

Assessing Project Feasibility System Stability using AQUASIM



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Outline

- Project Feasibility (substrates)
- AQUASIM
 - Why use a computer model?
 - Matching program to lab data
- Case Studies
 - Manure & FOG
 - Stillage only
 - Manure & Potatoes
- Conclusion
 - Biogas isn't just for farms!
 - AQUASIM is a useful tool to reduce costs



Project Feasibility

The following factors are considered when analyzing project feasibility:

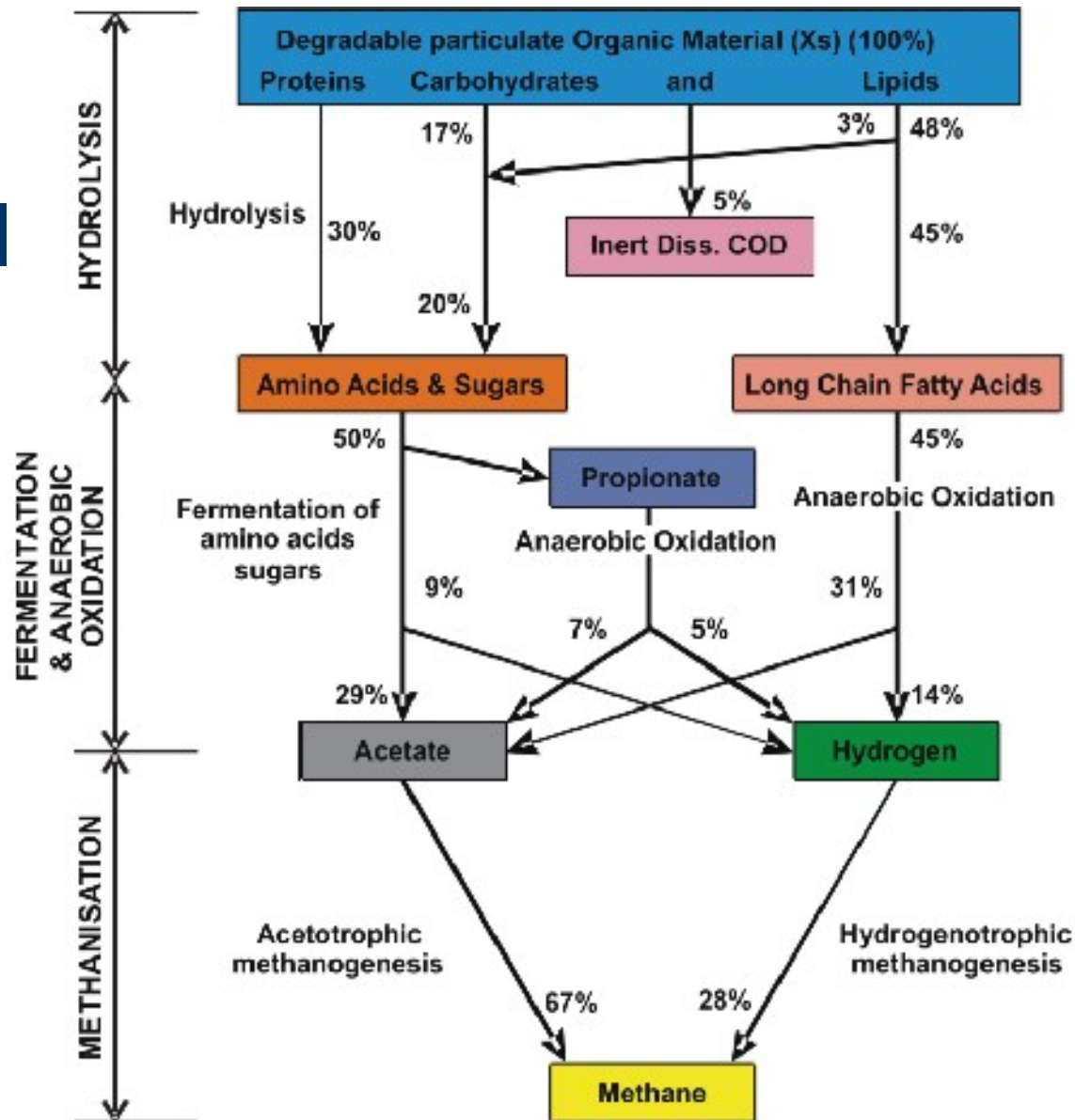
- Farm Profile
- Grid Connection
- Economic Factors
- System Stability 

System Stability: Co-digestion

- Co-digestion refers to the use of off-farm materials in a biogas system
- Co-digestion can increase:
 - biogas production and energy yields
 - economic yields
- Co-digestion can potentially decrease overall system stability
- A wide variety of organic wastes are suitable for digestion

System Stability: Energy Yields

- Cow manure yields ~ 40 m³ biogas/ton
- Typical co-substrates
 - Fats, Oil, Grease (FOG) yields 200-400 m³ biogas/ton
 - Source Separated Organics yields 100-300 m³ biogas/ton
- Anaerobic digestion as waste management in more than just the farming industry



Addition of Co-Substrates

How do you know the co-substrates will function in a digester?

- Build a digester and cross your fingers
- Lab tests
- Literature Research
- Computer Modelling

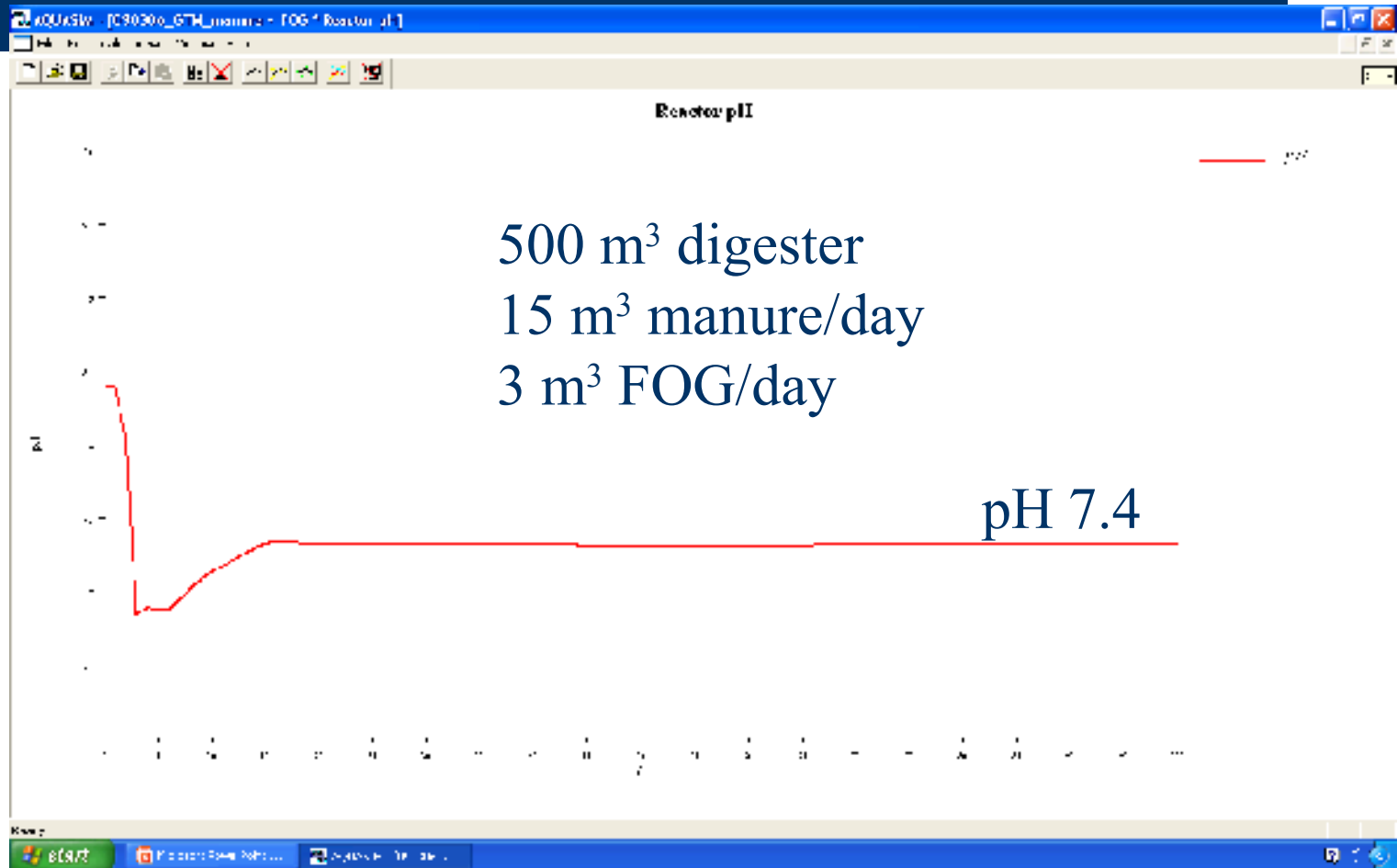
AQUASIM

- A computer program designed to identify and simulate **aquatic** systems
- IWA Task Group for Mathematical Modeling of Anaerobic Digestion Processes
 - Anaerobic Digestion Model (ADM)
 - Activated Sludge Model (ASM)
- Model has been calibrated with field and lab data

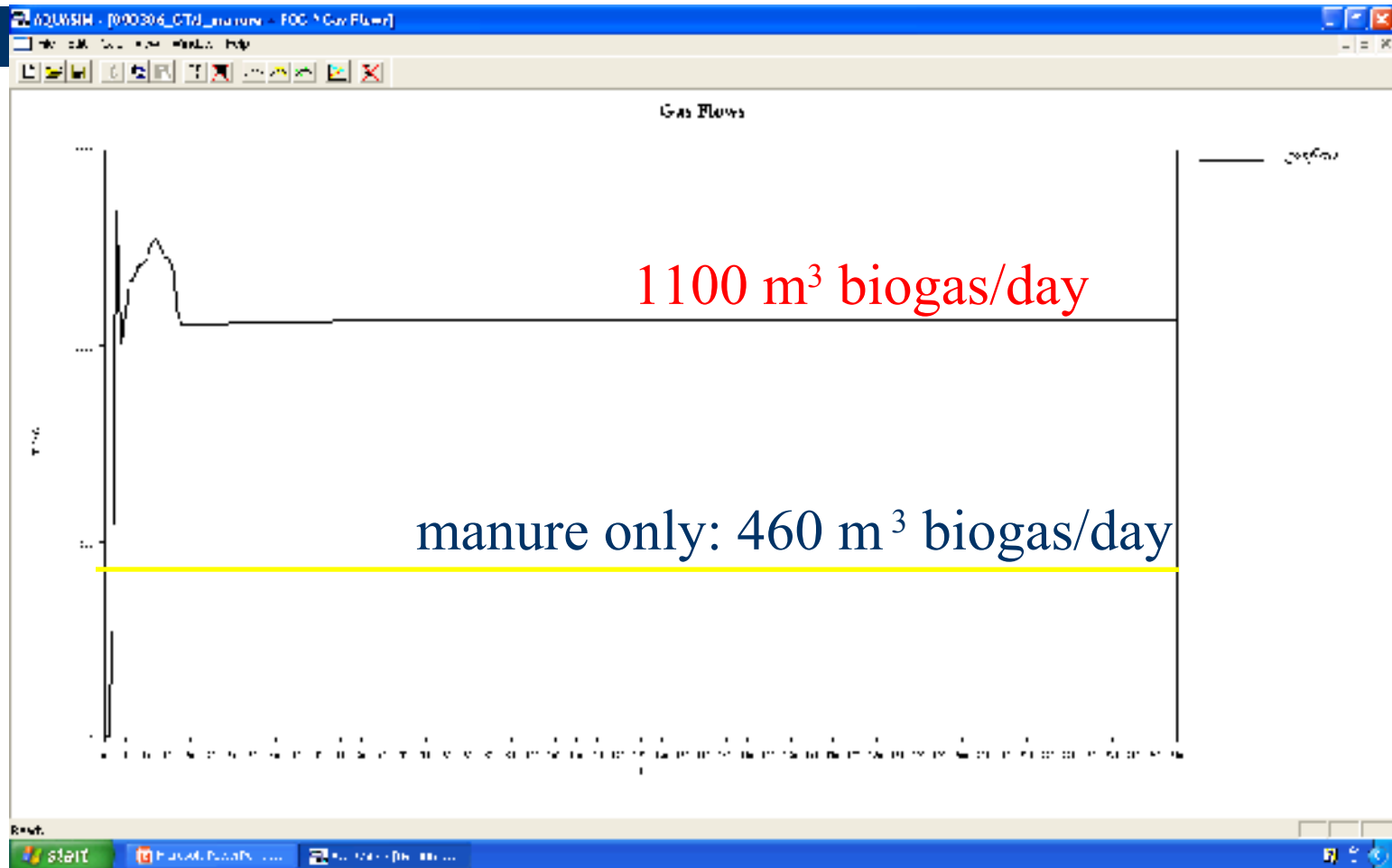
Cow Manure & FOG

- **Typical digester set-up**
- **Experimental data from a client**
 - 15 m³/day manure
 - 3 m³/day FOG
 - Our model matches initial data but we still have some analysis to do

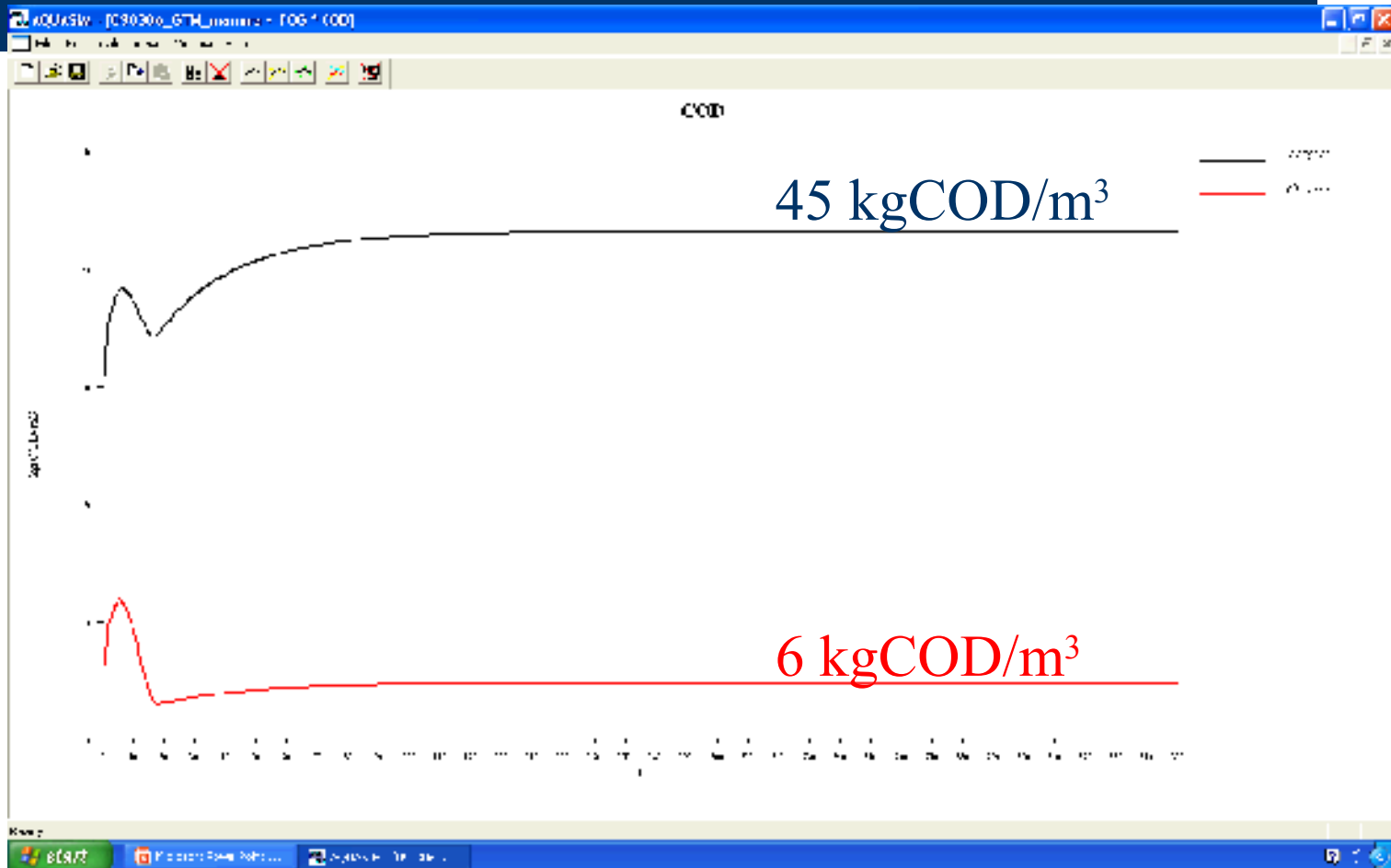
Manure & FOG pH



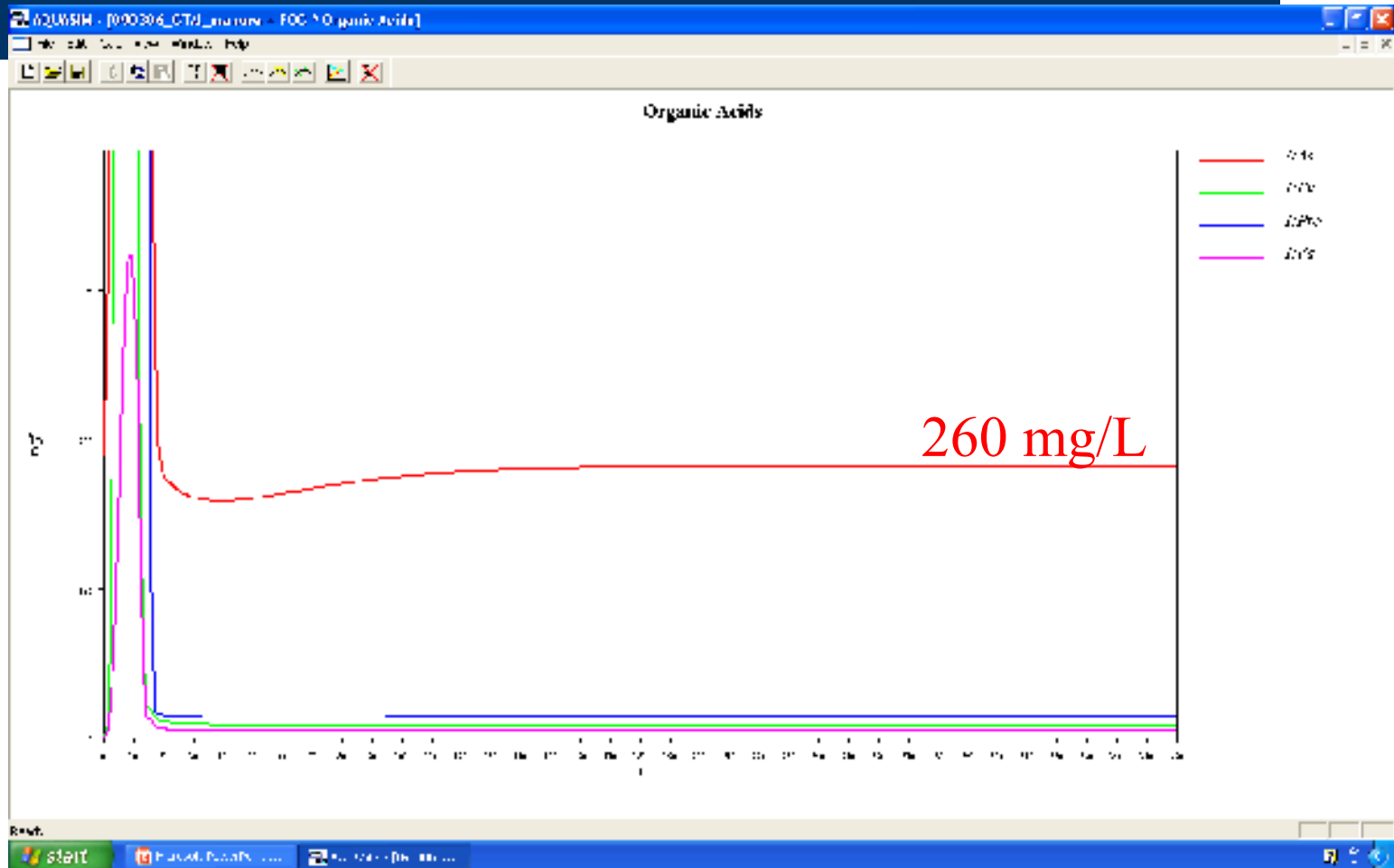
Manure & FOG Biogas



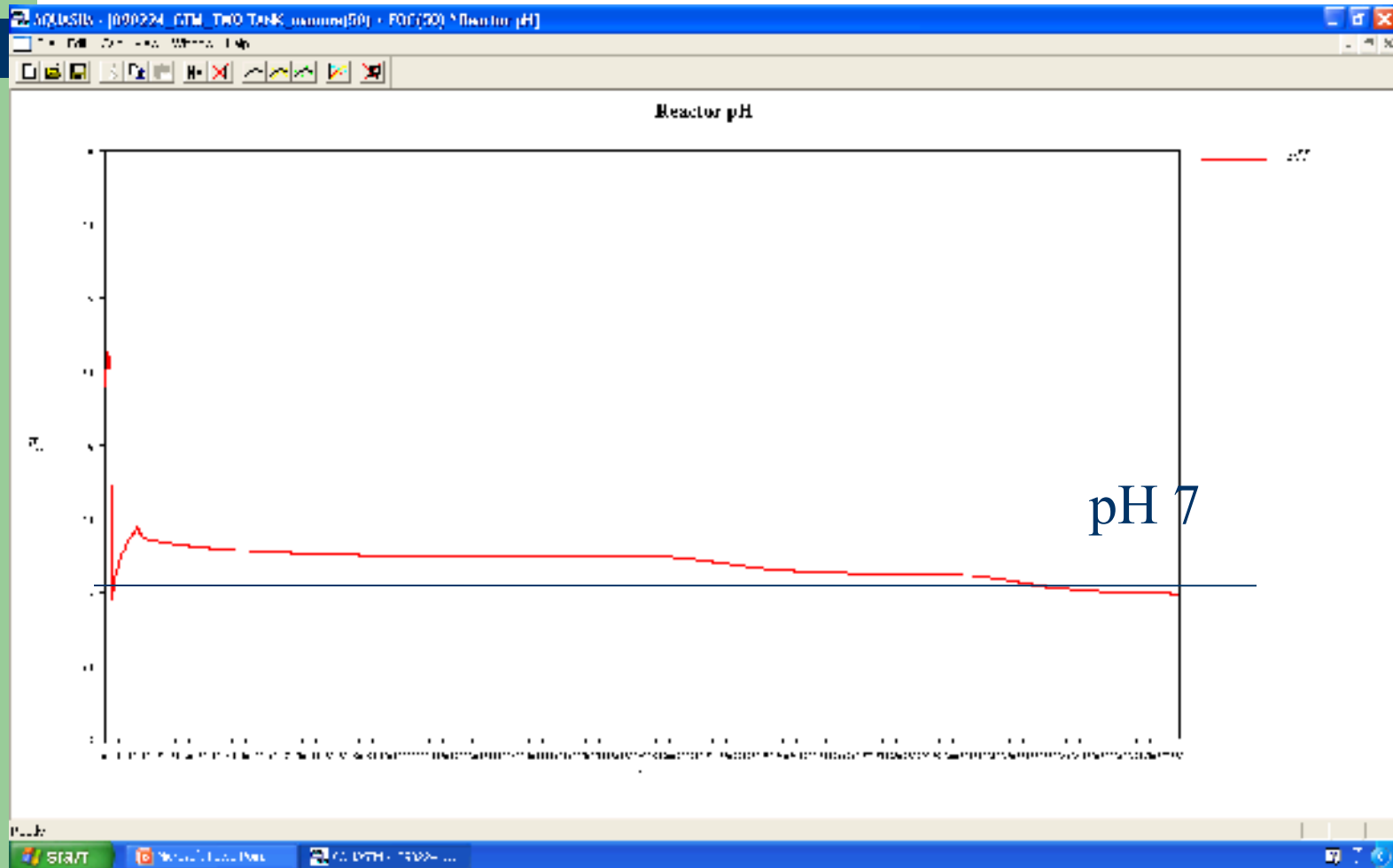
Manure & FOG COD



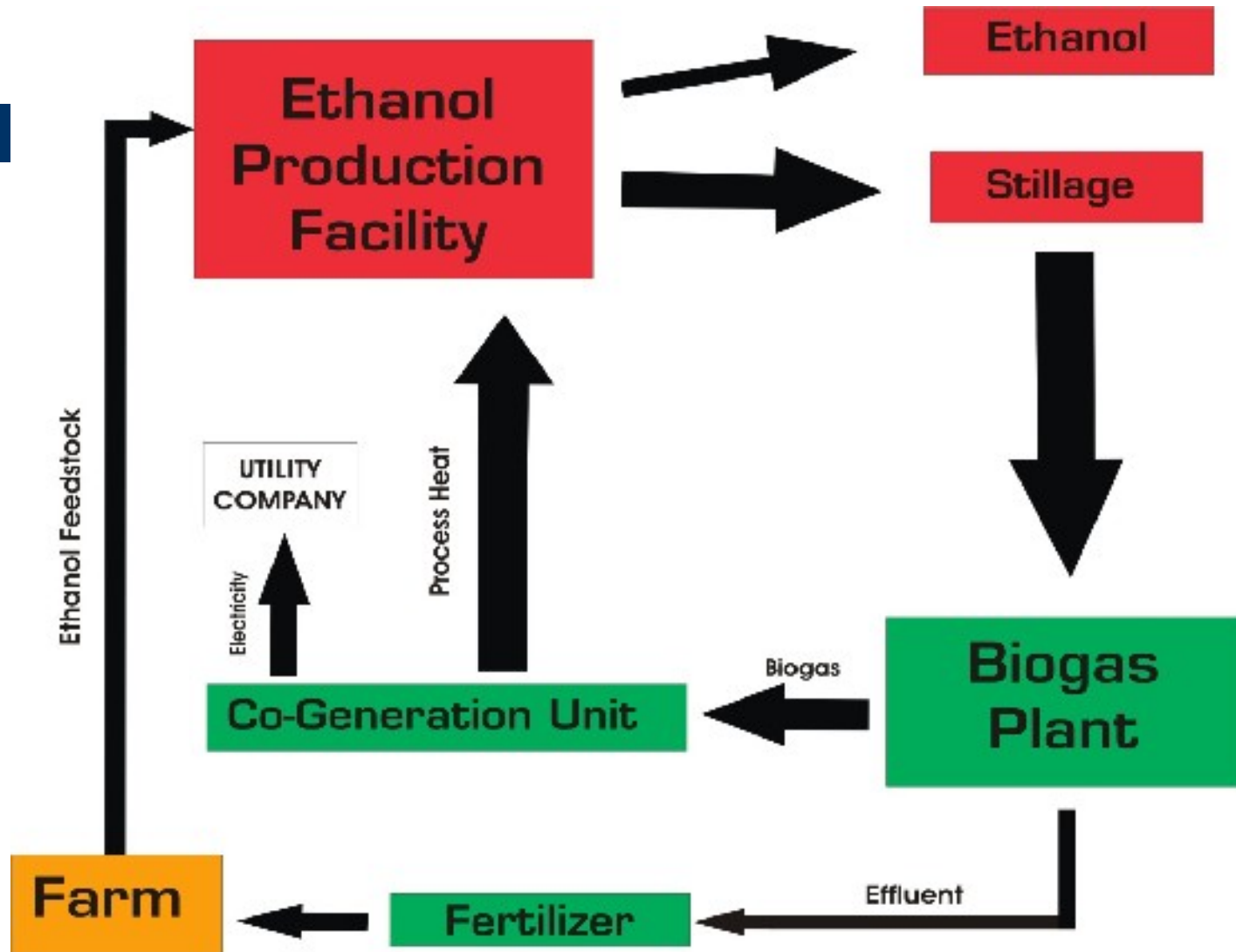
Manure & FOG Acid



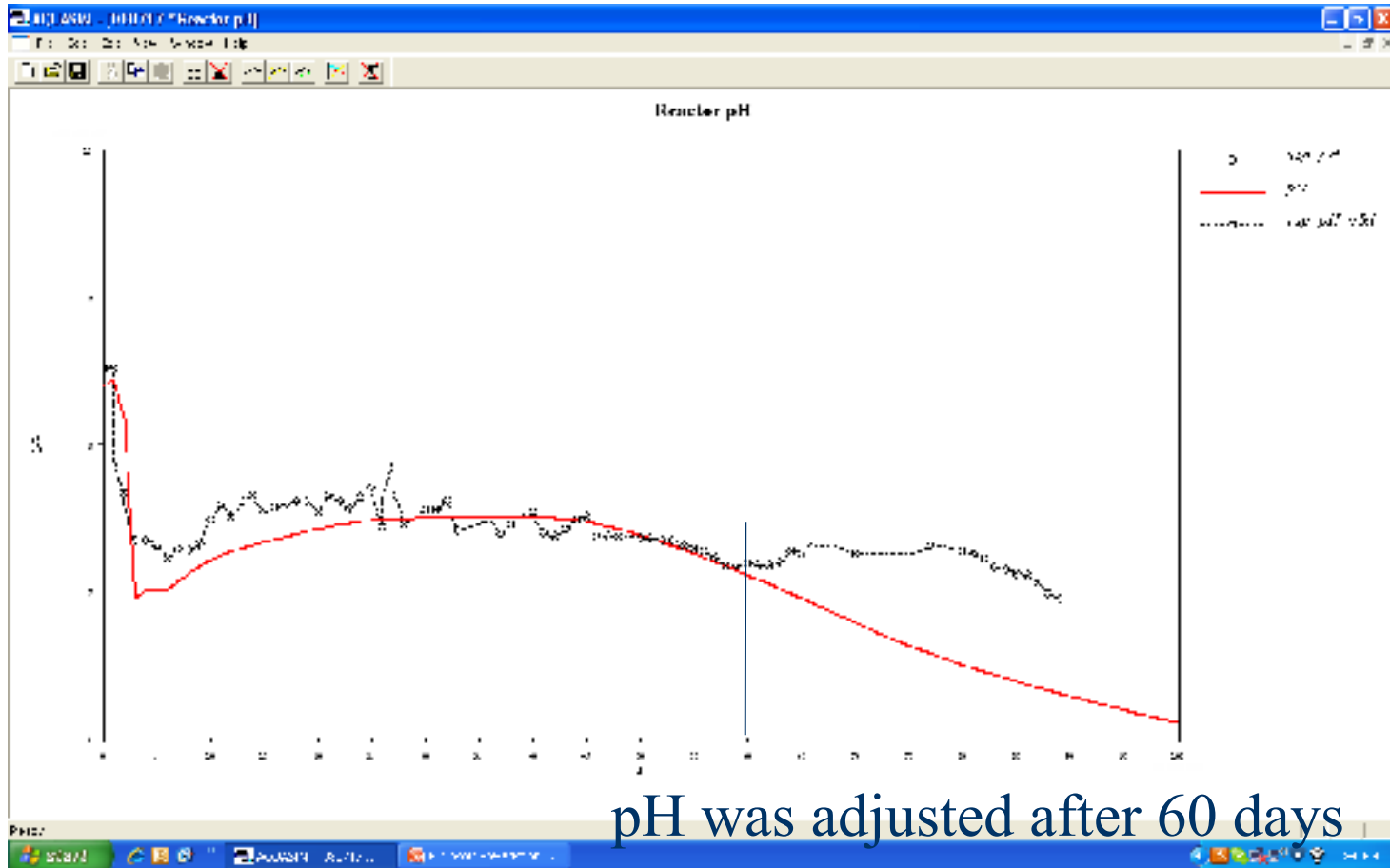
Manure & FOG Overload



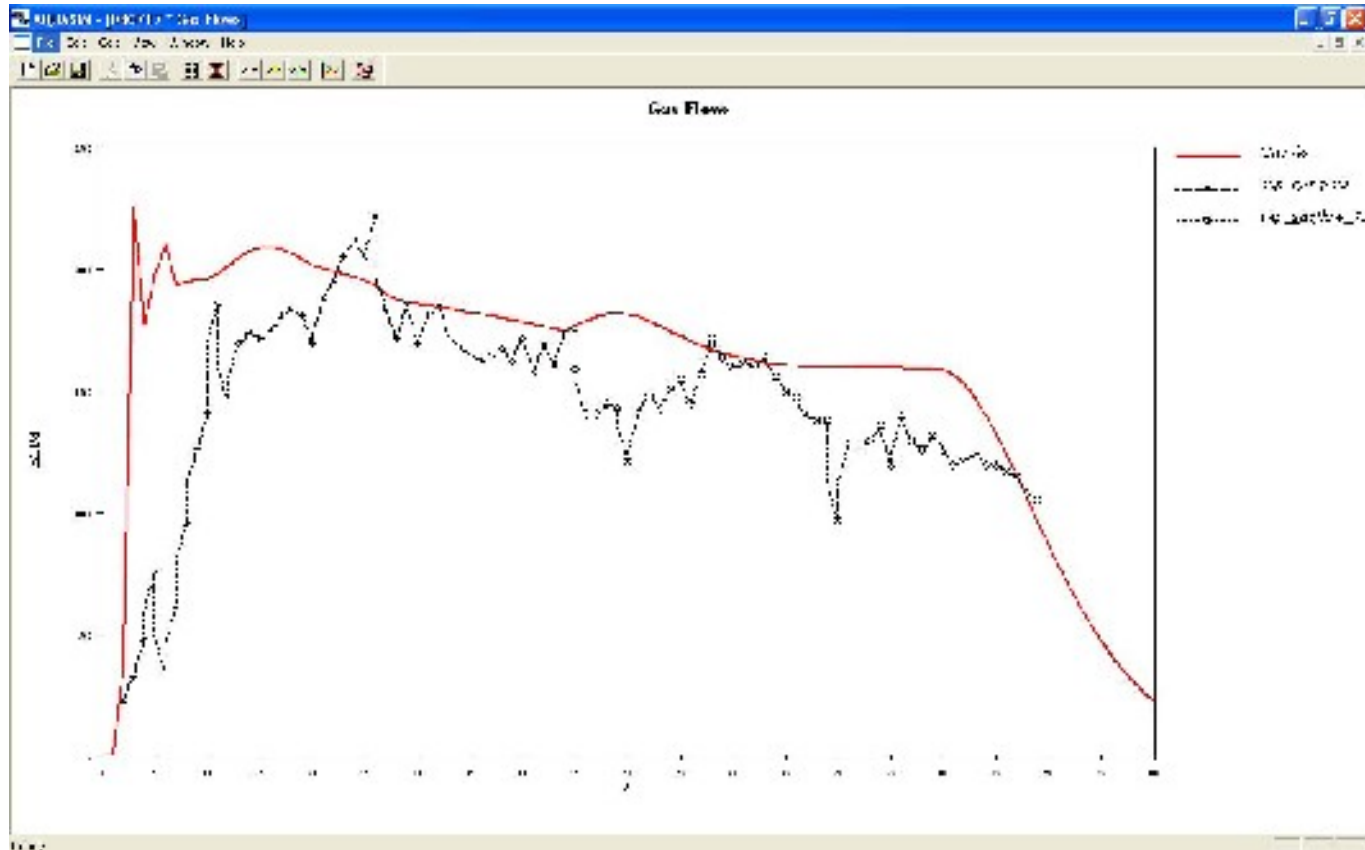
Stillage



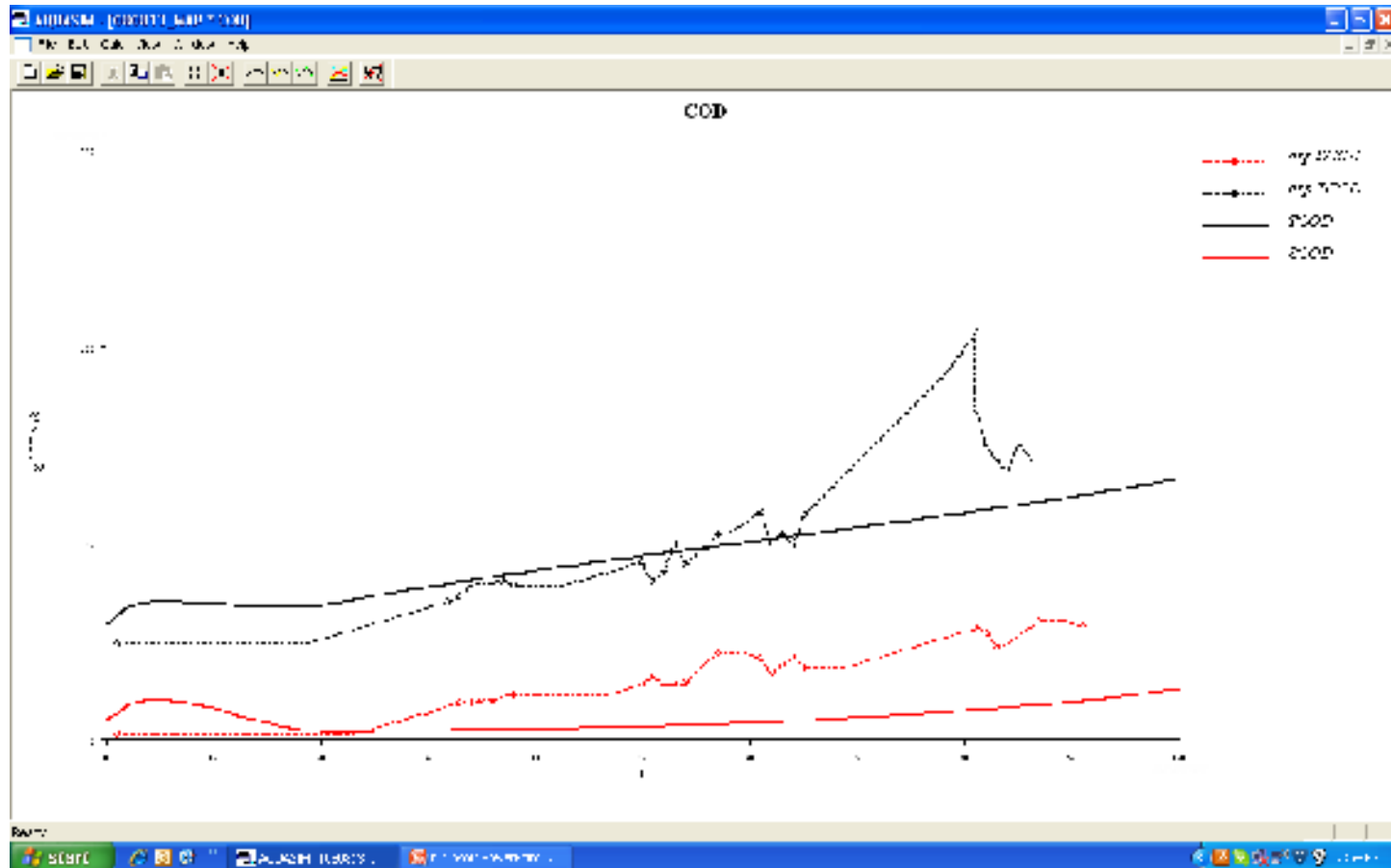
Stillage - pH



Stillage Biogas



Stillage - TCOD and SCOD

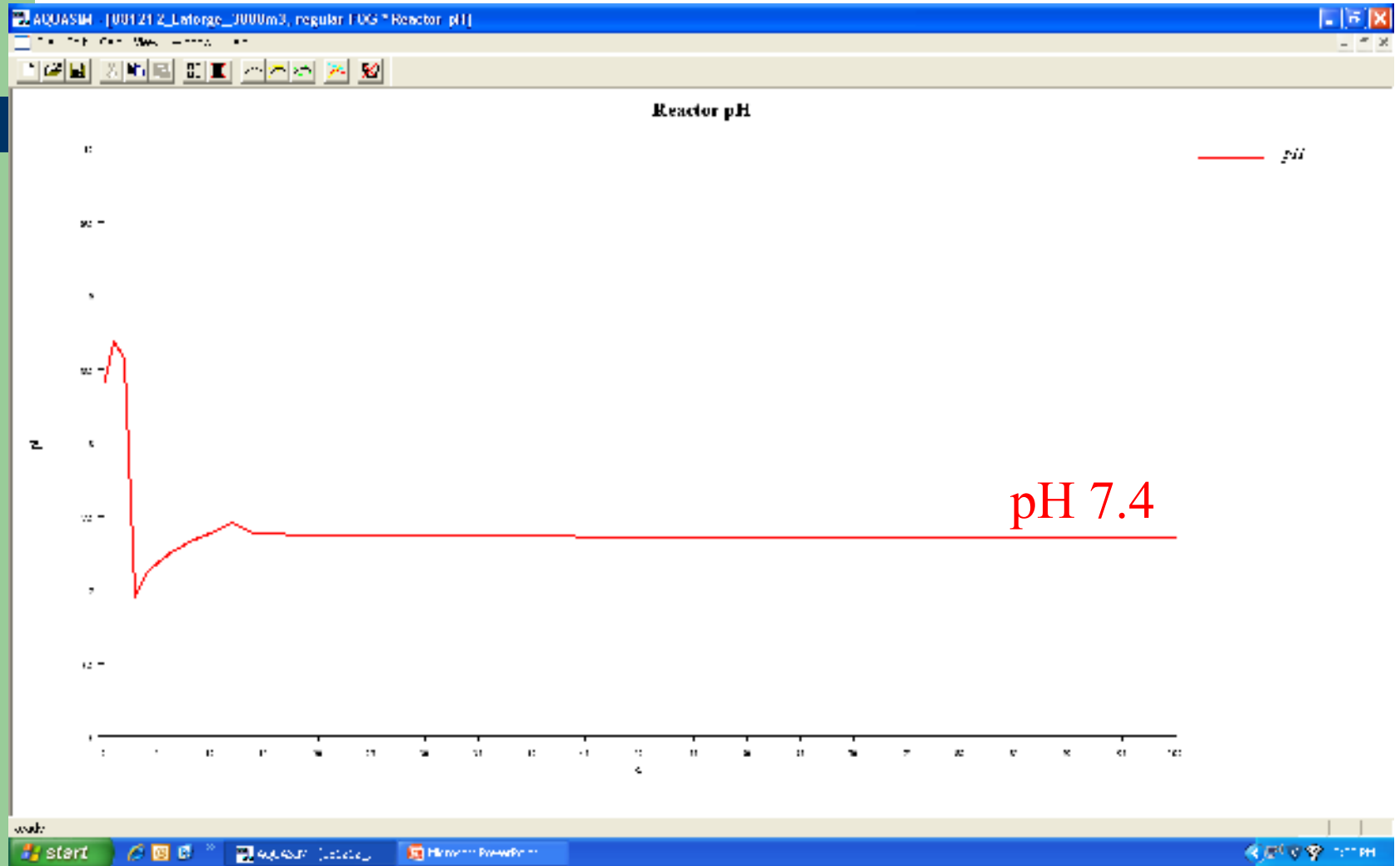


Manure & Potatoes

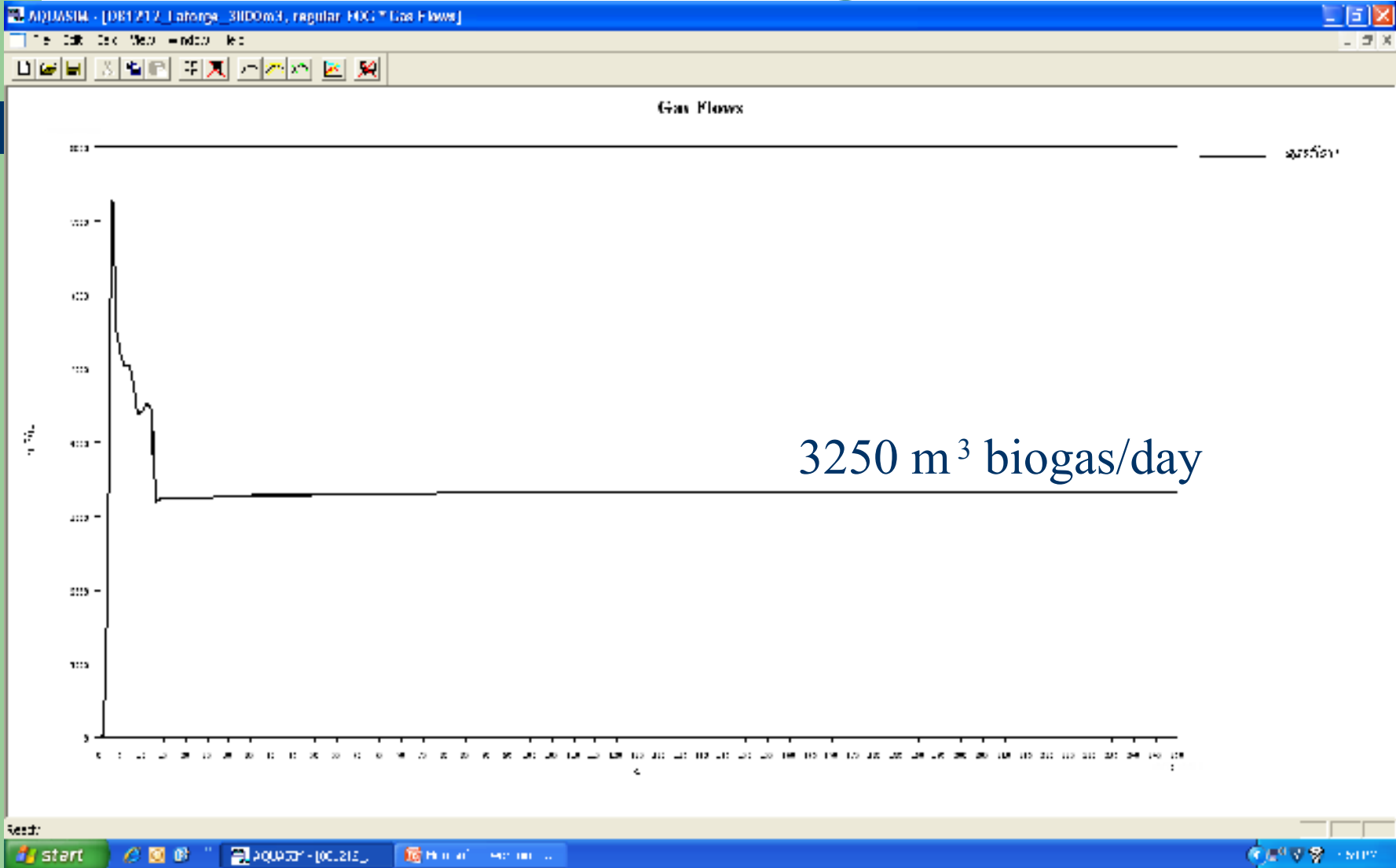
- This case study includes:
 - Dairy Manure: 3000 m³/day
 - Potatoes: 5500 m³/day
 - Starch: 1000 m³/day
 - Secondary Cake: 8000 m³/day
 - Grease: 150 m³/day
- System that is high in carbohydrates, must be careful with pH



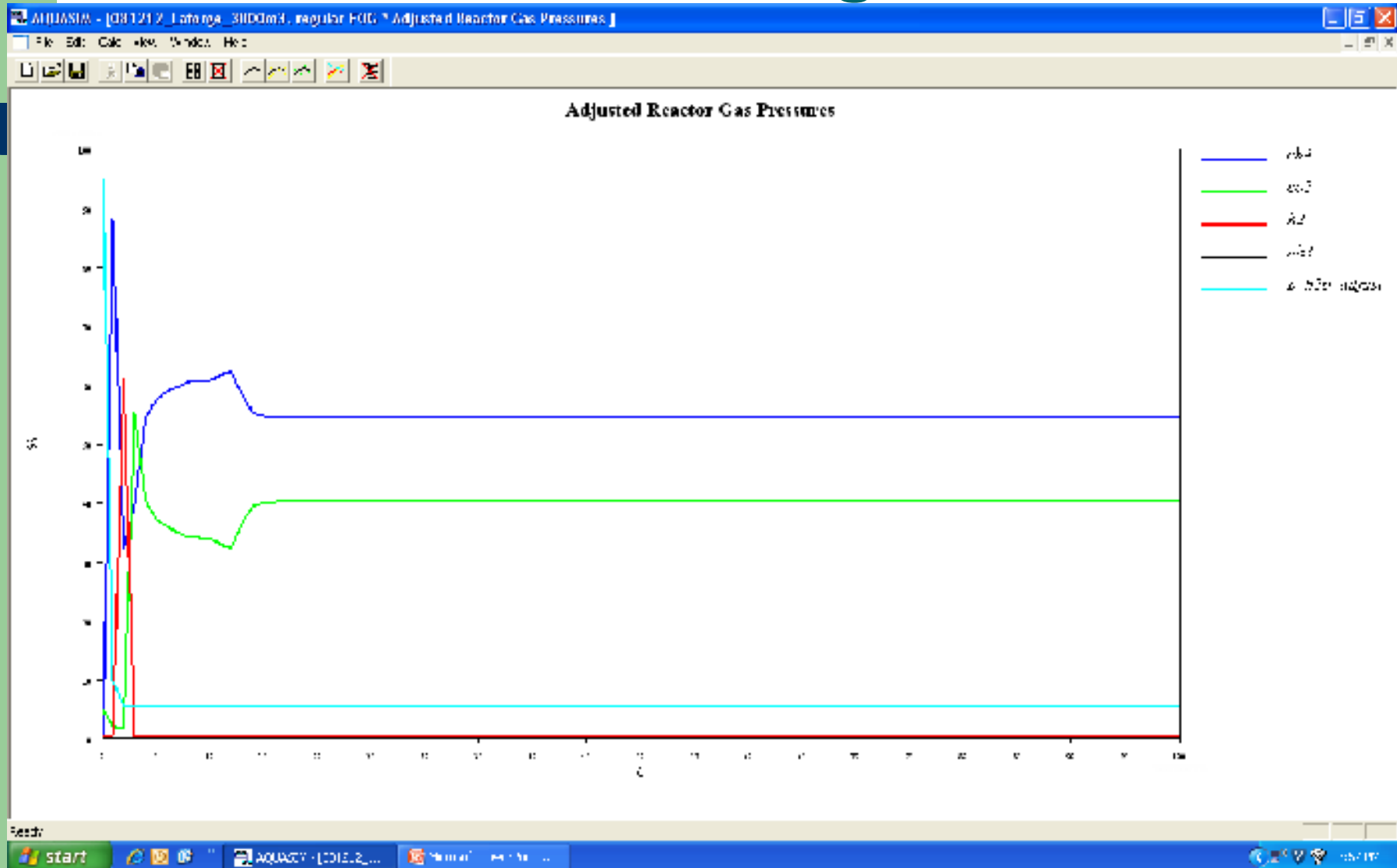
Manure & Potato pH



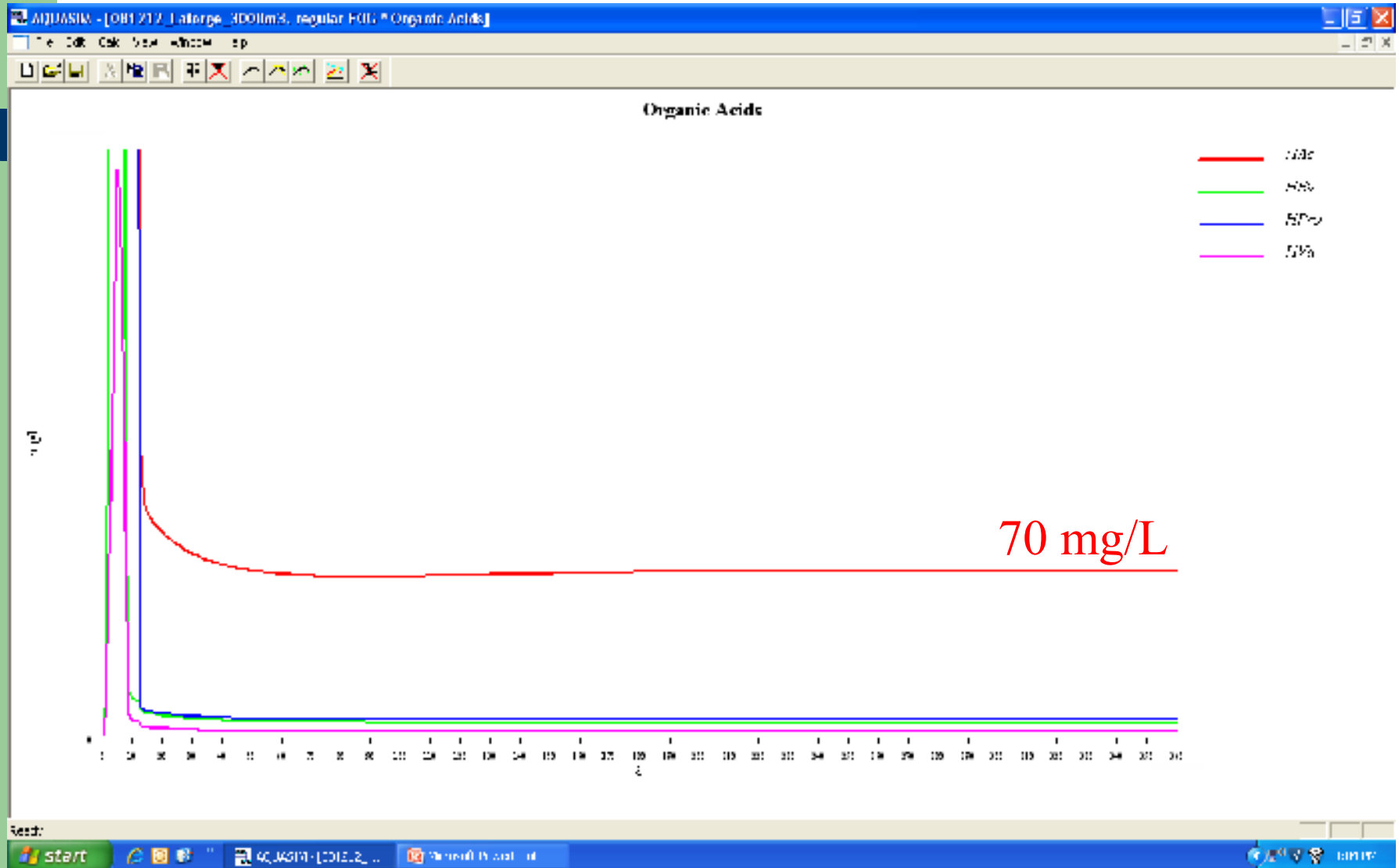
Manure & Potato Biogas



Manure & Potato Biogas



Manure & Potato Acid



Conclusion

- System stability is a vital part of overall project feasibility
- The use of a computer model allows us to analyze possible system digester configurations

QUESTIONS?

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