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*Collaboration. Innovation. Results.*

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### UPDATE ON WERF BIOSOLIDS RESEARCH

RBC Meeting at WEFTEC

Chicago, IL

October 22, 2008

#### Recently Published Research Reports

*An Economic Framework for Evaluating the Benefits & Costs of Biosolids Management Options* (04-CTS-2)

- Guidance on how to conduct benefit-cost analysis (BCA), including documentation and communication
- Tools, resource guides and templates to conduct BCAs for biosolids options
- Case studies
- Triple bottom line approach – directly applicable carbon footprint analysis

*Biosolids Processing Modifications for Cake Odor Reduction* (03-CTS-9T)

- Confirmed odor sampling methods
- Confirmed correlation between TVOSC and odors
- Added to understanding of the causes of biosolids odors
- Showed that biosolids odors can be reduced at some WWTPs with post-digestion aluminum or iron addition
- Provided new insights on effectiveness of digestion and dewatering processes

*Evaluation of Bacterial Pathogen and Indicator Densities after Dewatering of Anaerobically Digested Biosolids* [Reactivation/Regrowth] (04-CTS-3T)

- Increases in FC and *E. coli* density can occur after dewatering of anaerobically digested biosolids
- More prevalent with centrifuge dewatering compared to belt filter press dewatering (29/33 sites).
- Appears to be due to reactivation of non-culturable organisms, although mechanisms such as dispersal not ruled out.
- Additional growth of FC and *E. coli* can occur during cake storage (regrowth). Regrowth can occur without reactivation
- Bacterial pathogens in sludges entering digestion are generally low in numbers.
- ***For Class A and B thermophilic processes, increases in Salmonella after dewatering were not measured.***
- No confirmed positive results for other bacterial pathogens, although methods are not well developed for biosolids so reliability not well established
- Regrowth of *Salmonella* was observed Class B mesophilic processes.

*Protocol for the Timely Investigation of Reported Health Incidents Associated with Biosolids Applied to Land (06-HHE-5PP)*

- Top ranked priority from Biosolids Research Summit; uses Public Partnering approach
- Surveyed local, state and federal public health and biosolids officials to evaluate interest/capacity to implement health investigations
- Evaluated design strategies for investigation of health concerns reported by neighbors of land application sites
- Applicable to all soil amendments, including commercial fertilizers and animal manures
- Investigation Guide
  - Health questionnaire (local or state health department)
  - Site identification (permitting authority)
  - Biosolids generator questionnaire (wastewater utility)
  - Biosolids applier questionnaire (land applier)
  - Report of on-site inspection (investigation team)
- Draft protocol published January 2008
- Most likely users are local and state health agencies
- Proposals for Phase II field testing have been received; will get underway later this year

*State of the Science Report: Energy and Resource Recovery from Sludge (OWSO3R07)*

- Assessment of international practices
- Technical, capital cost and O&M cost information for numerous technologies in various stages of development
- Uses “triple bottom line” approach to look at social, economic and environmental considerations
- Effect of currently used treatment processes on potential for energy/resource recovery
- Market and regulatory drivers
- Feasibility – including cost, operability and sustainability
- Energy Recovery Technologies
  - Sludge-to-biogas (digestion/methane)
  - Sludge-to-syngas (pyrolysis/gasification)
  - Sludge-to-oil (pyrolysis/hydrothermal treatment)
  - Sludge-to-liquid (alternative to incineration w/heat recovery)
- Resource Recovery Technologies
  - Phosphorus/nitrogen/volatile acids
  - Building materials, e.g. aggregates, brick, slag, etc.

**Ongoing Projects**

*Fate of Estrogenic Compounds During Municipal Sludge Stabilization and Dewatering*

- Baseline information concerning the identity, concentration, characteristics, temporal/seasonal variations and potency of estrogenic compounds in biosolids during treatment processes
- Detailed examination of the impact of various sludge treatment and handling processes on the estrogenic compounds and the overall estrogenic activity
- Targeted full-scale monitoring and pilot/ bench-scale studies
- Continue to look at estrogenicity plus other microconstituents
- Additional digestion studies, including sequential anaerobic-aerobic
- Other treatment processes/techniques: composting, lime stabilization, polymer addition
- Land application studies: transport, transformation and fate
- Information needed to assess any exposure and risk associated with biosolids

*Evaluation of Best Management Practices for Sustainable Groundwater Protection at Biosolids Land Application Sites*

- Evaluate effectiveness of land application BMPs to mitigate potential risk of groundwater contamination
- Surveys of biosolids and groundwater data in geographically distinct areas
- Review recent improvements in pertinent risk assessment methodologies
- Compare monitoring data with risk assessment predictions
- Present results in technical fact sheets and products targeted to specific stakeholders

*Disinfecting and Stabilizing Biosolids Using E-Beam and Chemical Oxidants*

- Demonstrate disinfection capabilities of high energy E-beam irradiation
- Demonstrate destruction of estrogenic activity in biosolids by the E-beam irradiation
- Demonstrate improved disinfection and stabilization of biosolids when chemical oxidants combine with high-energy E-beam irradiation.
- Evaluate the potential for fecal coliform and *Salmonella* regrowth from E-beam treated + oxidants
- Preliminary cost-benefit analysis

**Research Challenges**

*Applying Advances in Pathogen Risk Assessment to Land Application of Biosolids and Communicating the Results*

- Facilitate use of biosolids pathogens risk assessment methodologies to make them generally available to users at the local, state and national level
- Essential refinements to existing risk assessment methodologies or creating new methodologies
- Development and testing of user-friendly interface that allows data to be readily input
- Siting, design, operational and regulatory applications
- Develop an integral methodology for risk communications methodology to be applied simultaneously starting with problem formulation
- Helps ensure that issues important to stakeholders are addressed
- Research team has been selected; includes both risk assessment and risk communication expertise; work started July, 2008

*Optimization of Wastewater and Solids Operations*

- Goal: Develop and demonstrate economical and environmentally responsible processes that improve wastewater and solids treatment operations efficiencies and cost by at least 20%
- Approach
  - Reduce environmental footprint of WWTFs and solids management practices
  - Facilitate RD&D and breakthroughs of innovative and emerging technologies
  - Explore innovative uses for solids
  - Improve resource recovery across entire facility
  - Minimize and conserve energy use
  - Reduce solids volume
- Ongoing Activities
  - Biotreatment integrating process models and control technology
  - Integrated methods for wastewater treatment plant upgrading

- Processes to reduce activated sludge
- Nitrifying fuel cell for sustainable wastewater treatment
- Greenhouse nitrogen emissions from wastewater treatment
- Test Life Cycle Assessment Manager Energy Recovery (LCAMER) for anaerobic digestion
- Co-digestion organic waste & wastewater solids
- Energy management protocols w/NYSERDA
- Decision support system sustainable energy management
- 2008 Roadmap
  - Toolbox for energy efficiency
  - Demonstration of energy management at subscriber facilities
  - Life-cycle tool for green energy options
  - Best practice case study w/ European experience
  - Optimization best practices database/tool
  - Technology roadmap for WWTP in carbon- constrained world

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