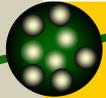


US EPA ARCHIVE DOCUMENT

Bioreactor Workshop

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Bioreactor Challenges

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Presentation

- ✦ Past Challenges
- ✦ Regulatory Challenges
- ✦ Operational Challenges
- ✦ Long-term Challenges





EPA Identified Challenges - 1999

- ✦ Long-term fate of metals
- ✦ Lack of data
- ✦ Increased operational requirements
- ✦ Landfill gas capture
- ✦ Leachate treatment and storage
- ✦ Landfill space and capacity reuse
- ✦ Greenhouse gas abatement
- ✦ Bioreactor design
- ✦ Solid waste density considerations
- ✦ Settlement
- ✦ Waste pretreatment
- ✦ Cover
- ✦ Management of amendments

Regulatory Challenges

- ✦ Infiltrating cover
- ✦ Alternative liner
- ✦ Non-indigenous liquids
- ✦ Airspace recovery

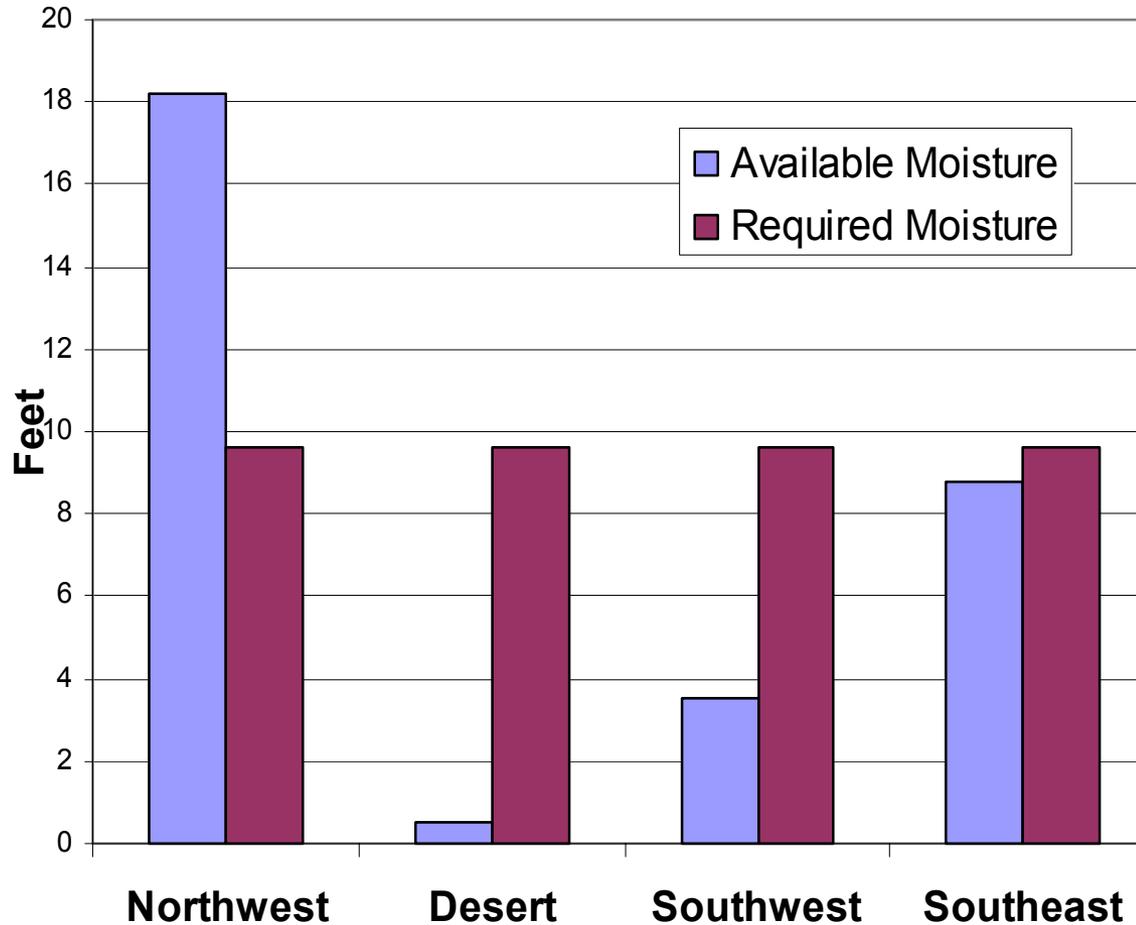


Operational Challenges

- ✦ Source of moisture
- ✦ Monitoring
- ✦ Gas collection
- ✦ Geotechnical stability
- ✦ Moisture distribution



Moisture Balance





Monitoring Challenges

- ✖ Waste heterogeneity
- ✖ Need for sensor contact with waste
- ✖ Corrosive conditions
- ✖ Cables
- ✖ Data Management
- ✖ Leachate/waste changes with respect to time



Monitoring Challenges – Cont'd

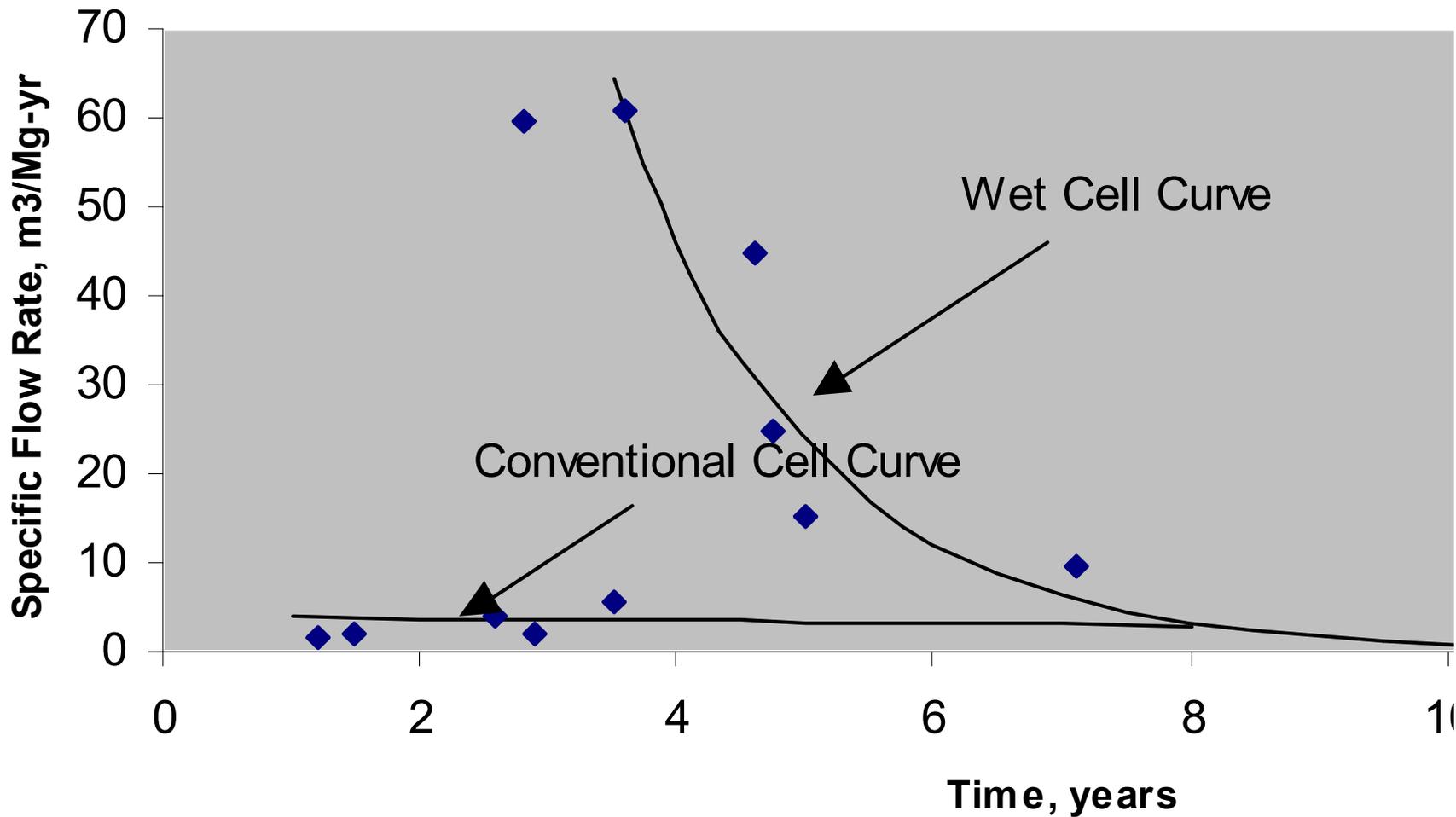
- ✖ How can we use leachate data to control the process?
- ✖ What parameters really need to be monitored and how often?
- ✖ How can we measure density and airspace utilization from location to location?
- ✖ How do geotechnical parameters change with depth?



Monitoring Challenges – Cont'd

- ✖ Can we standardize monitoring requirements?
- ✖ How do we balance economics with our need to understand the process?
- ✖ Can we develop instruments that do not require cables (wireless)?

Gas Production



Geotechnical Stability



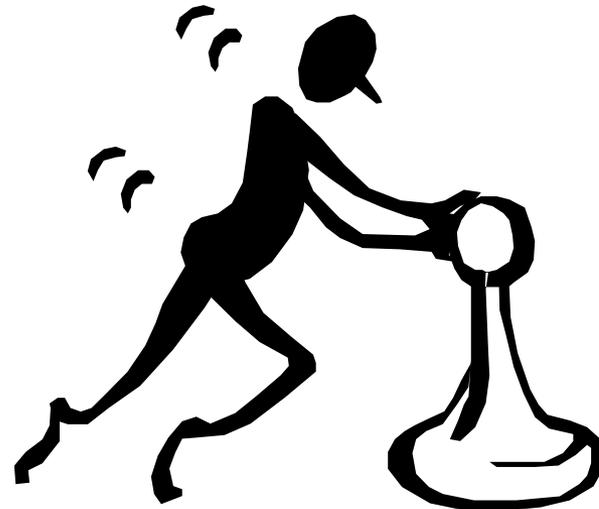
Moisture Distribution

- ✦ Alternative daily cover
- ✦ Liquid injection techniques
- ✦ Wicking
- ✦ Waste pretreatment
- ✦ Compaction



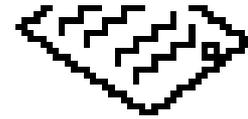
Long-Term Challenges

- ✦ How far does the bioreactor **need** to be pushed?
- ✦ How far **can** the bioreactor be pushed?

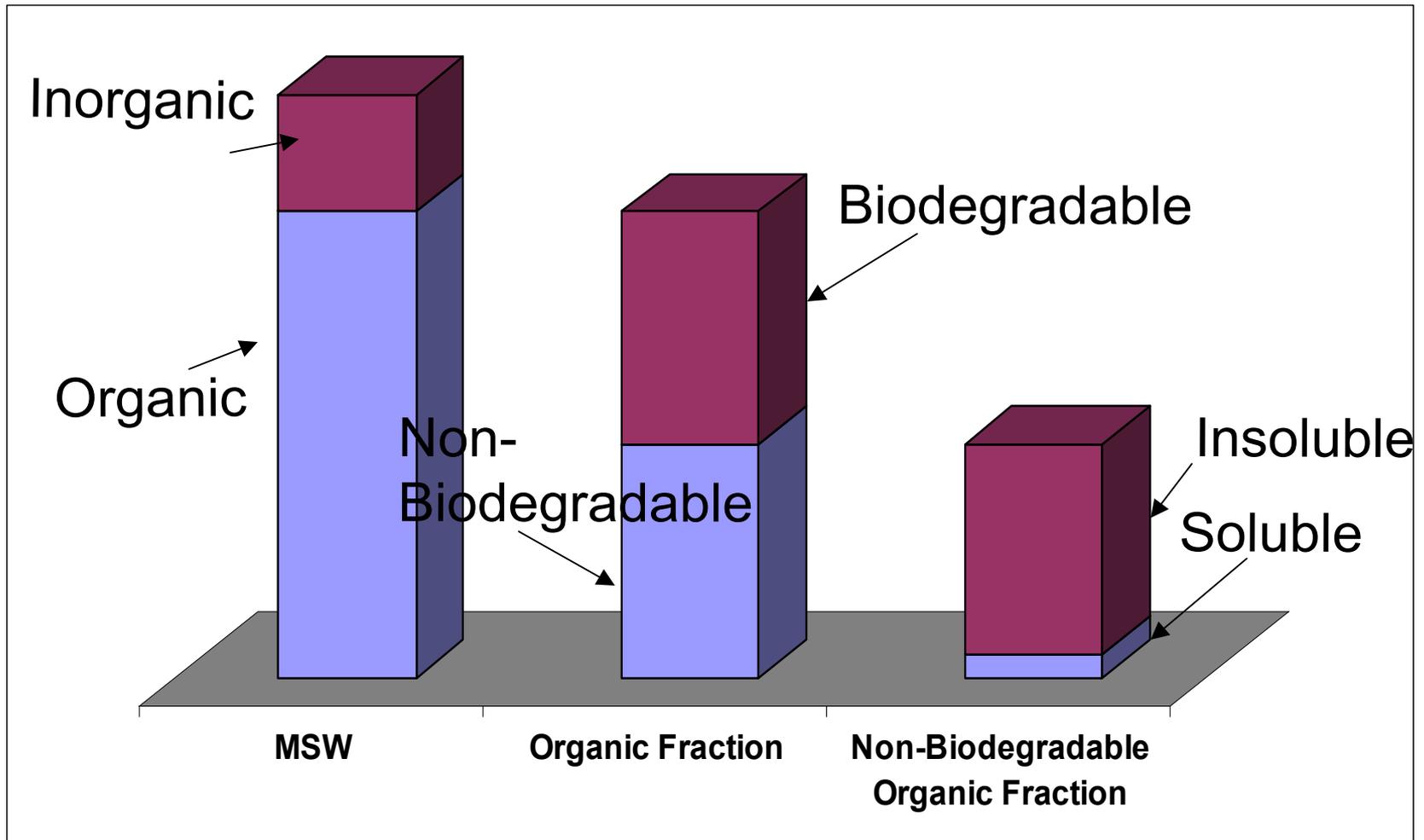




DATA

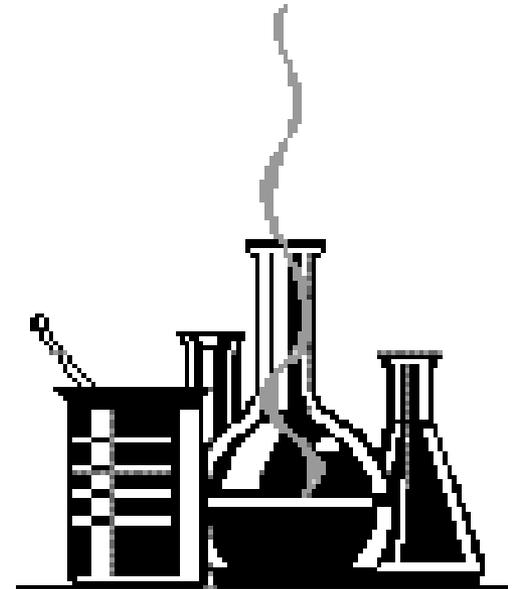


Organic Waste Degradation

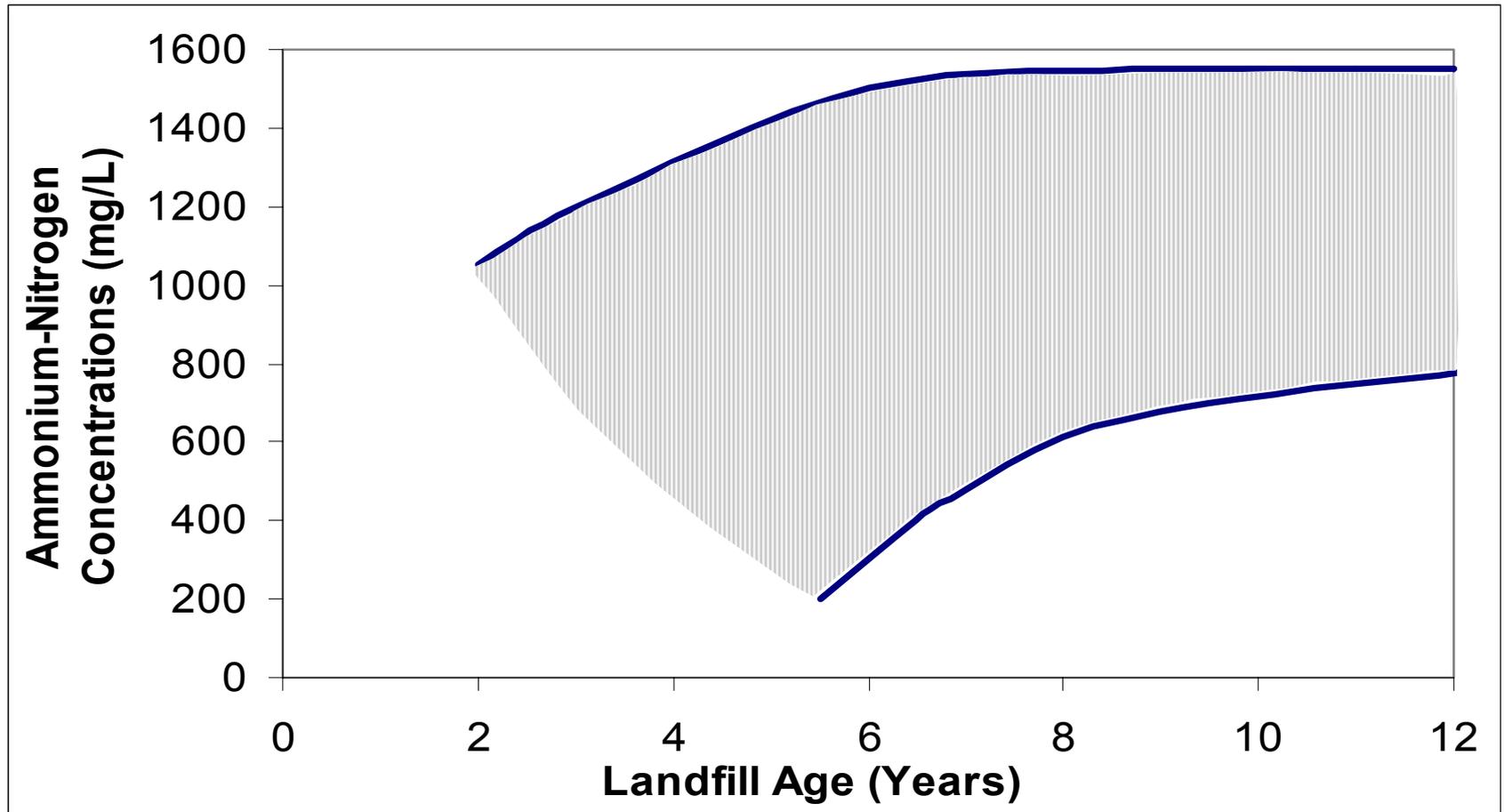


Why Treat Recalcitrant Organics?

- ✖ Adverse health and environmental effects
- ✖ Source of methane
- ✖ Potential metal transport



Leachate Ammonia



* Taken from Ehrig 1989

Why Remove Ammonia?

- ☼ Toxicity
- ☼ Oxygen demand
- ☼ Impact on post-closure





Conclusions

- ✦ Many engineering challenges have been met
- ✦ Regulatory and operational challenges remain
- ✦ Attention to data collection and reporting is essential
- ✦ Research into remaining opportunities available to treat waste components in situ is needed