

**USEPA Part 503 Regulations:**  
**Using Historical Developments as a**  
**Guide to Address Future Rulemaking**

**Presented**

**at**

**The MWRDGC Lue-Hing Research and**  
**Development Complex**

**Stickney, Illinois**

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**by**

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# Management Options in Use ~ 1960s > 1972

## Pre-Clean Water Act

- **Lagooning – Storage <**
  - a. **IL**
  - b. **Chicago: ~50, ~ 400 ac., 1.75 BG**
- **Incineration =**
- **Landfilling >**
- **Ocean Disposal\***
- **Land Application >**
- **Surface Disposal = < Other**

**\*Storm Clouds Already on the Horizon for Ocean Disposal**

# The Clean Water Act of October 1972

## And Amendments – 1977, 1987

- **The Industry's New Focus**
- **Go for Construction Grants Funding!!!**
- **Plant Expansion →**
- **Infrastructure Improvement →**
- **CSO/Flood Control Systems (TARP) →**
- **Biosolids Management →**
- **Land Application Systems →**

**The July 9-13, 1973 Conference**

**at**

**The University of Illinois, Urbana Champaign**

**“Recycling Municipal Sludges and Effluents on  
Land”**

**A Research Needs Workshop**

**~ 120 Participants**

**A Turning Point**

# **The Genesis and Sponsorship of the 1973 Conference**

**The EPA's Soils Treatment Systems STS – Concept**

**Used by Campbell's Soups, Anheuser Busch**

**“Recycling Municipal Sludges and Effluents on Land”**

**(A Sub-Committee of 19)**

- A Major Initiative of – EPA, USDA/CSRS, LG-Universities**
- To Learn More About Biosolids**
- To Provide Guidance to the Industry**
- Ten Workshop Groups – To Report on Research Needs**

**(Edu.>Pub. Health>Sci.>Eng.>Agron.> Mgmt.> Econ.>Politics)**

# Some of the Issues Raised

- **Metals Take Center Stage – The Golden Age of Metals**
- **The Metals Content of Biosolids & Their Potential Toxicities**
- **The Big Ten – As, Cd, Cr, Cu, Pb, Hg, Mo, Ni, Se, Zn,**
- **Impact of Biosolids Applied Metals on Crops/Food Chain**
- **Chumbley's Zinc Equivalent Concept found an Audience**
- **Chaney's Zinc/Cadmium Ratio – Proposal**
- **Chaney's Limit on Applied Metals Approach – Proposal**
- **Need for Improved Analytical Methodologies**

# Some of the Issues Raised

- **Cation Exchange Capacity (CEC) Controls Metals Uptake**
- **The Need to Disinfect/Pasteurize for Viruses, Pathogens**
- **The Survival of Pathogens in Biosolids Amended Soils**
- **PCBs – Uptake by Crops**
- **Need for Large Scale Demonstration Projects**
- **Nutrient Control to Ground Water**
- **Risk Concept – Biosolids >Soil >Plant >Animals > Humans**

# The W-170 Group: 1970s & 1980s

## USDA/CSRS Regional Committees & National Research Program

- **1972**
  - a. **NC-118, Util. and Disp. of Mun. Ind. & Ag. Waste on Land**
  - b. **W-124, Soil as a Waste Treatment System**
- **1984**
  - c. **W-170, Chem. & Bioavailability of Waste Constituents in Soils**
- **Researchers from 13 LG-Universities – 25+**
- **Labs. USDA 2, EPA 1,**
- **POTW, 1 – (Chicago), TVA**

## The W-170s National Research Program

# Other Important Conferences and Reports

- **CAST Report** ----- 1976\*
- **CAST Report** ----- 1980\*
- **UC Riverside/EPA – in Denver, CO** ----- 1983\*
- **UC Riverside/Ohio State in – Las Vegas Nevada---**1985\*
- **U. Min in Bloomington, MN** ----- 1993\*
- **U. FL in Orlando** ----- 2004

**\*Had Direct Impact on the Content of the Part 503**

# **The Pre-503 Contributing Groups**

**The Major Conference Proceedings & Reports**

**The Federal & State Agencies – EPA , USDA, ARS,  
CSRS**

**The W – 170 Group**

**The Universities, Mostly the LGUs**

**CAST – Council for Agricultural Science & Technology**

**AMSA – (NACWA), POTWs**

**The Environmental Engineering/Science Consultants**

**The Environmental Activists Groups**

# Amendments to the Clean Water Act

## Rule 40 CFR Part 257 – Issued 1979

### To Phase Out “Open Dumping”

- Identified Acceptable SW Disposal Practices including -
- **Dedicated Land Application & Landfilling**
- **Limit Annual & Cumulative Amounts of Cd Applied to Soils**
- **Require Maintenance of pH at 6.5 or Above**
- **Incorporate Material with PCB >10.0 mg/kg to Protect Cattle**
- **Imposed Pathogen Reduction Requirements**
- **Defined Op. Conditions to Achieve – PSRP & PFR**

# NACWA/Chicago Status Meeting with EPA

**December 1988**

**Yes !! – The Rule is Coming Out – Content not Happy Reading**

## The Strategy:

- **Review and Comments by All Major POTWs**
- **Reviews Must be Technically Sound**
- **Reviews Must Help Create Superior Final Rule**
- **Reviews Must Not be Simply Whining Pieces**
- **Review by a Credible and Nationally Respected Third Party Group\***

**\*This task presented the most serious challenge**

# The Draft Part 503 Rule

## Stakeholders Affected by the Draft Rule

**No Group Came Away Really Happy with the Draft!!**

- **The POTWs – NACWA Members**
  - a. the land appliers**
  - b. the incineration agencies**
  - c. the ocean disposers\***
  - d. the land fillers**
  - e. the surface disposers**
- **The States**
- **The Environmental Activists Groups**

**\*The Death Nell had already sounded for Ocean Disposal for sunset 12/31/91.**

# Issues of Concern to POTWs

## Land Appliers

- **Rule Overly Stringent**
- **Phytotoxicity as a Regulatory Parameter – Cd, Cr, Cu, Ni, Zn**
- **Used unrealistic Conservative Assumptions**
- **Will Discourage Beneficial Use**
- **Policy Decisions Disguised as Science**

## Incineration Agencies

- **Level of Air Emissions**
- **Continuous Monitoring – THC etc.**

# **The Need for a National Peer Review of the Draft Part 503**

**The Groundwork to Recruit The Major Peer Players**

**CLH/NACWA Meeting with W-170 in Las Vegas January 1989**

**The Major Players**

- **The W-170 Group**
- **AMSA-NACWA**
- **Chicago**
- **Expertise Needed Outside of The W-170 Group – Air Pollution, Risk Assessment, Groundwater Pollution, Radiological Health**
- **EPA Also Request W-170 Peer Review in 503 Preamble**

**W-170 Agrees to Participate in the Review Pro Bono**

# Funding The W-170 Group and Outside Expertise

## The Players

- **AMSA/NACWA/Chicago Connection – The NACWA Board \$\$**
- **AMSA/NACWA Funded All Travel Expenses for W-170 + Others**
- **Chicago Funded Consulting Costs for All Invited Non W-170 Experts**
- **EPA Joined as Non Financial Co-Sponsor – Access to EPA's Files**
- **Few Other Participants – NRDC – Funded Themselves**

**Peer Review Group Total = 35 +**

# **Some Critical Expertise Not Available Within the W-170 Group**

- **Air Pollution**
- **Risk Assessment**
- **Groundwater Pollution**
- **Radiological Health**

# The Peer Review Process

- **Elect Co-Chairs and Section Leaders**
- **Develop Consensus Review Report**
- **No Minority Report**
- **Logistics/Funding – NACWA, Others, Chicago**
- **Meetings: - 1989**
  - a. April – DC, compile & refine draft ~ 40+**
  - b. July – Hilton Head, develop final draft ~ 16**
  - c. July – Chicago, finalize draft, print & distribute ~ 7**

**Review Completed in Chicago ~ July 24, and filed ~ July 27, 1989.**

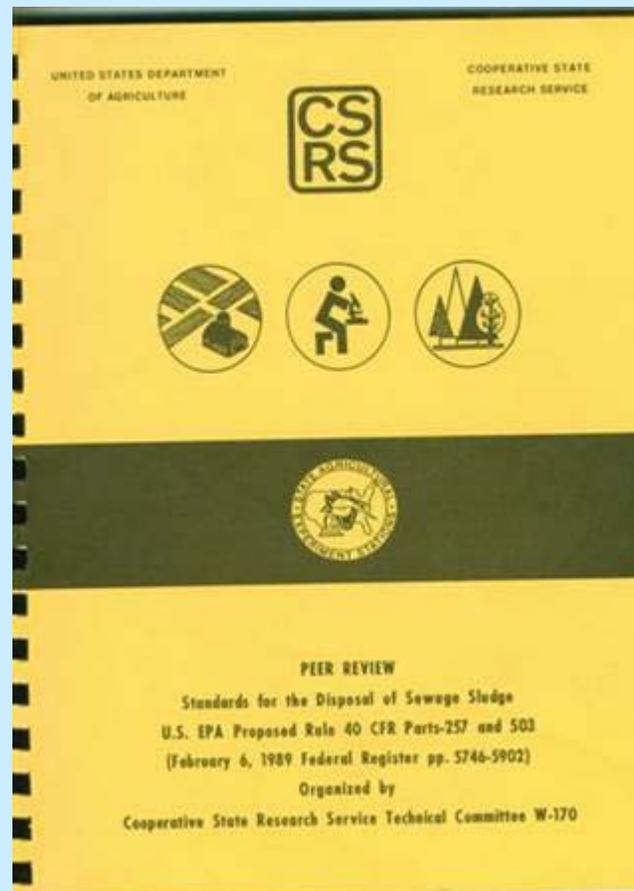
# Some Major Findings of the Peer Review

- The MEI an Unrealistic Human Target
- Failure to Separate Policy and Science
- Ignoring Aggregate Human Health Effects in Risk Assessment
- Poor Selection of Run-off & Groundwater Models
- Use of 98<sup>th</sup> Percentile Contaminant Value for Non – Ag. Land
- Biased Screening & Selection of Data – Used Pot Studies vs. Field
- Assumed Background Contaminant Levels = Zero
- Improper Use of Phytotoxicity as a Regulatory Parameter

**A SUPERIOR FINAL PRODUCT RESULTED !!!**

# The National Peer Review Report

Probably the Most Influential of all  
the Part 503 Reviews



# Some of Chicago's Contributions – Science/Communications

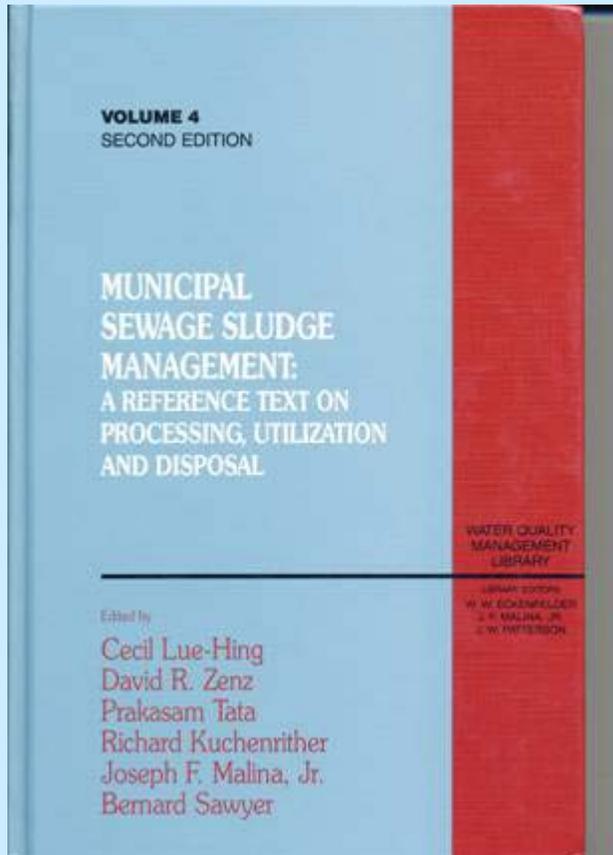
**The Fulton County Prairie Plan ~16,000 ac. – Dr. Tom Hinesley  
1979\***

- **Soil CEC has Minor Effect on Plant Metal Uptake on Amended Soils\***
- **Plant Metal Uptake After the First 2-3 Years Remains Constant. Later Confirmed by Prof. Richard Corey, UWM and Others\***
- **Metals are Restricted to the Surface Horizons of Amended Soils\***
- **Long Term Behavior of Metals Following Amendment**

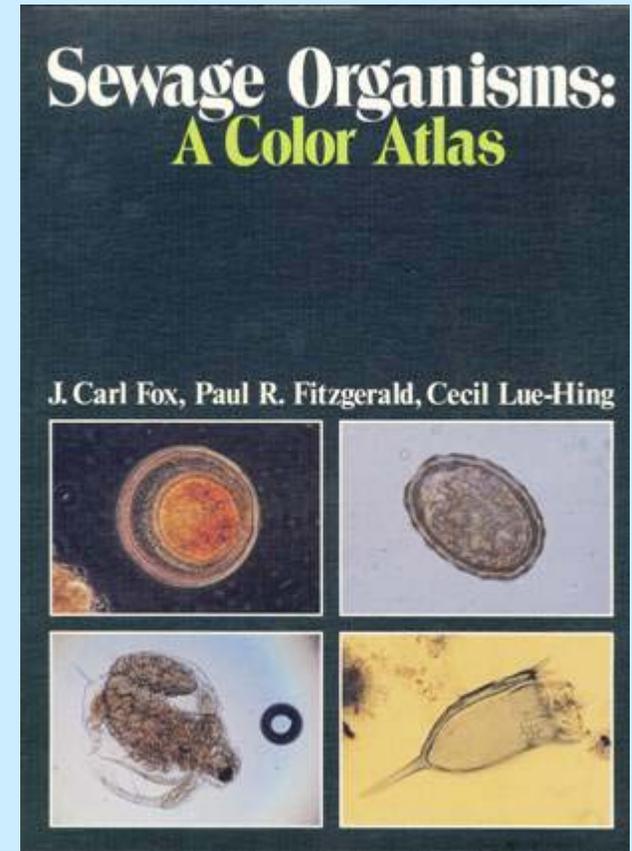
**Cyanide Content of Wastewater Streams & Biosolids Sewage  
Organisms: A Color Atlas – 1981, (UIUC Vet. Med.)**

**Municipal Sewage Sludge Mgmt: Processing Utilization &  
Disposal**

# Some of Chicago's Contributions



**Municipal Sewage Sludge Management**



**Sewage Organisms**

# Some of Chicago's Contributions

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- **MWRD prepared comprehensive comments on proposed rule and provided leadership and staff to coordinate and prepare comprehensive comments of AMSA sludge management committee.**
- **August 1989 comment period on proposed rule closed with EPA convinced that massive overhaul of rule was necessary prior to promulgation.**
- **Among most limiting aspects of original proposed rule were cumulative loading limits on metals (Cu & Zn due to phytotoxicity) and PCBs.**

# Some of Chicago's Contributions

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- **MWRD undertakes cooperative field study with Environment Canada and New Mexico State U. to generate field data for risk of PCB transmission through crop uptake pathways.**
  - **Study conducted at District's Fulton Co. Site**
  - **Used Corn Fertility Plots and St. David Gob Pile**
- **MWRD provides data from long-term biosolids amended field plots at Fulton County site (Corn Fertility Plots and General Application Fields) and from research conducted by Tom Hinesley from U. of Iowa to Peer Review Committee for use in Part 503 revision.**

# Some of Chicago's Contributions

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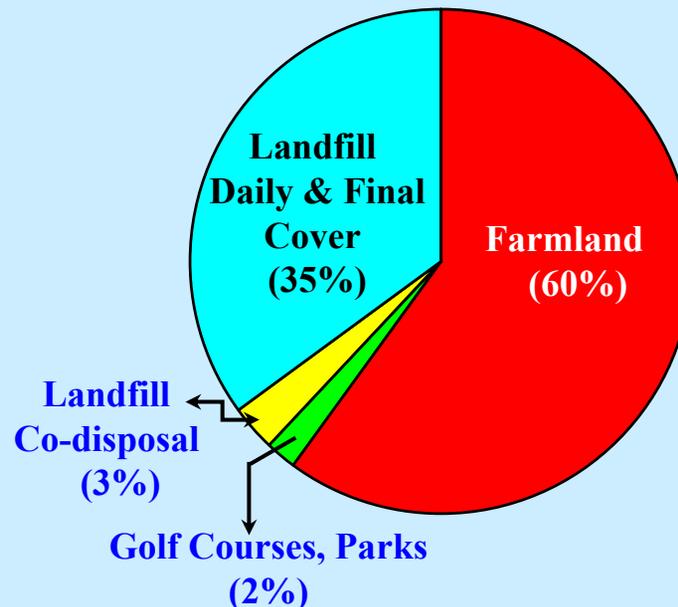
- **MWRD, in collaboration with UC-Riverside, provides technical support to Peer Review Committee on revision of phytotoxicity pathway.**
  - **Conduct exhaustive literature review and analysis of data from high loading rate plots**
  - **Developed new risk assessment algorithm**
  - **Compiled technical support for new pathway algorithm**
- **February 1993 EPA promulgates Part 503. Regulation is restructured including EQ concept, banned organic compounds are deleted, and phytotoxicity pathway is revised.**

# Management Options in Use Today – 2006

## USA

- Land Application ----- ~ 65%
- Incineration ----- ~ 25%
- Landfilling ----- ~ 8%
- Surface Disposal - Other --- ~ 2%

## Chicago



# **Current Status of Biosolids Regulations in The US**

# Current Status

## Round 2 Candidates, Issues and Beyond:

### Chemicals – New & Existing

- Antibiotics & Drugs
- Steroids & Hormones
- Molybdenum – Awaiting final USEPA Action

### Impact on Land Application

### Impact on Incinerator Emissions

### Refined Exposure and Hazard assessment

# Current Status

## Round 2 Candidates, Issues and Beyond:

### Microbiologicals

- Improved Analytical Methodologies
- Possible New Indicator Organisms
- Possible Increased Scrutiny of Class-B
- Impact on Land Application
- Bioaerosols
- Impact on Public Health

# **The NRC Report – 2002**

**Requested by USEPA**

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

**“There is no Documented Scientific Evidence that the Part 503 Has Failed to Protect Public Health.”**

- Prompted the WERF/USEPA Biosolids Summit – 2004**
- CLH One of the 73 Summit Participants**

# The Role of WERF

- **What is WERF?**
- **Age ~ 20 Years**
- **Early Years, Original Budget ~ \$300,000.00**
- **CLH Founding Member of Research Council**
- **CLH – Later Member WERF Board of Directors**
- **Current Status – Alive & Well & Contributing**

# The Role of WERF

- **Early Incineration Research Data on Emissions**
- **The Biosolids Summit in Partial Response to NRC Report**
- **Committed > \$500,000.00 for Biosolids Related Research**
- **The Molybdenum Issue:**

**“A Modified Risk Assessment to Establish Molybdenum Standards for Land Application of Biosolids”**

**EPA Limit = 18 mg/kg; Ceiling Limit = 75 mg/kg;**

**O’Connor Proposed Limit = 40 mg/kg;**

**George O’Connor, (UFL). JEQ.30:1490-1507 (2001)**

# **Lessons Learned From Round 1 of 503 Rule Making**

# Lessons Learned

- **Metal uptake coefficients generated from the studies conducted with pure metal salts or toxic concentrates do not represent metal bioavailability from biosolids.**
- **Information generated from laboratory and greenhouse studies may not be applicable to actual field conditions.**
- **Use of unrealistic assumptions may not be a good approach to determine limits.**
- **Use of multiple default coefficients in a risk model destroys credibility**

# Lessons Learned

- **Limits should be based on good science.**
- **Lack of data may not be a sound basis for deciding “not to regulate”. Limits based on reasonably conservative default values may be a better alternative.**
- **Positive public perception is the key.**

# Cumulative Probability of Worst-Case Exposure to Cadmium Translocated from Sludge Application to the Human Diet

<b>Occurrence</b>	<b>Probability</b>	<b>Probability of all Occurrences at Once</b>	<b>Individuals Affected*</b>
1. The subject is a teenage male	1-15	1-15	15.1 million
2. The subject is a gardener	1-3	1-45	5 million
3. The subject fertilizes his vegetables with sludge	1-20	1-900	251,111
4. The subject eats only vegetables from his garden	1-100	1-90,000	2,511
5. The subject is a vegetarian	1-50	1-4.5 million	50
6. The subject eats from his sludge fertilized garden for 50 years	1-100	1-450 million	0.5
7. The garden is fertilized with high sludge loading rate	1-25	1-11.3 billion	0.002
8. The garden is fertilized with a sludge containing a high			

**\*Based on U.S. population = 226,000,000**

# Most Exposed Individual Incineration of Sewage Sludge Part 503 Regulations

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- **Resides Downwind of Sludge Incinerator (Wind Direction Never Changes)**
- **Exposed to Maximum Ground Level Concentration\***
- **Exposed to Worst-Case Meteorological Conditions (Atlanta, Georgia)**
- **Exposed 24 Hours Per Day**
- **Exposed for 70 Years**
- **Resides Outside (Outside Conc. = Inside Conc.)**
- **Inhales 20 Cubic Meters of Air Per Day**
- **Lungs Retain 100% of All Inhaled Particles**

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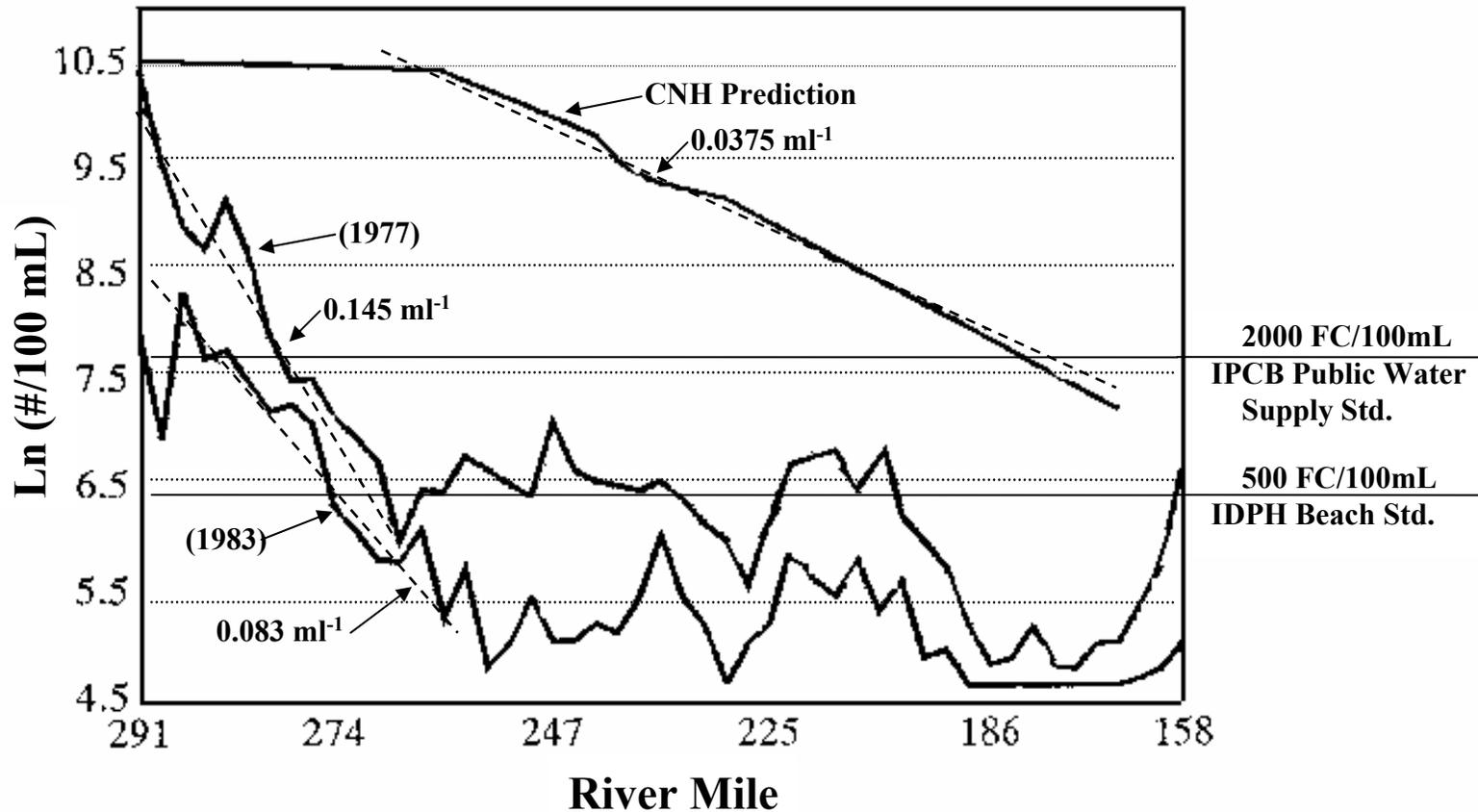
\*Maximum Ground Level Concentration occurs at one meter above ground level; therefore, the MEI must spend 70 years on his or her knees.

# Lessons Learned

## Illinois River Fecal Coliforms

August to October 1977, August to October 1983

Predictions of CNH December 14, 1981



# Lessons Learned

## Fecal Coliform Levels in the Illinois Waterway at Morris, IL Actual Versus Predicted Values 1977 and 1983

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<b>River Mile</b>	<b>Description</b>	<b>Predicted</b>		<b>Actual</b>	
		<b>Haas</b>	<b>Dumelle</b>	<b>1977</b>	<b>1983</b>
<b>265</b>	<b>Ups tream</b>			<b>625</b>	<b>432</b>
<b>263</b>	<b>Morris</b>	<b>28,700</b>	<b>4,100</b>	<b>612</b>	<b>187</b>
<b>261.6</b>	<b>Downs tream</b>			<b>861</b>	<b>297</b>

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Notes: Actual values are geometric means of four values expressed as colony forming units per 100 mL. Predicted values are estimated based on modeling runs and modifying calculations.

# What's on the Horizon

## Under Consideration

- **Phosphorus – Some States (IL) revising load limits to soils.**
- **Molybdenum – Still awaiting USEPA Decision**
- **USEPA's Decision on – Round 2 Candidates & Beyond**
  - **Chemical**
  - **Microbiological**
  - **Policy Changes**

# What's on the Horizon

## In the near future

- **Endocrine disruptors**
- **Antibiotics & antibiotic resistant microbes**
- **New concern – chemicals/nano-particles/prions**
- **Air emissions – greenhouse gases**
- **Air Quality**

# Take Home Message

- Regulations will not be well received if the Science on which they are based is not defensible.
- **The USEPA does not always have the best data.**
- **The USEPA does not always make reasonable assumptions.**
- **The USEPA will respond to credible data.**
- Stakeholders should be prepared to argue against bad regulations particularly with superior data.