

# REVIEW OF NAS REPORT

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## **Biosolids Applied to Land: Advancing Standards and Practices**

*Academic Perspective*

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# The University of Arizona National Science Foundation Water Quality Center

**Director: *Ian L. Pepper***

**An Industry/University  
Cooperative Research  
Center (I/UCRC)**



THE UNIVERSITY OF ARIZONA,  
NATIONAL  
SCIENCE  
FOUNDATION

**WATER**  
**QUALITY**  
**CENTER**

# LAND APPLICATION OF BIOSOLIDS: FACTS vs. FICTION

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- **National Academies of Science Report**
- **Bioaerosol research in Solano County**
- ***The Staphylococcus Story***
- **Fate and Transport of Virus From Biosolids**

# NAS REPORT

## BIOSOLIDS APPLIED TO LAND: ADVANCING STANDARDS AND PRACTICES

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- **16 member committee,**
- **18 month study**
- **Report released July 2002**

# NAS COMMITTEE TASK

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- **Review Federal 503 regulations for land application of biosolids with respect to chemicals**
- **Review Federal 503 regulations with respect to pathogens**
- **Evaluate risk assessment approaches**

# OVERARCHING FINDINGS (Verbatim)

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- There is no documented scientific evidence that the Part 503 rule has failed to protect public health.
- However additional scientific work is needed to reduce persistent uncertainty about the potential for adverse health effects from exposure to biosolids.
- Anecdotal allegations of disease.

# Overall need: (Verbatim)

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- **Ensure that the chemical and pathogen standards are supported by current scientific data and risk assessment methods.**
- **Demonstrate effective enforcement of the Part 503 rule, and**
- **Validate the effectiveness of biosolids—management practices.**

# **OVERARCHING RECOMMENDATIONS (Verbatim)**

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- **Use improved risk assessment methods to better establish standards for chemicals and pathogens.**
- **Conduct a new national survey of chemicals and pathogens in sewage sludge.**
- **Establish a framework for an approach to implement human health investigations.**
- **Increase resources devoted to EPA's biosolids program.**



# RELEASE OF THE NAS REPORT

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- **Report and press Release—July 2002**
- **Press Release ultra-negative**
- **Press Release did not reflect the findings of the Report nor the Committee's viewpoints**

# NEGATIVE PRESS RELEASE

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- **EPA based 503 Regulations on ‘outdated science’**
- **Implication that health hazards from land application very real, just not documented**
- **Very negative newspaper stories on land application occur nationally**
- **Land application moratorium or absolute bans occur nationally**

# NAS COMMITTEE

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- **Outraged by NAS Press Release**
- **15 of 16 members vigorously protest the Press Release**
- **A clarification on the Press Release is written and agreed to by 15 of 16 members**
- **NAS will not publish the clarification**
- **Instead NAS offers the OP-ED alternative**

# THE OP-ED

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- **Intended to clarify the Press Release**
- **First version written by Chairman Tom Burke,**  
*“The Inside Scoop on Recycled Poop”*
- **First version emphatically rejected by the NAS Committee**
- **Final acceptable OP-ED released in early September**

# THE OP-ED

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- **Written by Chairman Tom Burke**

- **Main point:**

**”But because some press accounts focused only on criticisms of EPA’s past efforts, and do not fully reflect the findings and recommendations of our report, I would like to clarify our findings. First, we found no evidence of an urgent public health risk from exposure to land-applied biosolids, based on our review of the scientific literature. Currently, there are no studies documenting adverse health effects from land application of biosolids, even though land application has been practiced for years.” (National Academies Op-Ed Service Archive, September 6, 2002).**

# THE ROLE OF ACADEMIA IN INTERPRETING AND APPLYING THE NAS REPORT

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- **Facts not fiction should be presented**
- **Facts should be based on scientific studies**
- **Academics should conduct research in the needed areas of interest with respect to land application of biosolids**
- **The University of Arizona National Science Foundation Water Quality Center research:**
  - **bioaerosol potential**
  - ***Staphylococcus aureus***
  - **fate and transport of pathogens from biosolids**

# CURRENT BIOAEROSOL RESEARCH

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- **Two Ph.D. candidates—  
John Brooks and Ben Tanner**
  - **P.I.'s—Ian Pepper and Charles  
Gerba**
  - **Over 300 samples analyzed**
  - **Odors clearly a real problem**

# BIOAEROSOL RESEARCH:

- **Samples analysed for heterotrophic plate count bacteria, total coliforms, *E. coli*, *Salmonella*, enteroviruses phage, *Clostridium perfringens*, *Aspergillus* spp.**





















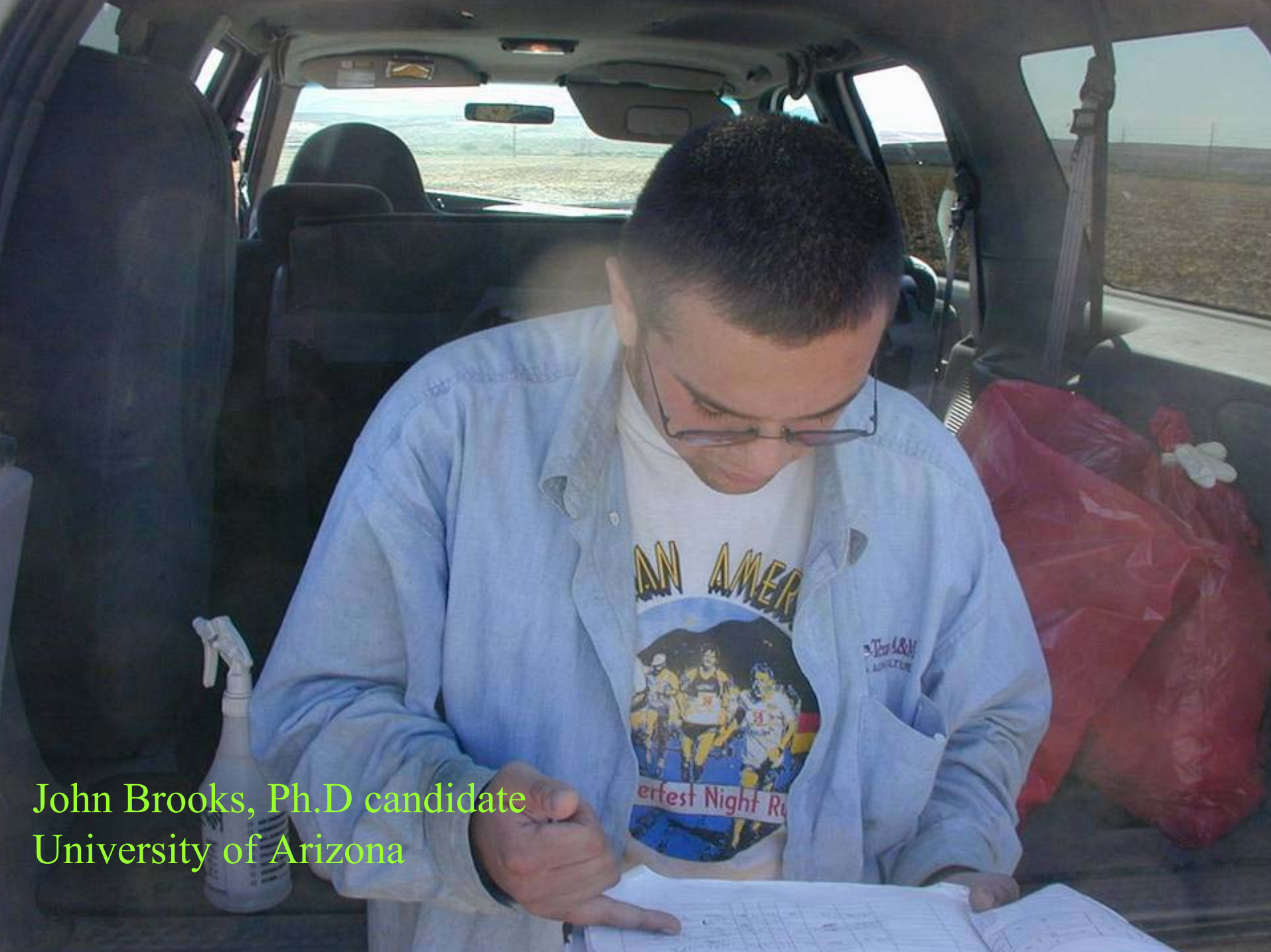










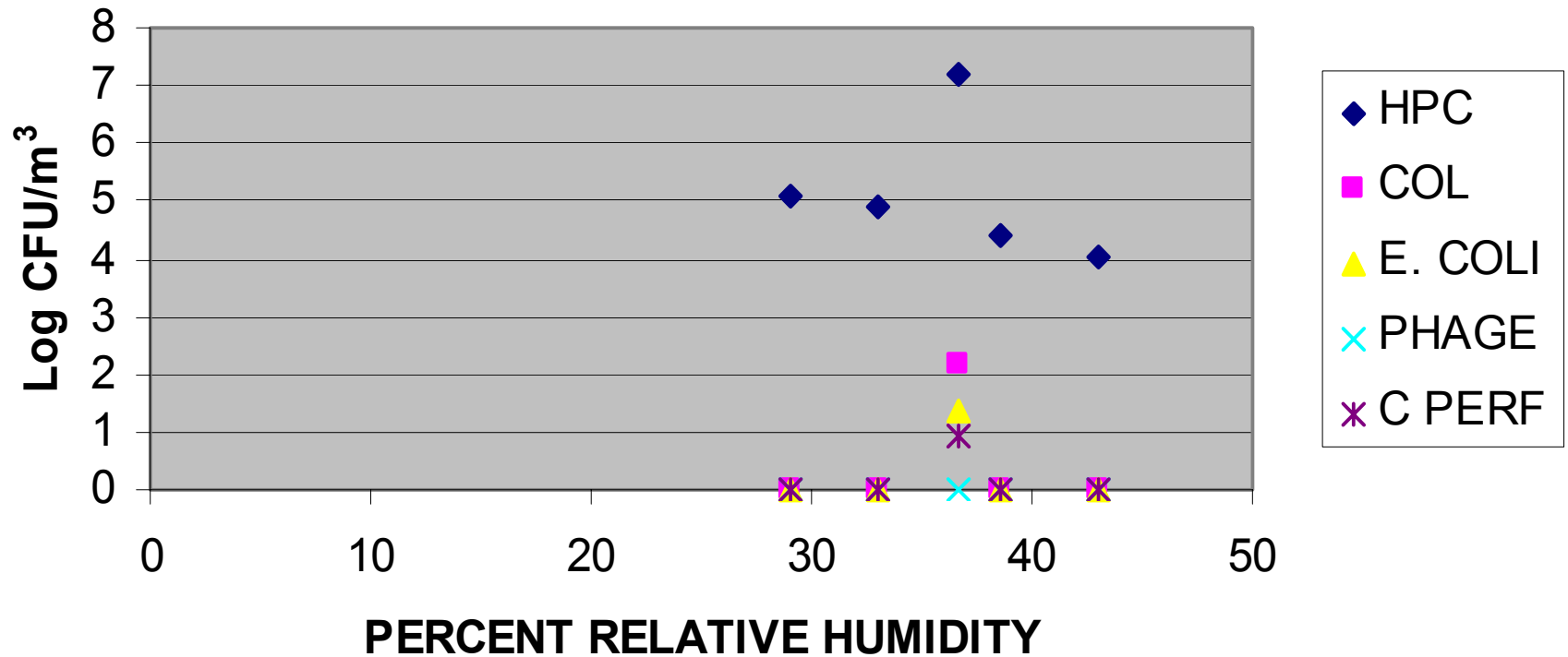


John Brooks, Ph.D candidate  
University of Arizona



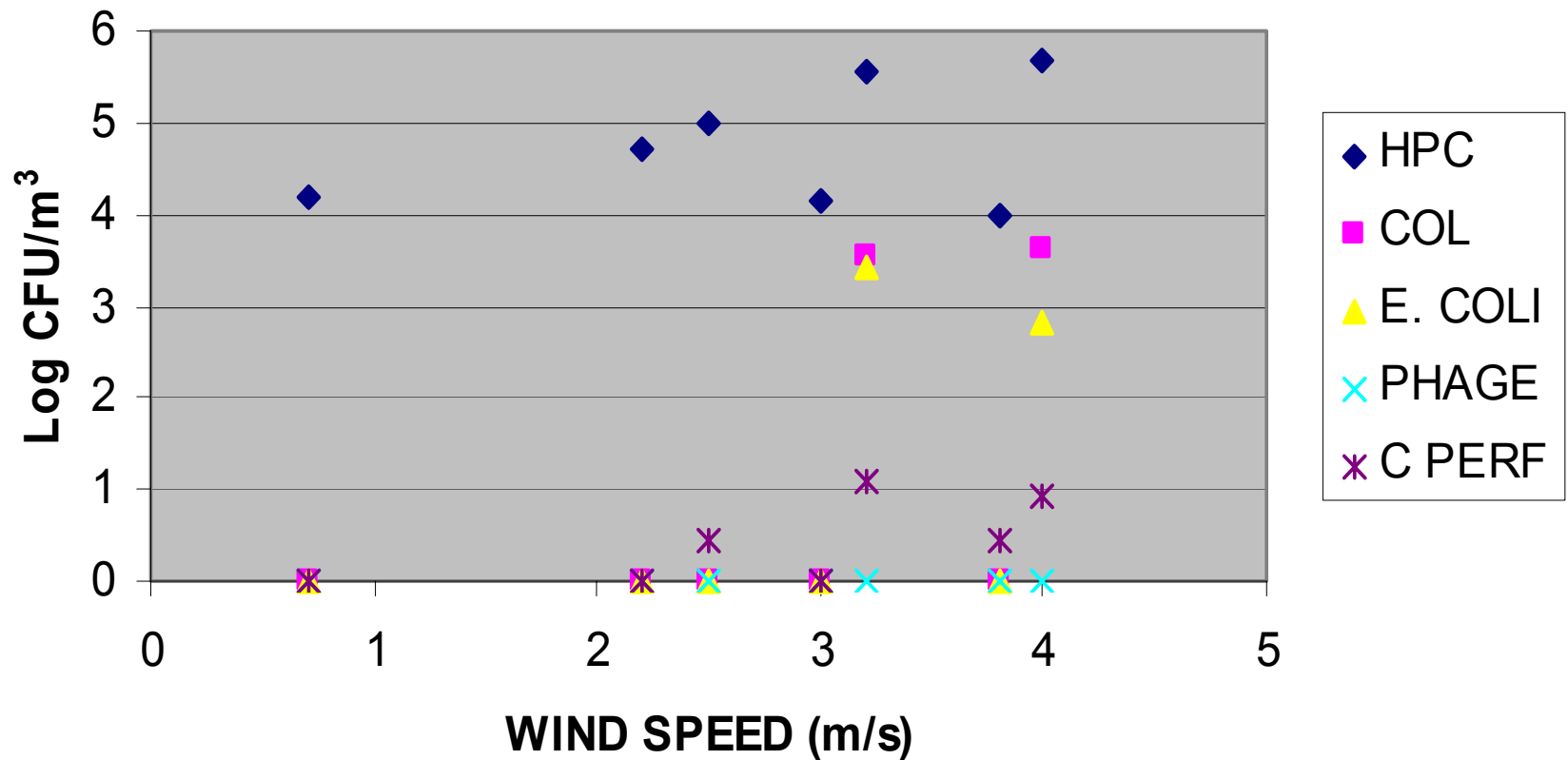
# Example of Research Data

## LAUGHLIN, NV: MICROBES VS RELATIVE HUMIDITY



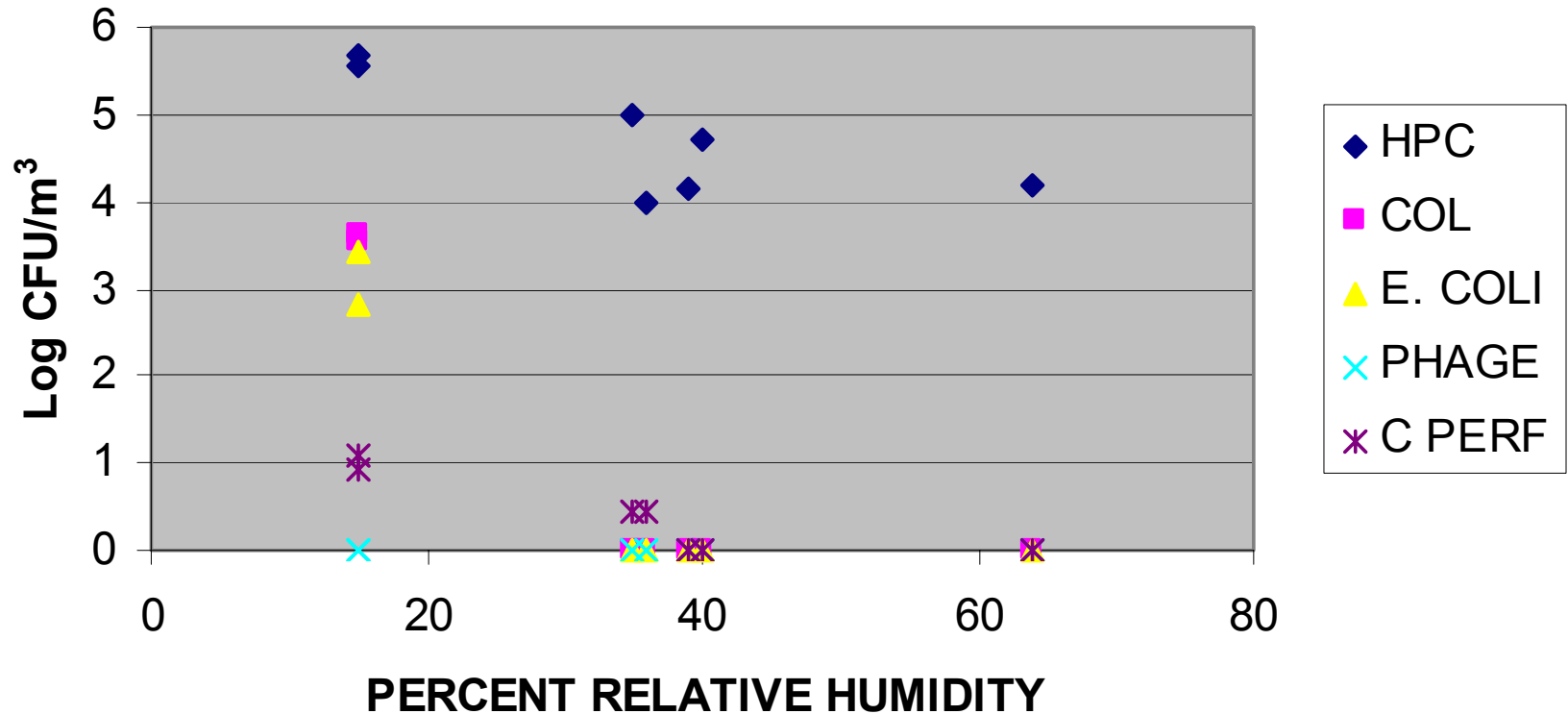
# Example of Research Data

## SOLANO, CA: MICROBES VS WIND SPEED



# Example of Research Data

**SOLANO, CA: MICROBES VS REL HUMIDITY**



# RESULTS

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- **Bacteria counts from tractor operation (no biosolids) 10,000/ cubic meter of air**
- **Coliform bacteria (indicators not pathogens) found occasionally**
- ***E. coli* found occasionally**
- ***Salmonella* not found**
- **Phage not found**
- ***Staphylococcus aureus* not found**
- **Low concentration *Clostridium perfringens* found once during application**

# DISCUSSION

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- **Dust responsible for HPC as well as biosolids**
- **No known enteric pathogens detected in the study**
- **Low concentrations of indicator organisms found (coliforms)**
- **Low windspeed reduces transport**
- **High temperatures reduces organism viability**
- **Low humidity reduces organism viability**

# CONCLUSIONS

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## FACT:

**No human enteric pathogens detected in bioaerosols.**

## FICTION:

**That pathogens are omnipresent from land application of biosolids.**

# THE *STAPHYLOCOCCUS* STORY: FACTS

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## *Staphylococcus aureus*

- **Gram positive coccus**
- **Commonly found within nose of healthy people**
- **Can result in minor or major skin infections**

# THE *STAPHYLOCOCCUS* STORY: ALLEGATIONS

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- *Staphylococcus aureus* is found in biosolids
- *Staphylococcus aureus* from biosolids results in adverse public health affects
- *Staphylococcus aureus* from land applied biosolids has resulted in deaths



# THE *STAPHYLOCOCCUS* STORY: FACTS

## Research at The University of Arizona:

- **Research conducted in 2002**
- ***Staphylococcus aureus* detected in raw sewage**
- ***Staphylococcus aureus* was not detected in bioaerosols from land applied biosolids (53 samples)**
- ***Staphylococcus aureus* was not detected in treated biosolids (21 different samples)**

# THE *STAPHYLOCOCCUS* STORY: FACTS

## Research Findings at The University of Arizona

### Sample

### Location

### Result

**Mesophilic anaerobic digestion  
(Class B)**

**Arizona**

***Staphylococcus aureus* not  
detected**

**Mesophilic anaerobic digestion  
(Class B)**

**East Coast  
Site 1**

***Staphylococcus aureus* not  
detected**

**Anaerobic digestion, lime  
treated (Class B)**

**East Coast  
Site 1**

***Staphylococcus aureus* not  
detected**

**Thermophilic aerobic digestion  
(Class A)**

**East Coast  
Site 2**

***Staphylococcus aureus* not  
detected**

**Bioaerosol**

**Arizona**

***Staphylococcus aureus* not  
detected**

**Bioaerosol**

**California**

***Staphylococcus aureus* not  
detected**

**Bioaerosol**

**Solano County**

***Staphylococcus aureus* not  
detected**

**Unamended soil**

**Arizona**

***Staphylococcus aureus* not**

**Soil amended with biosolids**

**Arizona**

**detected**

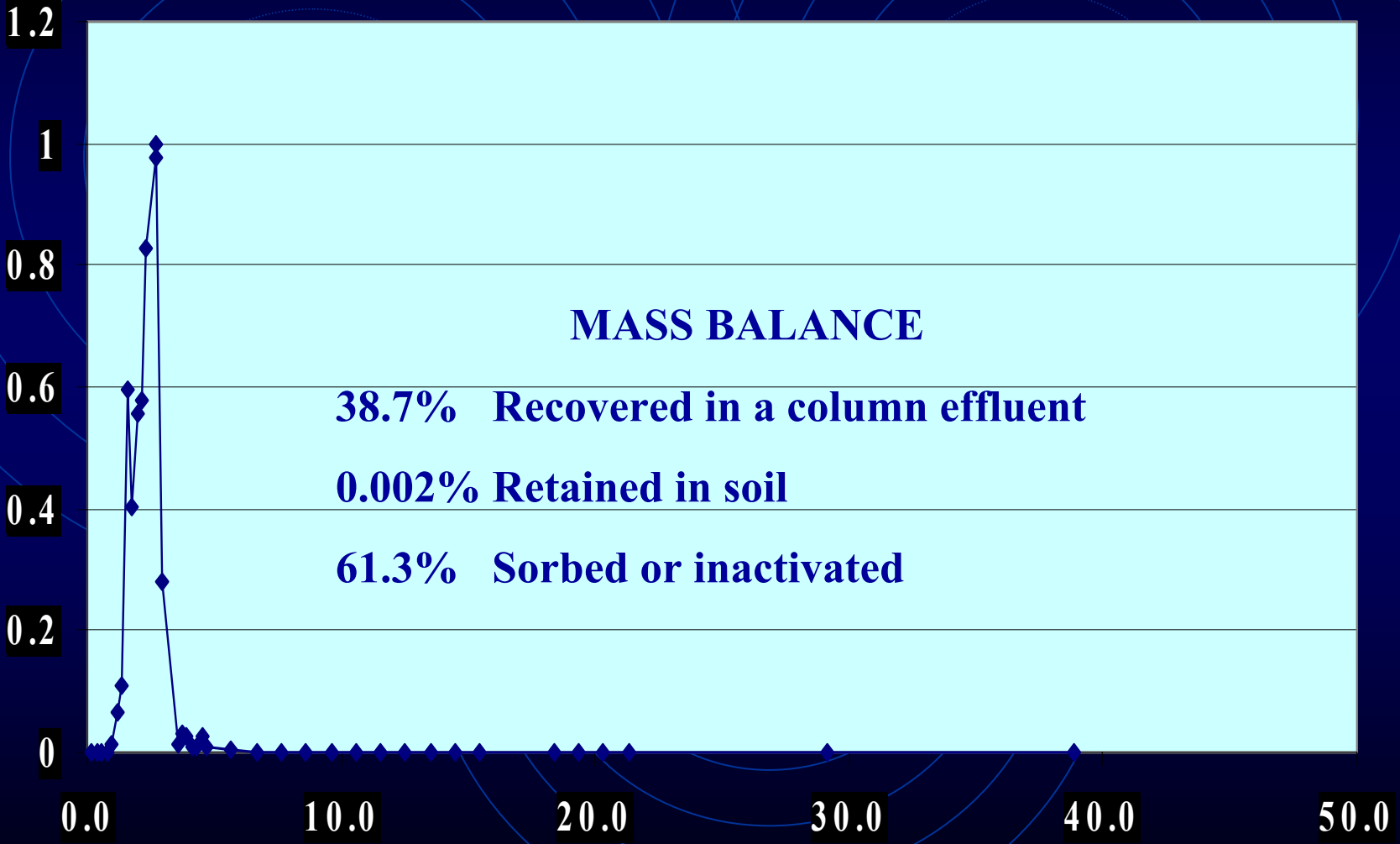
# FATE AND TRANSPORT OF PATHOGENS FROM BIOSOLIDS

- **Can pathogens from biosolids contaminate groundwater via transport through soil and vadose zone?**
- **Does the presence of biosolids affect transport of virus?**
- **Most likely candidate for groundwater contamination: *virus***

# UNIVERSITY OF ARIZONA CURRENT TRANSPORT STUDIES

- **Alexandra Chetochine—Studying for M.S. degree**
- **Column studies filled with Vinton sand**
- **Saturated flow**
- **Transport of pure cultures of phage studied, and phage from within biosolid**

# First Experiment: MS2 Phage Transport When Seeded in Groundwater



**MASS BALANCE**

**38.7% Recovered in a column effluent**

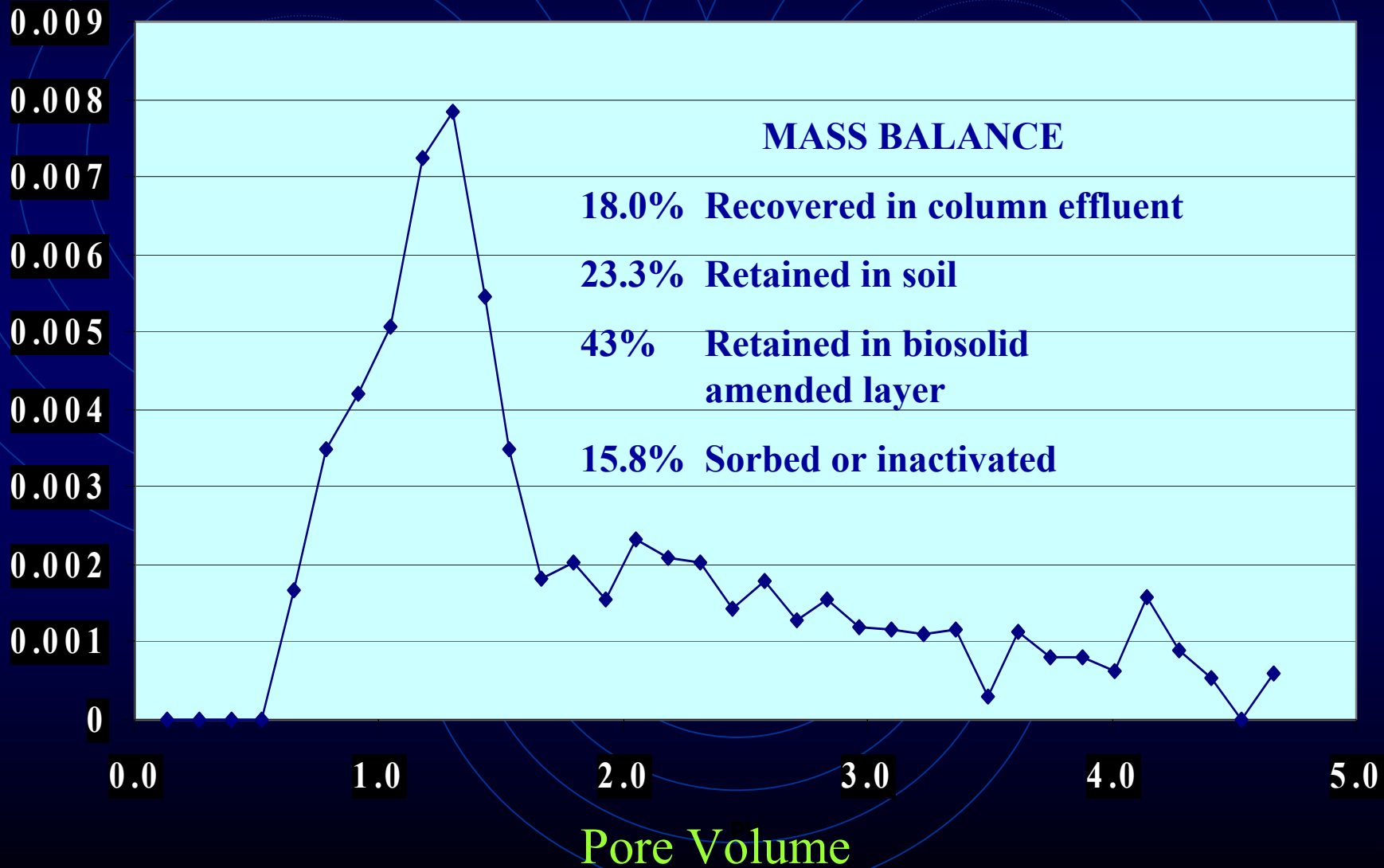
**0.002% Retained in soil**

**61.3% Sorbed or inactivated**

$C/C_0$

Pore Volume

# First Experiment: Biosolid Amended Soil MS2 Transport



# FATE AND TRANSPORT—DISCUSSION

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- **Transport of phage from land applied biosolids less than from phage in pure culture**
- **Contamination of groundwater from phage unlikely**
- **U of A annual monitoring of groundwater from wells near land applied biosolids negative (1985—Present)**

# LAND APPLICATION OF BIOSOLIDS

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- **Two off-site potential threats to the community:**
  - **bioaerosols**
  - **contamination of groundwater**
- **NSF Water Quality Center studying both areas**



# LAND APPLICATION OF BIOSOLIDS

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**Two areas of concern:**

- **Odor**
- **Local biosolids**

# SUMMARY

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- **NAS Report balanced**
- **NAS Report points out relevant needed areas of research**
- **Science should drive regulations, not public opinion**