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INNOVATIVE RESEARCH FOR A SUSTAINABLE FUTURE

EPA SUSTAINABLE AND HEALTHY COMMUNITIES RESEARCH PROGRAM

Project 3.63 Sustainable Materials Management

The US EPA, in collaboration with states, and communities will enhance sustainable materials management, and the cyclic use of resources to promote and protect community public health, ecosystem services, and economic development.

Summary

The goal of this research effort is to enable communities, states, and the Agency to better protect and enhance human health, well-being and the environment for current and future generations. This is achieved through the minimization of adverse impacts associated with products and materials lifecycle. This research effort further supports the Agency's goals to enhance energy and materials recovery from existing waste streams and improve the effectiveness and efficiency of methods to prevent air, land and water contamination.

The steps needed to take the transition from the current materials management approach to a more sustainable system can be challenging. Decision support for sustainability at the community-level is complex and requires managing the total sum of human activities, including numerous goods and services. The challenge for communities is understanding how each of the overwhelming number of materials in society can best be prioritized and managed to minimize potential impacts.

Given the numerous ways in which materials can cause impact throughout their life cycles, there are many options for reducing their total impacts. Navigating these options will require detailed knowledge at the specific product or material level to understand how to develop viable alternatives that achieve a higher level of sustainability. Therefore, the objective of this project is to develop tools and methods that integrate knowledge being generated in ORD regarding national, state, and community-level environmental and human health impact assessments, design of sustainable materials and processes, beneficial use of materials and wastes, and organic materials management within a life cycle framework that is capable of addressing emerging considerations in decision-making for sustainability at various levels of management (e.g., national, state, and local levels as well as industry).

The project aims to provide tools and information under the following research areas: Tools and methods for Life Cycle Management of Materials (LCMM); Beneficial Use of Materials; Long-term Performance; and Net Zero.

Tools and Methods for LCMM Decision Analytics

Life cycle assessment (LCA) has emerged as an invaluable tool for identifying the impacts associated with the environmental emissions and mass/energy flows of a material, product, or process. LCMM research will integrate next-generation LCA methods being developed throughout ORD's national research programs with approaches for the design of sustainable alternatives within a framework that provides a suite of tools and methods to help states and communities identify the best SMM strategy given the numerous options for impact reduction within a material life cycle. It will provide information on what opportunities and options exist to reduce these impacts.

Beneficial Use of Materials

Beneficially using spent materials and waste streams, and the use of organics energy recovery options provides an opportunity to reduce life cycle impacts and enhance sustainability. Research in this area will develop dynamic data and tools to assist communities in framing sustainability goals to enhance energy generation and materials recovery from existing waste streams or underutilized material flows.

Long-term Performance

Research evaluates current practices for two important waste management challenges facing the nation: (1) used electronics and (2) the long-term performance of materials management systems, particularly for municipal landfills and other solid and hazardous waste management facilities. The data and results generated will provide information that can be immediately used by the Agency to identify areas for the improvement of materials management.

Net Zero
EPA has established a partnership with the U.S. Army to research and advance and operationalize *Net Zero*, which the Army defines as practices and systems that reduce, reuses, and recover waste streams, converting them to resource values with zero solid waste to landfill.

Through application of EPA science and tools, the research will demonstrate three case studies working towards achieving Net Zero waste to landfill through co-digestion and small-scale technologies. The work will not only focus on military installations, but surrounding non-military communities at well. The goal is to facilitate public-private partnerships that advance integrated solutions for sustainable outcomes. To the greatest extent possible, the research will strive to incorporate social and behavioral science, cost-benefit and other economic analyses.

Key Products
Tools and Methods for LCMM Decision Analytics:
- State of the Practice for Construction, Demolition and Recycling
- Updated SEFA (Spreadsheet Environmental Footprint Analysis) Tool System
- Book on Incorporating Sustainability into Design of Products and Processes
- Mesoporous Material Derived from Poultry and Fishery Wastes
- Designing Biochars for Remediating Metals-Contaminated Soils
- Status of Platform Chemicals Derived from Biorefinery
- Methodology RIMM Tool System Technology Transfer and Demonstration
- Inventories and flows of wood in the U.S. economy
- SMM Prioritization Tool
- A web-based tool for the application of Green Engineering Materials Management (GEMM)
- Interpretation of life cycle impacts to identify sustainable materials for laptop enclosures using DASEES(1.61)

Beneficial Use of Materials:
- Guide for Use of Leaching Environmental Assessment Framework (LEAF) data and source term derivation for use of LEAF data
- Optimizing the Beneficial Use of Waste Materials (algorithm for evaluation of waste reuse)
- Land application of biosolids: field test 2 (evaluate the fate of chemical/microbial species when Class B biosolids (sewage sludge) are land applied)
- Mesoporous Material Derived from Poultry and Fishery Wastes
- Designing Biochars for Remediating Metals-Contaminated Soils
- Status of Platform Chemicals Derived from Biorefinery Methodology
- Methods to Quantify Beneficial Use of Un-encapsulated Waste
- Advances in Materials for Separation of Solvent-Water Mixtures
- Method to Create Novel Platform Chemicals from Waste Cellulosic or Lignin Biomass

Long-term Performance
- Comprehensive assessment of the flow of used electronics for selected states
- Adapting materials management approaches to climate change
- Evaluation of performance of MSW Containment Systems–30 year update
- Mapping Soil-Moisture using Electromagnetic Induction
- Evaluation performance of Hazardous Waste Containment Systems
- Software and Field Approaches for Landfill Moisture Characterization
- A Landfill Module for the Geophysical Toolbox Decision Support System (GTDSS)
- Resiliency of Waste Containment Systems to Extreme Weather Events
- Modelling Heat Generation and Migration Profiles in Landfills
- Subsurface Exothermic Reactions in MSW Landfills

Net Zero
- Managing Food Waste in Columbia, SC
- Towards Net Zero Waste: Co-Digestion at Fort Huachuca
- Methodology for tracking, quantifying and reporting used electronics in the U.S.
- Evaluation of Open Dumps in Remote Pacific Island Communities

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Updated October, 2016