Sustainable and Healthy Communities (SHC) Research Program

Update with Program and Regional Partners:

Sustainable Materials Management

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Agenda

- FY15 Product Overviews
  - Sustainable Uses of Wastes and Materials Management (3.63)
  - Integrated Solutions for Sustainable Outcomes (4.61)
    - Products re: Sustainable Materials Management - today
    - Products re: Nutrients – August partner call

SHC's Research Topics

Decision Support Tools

Develop tools and approaches to assist community stakeholders in making environmental decisions

Community Well-Being

Provide research and metrics to predict interactions between natural and built environment to promote individual and community well-being and maintain or restore high environmental quality

Sustainable Approaches for Contaminated Sites and Materials Management

Provide science and technical support to assess and manage contaminated sites. Develop science that supports materials reduction, reuse, recycling, and disposal to minimize environmental impacts

Integrated Solutions for Sustainable Communities

Integrated sustainability assessments: Develop tools and research to assist communities in holistically evaluating their decisions so they can optimize economic, societal, ecological, and human health outcomes

Topic 3: Sustainable Approaches for Contaminated Sites and Materials Management

Provide science and technical support to assess and manage contaminated sites. Develop science that supports materials reduction, reuse, recycling, and disposal to minimize environmental impacts.

Project 3.61

Contaminated Sites

(a) Technical Support; (b) Site Characterization, Remediation, & Management; (c) Impacts of Contaminated Ground Water

Project 3.62

Environmental Releases of Oils and Fuels

(a) Oil Spills; (b) LUST

Project 3.63

Sustainable Materials Management

(a) Life Cycle Management; (b) Re-use of Organics & Other Materials; (c) Regulatory Support

Topic 4: Integrated Solutions for Sustainable Communities

Integrated sustainability assessments: Develop tools and research to assist communities in holistically evaluating their decisions so they can optimize economic, societal, ecological, and human health outcomes (while minimizing adverse impacts and costs).

Project 4.61	**Integrated Solutions for Sustainable Outcomes** (a) Sustainability Tool Box; (b) Sustainability Assessment & Management for Communities; (c) Case Studies

Sustainable Materials Management (SMM) Program Vision

- Protecting human health and the environment by advancing the sustainable use of materials throughout their lifecycle to minimize waste and environmental impacts

SMM Program Objectives

- Objective 1: Decrease disposal rate - This objective focuses on tracking and reducing the overall amount of materials disposed, which would encompass activities targeting source reduction, reuse, recycling and prevention.
- Objective 2: Reduce environmental impacts of materials - This objective focuses on reducing the environmental impacts of materials across their life cycle, including greenhouse gas emissions and reductions in water and energy use.
- Objective 3: Increase socio-economic benefits - This objective focuses on tracking and reporting material impacts on the economy as well as social aspects.
- Objective 4: Increase capacity of state and local governments, communities and key stakeholders to adopt and implement SMM policies, practices and incentives - This objective involves increasing the number of states and communities where SMM capacity has been expanded as a result of EPA's technical assistance and support. This objective also involves increasing the per capita quantity and/or quality of recyclables recovered for manufacturing and increasing the number of households with access to organic collection and recycling.

Quick Orientation on Sustainable Materials Management

- **SMM Strategic Priorities**
  - The Built Environment
  - Sustainable Food Management
  - Sustainable Packaging
- **Additional Emphasis Areas**
  - Sustainable Electronics Management
  - Life Cycle Assessment and SMM International Efforts
  - Overarching Measurement Efforts
- **Challenges to SMM Implementation**
  - Financial Barriers
  - Limited Coordination and Authority
  - Timing Challenges
  - Limited Local Benefits
  - Access to Information that can Inform Complex Decisions

Method for Determining the Generation Rate of Construction and Demolition Debris in the U.S.

Product Lead:
Edwin Barth

Research Context:

- Construction and demolition debris (CDD) constitutes a significant waste stream in the US. It 2013, its estimated volume was more than twice that of municipal solid waste (source: EPA's SMM website).
- CDD is often big, bulky material such as concrete, asphalt, wood, drywall, and metal. CDD regulations and definitions differ by State (they are not set at the Federal level).
- Building-related CDD recycling and reuse practices have evolved over the past decade due to the growing recognition of the importance of CDD in sustainable materials management and from motivation stemming from initiatives such as the green building rating system requirements and credits, local government CDD ordinances, and state and local building code requirements.
- The evolving state regulatory field, and the related need for better collection, compilation, and tracking of CDD data – including its quantity, composition, and ultimate handling (landfill vs recycled) – provided the underlying motivation for this new methodology.

Method for Determining the Generation Rate of Construction and Demolition Debris (CDD) in the U.S.

Product Lead:
Edwin Barth

EPA Report (EPA/600/R-15/111)

Contact: Thabet Tolaymat

Description: This report provides a standardized methodology for estimating and tracking CDD generation, composition, and disposition using readily available data from states and trade organizations. Notably, the methodology includes materials from buildings as well as roads, bridges, and infrastructure.

Findings:

CDD Generated = CDD Disposed + Materials Managed at CDD Recycling and Processing Facilities + RAP Recycled by Asphalt Mix Plants

Details in Section 3 | Details in Section 4 | Details in Section 5

Expected Use: This methodology is used by OLEM for the development of CDD estimates in support of EPA's "Advancing Sustainable Materials Management: Facts and Figures Report"

Available online: [Methodology to Estimate the Quantity, Composition, and Management of Construction and Demolition Debris in the United States]

Develop Open Platform for WAste Reduction Model (WARM) Life Cycle Assessment (LCA)

Project Lead:
Edwin Barth

Research Context:

- ORCR created the Waste Reduction Model (WARM) to help solid waste planners and organizations estimate greenhouse gas (GHG) emission reductions from several different waste management practices.
- WARM is currently available as an Excel spreadsheet that calculates GHG emissions for baseline and alternative waste management practices. These practices include source reduction, recycling, composting, combustion and landfilling. The calculator recognizes 54 types of materials, including metal, glass, plastic, paper, wood, food waste, yard trimmings, and various construction and demolition debris materials.
- The GHG factors used in WARM are based on a life cycle perspective. However, in its spreadsheet form, WARM does not facilitate the use of the information it provides in full life-cycle assessment because of its format, lack of support for estimations of other environmental impacts, and limited transparency.
- ORCR enlisted ORD's aid to create an improved WARM model that supports life cycle assessment.

Product (3.63.1)

Develop Open Platform for WAste Reduction Model (WARM) Life Cycle Assessment (LCA)

Project Lead: Edwin Barth

Sustainable Uses of Wastes And Materials Management

Beta Version of Open LCA Platform for WARM and User's Guide

Contact: Wesley Ingwersen or Thabet Tolaymat

Description: WARM is a tool to help solid waste planners and organizations estimate greenhouse gas (GHG) emission reductions from different waste management practices. In collaboration with the Office of Resource Conservation and Recovery (ORCR), ORD created a beta version of WARM in openLCA. This free platform is used by ORD in LCA studies and provides interoperability with LCA models based on international standards. The model provides the user with the same choices for modeling as the current WARM spreadsheet while presenting results in more detail to facilitate improved interpretation and use in LCA studies.

Steps to Public Release: ORD and ORCR are working to sync WARM openLCA with desired updates and to develop a long term management plan for the model. WARM openLCA is expected to be released publicly this fall.

Expected Use: WARM openLCA can be used by individuals and organizations ranging from state and local governments, solid waste planners, students, small businesses, and other organizations interested in the energy and GHG impacts form materials management decisions. EPA may also use it in other LCA studies or with other life cycle tools under development such as the Sustainable Material Management Tool.

Available on SHC's Intranet: Waste Reduction Model (WARM) Tool User's Guide

EPA webpage where WARM open LCA will be posted this fall: https://www.epa.gov/warm

Beneficial Use of Materials: Secondary Aluminum Processing (SAP)

Project Lead:
Edwin Barth

Research Context:

- Unlike other metals, aluminum can be almost completely recycled into new products through a series of processes that re-melt it to produce an aluminum product at SAP facilities.
- Traditionally baghouse dust (BHD) and salt cake from SAP facilities are disposed in municipal solid waste landfills. Almost one million metric tonne of aluminum wastes is landfilled annually in the US. The process of treating and disposing the waste from aluminum production as well as the presence of byproducts of the aluminum recycling process is becoming not only a problem in the U.S., but globally.
- There are concerns that BHD and salt cake are reactive in a landfill environment.
- EPA initiated a collaborative research effort with the Aluminum Association and the Environmental Research and Education Foundation to systematically study the characteristics and reactivity of these SAP wastes. The following 2 research products are part of this collaborative effort.

Product
(3.63.2)

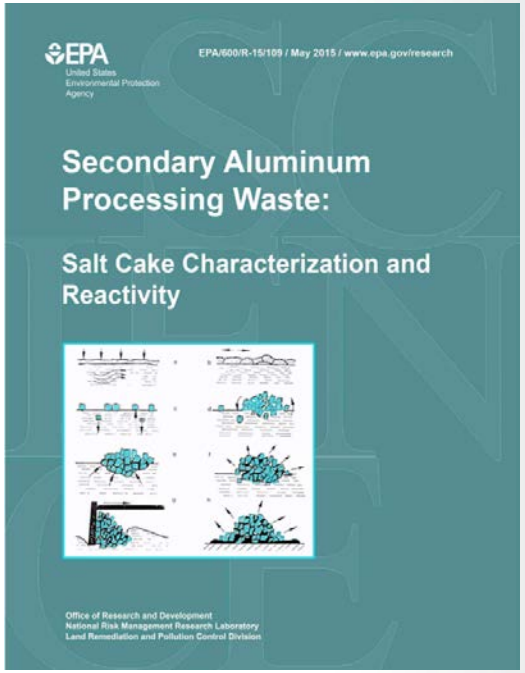
Characterization of Aluminum Dross from Secondary Aluminum Processing (SAP) Plants

Project Lead:
Edwin Barth

Sustainable Uses of Wastes
And Materials Management

EPA Report (EPA/600/R-15/109)

Contact: Thabet Tolaymat



Description: This report presents the first systematic study on the characteristics and reactivity of salt cake derived from operating SAP facilities in the U.S. The mineral phases, metal content, and metal leachability of 39 SAP waste salt cake samples collected from 10 different facilities were characterized. The reactivity of salt cake under anaerobic conditions was investigated for temperature changes, heat release, and gas generation.

Findings: Salt cake samples displayed a high degree of compositional variability. H2 gas will be generated as a result of reactivity, and will be of concern. Leachable metal content may pose a contamination concern. SC should always be managed at facilities that utilize synthetic liner systems with leachate collection.

Expected Use: These findings provide valuable information that may be used by managers of SAP and solid waste disposal facilities and regulators to determine the best management practices for salt cake.

Available online: Secondary Aluminum Processing Waste: Salt Cake Characterization and Reactivity

Characterization of Bag House Dust (BHD) from Secondary Aluminum Processing Plants

Project Lead:
Edwin Barth

EPA Report (pending publication, EPA/600/R-15/203) and Journal Article

Contact: Thabet Tolaymat

Description: In this report, a total of 78 BHD samples from 13 SAP facilities across the U.S. were evaluated for total metals and seven RCRA metals by TCLP. 44 of these samples were further evaluated for their crystalline phases and leachable metals after the BHD's reaction with deionized water under anaerobic conditions.

Findings: BHD had similar mineral phases as salt cake, but had higher potential to exhibit the toxicity characteristics of RCRA metals. Leachable metal content may pose a contamination concern. Elevated levels of H2 gas (explosion concern) and heat may be released as a result of reactions between the metallic aluminum in BHD and water at the elevated temperatures encountered in MSW landfills.

Expected Use: This report's findings may be used by OLEM, other regulators, the Aluminum Association, and SAP and solid waste disposal facilities to determine the best management practices for BHD.

Draft on SHC's Intranet: Secondary Aluminum Processing Waste: Baghouse Dust Characterization and Reactivity

Journal article: Mineral phases and metals in baghouse dust from secondary aluminum production

Web-Based Wizards for Sustainable Decision Making and Analysis: SMM

Project Lead:
Tim Gleason

Research Context:

- Traditionally, community-level decisions about materials have centered on minimizing the cost and environmental impacts of "end-of-pipe" waste management options for household and commercial wastes.
- SMM policies often accrue benefits across materials' life cycle and large geographic scales, but only a portion of these benefits accrue to the community or stakeholder implementing the policy. This can reduce the attractiveness of SMM options to community decision-makers.
- EPA's SMM program aims to expand the thinking of communities to bring a systems approach to materials use and management. The following two research products are steps in that direction.

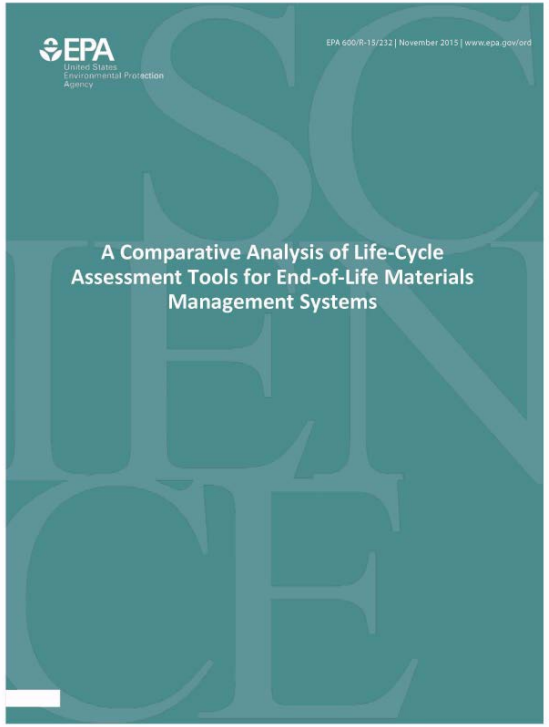
A Comparison of Life Cycle Assessment Tools for Sustainable Materials Management

Project Lead:
Tim Gleason

EPA Report (EPA 600/R-15/232)

Contact: Brian Dyson

Description: This report evaluates 5 tools that communities can use to conduct a life-cycle assessment of municipal solid waste management systems.



Findings:

- All of the tools can assess common materials management processes such as collection and transport, recovery and recycling, composting, combustion for energy recovery, and landfill disposal.
- The life-cycle inventories are based on data available at the time of tool development and may need to be updated.
- Some notable differences in functionality
  - WARM – source reduction and CDD; WRATE -- pyrolysis

Expected Use: OLEM/ORCR and life-cycle assessors can use the report to identify the best existing tool for a given situation, and to see where tool improvements are desirable.

Available online: A Comparative Analysis of Life-Cycle Assessment Tools for End-of-Life Materials Management Systems

A Systems Approach to Sustainable Materials Management

Project Lead:
Tim Gleason

White Paper: A Systems Approach to SMM

Contact: Brian Dyson

Description: This paper uses the triple value framework to present a systems view of common SMM practices. By presenting the interactions between flows of materials, energy, water, and food in the economy, society, and the environment, it serves as the basis for a community-level SMM strategy.

Findings: For each of the 7 main SMM practices, this paper provides

- A triple value framework diagram.
- Examples of local economic, societal, and environmental impacts.
- Community program / policy options and important authorities.

Expected Use: OLEM and EPA Regions can use this paper to help drive effective national and regional SMM policies. Material in this paper could also be incorporated into effective SMM outreach materials for communities and target industries and institutions.

Available on SHC's Intranet: A Systems Approach to SMM

A Systems Approach to SMM (cont.)