

# **Recent Developments in Biosolids Health Effects Analysis**

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# **This Presentation Will Discuss**

- NAS/NRC Report
- Pertinent Scientific Literature
- Lewis/Harrison/Shields Health Surveys
- Measurement of Ammonia Emission Rates
- PBDE Risk Assessment

PREPUBLICATION COPY

**BIOSOLIDS APPLIED TO LAND:  
ADVANCING STANDARDS AND PRACTICES**

Committee on Toxicants and Pathogens in Biosolids Applied to Land

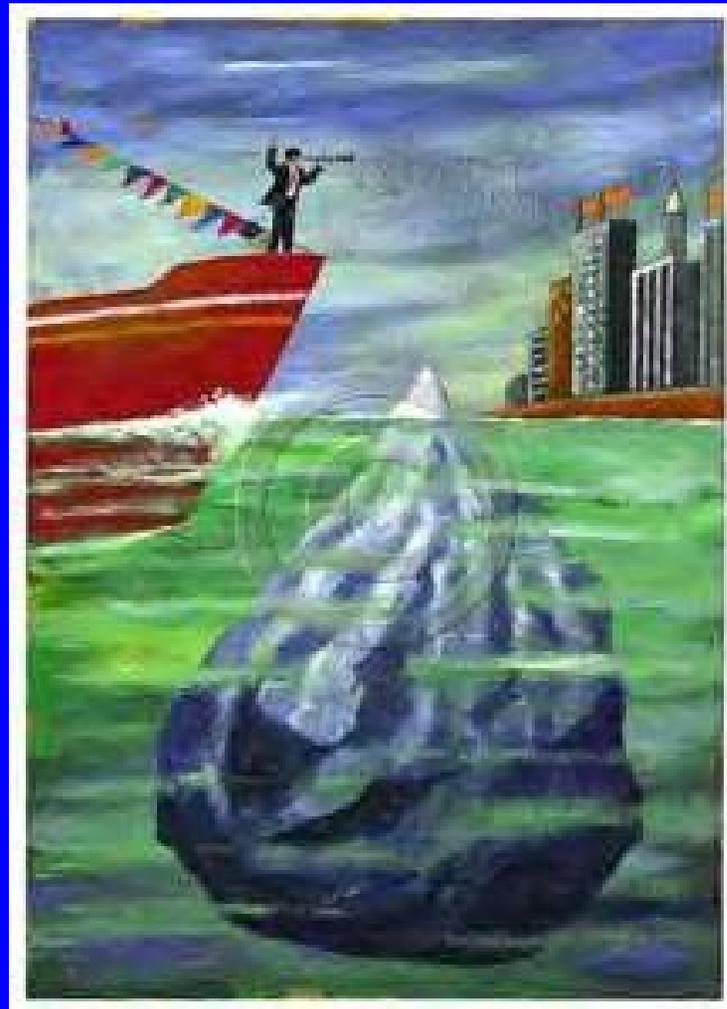
Board on Environmental Studies and Toxicology

Division on Earth and Life Studies

National Research Council

**National Academy Press  
Washington, DC**

# NAS Meets the Biosolids Database



# NAS/NRC Report

- Limited time and resources
- Lack of balance on panel
- No literature search and review
- Relied primarily on published data
- Performed no risk or health assessments
- Concluded more research needed to reduce uncertainty

# Scientific Literature



- Peer reviewed articles
- Treatises
- Conferences
- Government documents
- Unpublished reports
- Raw data
- Researcher interviews

# Many Data Gaps Can Be Filled From Literature

- EPA 1995 Pathogen Risk Assessment Methodology for Municipal Sewage Sludge Landfilling and Surface Disposal
- WEAO 2001 Fate and Significance of Selected Contaminants in Sewage Sludge Biosolids Applied to Agricultural Land
- Cal WRCB 2001 Statewide EIR for Biosolids Land Application Projects
- Penn State 2002 Agricultural Utilization of Biosolids In Pennsylvania

# Lewis/Harrison/Shields

## Health Surveys



- [www.sludgevictims.net](http://www.sludgevictims.net)
- Harrison database and forthcoming article
- Lewis BMC article

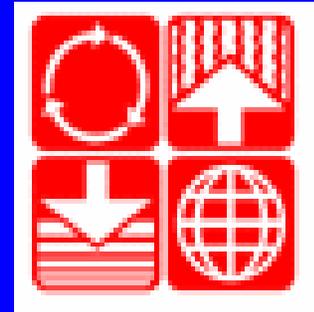
# The Connection

“Right now we are making a great breakthrough. Our database of ‘sludge victims’, the few doctor reports stating that ‘so-and-so illness is related to sludge’, the hard work of scientists like **David Lewis**, sludge activists like **Helene Shields**, university scientists like my director, **Ellen Harrison**, and community people that stick together are making this breakthrough possible.”

Summer Oakes, CWMI

# Leading Questions

- “You or someone in your family did have some health concerns dealing with land-application of biosolids at some point in time, correct?”
- “Do you have any information on people who have experienced illness from the sludge since it has been applied”?



# The Role of the Interviewers

“An interviewer...may be a source of bias – his or her expectations or preferences may influence the answers or the way they are interpreted and recorded. An interviewer who knows what hypothesis the study is testing may tend to get responses that fit in with his or her view of the validity of the hypothesis.” – Abramson & Abramson 1999

# Symptom Lists

- Congestion
- Coughing
- Skin rashes
- Nausea
- Diarrhea
- Fever
- Flu-like symptoms
- Allergies
- Birth defects
- Watery eyes
- Headaches
- Weight loss
- Fatigue
- Ear problems

# Harrison Database and Article

- Database compiled by undergraduate student from phone survey, press reports, internet
- “We conducted investigations into the numerous incidents in which residents living near sites where sewage sludge was applied have reported illness.”
- Class B should be eliminated; testimony calls for elimination of EQ, concerns with other Class A.

# Harrison Database and Article

- “It has not been confirmed by scientific investigation that these persons became ill due to land application of sludges.” (Database, not article)
- In deposition, Harrison could not point to any single case where causation was demonstrated
- Conclusions based on subjective impressions

# Harrison Deposition Testimony

- WERF research is biased
- Qualifications of authors/technical accuracy of an article are irrelevant if peer reviewed
- State health departments are suspect
- Landfilling is safer than beneficial reuse
- Doesn't agree with much of NAS/NRC report



# Lewis BMC-PH Article

- Concludes Class B biosolids cause health effects by action of irritant gases and pathogens
- Rejected for publication in *The Lancet*
- Based on telephone interviews, presumption of *Staph aureus*
- Rewrite of *Marshall* case expert report

# Lewis BMC-PH Article

- No microbiological evidence for *Staph aureus* in biosolids
- Survey unscientific, no controls, recall bias, no risk analysis
- No measurements of chemicals or microorganisms at any of Lewis' sites
- EPA and external peer reviewers comments ignored

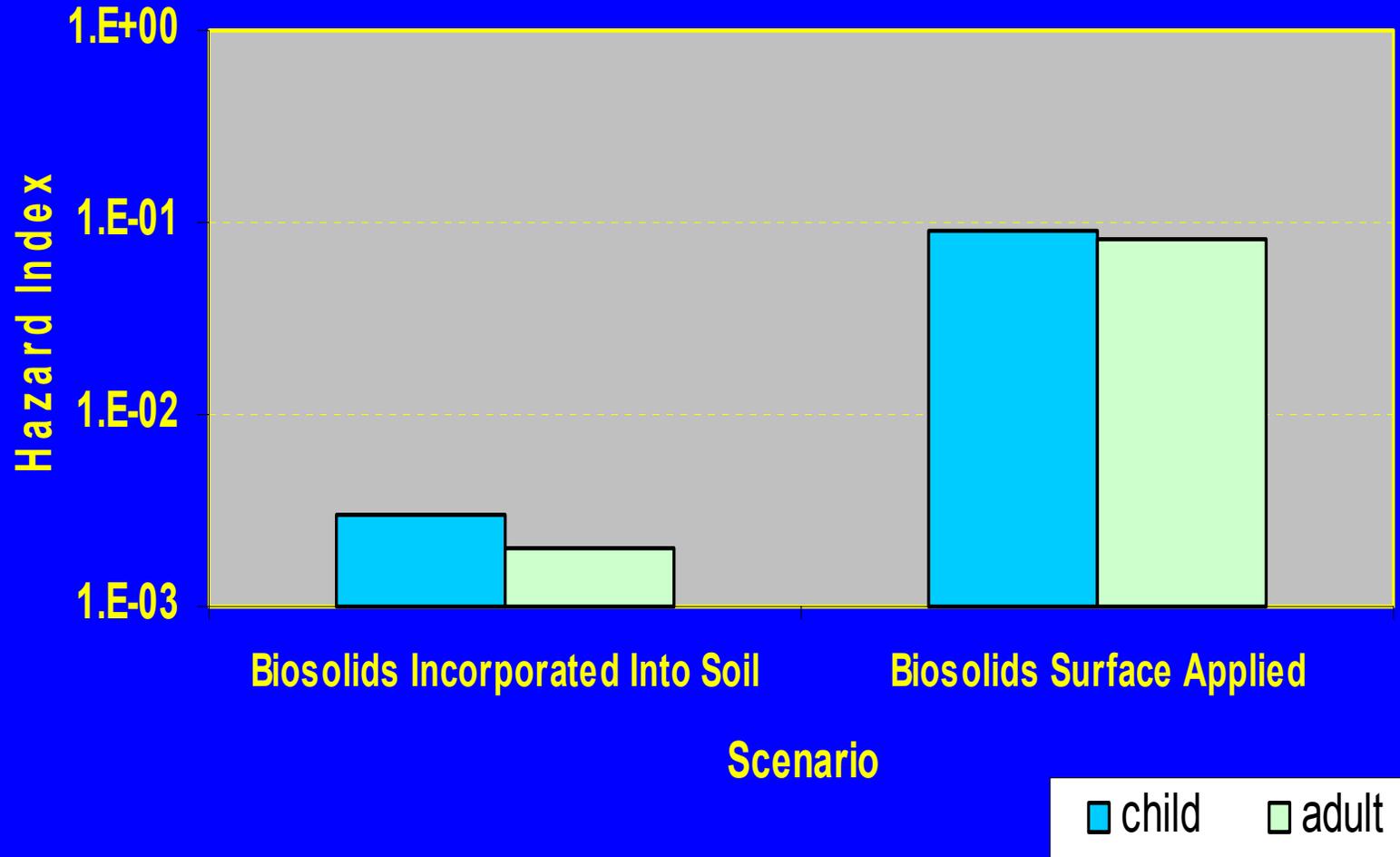
# How To Fill Data Gaps— Emerging Chemicals

- PBDEs - widely used flame retardants
- Hale et al. (2001) found PBDEs in both Class A and B biosolids
- Focused risk assessment using EPA guidance and toxicity information
- In risk assessment, biosolids either surface applied or incorporated to 6 inches at typical agronomic rate

# PBDE Risk Assessment

- Exposure scenarios included direct contact, ingestion of crops, and ingestion of beef
- Hypothetical scenarios included children and adults
- Conservatively assumed no degradation
- Risk assessment resources required about 2 person-weeks

# PBDE Risk Assessment Results



# How To Fill Data Gaps – Ammonia Emissions

- $\text{NH}_3$  is major odorant formed primarily from decomposition of choline and amino acids
- Lime stabilization may cause greater  $\text{NH}_3$
- Lewis assumed 1,000 ppm  $\text{NH}_3$  over field with lime stabilized Class B biosolids
- EPA database has no emission factors for  $\text{NH}_3$  from lime stabilized Class B biosolids

# Ammonia Emission Tests

- Nine samples from 3 lime stabilized biosolids (pH 8.22-12.24)
- Flux chambers (ASTM D5116) with loading of 26.5 wet tons/acre or loading of 5.94 kg/m<sup>2</sup>
- NH<sub>3</sub> measured by ion chromatography

# Results of Ammonia Emission Tests

- 7/9 samples had detectable emissions (DL 0.04-0.11  g/g-hr)
- Highest levels peaked at 4 hours; exponentially declined over 24 hours
- Average at 24 hours was 2.10-1.77  g/g-hr or about 12.7 mg/m<sup>2</sup>-hr

# Significance of Ammonia Tests

- Measured  $\text{NH}_3$  emissions, screening model → air concentration of 1  $\mu\text{g}/\text{m}^3$
- Henry/Hoffnagle model → air concentration of 2.8  $\mu\text{g}/\text{m}^3$
- Lewis model → concentration of 260,000  $\mu\text{g}/\text{m}^3$
- Ambient measurements at application sites < 350  $\mu\text{g}/\text{m}^3$
- EPA chronic RfC = 100  $\mu\text{g}/\text{m}^3$ ,  
8-hour TLV = 17,500  $\mu\text{g}/\text{m}^3$

# Conclusions

- NAS/NRC report reflects lack of awareness more than lack of knowledge
- Lewis/Harrison/Shields efforts are crudely disguised advocacy, not attempts at filling data gaps
- Many data gaps can be filled with literature information, focused risk assessments and research