

# **BIOREACTOR LANDFILLS-**

## **A Federal Perspective on Landfill Initiatives**

**ASTSWMO**

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**Scottsdale, AZ**

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**Office of Solid Waste**

# Briefing Purpose

- **Benefits/Concerns of Bioreactors**
- **Update Landfill Managers/Operators on EPA's work on Bioreactor**
- **Show Progress to Date**
- **Discuss Bioreactor strategy for future work**
- **Conclusion**

# **Bioreactor Landfills**

**Municipal solid waste landfills that utilize bulk liquids in an effort to accelerate the degradation of solid waste.**

# EPA Bioreactor Program

## EPA

- **ORD**  
- CRADA

**OPEI**

- XL

- **OAR**

- LMOP

- **OSW**

- RD&D Rule

- State of the Practice (ORD & OSW)

Data analysis

- Post Closure – EFEF

## Strategic Goal

Waste Management, Inc., Louisville, KY

Regulatory Relief for Environmental Excellence

Capture Methane and reduce greenhouse gases

Finalized Rule for States

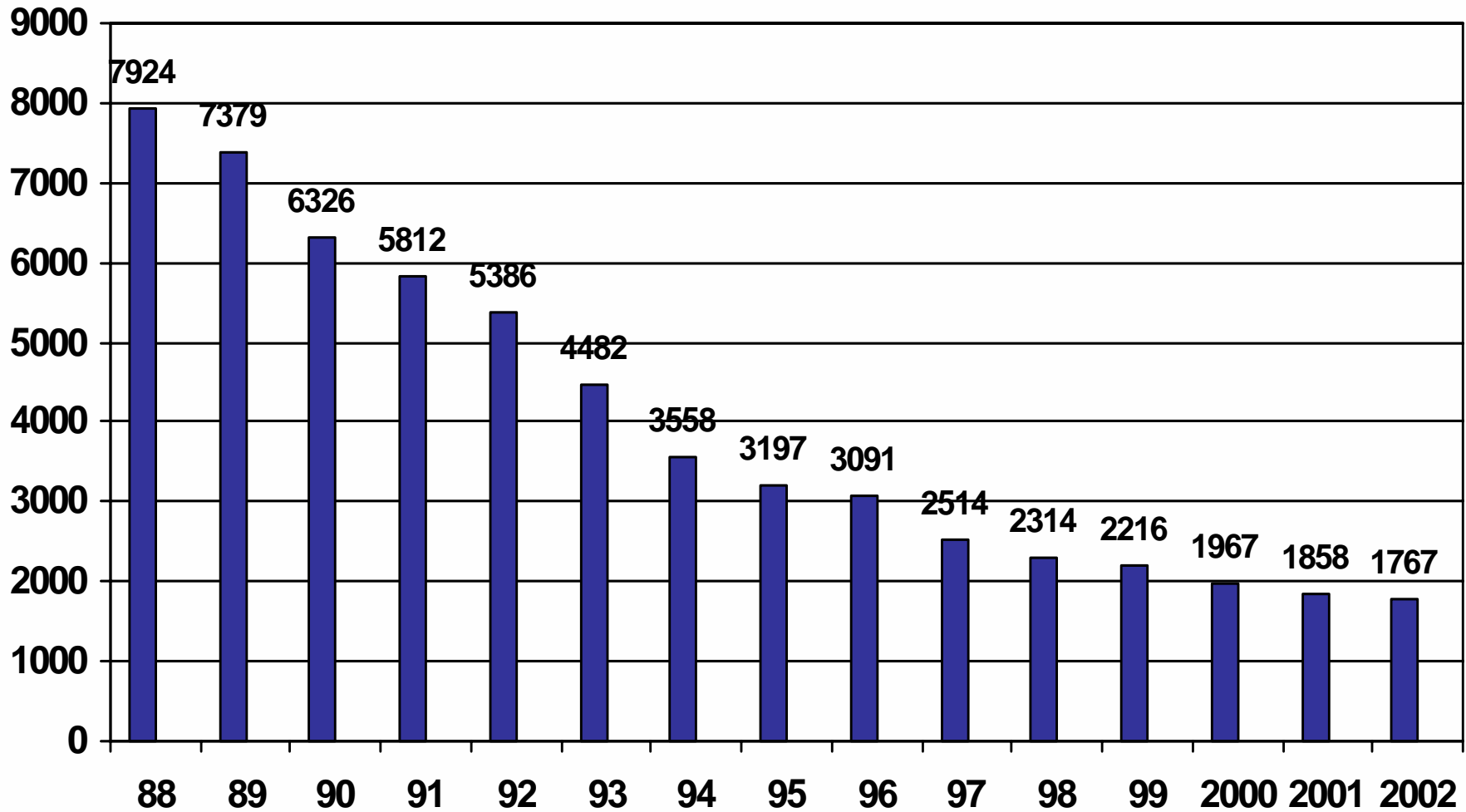
Allow States innovative technology

Determine when done

## External Partners

SWANA, ASTWMO, EREF, ITRC

# Number of Landfills in the U.S.



# **§258- MSWLF Criteria (Subtitle D)- 1991**

**Developed to  
Promote Dry Tomb Landfills with Criteria  
on :**

- Location Restrictions**
- Operating Criteria**
- Design Criteria**
- Ground-water Monitoring**
- Corrective Action**
- Closure**
- Post-closure Care (Perpetual Care)**
- Financial Assurance**

# Existing Regulations

- **Leachate recirculation allowed if the landfill has a composite liner**
- **RD&D**
  - **Flexibility on: cover, run-on, liquids restriction; design criteria, and closure**
  - **Three-year period renewable up to a total of 12 years**

# **Historical View of Bioreactor Landfill Technology**

- US EPA sponsored research as early as 1974**
- Preamble to Subtitle D regulations points to some of the benefits of moisture addition**
- Uncertainty about long-term performance of MSW containment systems hindered full scale operations**



# **Benefits of Bioreactor Landfills**

# **Leachate Treatment and Management**

- **Leachate from active or closed cell reintroduced into bioreactor landfill cells offers an economical disposal method**

# **Increase in MSW Stabilization Rate-**

- **Moisture in the solid waste mass**
  - **Facilitates the movement of nutrients**
  - **Medium for Microbial growth**
  - **Acts as a seed**
- **Thus increasing the rate of decomposition and ultimately the stabilization rate.**
- **Currently EPA does not provide a definition for “stable solid waste”**

# Increase in Landfill Gas Generation Rate

- Increase in the rate of decomposition leads to an increase in the methane and carbon dioxide generation rate
- Potential gas to energy if gas collected efficient



# **Increase in Landfill Capacity (Settlement)**

- **Increase in the settlement rate**
  - **Primary settlement caused by the added weight of the liquids**
  - **Secondary settlement caused by the increase in the rate of organic degradation of organic matter**

# Potential Long-Term Risk Reduction

- **Controlled short term decomposition rather than persistent long term release**

# Economics

- **Increase landfill capacity**
- **Industrial liquids**
- **Potential reduction in post closure care (PCC)**
- **Gas to Energy**

The background of the slide features a pattern of interlocking gears. The gears are rendered in a light blue and white color scheme, with a glowing, ethereal quality. The lighting is soft and diffused, creating a sense of depth and movement. The overall aesthetic is clean and modern, with a focus on geometric shapes and a cool color palette.

# **Concerns About Bioreactor Landfills**

# Operational Concerns

- **Increase in leachate break outs**
- **Increase in odor**
- **Increase in the potential of standing water**
- **Fires in aerobic systems**
- **Record Keeping**

# Design Concerns

- **Slope stability**
  - The increase of moisture content and the concurrent increase in gas generation may result in an increase in pore water pressure
  - High pore water pressure may lead to slope failure
- **Perched liquids within the landfill**
- **Head on the liner**
- **Differential settlement**
- **Watering out of gas collection lines**

# Gas Emission

- **If not collected efficiently, the increase in LFG generation rate may result in an increase surface emissions of**
  - **CH<sub>4</sub>**
  - **CO<sub>2</sub>**
  - **NMOC**

# **Update on Current EPA Work on Bioreactors**

- **ORD – Draft State of the Practice Review (August 2005)**
- **ORD – Monitoring Approaches for Landfill Bioreactors (December 2004)**
- **OSW – Draft Report on Design & Operational Approaches for Bioreactors to be finalized in December 2005**

# **Update on Current EPA Work on Bioreactors- ORD**

- **ORD – Draft State of the Practice Review**
  - **Examine 6 operating bioreactors (including recirculation only)**
  - **Looking at waste degradation, leachate quality, settlement data**
  - **Providing perspective of current bioreactor practices & technical issues**

# **Update on Current EPA Work on Bioreactors- ORD (Con't)**

- **Draft Monitoring Approaches for landfill bioreactors**
- **Suggestions for monitoring parameters for those interested in a bioreactor landfill.**

# **Update on Current EPA Work on Bioreactors- OSW**

- **Draft Report on Design & Operational Approaches for Bioreactors-**
  - **Looking at 7 bioreactors to see original monitoring, design & operational plans**
  - **Looking to see how original plans changed and reasons why**
  - **Report to provide information of current best monitoring, design & operational practices**



# **Progress to Date**

**ORD work with Waste  
Management, Inc. at CRADA  
(Outer Loop Landfill- Louisville,  
Ky)**

**This will be presented by EPA/ORD**

# **Bioreactor Strategy for Future Work**

- **Proceeding to better understand data that is better gathered**
- **Looking at Project XL's & CRADA**
- **Future work**

# Conclusion

- **Operating an MSW landfill as a bioreactor has many advantages and disadvantages**
- **Landfills designed as bioreactors need to be operated as such**
- ***Correctly* designed and operated bioreactor landfills *may* reduce liability and long-term risk to human health and the environment**