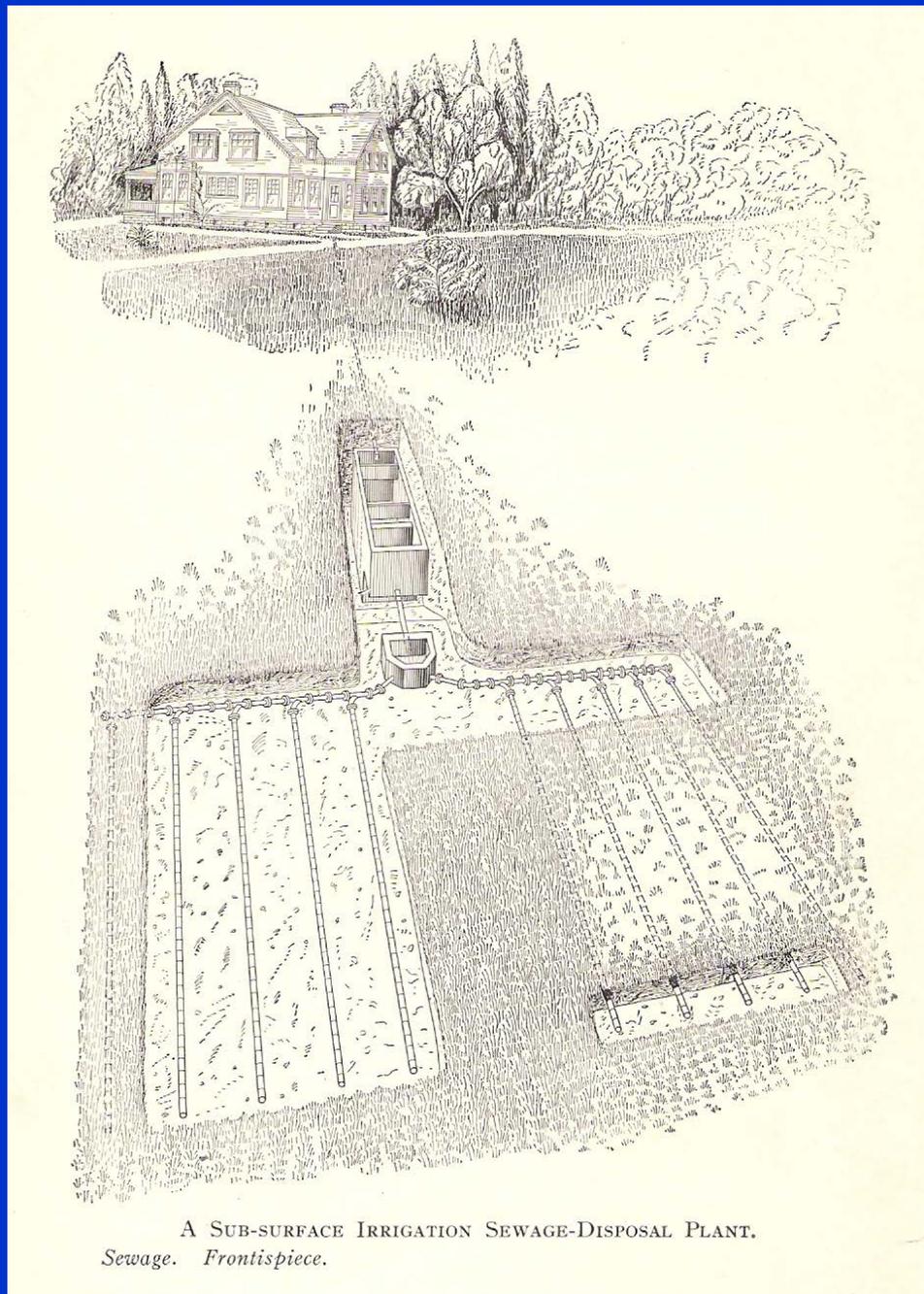
1894

- By George E. Waring, Jr.
- *“It has hitherto been – and, in fact, it still is – the practice of the world to consider its wastes satisfactorily disposed of when they are hidden from sight.”*

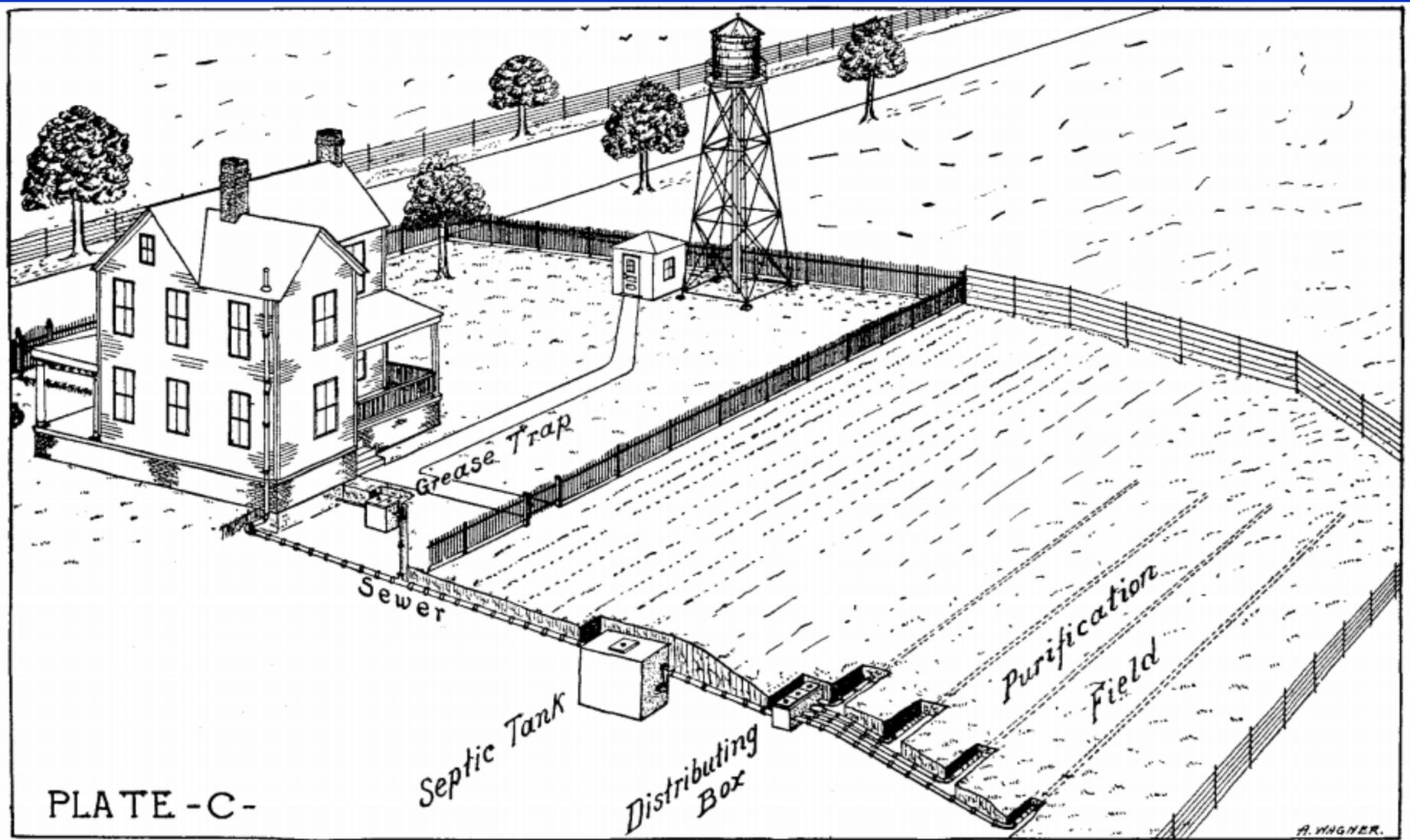
What does it look like?

Septic System

• 1913



USPHS, 1926



Public Health Implications

Sewage Disposal on the Farm

1896

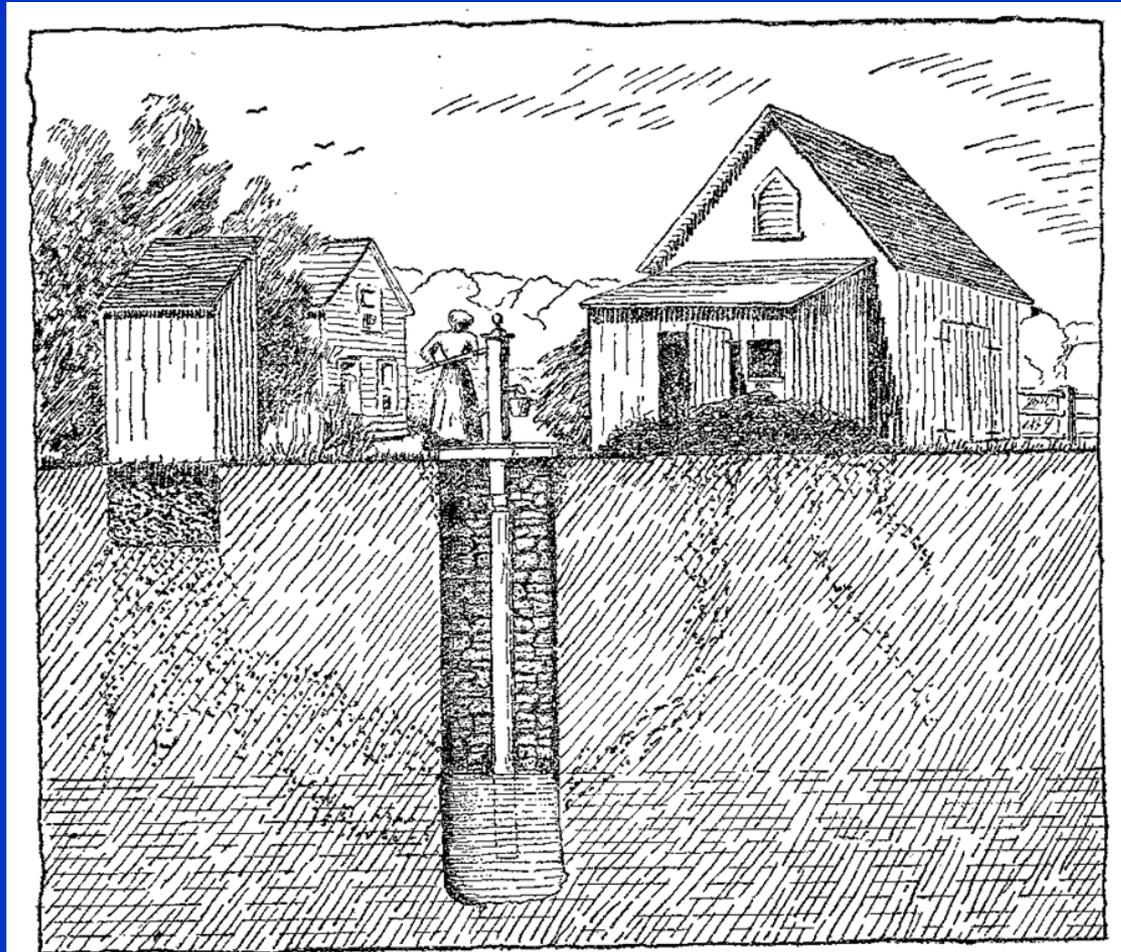
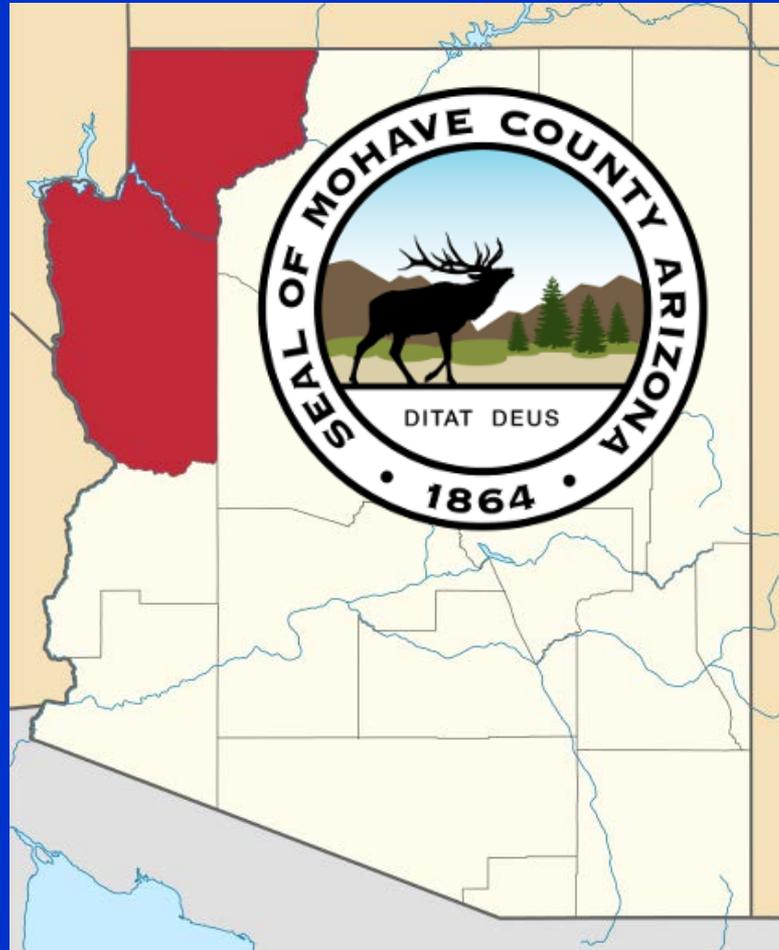


FIG. 1.--The shallow barnyard well, with privy vault and manure heaps near by. The water is likely to receive fluid from these at any time.



FIGURE 2

Mohave County Prescriptive Regs Example



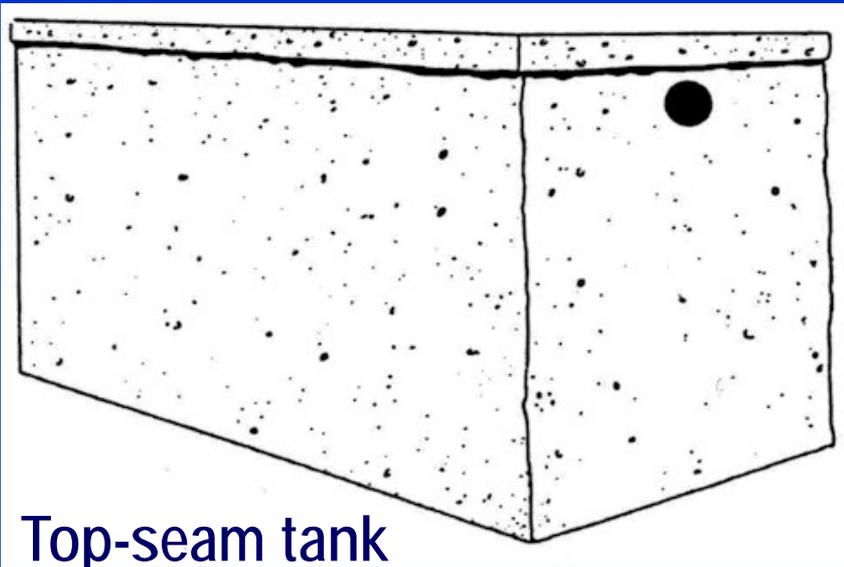
Mohave County

Watertightness Testing

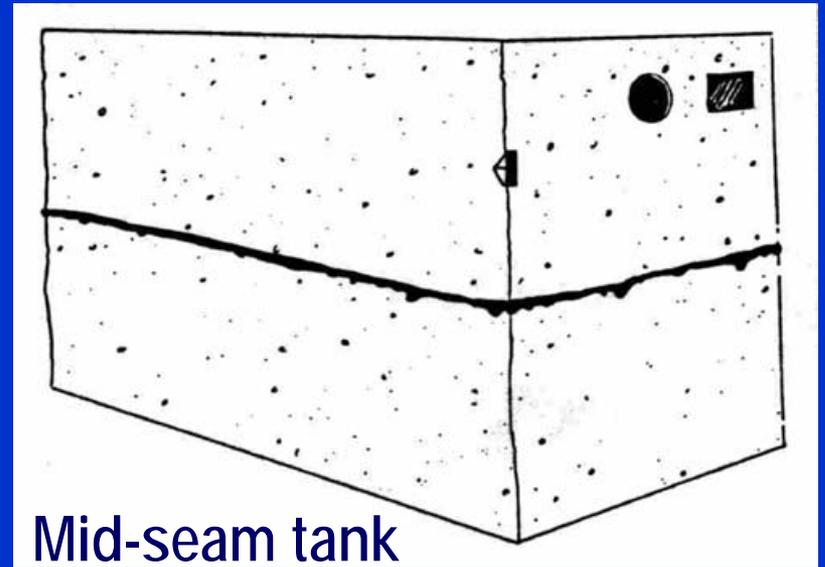
- Why did testing begin?
- Testing period from March 1995 – February 1996
- 500 septic tanks water-tested
- Only new installations tested
- Tanks tested to the flow-line

Tank Examples

- Example of top-seam & mid-seam tanks



Top-seam tank



Mid-seam tank

MC Testing Results

<i>Tank type</i>	<i>#Pass test</i>	<i>#Fail test</i>	<i>% P/F</i>	<i>Total</i>
Concrete mid-seam (2-piece)	307	108	74/26	415
Concrete slab cover (1-piece)	22	3	88/12	25
Fiberglass	58	0	100/0	58
Plastic	2	0	100/0	2
<i>Total</i>	389	111	78/22	500

In-field Watertightness Testing

- 2,500 gallons
- Leak at mid-seam



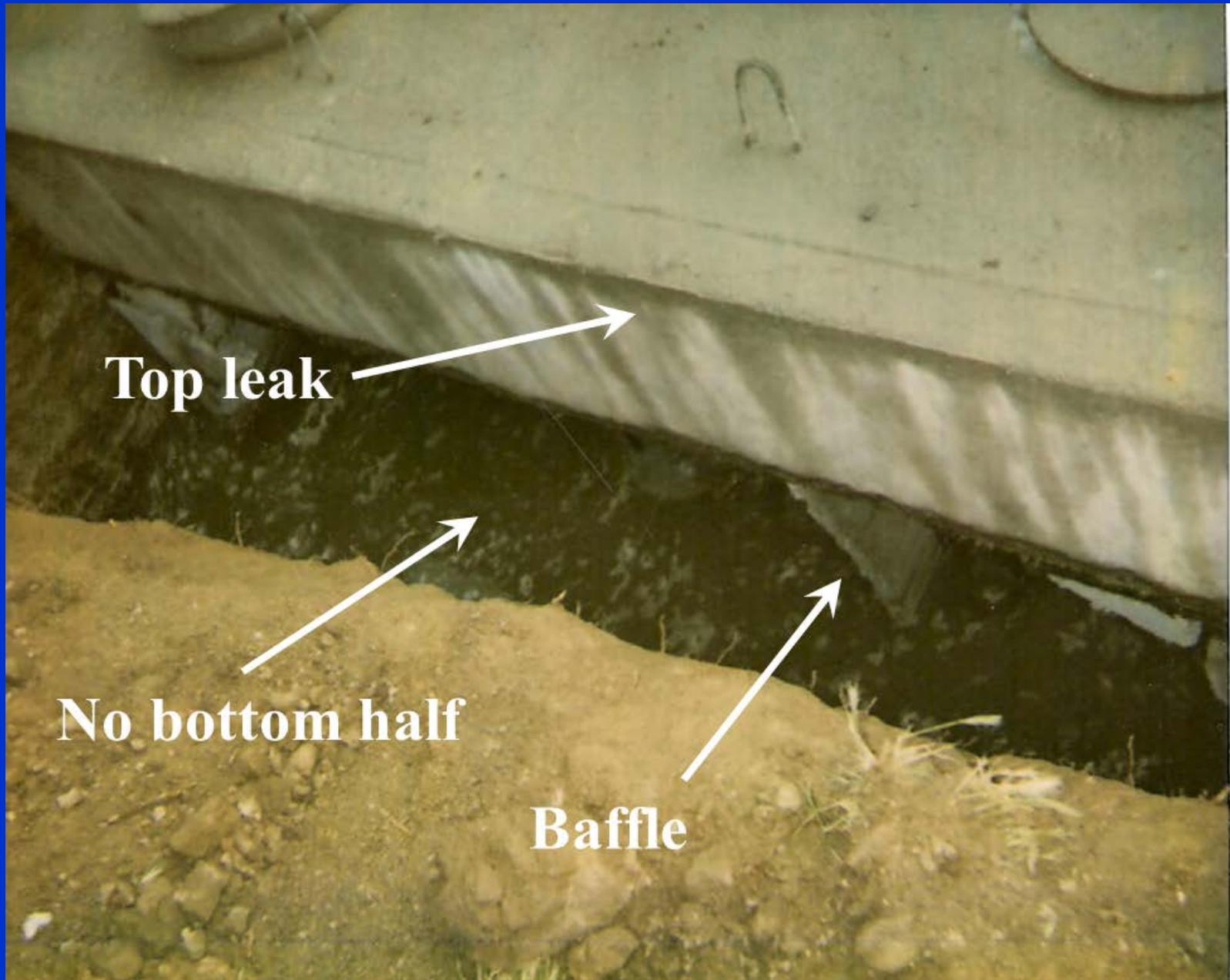
In-field Watertightness Testing

- 2,500 gallons
- Leak at mid-seam
- Leak in side-wall



In-field Watertightness Testing

- 1,000 gallons
- Mid-seam tank
- Bottom half collapsed
- Leak at top



Top leak

No bottom half

Baffle

In-field Watertightness Testing

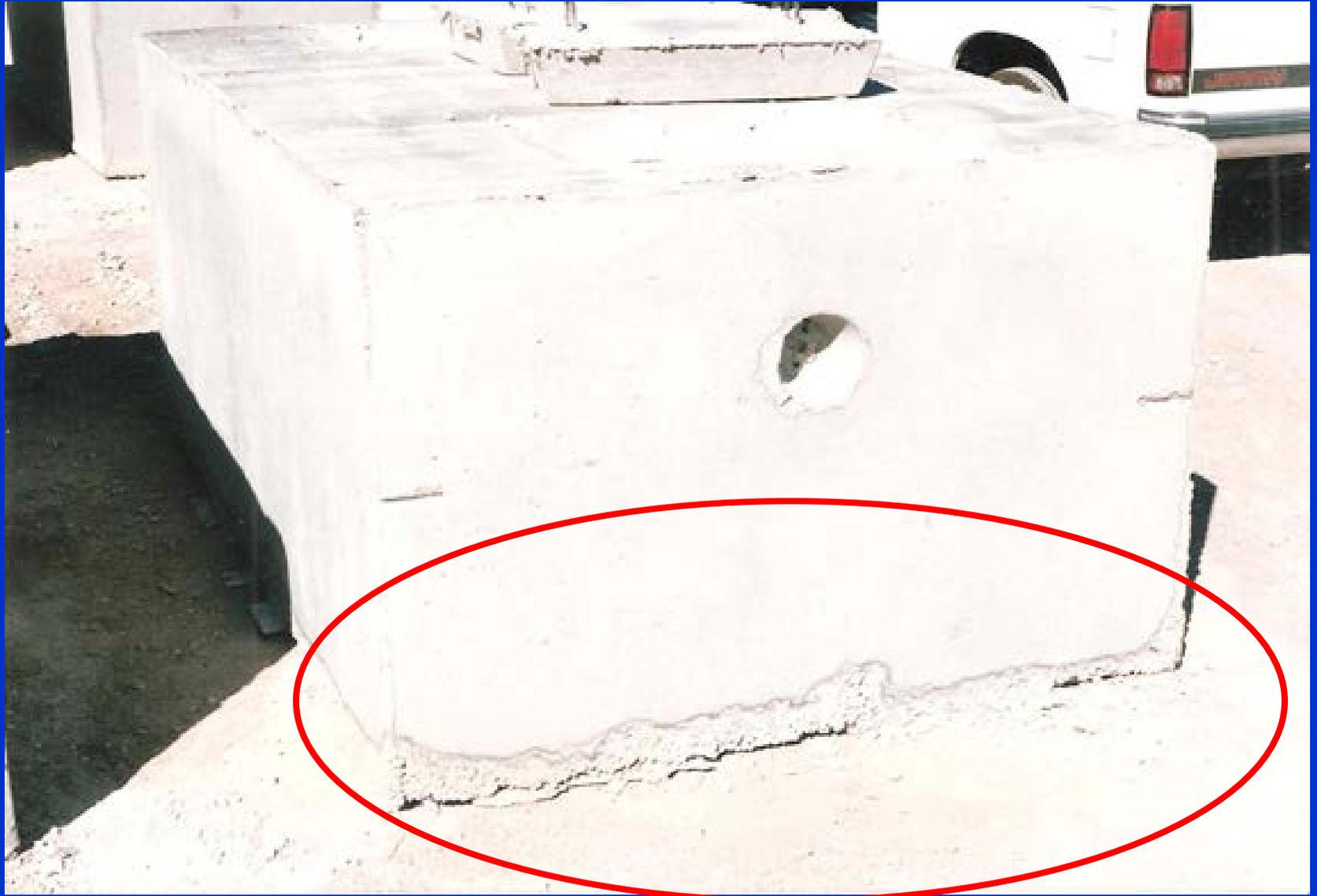
- 1,000 gallons
- Mid-seam tank
- Bottom half collapsed
- Leak at top



**Collapsed
End-wall**

Tank Manufacturing

- 1,000 gallon top half
- Extensive honeycombing at mid-seam



End Result?

- Hearings at Arizona House of Representatives

B6 The Arizona Republic Friday, August 4, 1995

Panel told of faulty septic tanks

Up to 80% said to be leaking in Mohave County

By Jonathan Sidener
The Arizona Republic

As many as 80 percent of new Mohave County septic systems have significant leaks, a county environmental official told a state panel Thursday.

"There clearly is a problem," said Norm Marrah of the county health department. "It's not just one here or

there. There are actual gaps in the tanks, actual gushers."

Problems with existing tanks have led Mohave County officials to begin testing all of the new tanks that have been installed.

The House panel of lawmakers, state regulators and industry representatives was called by Rep. Don Aldridge, R-Lake Havasu City, to discuss septic-tank regulation.

In an unsigned June letter to the then director of the state Department of Environmental Quality, Ed Fox, Aldridge said the hearings were prompted by a "totally unreasonable" DEQ response to the problems.

Aldridge said DEQ and the county

health department had planned to ban a certain type of tank and by doing so would put two manufacturers out of business.

He said the ban also would cripple the local housing industry.

Aldridge said that the DEQ ban on the leak-prone tanks, which had been scheduled to take effect Aug. 20, was a "slap in the face" because it would go into force before he could conduct public hearings.

"To arbitrarily set August 20 as the date, with all the other complications, and throwing it in my face when I've agreed to hold hearings just amazes me," he wrote.

Performance End Result?

- 10 years later...
- In-field testing written into code
- Effective November 12, 2005,

R18-9-A314(5)(d):

“The septic tank is tested for watertightness after installation by the water test described in subsections (5)(d)(i) and (5)(d)(ii) and repaired or replaced, if necessary.”

Learning from Food Safety History

- Event that forever changed food safety

1993

Jack In The Box Outbreak

- E. coli O157:H7
- Over 600 people sickened
- 4 were killed
- 73 restaurants in western states



Do We Have An Outbreak?

Lake Powell



Lake Mead



Almaden Reservoir near San Jose



What is HACCP?

HACCP Origins

- Pillsbury developed for NASA in 1960s
- NASA imposed strict microbiological requirements



The Story of HACCP

- *Satire Warning*
- The HACCP Team was assembled...
- The best & brightest minds were involved...

The Story of HACCP

- PhD

The Story of HACCP

- Professional **H**ead **D**ude

The Story of HACCP

- MD

The Story of HACCP

- **Mega Dude**

The Story of HACCP

- JD

The Story of HACCP

- Jane Doe

The Story of HACCP

- PE

The Story of HACCP

- Professional Ego

The Story of HACCP

- The team wasn't coming together...
- Problems ensued...
- Something was missing...

The Story of HACCP

- RS

The Story of HACCP

- Rocket Scientist

HACCP Today

- 7 principles
- Incorporated into regulations
- Implemented by Retail Food Establishments (e.g. restaurants)

HACCP Principles

- Principle 1: Conduct a hazard (risk) analysis.
- Principle 2: Determine the critical control points.
- Principle 3: Establish critical limits.
- Principle 4: Establish monitoring procedures.

HACCP Principles, cont'd

- Principle 5: Establish corrective actions.
- Principle 6: Establish verification procedures.
- Principle 7: Establish record-keeping & documentation procedures.

Potential Food Hazards

- **Biological**
 - Bacteria, Viruses, Parasites
- **Chemical**
 - Cleaners, sanitizers, lubricants, pesticides
- **Physical**
 - Foreign objects like glass, wood, metal

Biological Hazards

- Pathogen growth factors
 - Temperature
 - Time
 - Water Activity (Moisture)
 - pH
 - Atmosphere (Oxygen)



HACCP for Onsite?

- HACCP benefits lead to improved...
 - Understanding of risks & risk management
 - Public health & environmental protection
 - Regulatory compliance
 - Design & operation of systems

HACCP for Onsite?

<i>Risk Factor Matrix:</i>		<i>Severity of Consequences</i>				
		Insignificant (No impact / not detectable)	Minor (Customer Complaint)	Moderate (Impact on Customer Charter)	Major (Impact on Operating License)	Catastrophic (Public Health Risk)
<i>Likelihood</i>	Almost Certain (Once a day)	5	10	15	20	25
	Likely (Once a week)	4	8	12	16	20
	Moderate (Once a month)	3	6	9	12	15
	Unlikely (Once a year)	2	4	6	8	10
	Rare (Once every 5 years)	1	2	3	4	5

Source: Standards Australia/Standards New Zealand (1999)

Figure 3. Example Risk Factor Matrix

HACCP for Onsite?

Risk Management Systems

- HACCP - Food & beverage safety & quality
- HAZOP - Plant operation
- CHAIR - Plant layout/operability, safety
- AZ/NZS 4360 - Risk management



Potential Hazards from Onsite

- Biological?

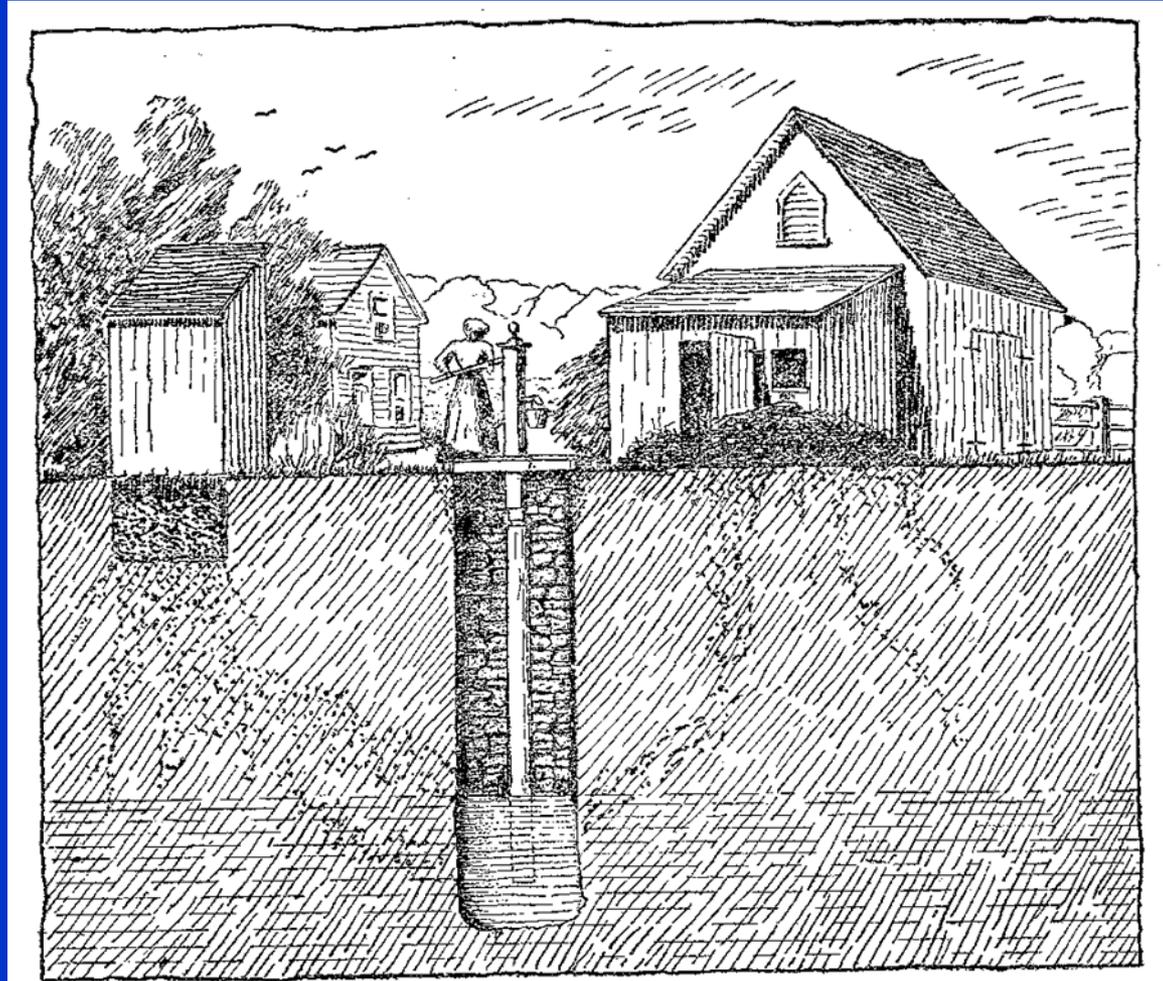
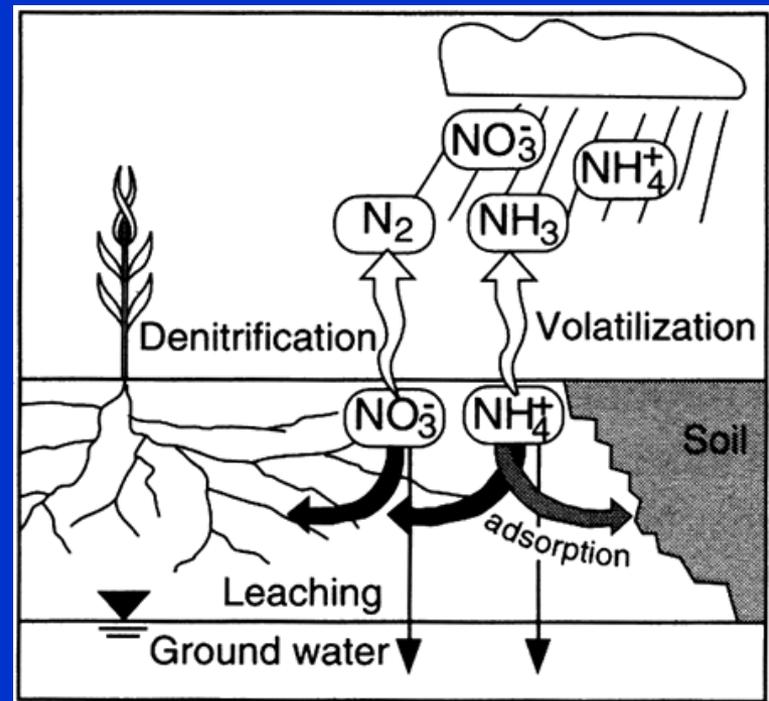


FIG. 1.--The shallow barnyard well, with privy vault and manure heaps near by. The water is likely to receive fluid from these at any time.

Potential Hazards from Onsite

- Chemical?



Potential Hazards from Onsite

- Physical?



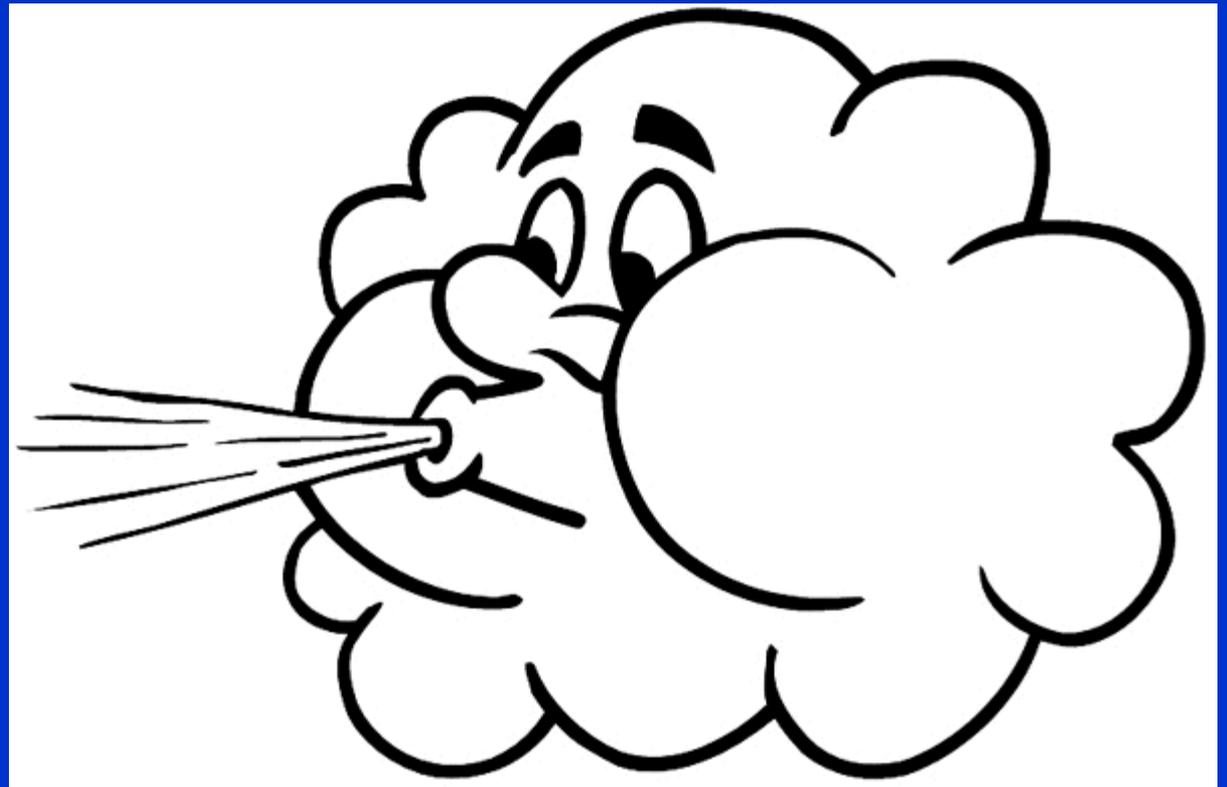
Potential Critical Control Points

- Water?



Potential Critical Control Points

- Air?



Potential Critical Control Points

- Food/Energy/Nutrients (Cell Growth)?



Potential Critical Control Points

- Time?

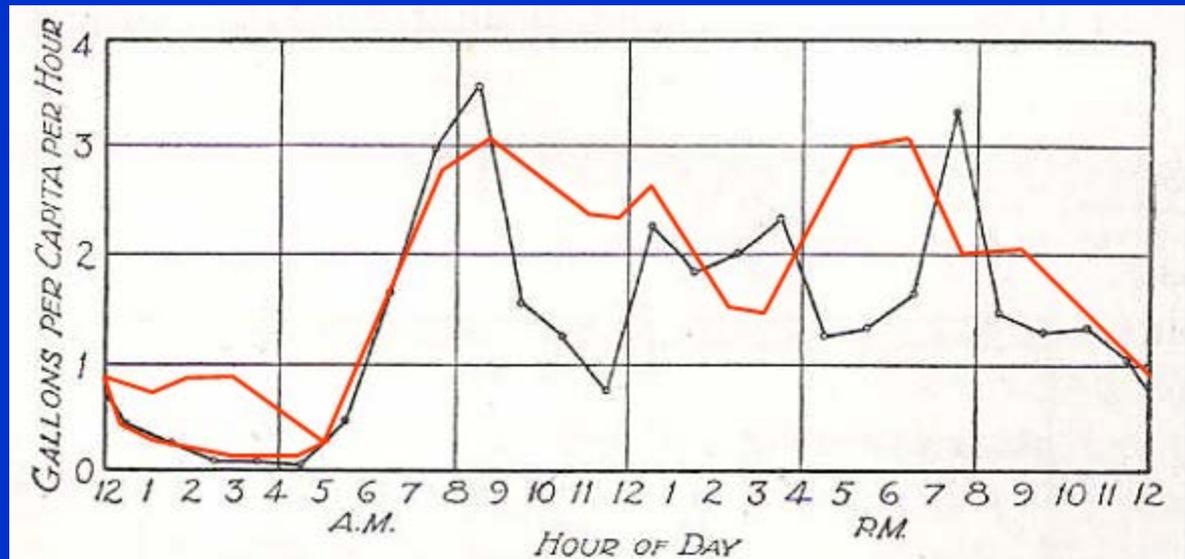
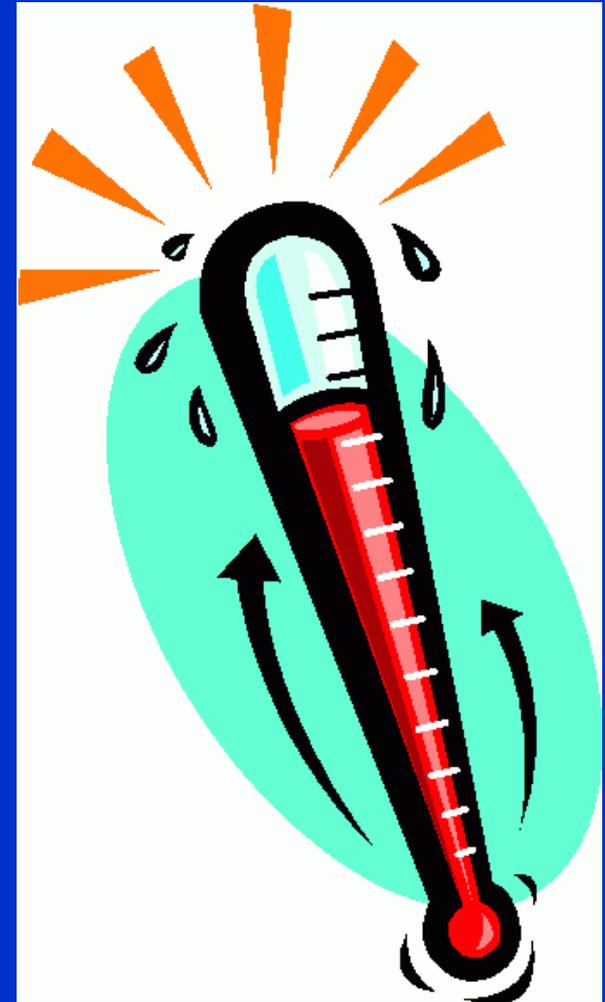


FIG. 3.—RATE OF SEWAGE FLOW FROM A FARM HOME OF THREE PEOPLE

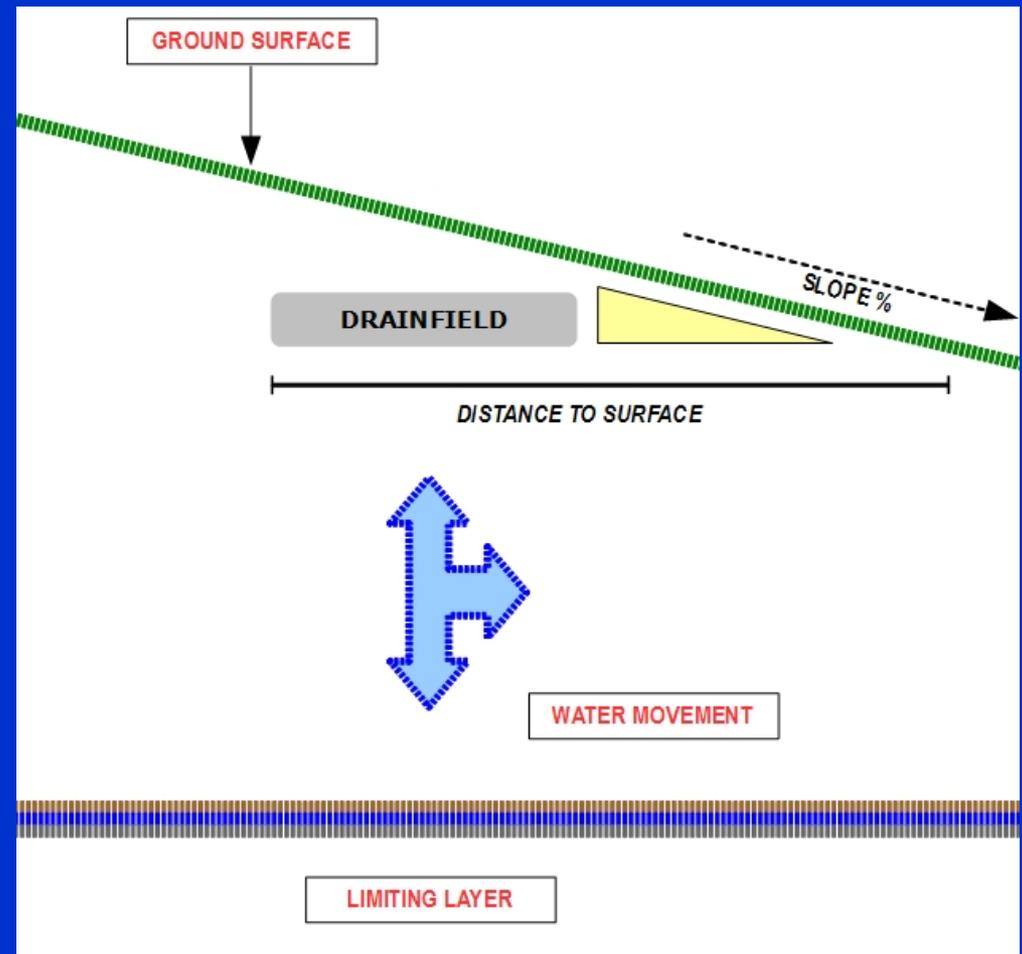
Potential Critical Control Points

- Temperature?



Potential Critical Control Points

- Spatiality?



Potential Critical Limits

- Performance treatment levels?
 - Carbon: Should we use BOD₅ anymore?
 - Nitrogen
 - Phosphorus
 - Solids: Should we use TSS anymore?
 - Pathogens
 - Where's the water?

Potential Critical Limits

- Conventional septic tank & soil absorption system + MVS

Assumed to meet performance...

- Carbon
- Solids
- Pathogens
- Water absorption in soil

Onsite Treatment

- **Biological**
 - Metabolic activities of microorganisms
- **Physical**
 - Filtration, flotation, sedimentation
- **Chemical**
 - Adsorption, cation exchange capacity, precipitation, pH adjustment

Onsite Treatment

- Classify systems based on...
 - Treatment processes
 - Performance monitoring results

Flexible Regulations

- States provide critical limitations for systems but do not “approve” systems or keep lists
- Overhaul state regulations to incorporate HACCP model
- Regulations provide flexibility for “building blocks”

Flexible Regulations

- Considerations
 - Statistical analysis for 3rd party data
 - Develop risk model for data weighting
 - Test Center Data
 - Field Data
 - Risk matrix

Flexible Regulations

- Local regulatory permitting authority evaluates based on:
 - HACCP plan: Designer submits
 - Statistical data analysis, where required
 - Process justification
 - Monitoring procedures

Flexible Regulations, cont'd

- Corrective actions logged & reported
- Local regulatory permitting authority to develop enforcement plan, like citations

Flexible Regulations

- Monitor & document
 - Field test for ORP, DO, pH, TOC, COD, turbidity, alkalinity
 - Embedded system sensors are future



Why HACCP?: The Future

- Site Management of All Resources in Total = **SMART**
 - Capture & Reuse: no such thing as “wastewater”
 - **RESOURCE WATER**
 - We want it!
 - Water & nutrients
 - Closed loop systems

Reuse

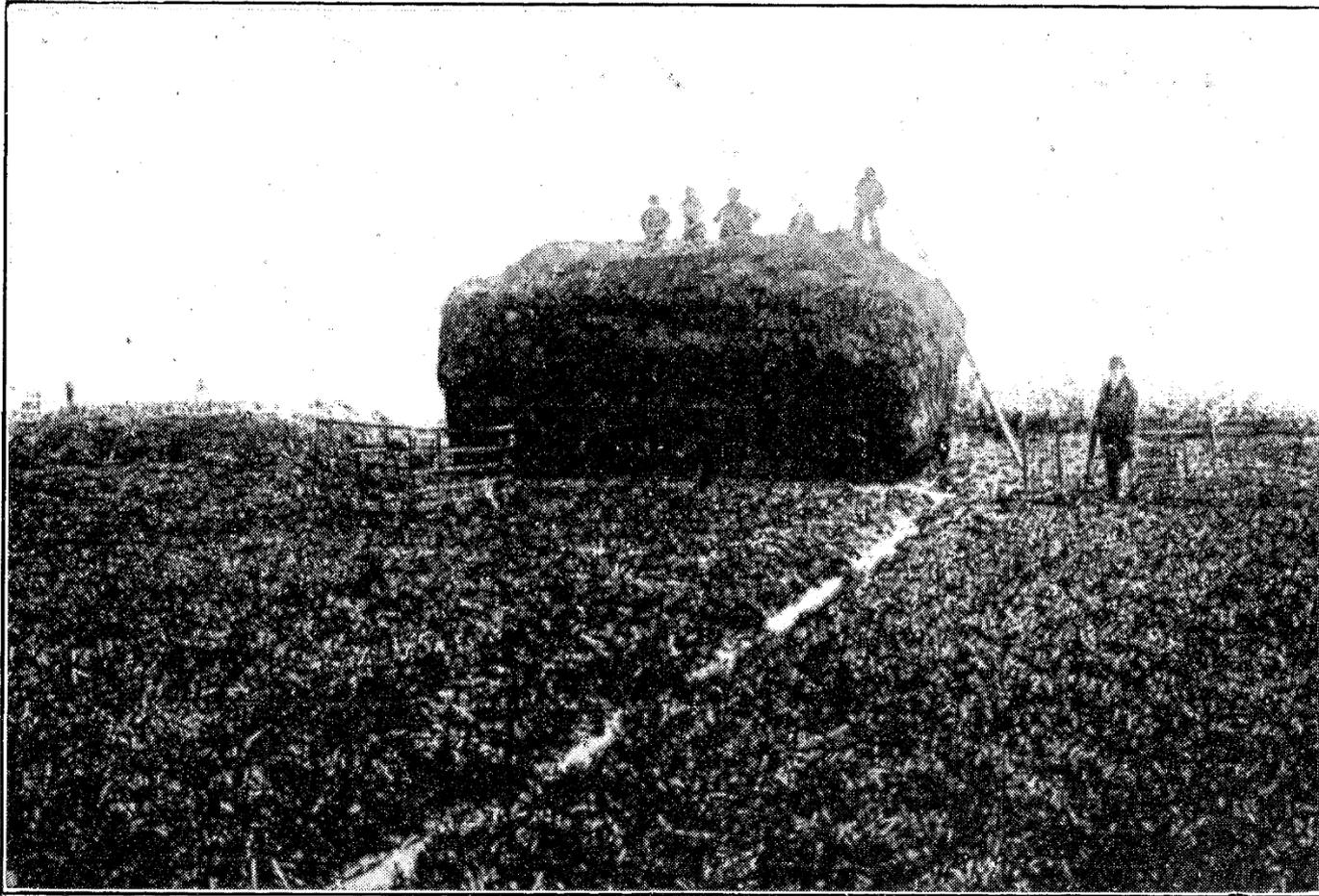


FIG. 60. Getting in the Hay Crop on an English Sewage Farm.

Reuse



FIG. 62. Cornfield on the Pasadena Sewage Farm.

Reuse



FIG. 63. Walnuts on the Pasadena Sewage Farm.

Impacts of Infrastructure Independence on Sustainability

- Less intrusive land development
- Reduced watershed impacts
- Resource capture & reuse
- Water, food & energy
- National & homeland security
- Individual/family or localized “buy-in”, investment & accountability

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Clean Water. Clean Air.

Harnessing nature in proven treatment solutions.