2030 FRAMEWORK FOR ACTION: ACHIEVING THE DESIRED INTEGRATED MANAGEMENT SOLID WASTE END STATE IN U.S. EPA REGION 4

10/6/2017 FINAL

U.S. EPA Region 4 would like to thank the many stakeholders in the region (which included state, local, and private-sector stakeholders from Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, and Tennessee) for taking the time to share their thoughtful insights and ideas to help shape this vision.

Introduction

This Framework for Action is a tool to aid U.S. EPA Region 4 advance toward achieving the Desired End State (DES) Vision for Integrated Solid Waste Management. The (DES), is that all materials be managed sustainably based on their social, economic, environmental and life-cycle impacts. This DES, developed with input from Region 4 state and local government representatives, differs from traditional solid waste management in several ways. First, it involves considering environmental and social impacts along the entire life cycle of products and packaging, not just at the end of their useful life. Sustainable materials management (SMM) is "a systemic approach to using and reusing materials more productively over their entire life cycles.[1]" SMM includes evaluating impacts of sourcing, harvesting, processing, manufacturing, transporting, use, and end-of-life management. It incorporates life cycle analysis and systems thinking, calls for a holistic, integrated approach, and focuses on using fewer resources and avoiding the use of toxics and other environmental and social impacts. SMM supports the Circular Economy, which "aims to redefine products and services to design waste out, while minimizing negative impacts.[2]" The Circular Economy entails the highest, best and continual use of resources to optimize resource utilization, while minimizing environmental and societal impacts, enhancing the economy, and balancing activities with financial constraints. Due to their expanded scope beyond end-of-life[3] management, SMM and the circular economy involve many more stakeholders than traditional solid waste management, including product manufacturers/brand owners and businesses involved in their supply chain, to consumers and state and local governments. Therefore, there is more collaboration, information-sharing, and an emphasis on education and engagement, innovation, and transparency.

Sustainable Materials Management and the Circular Economy

SMM – Aims to use and reuse materials in the most productive and sustainable way across entire lifecycles by minimizing the amount of materials involved, reducing the use of toxic materials, and minimizing overall environmental impacts, while balancing with economic constraints (U.S. EPA).

CE – Restorative and regenerative by design, and aims to keep products, components, and materials at their highest utility and value at all times. The concept distinguishes between technical and biological cycles. (Ellen MacArthur Foundation).

SMM systems must be established for a circular economy to evolve.

Framework for Action

The Framework for Action provides suggested actions for consideration primarily by state and local SMM leaders in developing plans and activities aimed at achieving the DES Vision. EPA's statutory role is to support state and local solid waste programs by providing direction to helping with the success of their programs. It is EPA's role to integrate solid waste management with resource conservation and recovery as part of SMM. The strength of SMM is due to the multi-stakeholder approach, most actions

[1] U.S. EPA,"What is Sustainable Materials Management," Accessed on June 8, 2017.
[2] The Ellen MacArthur Foundation, Accessed on June 8, 2017.
[3] The phrase "end-of-life" has become a common term meaning at the end of a product or package's original intended use. Under the SMM/CE models, however, resources would ideally be used again in a way that preserves resource value and minimizes environmental and social impacts.

involve private businesses, other governmental agencies, non-governmental organizations (NGOs), state recycling organizations (SROs), the research community, and others. The Framework is not intended to be prescriptive in nature, but, rather to present actions for consideration, as some jurisdictions may have already implemented certain actions, and not all actions presented are suitable for all jurisdictions.

In U.S. EPA Region 4, the current status regarding sustainable materials management is that the focus of most programs, as is the case in most of the U.S., is on end-of-life management, with a greater emphasis on residentially generated materials. Infrastructure and access are not fully developed in all locations – particularly in rural areas. The infrastructure for recovery, food waste collection and processing is emerging in some areas in the southeast, with some state agencies and some cities promoting and educating about food recovery and state agencies encouraging the development of food scrap composting programs. The infrastructure for the collection and processing of yard trimmings is more fully developed. Similarly, areas in the southeast have developed some policies and programs to encourage the recycling of construction and demolition debris (C&D), however, largely due to inexpensive disposal, adequate disposal capacity, and lack of policies, the C&D processing infrastructure is not fully developed. Material Recovery Facility (MRF) processing, as is true in most of the country, has not advanced in response to changes in the mix of incoming packaging and printed paper, leaving many MRFs operating sub-optimally to process today's recyclables. The Southeast Recycling Development Coalition (SERDC) has made strides to identify existing processing gaps and the potential for recovered materials to be used by manufacturers within the region, though there is still more opportunity to develop regional markets for recovered materials. As is the case nationwide, funding and other resources for education and engagement are generally inadequate.

States and local governments have worked hard to develop and sustain existing recycling programs. They continue to face challenges in achieving the DES. Most jurisdictions have funding constraints and some lack the expertise in and control over elements of SMM that need to be addressed. Considering upstream environmental and social impacts as part of SMM requires a paradigm shift, and the expertise and engagement of other stakeholders. Similarly, governments may not be the best suited to develop and implement some education and engagement activities, and product manufacturers and brand owners must play a role in product design/packaging selection that optimizes resource use and environmental impacts. An opportunity for Region 4 is the existence of a strong manufacturing economy with the potential to increase the amount of recovered material from the region used as feedstocks.

Fortunately, product and packaging manufacturers, brand owners and others have begun to understand that there is a strong business case for advancing SMM and the circular economy. Businesses realize that their long-term ability to source feedstocks is dependent upon establishing a more sustainable and traceable supply chain and effecting a smaller environmental footprint overall. Consumers and investors are also increasingly expecting that companies adopt sustainable practices, and corporate leadership often supports these initiatives. At the same time, research has been emerging, albeit slowly and on a product-by-product basis, on life cycle impacts of goods and packaging. Also, innovation is catalyzing technological advances that will enable the use of more responsibly sourced feedstocks, and the processing of and re-manufacturing using recovered materials. Collaboration with other regions and service providers can also help harmonize programs and education and engagement efforts. There is also an opportunity to use policy and funding mechanisms to incentivize behaviors that lead to more sustainable outcomes.

Achieving the DES will require collaboration with stakeholders along the entire supply chain, and with an expanded array of entities beyond those that focus on end of life management. Product and packaging manufacturers, brand owners, retailers, NGOs and the research community all have important roles to play in optimizing systems such that environmental benefits are balanced with economic constraints. Achieving the DES will also require sharing and integrating information and expertise, expanding education and engagement efforts, and strengthening research and development efforts to catalyze innovation in product design, manufacturing, processing and re-manufacturing. It is also important to ensure that there is transparency regarding the costs and benefits of SMM-related activities.

The following are principles of the DES Vision, and jointly describe the ideal outcome if SMM were achieved. The complete DES Vision is provided in Appendix A.

Principles of SMM Desired End State

	1) A circular economy exists where **inputs to products and packaging are optimized** and the materials that are used are treated as valuable resources.
	2) Citizens, businesses, and other organizations have **convenient access to information and services that help them make sustainable product and packaging sourcing, design, purchasing, use and end-of-life management decisions**, thus facilitating the highest use for materials throughout and at the end of their useful life.
	3) Governmental entities leading SMM take **a holistic approach in managing materials and ensuring sustainable policies and programs exist**, **and are pro-active in developing and enhancing the circular economy** and coordinating collaboration and information-sharing among stakeholders.
	4) **Managing materials at the end of their useful life is a shared responsibility among all stakeholders** – including governmental entities, producers/brand owners, retailers and consumers.

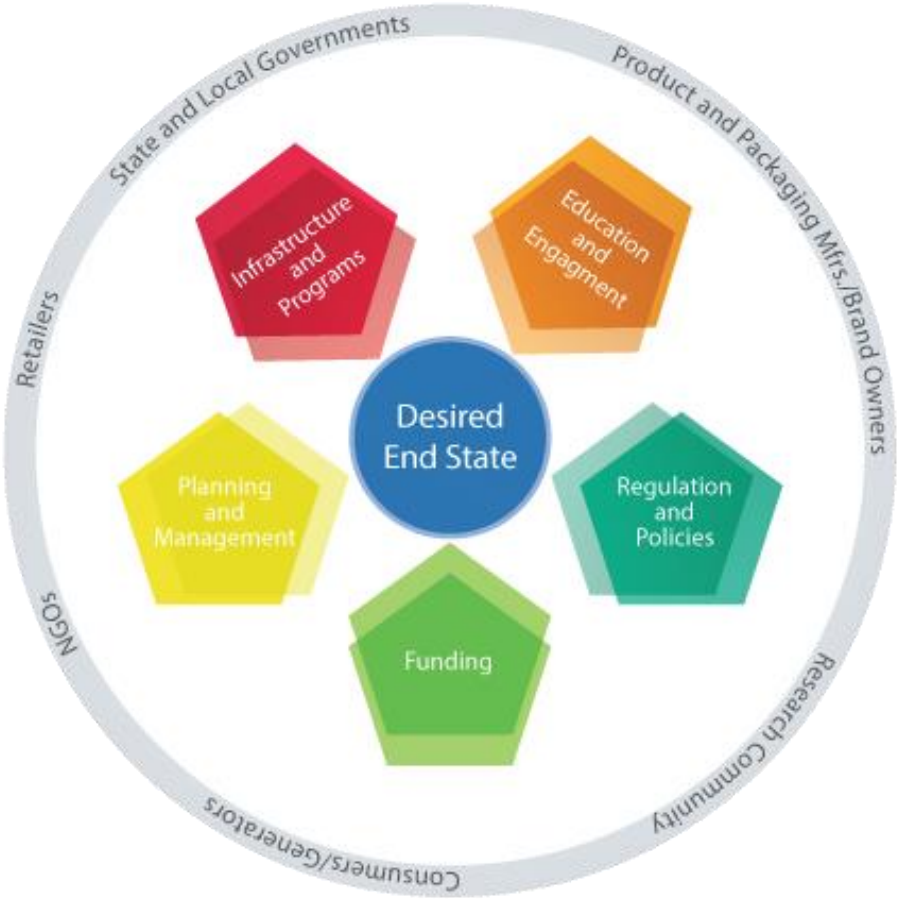
Structure of the Framework for Action

The actions and considerations presented in the Framework for Action are organized by the following "Elements:"

1. Planning and Management (P)
2. Infrastructure and Programs (I)
3. Regulations and Policies (R)
4. Education and Engagement (E)
5. Funding (F)

Although some entities may focus on individual elements identified, all Elements must be addressed in a coordinated fashion to implement SMM, as Figure 1 illustrates.

Figure 1: Elements and Entities Required to Bring about The SMM Desired End State



For each Element, actions that can be undertaken to move the states and region closer to reaching the DES are presented in the Framework, often with additional considerations.

Actions are relatively broad and are enumerated with the letter symbol for the element -- e.g., P1 is associated with Action #1 under Planning and Management. Additional considerations within the Actions presented are preceded by a lower-case letter. Programs and activities often involve multiple elements, so there is some degree of overlap throughout the Framework.

Next to each Action is a symbol relating to the SMM principles addressed by the Action.

When more detail or examples are potentially of value, a "Tip" section is provided.

Planning and Management

Planning and management are important processes through which states and local governments identify and prioritize actions they intend to take, as well as coordinate implementation. Planning and management also includes establishing meaningful goals and developing benchmarks, systems and analytics assessing progress toward achieving them. While some states develop multi-year plans, others are less formal in their planning, but still conduct many planning and management activities.

Action #/ Principles Addressed	Planning and Management (P) Actions and Considerations
P1	**Set goals with consideration of Principles of SMM Desired End State**
   	a. Develop goals that are not solely weight-based – such as percentage recovered over generated, to account for reduced per-capita consumption/light-weighting. b. Prioritize and develop specific goals for specific product/packaging systems or types of materials (e.g., organics) by incorporating research about LCA benefits and other factors, including: • Prevalence in waste stream; • Difficulty in managing material; • Social and health impacts (e.g., food waste, toxics); • Economic impacts (e.g., local market for material); • Overall LCA results – taking into consideration various material applications, product/packaging systems, and material alternatives; • Contamination rate of source separated materials; and • Environmental impacts ('hotspots') -- (e.g., toxicity, items that tend to be illegally dumped, marine impacts) (Example: Oregon DEQ's specific goals for certain material streams including carpet, plastics, and food waste). Develop goals to limit/reduce/prevent environmental impacts. c. Confer with other jurisdictions in the region to consider standardizing some metrics and goals. d. Coordinate with other agencies/entities (e.g., sustainability-related agencies/ departments, toxics reduction task forces) if they exist. e. Consider implementing more stringent goals for government agencies/departments. f. To the extent possible, ensure goals of businesses and public entities are in alignment.
Tip – Consider implementing multiple goals, as no single goal "tells the whole story" or addresses all needs. Some goals may be quantitative in nature; others may be qualitative. Goals can be associated with a timeframe, or apply to certain generator groups, e.g., to communities of a certain size. Some goals may be associated with outcomes, others with actions. Some goals might require waste composition studies to properly assess attainment. Examples of potential goals include: • Implement a statewide disposal goal of x pounds of MSW per capita per year. • Implement a goal to reduce per-capita, overall waste generation or other appropriate and quantifiable performance indicators. • Implement a statewide recovery goal of x% of C&D generated. • Implement a statewide disposal goal of y pounds per capita of total waste per year. • Food waste comprises less than x% of disposed waste. • Recyclable/compostable materials, including organics, comprise less than x% of disposed waste. • Implement a statewide prescription drug takeback program within 5 years. • Implement universal recycling in municipalities of 4,000 households or more. • Ensure a food recovery infrastructure is in place and information about the ways to recover food are provided to generators. • Achieve a contamination rate of less than z% for mixed recyclables. • Ensure all jurisdictions have a well-trained SMM professional that spends at least 50% of their time on SMM issues.	

Action #/ Principles Addressed	Planning and Management (P) Actions and Considerations
	• Conduct education and engagement activities to x% of product manufacturers in the jurisdiction about SMM issues including sustainable sourcing. • Meet with at least x businesses per year to discuss ways to minimize negative environmental impacts of their business.
P2	**Ensure a process is in place for reporting data such that progress toward achieving goals can be assessed with relative ease and accuracy.**
 	a. Develop analytics, benchmarks and tools to measure progress in achieving goals. b. Implement an easy-to-use reporting tool (or tools). c. Ensure reporting is simple and does not overly burden reporting entities. d. Consider implementing policies/regulations, if necessary, to require reporting.
	Tip – Ensure that whatever data to be collected has a purpose. Do not ask for more detail than needed. Field test data gathering to identify opportunities for clarification. Use a web-based platform for reporting so users do not have to purchase and maintain software.
P3	**Develop/update/refer to a sustainable materials management plan and/or action plan.**
   	a. Prioritize activities based on factors such as: • Expected impact on volume of material(s); • Expected impact on difficult-to-manage/potentially hazardous material; • Overall environmental impact; • Ease of implementation; and • Cost relative to expected results (cost effectiveness). b. Allow for flexibility for rural communities, communities with greater infrastructure needs, and communities facing other challenges (e.g., large numbers of multi-family households, those with changing populations such as college students and tourists, etc.). c. Develop an implementation plan – include timeframes, budgets, responsible parties (may span different organizations) funding strategies and opportunities for regionalization and collaboration. d. Refer to plan for guidance, prioritization of programs. e. Update plan on a regularly scheduled basis, optimizing the system to balance environmental and social impacts with economic constraints and to consider emerging processing technologies and goods and packaging/product systems. f. Gain an understanding of future waste disposal costs, to better assess the value of current source reduction and recycling programs. Consider the increasing cost of land, rising costs of construction and materials, cost of transportation/transfer station to deliver waste to a more distant landfill, as appropriate.
P4	**Implement a continuous improvement process for all SMM programs.**
 	a. Summarize progress formally at least annually. Consider submitting an annual report to the legislature, which provides transparency and keeps legislators informed. b. Identify effective policies and programs as well as gaps in infrastructure, service, information and participation. c. Develop and plan to implement strategies to address gaps/improve programs and services. d. Consider regionalization and public/private partnerships in addressing gaps.

Action #/ Principles Addressed	Planning and Management (P) Actions and Considerations
	e. Identify opportunities to make programs more efficient/cost effective.
P5	**Identify opportunities to develop and strengthen external collaborations and partnerships.**
   	a. Partner with other jurisdictions in the region to develop more cost-effective programs and facilities/infrastructure. b. Establish partnerships/engage in conversations with private industry and universities to better understand and advance, where appropriate, SMM activities such as research and development (R&D) to overcome technical challenges, innovative product design, reuse, material exchange, technical assistance and borrowing/repair programs. c. Develop linkages with economic development staff, business groups (i.e., chambers of commerce) and others to improve SMM understanding and awareness, and participation in program implementation such as recycling promotion to increase materials capture and minimize contamination, as well as to grow processing and end markets. d. Work with institutions, including colleges and universities, hospitals and others to improve their use of SMM best practices and to engage them in broader SMM work such as relevant academic research. e. Work with state and regional recycling organizations (e.g., SERDC) and other environmental organizations (e.g., Keep America Beautiful) to identify means to fill programmatic and informational gaps in the region. f. Develop linkages with economic development staff, chamber of commerce, and/or other organizations to grow recycling participation, processing, and end markets in your region, including coordination among intermediate processors and end users. g. Continuously review goals and policies and regulations to ensure they consider current materials, technologies, research regarding LCA, and best practices. h. Continuously monitor and consider opportunities to implement new technology to advance SMM programs. Examples include technologies that enhance data-gathering, analysis, and reporting processes, as well as technologies that enable and enhance education, engagement, and information sharing.
P6	**Consider agency restructuring to provide for a more holistic approach to address SMM, beyond traditional waste management and develop other organizational ties.**
  	a. Strengthen integration of solid waste, climate change, water protection, soil and other agency staff as appropriate to enable a holistic approach to SMM. b. Change the agency name and mission to reflect its more holistic nature. c. Work with other departments and internal agencies to achieve other environmental goals and gain access to additional resources and information, e.g., Sustainable Cities, LEED, and Green Sports Alliance. d. Include goals and plan to implement programs that address materials along the entire life cycle, including product design, selection, material sourcing, and product use. e. Ensure strong leadership is in place that supports and propels SMM activities and catalyzes relationships.

Infrastructure and Programs

When the DES is achieved, citizens, businesses and others have convenient access to recovery programs and services for recyclable materials, special wastes, and non-recyclable materials having fuel value, to enable the sustainable management of these materials. In addition, technological advances have been made to ensure that processes that minimize resource use are in place and to recover material value at end of use. Therefore, the infrastructure and programs element includes actions associated with traditional recycling programs and infrastructure, as well as those addressing reuse/repair/sharing/borrowing economy, source reduction, and market development that help bring about the DES for all materials. Infrastructure and programs, as well as product and packaging themselves, evolve to achieve the DES, in part, through the critical activities of research and development and technological innovation.

Action # and Principles Addressed	Infrastructure and Programs (I) Actions and Considerations
I1	**Establish/encourage programs and infrastructure that encourage source reduction/light-weighting of goods and packaging to the extent that LCA studies and social and economic impacts support such decisions. Source reduction activities conserve resources, lower environmental impacts, and typically involve low-cost adjustments in sourcing, behavior, or operations and often result in cost savings.**
	a. Encourage residential, commercial, industrial, and institutional generators to make purchasing decisions that minimize waste, and focus on product longevity. b. Identify and inform generators of existing or potential source reduction programs and inform generators of their potential to conserve resources and, the cost savings that can be achieved. c. When implementing source reduction programs, prioritize materials that are high-impact (e.g., difficult-to-manage/toxic – or 'hotspots'); are likely to result in cost savings to the generator; and whose generation has the potential to be significantly reduced (e.g., food waste). d. Implement source reduction programs in government agency offices to the extent that they result in optimized resource use, relative to environmental, economic and social impacts. e. Identify and address opportunities to address source reduction program gaps and overall reduction of environmental impacts based on LCA.
I2	**Develop/promote programs that encourage and facilitate the reuse of certain goods, including through the salvage, repair, resale, and borrowing economy. Reuse and borrowing of goods conserves resources, extends the life of goods, and provides individuals with low-cost or no-cost items they can use.**
	a. Identify opportunities to support and facilitate reuse of goods. Examples include repair and reuse of electronics and equipment, and reuse of paint, recovered reusable building materials, and outdoor furniture and toys. Actions might include identifying and informing residents, businesses, and institutions of existing programs, developing or facilitating the development of a repair/reuse program, or encouraging businesses to develop a repair/reuse program.

Action # and Principles Addressed	Infrastructure and Programs (I) Actions and Considerations
	b. Identify opportunities to support and facilitate the borrowing economy. The borrowing economy ensures that goods that tend to be relatively high cost and/or infrequently used are more fully used over the product's life cycle, resulting in resource conservation, reduced environmental impacts, and overall lower cost per use. Actions might include identifying and informing residents, businesses, and institutions of existing programs, facilitating the development of a borrowing program, or encouraging businesses to develop a borrowing program.
Tip – Food rescues and food pantries are examples of reuse programs that help to optimize the use of resources. Often food rescues exist, but are not well publicized or convenient to use. State and local governments may be able to play a role in matching consumable food with outlets.	
Tip – Borrowing programs can be implemented by private- or public-sector organizations. Types of goods suitable for lending can vary by location. For example, a beach community might consider renting or lending umbrellas, beach chairs, and beach strollers. The City of San Francisco has a tool lending program, and some communities have toy lending programs through libraries.	
I3	**Establish/facilitate programs that strive to ensure that convenient, cost-effective and well-run recycling and composting collection programs and processing facilities exist for materials from all generators. Identify infrastructure gaps and work to fill them, optimizing systems to balance economic and social impacts with economic constraints.**
  	a. Consider programs for residential generators – both single- and multi-family, covering paper and packaging, yard trimmings and food scraps, at a minimum, that follow current best practices. b. Consider programs that incorporate current best practices for commercial, institutional and industrial generators as well as public space recycling for, at a minimum, paper and packaging, yard trimmings and food scraps, and construction and demolition debris. Consider additional materials if generated on site, and to the extent that markets exist. c. Ensure that public facilities have programs in place that follow best practices, and serve as a model for other programs. d. Promote/facilitate harmonization of materials collected among communities in the MRF-shed, and congruent with MRF capabilities and available markets. e. Identify and foster opportunities for rural communities, such as hub-and-spoke infrastructure development to enhance the opportunity to recover, process and market recovered materials from lower volume generators. f. Develop public/private partnerships and regionalization/cooperation with other jurisdictions, businesses and NGOs to implement or strengthen programs. g. Consider anticipated population projections relative to existing and planned infrastructure to ensure capacity is appropriate. h. Consider opportunities that enable addressing infrastructure gaps through longer-term service contracts.
Tip – Level of service or type of program may differ for some generators depending upon circumstances. For example, collection of curbside recyclables may be less frequent in rural areas, to achieve cost effectiveness. Obtaining input from local governments, recycling professionals, private	

Action # and Principles Addressed	Infrastructure and Programs (I) Actions and Considerations
service providers, and, likely, commercial/institutional establishments, will help identify and address gaps, and develop programs and infrastructure that address the needs of a specific area.	
I4	**Establish/facilitate programs that strive to ensure convenient, cost-effective and well-run collection programs for hard-to-manage goods that will result in the responsible, environmentally friendly management of these materials.**
  	Consider the following, balancing environmental, social and economic impacts: a. Establish programs for household hazardous waste, tires, appliances, furniture, post-consumer pharmaceutical waste, mercury-containing lightbulbs, carpet and carpet padding, and sharps. b. Establish producer-run programs, including extended producer responsibility. c. Provide programs via public/private partnership. d. Opportunities for procurement/negotiation of a statewide or multi-jurisdictional service contract for such services, which can result in a more cost-effective program and reduced environmental impacts.
I5	**Facilitate and encourage and/or develop end markets/beneficial uses for recovered goods and materials that lack adequate markets, maximizing resource use to the extent supported by LCA, and balancing costs and social impacts.**
  	a. Collaborate with private industry and research organizations to facilitate and/or conduct and share research regarding emerging markets/uses for recovered materials. b. Conduct a pilot study, perhaps through a public/private partnership, to test or demonstrate the feasibility of using a recovered material as a feedstock in manufacturing, or as a beneficial use or product substitute in municipal projects. c. Work with economic development agencies and chambers of commerce to engage the private sector in filling infrastructure gaps. d. Collaborate with other organizations (possibly a college or university, a market development center, or a private service provider) to develop a materials exchange to match generators of materials with potential end users. e. Engage with industry and SMM-supporting organizations to stay well-informed of innovations in processing technologies and packaging and product design and their potential suitability for and impacts on SMM systems.
Tip – Governments often implement programs to beneficially use materials that might otherwise not have markets, or may lack cost-effective markets. Examples include using ground non-recyclable C&D debris for alternative daily landfill cover, using tire chips for pipe underlayment, septic system filtration medium, and landfill leachate filtration medium, and using processed glass in constructing roads.	
I6	**Foster research and development and use of technologies to extract resource value and/or energy from recovered materials.**

Action # and Principles Addressed	Infrastructure and Programs (I) Actions and Considerations
  	a. Conduct research, encourage innovation and expand the use of new technology to advance SMM principles. b. To the extent possible, and as appropriate given the economic, social and environmental impacts, prioritize resource conservation and reuse (e.g., feedstock in manufacturing) over solely energy generation. c. Work with economic development agencies, chambers of commerce and other industry organizations, as appropriate, to identify opportunities for private-sector entities to develop a facility to extract energy and/or resource value from recovered materials. d. Consider partnering with a private entity to conduct a pilot or demonstration project using an emerging or underutilized technology at a state facility, and use the learnings to expand use of the technology, if appropriate. An example might be using a small anaerobic digestion system to process organics at a state park.
Tip – State governments often target grants for development of a technology or business to process a specific material type. Grants are sometimes available to public or private entities that meet certain requirements, including matching funds and a strong business plan.	

Regulations and Policies

Sustainable Materials Management is supported by regulations and policies that encourage or mandate actions that help achieve the DES. Under the DES, all citizens, businesses and other organizations have convenient access to programs and services, which may be facilitated through policies. Additionally, managing materials at the end of their useful life is seen as a shared responsibility, which may also be facilitated through regulations and policies. Similarly, brand owners/product manufacturers and consumers share in the responsibility for optimizing systems to minimize environmental and social impacts, including through sustainable sourcing of feedstocks and product use. This element includes state and local regulations and policies, and may also include working with NGOs and others to support federal-regulations and policies that help bring about the DES.

Action # and Principles Addressed	Regulations and Policies (R) Actions and Considerations
R1	**Implement policies that encourage designing, manufacturing, selecting, using, and managing materials at the end of their useful life in a manner that is in line with SMM principles – maximizing resource value and minimizing social and environmental impacts. Include residential, commercial, institutional, and industrial generators of all MSW materials.**
	Consider the following, weighing environmental, social and economic impacts: a. Mandate the recovery and recycling /composting of certain specified materials.

Action # and Principles Addressed	Regulations and Policies (R) Actions and Considerations
  	b. Ban the disposal of certain recyclable/compostable materials (e.g., yard trimmings, curbside collected recyclable materials). c. Ban the disposal of /requiring recycling/composting of certain materials for large-scale generators (e.g., large-scale generators of cardboard; large-scale generators of food scraps). d. Require haulers to provide recycling service (and possibly source separated yard trimmings and/or food scraps for composting) to their trash customers, including those living in multi-family dwellings, and with no separate fee to the customer. e. Require haulers serving single-family households to implement PAYT user fees. f. Requiring owners of multi-family dwellings to provide convenient recycling services for materials allowed in jurisdiction's curbside or drop-off program. g. Require businesses and facilities that provide trash cans for employees/customers/ visitors to also provide recycling for materials generated on site. Consider stipulating that the volume must be at least as large as that of the trash can, or larger. h. Ban or place fees on the use of certain types of packaging/goods that have negative health/environmental impacts. i. Reassess policies as new packaging types/products and recycling processing and end markets are developed. j. Implement policies that require generators/receiving facilities to report needed data. k. Implement contracting policies with private service providers, such as long-term contracts/risk sharing, that allow for private sector to fill infrastructure gaps. l. Identify opportunities to establish contracting policies with surrounding jurisdictions, such as long-term contracts/risk sharing, that allow for the jurisdiction to fill infrastructure gaps, and for harmonization of programs, economies of scale, and reduced pricing m. Identify opportunities to establish contracting policies that encourage the recovery of the most material and directing material to the highest value, such as revenue shares (with price floors and ceilings, to mitigate risk) with processing facilities. n. Require brand owners/product manufacturers and/or retailers to provide information about environmental impacts of manufacture/use of goods and services and/or proper management at end of life. o. Require brand owners/product manufacturers/retailers to support or provide recycling collection/processing systems. p. Develop and implement preferential purchasing policies for goods and services with reduced environmental and health impacts. q. Consider requiring haulers, materials processors, and transfer and disposal facilities to undertake activities to reduce environmental impacts. Examples include recovering methane, using clean, renewable fuels, treating/recirculating water used for cleaning vehicles and containers, and using low-energy lighting and HVAC systems. r. Include stakeholders in discussions about policies/regulations being considered.
Tip – One of the most impactful means of encouraging generators to reduce the amount of MSW they dispose is pay-as-you-throw. Where residents hire their own haulers, haulers can be part of a permitting or licensing program that requires them to implement PAYT. Pricing differentials among incremental	

Action # and Principles Addressed	Regulations and Policies (R) Actions and Considerations
levels of trash disposal should be significant enough to provide an adequate financial incentive to change behaviors.	
R2	**Implement policies and regulations to encourage the use of SMM principles in the built environment, and encourage the development of C&D reuse/recycling infrastructure.**
   	Consider the following, weighing environmental, social, and economic impacts: a. Mandate recycling of certain C&D materials, or developing a recycling plan for projects of a certain size or value and/or for publicly funded projects. b. Establish financial or other incentives for permit applicants that recycle a certain percentage of material (e.g., fee rebate, fast-track permitting). a. Mandate LEED certification of a specified level for all public projects, or for public projects of a certain size or value. b. Implement disposal bans or disposal surcharges on certain C&D material types and/or on mixed C&D. c. Require all C&D materials generated to be delivered to a C&D processing facility. d. Implement EPR for certain C&D materials (some states have EPR in place for paint and carpet, for example). e. Require brand owners/product manufacturers/retailers to provide information to customers/builders on environmental and/or health impacts of products through "environmental product declarations" (EPDs) and/or "health product declarations" (HPDs). f. Require new construction of property or significant renovations to require adequate space for recycling containers. g. Require multi-family apartment complexes to be constructed with chutes to make recycling more convenient, and adequate storage space for recyclables. h. Consider requiring C&D haulers, processors, and transfer and disposal facilities to undertake activities to reduce environmental impacts. Examples include recovering methane, using clean, renewable fuels, treating/recirculating water used for cleaning vehicles and containers, and using low-energy lighting and HVAC systems. i. Include stakeholders in discussions about policies/regulations being considered.
Tip – There are a myriad of ways to implement C&D recycling policies. Jurisdictions can require recycling plans for projects in which the developer/permit applicant must describe material types and quantities to be generated and how these materials will be recovered for reuse/recycling. If material is not to be recycled, the applicant must provide a reason. This approach can stimulate the development of processing and end markets for C&D materials, and once markets are fully established, jurisdictions can consider implementing additional policies. Some local and state governments develop/facilitate beneficial uses for material types.	
Tip – Disposal bans can be announced several months or even a year or two prior to their implementation to encourage the private sector to develop recycling infrastructure. Massachusetts has taken this approach in establishing some of its disposal bans, which include clean gypsum wallboard, asphalt, pavement, brick and concrete, and treated and untreated wood (landfill ban only), among others.	
R3	**Implement policies that encourage consumers/generators of difficult-to-manage products to select, consume, and manage them responsibly throughout and at the end of**

Action # and Principles Addressed	Regulations and Policies (R) Actions and Considerations
	their useful life. Include residential, commercial, institutional, and industrial generators of difficult-to manage materials.
   	Consider the following, weighing environmental, social and economic impacts: a. Establish policies to encourage proper management at end of life for, at a minimum, household hazardous wastes, furniture, appliances, electronics, pharmaceuticals, sharps, tires, lead-acid batteries, and mercury-containing lightbulbs. b. Require brand owners/product manufacturers and/or retailers to provide information about proper end-of-life management of product. c. Require brand owners/product manufacturers/retailers to support or provide recycling collection/processing systems. d. Require brand owners/product manufacturers to discontinue (or phase out) the use of environmentally impactful (or hazardous) inputs. e. Implement advance recycling fees to encourage proper end-of-life management of specific material types. f. Implement a policy requiring a specific department/entity to implement a takeback program (e.g., police department or pharmacy to collect and responsibly manage certain medications). g. Include stakeholders in discussions about policies/regulations being considered.
R4	**Review existing policies to ensure they do not inadvertently/unnecessarily discourage the use of recovered materials to maximize their resource value or discourage the development of processing facilities, while balancing with other environmental impacts and social and economic impacts.**
  	a. Ensure composting regulations are not overly onerous. b. Ensure existing policies do not discourage the recovery of consumable food. c. Ensure polices relating to recycling and other processing (including energy recovery and emerging technologies) do not unnecessarily hinder the development of processing/recycling facilities. d. Ensure regulations and policies do not unnecessarily restrict the use of materials for beneficial reuse, particularly where end markets are scarce or of low value (e.g., glass) e. Ensure environmentally preferable purchasing policies do not solely focus on recyclability or recycled content. Consider other SMM-related factors including source reduction, use of sustainably sourced renewable resources, reduced use of toxics, reduced use of other resources (e.g., water and electricity), product longevity, and products with the least environmental impact over the course of their life (i.e., life cycle cost impacts). f. Implement public purchasing policies that allow for a specific price differential if products and services with environmental/health benefits are more costly. g. Include stakeholders in discussions about policies/regulations being considered.
Tip – The U.S. Composting Council provides links to state compost regulations and a model rules template for composting facilities, which can serve as a reference in assessing your state's compost regulations and rules. Several states have reviewed and updated their composting regulations, in part to ensure they are not overly onerous, particularly for relatively small-scale or on-farm composting facilities.	

Action # and Principles Addressed	Regulations and Policies (R) Actions and Considerations
R5	**Implement policies that encourage the creation and strengthening of SMM-supporting activities, programs and facilities including source reduction, reuse/repair/borrowing, recycling, and design and use of goods and packaging/product systems with low environmental and social impacts, relative to costs.**
 	Consider the following, weighing environmental, social and economic impacts: a. Implement policies that provide financial incentives, such as tax credits, innovative development districts, and grants, that incentivize the development of SMM-supporting businesses and programs. b. Develop/revise public agency environmentally preferable purchasing policies such that they support and encourage SMM principles, including source reduction, product longevity, reduction in toxicity, and recycling or donation at end of useful life. c. Implement advance recycling fees for certain products/goods to encourage the development of a recycling infrastructure. d. Announce a disposal ban (phased in over time) for certain products or packaging types or product/packaging systems to encourage the research and development and/or use of environmentally preferable options. e. Announce a disposal ban (phased in over time) on food scraps to encourage the development of food processing facilities. f. Implement product stewardship policies to help implement SMM programs and minimize environmental impacts of goods and packaging. g. Work jointly with industry stakeholders to develop policies that require product manufacturers/brand owners/retailers to provide consumers with product information related to environmental impacts. Examples include environmental footprint information, hazardous product information, and end-of-life management information. h. Implement policies that require haulers, processors, and transfer and disposal facilities of recovered materials and waste to minimize environmental impacts. Examples might include requiring the use of clean, renewable fuels, ensuring collection routes are as efficient as possible, limiting idling time, treating/recirculating water used for cleaning vehicles and containers, and recovery of methane at landfills. i. Include stakeholders in discussions about policies/regulations being considered.
R6	**Ensure environmental agencies, at a minimum, and potentially all governmental departments, serve as role models regarding SMM programs and activities.**
 	a. Ensure governmental agencies have strong policies in place that incorporate SMM principles in product selection/purchasing, use and end-of-life management. b. Consider making governmental agency/department SMM goals more stringent than statewide and/or local goals. c. Incorporate SMM program participation expectations in employee policies. d. Include stakeholders in discussions about policies/regulations being considered.

Education and Engagement

Because SMM represents a significant change from traditional end-of-life focus and represents a holistic model beyond the traditional linear "take, make, use and dispose or recycle" system, education and engagement is a particularly important element. Under the DES, all citizens, businesses and other organizations have information that helps them make sustainable product and packaging design, purchasing, consumption, and end-of-life management decisions. Therefore, the education and engagement element not only includes educating generators about recycling programs and policies, but also product environmental impact information. It includes education and engagement regarding source reduction and repair/reuse/sharing of goods, outreach to key decision makers, elected officials, and others regarding the environmental and economic benefits of SMM programs, and informing businesses about opportunities to help bring about the circular economy.

Action # and Principles Addressed	Education and Engagement (E) Actions and Considerations
E1	**Ensure state and local government SMM professionals/leaders are informed on SMM-related topics and engaged in ongoing conversations about evolving topics, including LCA, emerging sourcing, manufacturing, and processing technologies, policies and programs that advance SMM and associated best management practices.**
  	a. Identify and disseminate to state and local professionals existing published information on SMM and the circular economy, including LCA and SMM resources developed by existing governments and other organizations (e.g., Ellen MacArthur Foundation, AMERIPEN, Recycling Partnership, Carton Council, Sustainable Packaging Coalition). b. Solicit information and engage in conversations with states that are farther along in adopting SMM programs and policies, as well as with businesses, industry organizations, and other organizations (the research community, NGOs, SROs) as appropriate to keep current with emerging SMM topics, including LCA/environmental footprint studies. Such information can help identify materials and processes with the greatest environmental impacts, which present opportunities for change. c. Develop and implement a training program on SMM for professionals at the state and local level, and offer regular opportunities for engagement, networking, problem-solving, and continuing education on SMM topics, programs, policies and best practices. Consider public/private partnerships or working with other organizations (e.g., SERDC, SROs, other NGOs) to develop and conduct the training.
E2	**Encourage state and local governments, as appropriate, to develop and share information to generators regarding SMM principles and best practices, programs and policies to advance SMM.**
 	a. Develop and share with generators and elected officials, existing SMM education and engagement tools developed by other organizations and governments. b. Disseminate information to residents, businesses and institutions about the concepts of LCA, SMM, and CE, so that they can make informed decisions when sourcing/purchasing, using and managing goods at the end of their useful life, as well

Action # and Principles Addressed	Education and Engagement (E) Actions and Considerations
	as ways to avoid generating waste (e.g., source reduction). Include information about alternatives to toxics and other potentially harmful products. c. Provide easy-to-find, concise information about proper ways to manage materials at the end of their useful life. Include easy-to-understand graphics that address what can be included, how materials are to be prepared, and what cannot be included in recycling programs. Also provide information about reuse and borrowing programs, (e.g., food rescues). Consider employing technology (e.g., an "app") to make this information readily accessible. d. Develop and share with residents, businesses and institutions, optimal ways to manage difficult-to-manage materials at the end of their useful life, and available programs and outlets. Include information about repair/reuse programs (e.g., sharing programs, borrowing programs), recycling, and other management programs (e.g., auto battery and scrap tire retail takeback programs, HHW programs). Consider employing technology (e.g., an "app") to make this information readily accessible. e. Make information about SMM-related goals, policies and regulations, progress toward reaching goals, and costs of SMM services and programs is transparent to all interested parties including businesses, residents, commercial, and institutional generators. f. Conduct effective monitoring/enforcement of SMM policies, using a best practices approach that includes feedback and education as a first response strategy. g. Collaborate with chambers of commerce, economic development agencies, SROs and other organizations as appropriate to further educate and engage businesses, industry and institutions in SMM activities and programs, including sourcing, use, and end-of-life management of feedstocks, byproducts and goods. h. Develop and implement strong education and engagement programs and activities for students in the jurisdiction, such that they are aware of LCA thinking and environmental impacts associated with product selection, use, and end-of-life management. i. Work with local jurisdictions in MRF-sheds, as well as with the MRFs, to ensure programs and associated education and engagement materials are harmonized and clear. Consider engaging a professional graphic artist/ad agency to develop materials. Consider seeking public/private partnership to develop and disseminate materials. j. Identify opportunities for public/private partnership and collaboration with other jurisdictions in developing and disseminating education and engagement materials and strategies. k. Share/promote environmentally purchasing policies with businesses and institutions that might be interested in adopting them (or a variation of them) voluntarily.
Tip – Tools and tips to help local governments improve programs and implement policies that support SMM can be found on the Carton Council and Recycling Partnership's websites, among others.	
Tip – Engaging state legislators in discussions about the benefits (economic, environmental, and social) of SMM programs and policies can help them make more informed policy decisions. The Carolina Recycling Association conducts such activities annually in NC and SC**.**	

Action # and Principles Addressed	Education and Engagement (E) Actions and Considerations
E3	**Educate and engage stakeholders in the built community, including developers, builders, residents, and processors, about SMM-related programs, policies and infrastructure for C&D and related products, materials and best practices.**
	a. Develop and undertake education and engagement activities to the building community including providing information about life cycle thinking and assessments (LCT/LCA) and about building products/practices that may inform SMM decisions. b. Ensure information about policies and programs that relate to C&D materials, including any requirements for recycling, development of material management plans, disposal bans, etc., are conveyed to stakeholders, as well as best practices to source reduce and maximize recovery. c. Develop and disseminate tools (e.g., paint calculators, other estimating tools, purchasing and contracting tips) that facilitate minimizing waste in C&D projects. d. Develop and disseminate tools to help developers understand best practices to retain value of recovered materials, and to develop successful, convenient recycling programs. Consider implementing a "train the trainer" program so project managers can train staff appropriately. e. Develop and provide information to C&D stakeholders about markets/outlets for C&D materials, including reuse markets and manufacturer-sponsored takeback programs (e.g., carpet tiles and ceiling tiles), and C&D processing facilities. f. Consider having an SMM professional in the jurisdiction become credentialed in LEED to be better informed to develop programs and policies that support SMM in the built environment. g. Identify opportunities for public/private partnership and collaboration with other jurisdictions in developing and disseminating education and engagement materials and strategies.
E4	**Ensure public employees are kept informed of SMM programs and policies in the jurisdiction, and that participation is strong.**
	a. Identify/develop/share research and information with the appropriate local government staff to help them identify beneficial uses of materials in certain applications, including road and landfill construction, as deemed appropriate and optimal. Consider implementing a demonstration project to educate and inform citizens about selected beneficial uses. b. Ensure public employees are well trained on SMM as it relates to their roles, and that full participation in programs and compliance with policies expected. Convey that leadership supports these efforts and implements monitoring/enforcement. c. Provide training to public employees that have purchasing responsibilities regarding the jurisdiction's environmentally preferable purchasing policies. d. Consider implementing a training program to train recycling program leads at public buildings and facilities, including schools, to ensure they are using best practices to maximize recovery and minimize contamination. e. Share information about more broad but related efforts across agencies/departments, as applicable, to better coordinate goal setting, planning and program implementation.

Action # and Principles Addressed	Education and Engagement (E) Actions and Considerations
E5	**Work with industry, local jurisdictions and others to identify and share information about outlets for recovered materials, and to expand potential programs, infrastructure, and markets for materials.**
  	a. Identify or develop and share a materials exchange with industry, or consider dedicating staff to identifying outlets for industrial byproducts. b. Engage local governments in information sharing to identify opportunities to expand material recycling options, particularly for small-scale generators, by consolidating material (e.g., to develop a hub-and-spoke or coordinate a milk run collection program). c. Through information sharing, foster sharing of collection and/or processing infrastructure, where beneficial uses or end markets exist. Potential examples include grinding of yard trimmings, grinding of asphalt shingles, or glass pre-processing.
E6	**Consider implementing and/or strengthening a statewide SMM campaign.**
 	a. Consider obtaining support from private industry and other organizations. (As an example, North Carolina has implemented a Recycle More NC website that provides information about recycling programs, including public space, and South Carolina has implemented a RecyleMoreSC campaign, with support from private businesses and NGOs.) b. Consider a simple, succinct message for a broad campaign, with a call to action and a resource (e.g., a catchy website) where more detailed information can be provided.

Funding

Achieving the DES requires programs, infrastructure, information sharing and technological advances, all of which require funding. Under the DES, managing materials at the end of their useful life is a shared responsibility among stakeholders. There are also transparent, sustainable funding mechanisms in place to manage materials at the end of their useful life. Further, funding mechanisms incentivize behaviors that support and adhere to SMM principles.

Action # and Principles Addressed	Funding (F) Actions and Considerations
F1	**Assess the adequacy of existing funding mechanisms and their alignment with SMM principles, and consider implementing additional funding mechanisms.**
 	a. Partner with entities such as The Recycling Partnership, Closed Loop Fund, and Keep America Beautiful to access available private sector funding for local program enhancement and market development. b. Encourage and provide tools for local governments to gain a clear understanding of the costs of their SMM programs using full cost accounting principles and to identify cost reduction opportunities.

Action # and Principles Addressed	Funding (F) Actions and Considerations
	c. Consider and plan for changing funding strategies over the long term in response to changing circumstances such as the evolving nature of materials collected for recycling and declines in waste disposed as recovery programs grow d. Consider implementing funding mechanisms such that all stakeholders bear some financial responsibility for managing materials at the end of their useful life in a manner that is equitable as well as sustainable. e. Promote/implement funding mechanisms that incentivize behaviors that advance SMM. Examples include PAYT programs, which incentivize recycling and reducing the amount of waste disposed, and recycling fees, which encourage consumers/generators to manage difficult-to-manage items (e.g., tires and electronics) at the end of their useful life, and revenues shares that encourage generators (i.e., municipalities) and processors (i.e., MRFs) to recover the greatest volume of recyclable materials possible, and to decrease contamination levels. Disposal surcharges are another mechanism that may discourage disposal. f. Have multiple funding mechanisms in place to reduce risk if one source of funding is diverted for other uses (e.g., as happens frequently with tax-based funding). g. Consider targeted funding mechanisms to support SMM activities and programs for specific material types (e.g., advance recycling fees). This might include EPR. h. Consider targeted funding mechanisms that encourage innovation in SMM-related activities, such as grants for a private entity to fill an infrastructure gap. Implement using best practices. i. When considering funding mechanisms, consider costs to implement and administer, risk of non-payment and diversion for other uses.
F2	**Explore and implement means to protect funds for their intended purpose, and to ensure costs and funding sources are transparent to the public.**
 	a. State-level funding supporting SMM may be better protected by having a quasi-governmental agency over SMM, ensuring that no large balances remain in the account, and having dedicated special accounts for revenues. At the local level solid waste authorities may be in a better position to protect funds than local government departments, and enterprise funds used to manage user fees can be better protected than general funds from property taxes. b. Ensure that there is transparency in state and local SMM program funding sources and costs. Use full-cost accounting to gain a thorough and clear understanding of all program costs, make this information public, and ensure services are priced in an equitable fashion.
Tip – U.S. EPA Region 4 has developed tools to help local governments in the area of SMM program funding. The tools include a spreadsheet-based model that provides "directional insights" for comparing costs and impacts of various programs, a funding and accounting handbook that can help local governments clearly identify program costs and develop an equitable rate structure, and spreadsheet-based full-cost accounting tools for local governments to use.	

Sustainable Materials Management is a marked shift from traditional integrated solid waste management. The breadth of environmental, social, and economic impacts to consider along the entire

supply chain and through end-of-life management are complex, varied, and evolving. Sharing of information among state and local governments, NGOs, research entities, and private industry will be key in bringing about SMM in a cost-effective manner. The actions presented within this Framework are founded on SMM principles and concurrently supports a transition to the Circular Economy, as businesses are incentivized to innovate more resource-efficient, environmentally friendly products, including products that are longer-lasting, repairable, and less toxic, and packaging made from renewable and recyclable materials. Innovative businesses have the ability to serve as change leaders in product design and manufacturing, and in catalyzing change that spurs economic growth. There is considerable work to be done, but this work is important in conserving resources and protecting the environment for future generations.

2030 VISION FOR INTEGRATED SOLID WASTE MANAGEMENT IN U.S. EPA REGION 4

6/29/2017

Final

U.S. EPA Region 4 would like to thank the many stakeholders in the region (which included state, local, and private-sector stakeholders from Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, and Tennessee) for taking the time to share their thoughtful insights and ideas to help shape this vision.

Introduction

We live in a material world. How our society uses materials is fundamental to many aspects of our economic and environmental future. If we want the U.S. to be competitive in the world economy, the sustainable use of materials must be our goal.

Our key message is simple.

- *Our use of materials is very large and increasing with population and economic growth. Energy and water use accompany materials use.*
- *Our use of materials now challenges the capacity of the Earth – air, water and land – to withstand the many resulting environmental problems. This situation fundamentally affects many other aspects of our future, such as the economy, energy and climate. We need to fulfill our human needs and prosper while using less material, reducing toxics and recovering more material at the end of its useful life. Business as usual cannot continue.*
- *The public and private sectors have many of the tools that we need to manage materials much more carefully than we typically do today. However, these tools are seldom used to address the full life cycle of materials. [There are] specific measures that EPA and state environmental agencies can take to: (1) promote efforts to manage materials and products on a life cycle basis, using present authorities, (2) build our capacity to manage materials in the future, and (3) accelerate the public dialogue necessary to start a generation-long shift in how we manage materials, and create a green, resilient and competitive economy. We should begin aggressively.*

Source: U.S. EPA, Sustainable Materials Management: The Road Ahead (2009)

The concept of sustainable materials management (SMM) is a departure from how EPA's national guidance to solid waste management agencies has historically focused on managing discards and landfill design and operation. SMM is a systemic approach to using and reusing materials more productively over their entire life cycles[4], thus conserving resources and reducing overall environmental impacts. SMM can be challenging to implement because it relies heavily on life cycle analysis (LCA) data, which can be challenging and costly to obtain. SMM also considers social and economic impacts that may not be reflected in LCA studies, or that may be at odds with other impacts, and some aspects of SMM are outside of the traditional scope of solid waste management agency authorities.

The Resource Conservation and Recovery Act (RCRA) program is designed and implemented to anticipate a need for aggressive, nationwide resource conservation that minimizes waste generation and disposal by "encouraging process substitution, materials recovery, properly conducted recycling and reuse, and treatment" [RCRA § 1003 (a)]. Accordingly, the RCRA program continues to expand beyond "waste management" to "sustainable materials management." Doing so will support a dynamic and sustainable economy through improved materials use.

[4] U.S. EPA, https://www.epa.gov/smm/sustainable-materials-management-basics

To accomplish this goal, the RCRA program will continue to balance waste and materials management with our nation's current and anticipated materials and resource consumption habits. The EPA and its state partners will:

- Provide ongoing leadership in applying rigorous scientific principles and risk assessment techniques, and fostering innovation to support a dynamic and sustainable economy; and
- Provide information, convene stakeholders, and work with manufacturers to lower life cycle impacts and advance sustainable materials management.

To find new ideas and reach better, more sustainable solutions, RCRA professionals will continue enhancing collaboration; strengthening partnerships; leveraging technologies, resources and skills; and making science and information accessible to build capacity in American communities.

Project Background

In 2014, U.S. EPA Region 4 undertook a project promote the adoption of SMM in the Southeast. The framework of integrated solid waste management (ISWM) was selected because it refers to a strategic approach to sustainable management of solid wastes, and the framework fits well within the regional state partners' solid waste-oriented organizational and regulatory structures. ISWM builds on the states' existing solid waste management plans that were created as part of federal approval of state solid waste regulatory programs. In essence, ISWM includes all sources and all aspects of waste management, covering generation, segregation, transfer, sorting, treatment, recovery and disposal in an integrated manner, with an emphasis on maximizing resource use efficiency. An effective ISWM system considers how to prevent pollution, recycle, and manage solid waste in ways that most effectively protect human health and the environment. ISWM involves evaluating local needs and conditions, and then selecting and combining the most appropriate material management activities for those conditions. ISWM is, therefore, the method and apparatus for implementing SMM in Region 4. SMM is broader in scope than ISWM and considers all aspects of the life cycles of products.

During this project, Region 4 and its stakeholders recognized the need to develop a regional "Desired End State Vision" portraying what a fully implemented ISWM system that supports SMM would look like, with a target date of 2030.

Project steps included:

1) Developing a data call for states to solicit their ideas regarding components of SMM that should be included in the Desired End State Vision;

2) Developing the draft vision statement using that input and sharing it with stakeholders;

3) Meeting with stakeholders from each state in the region to solicit feedback on the draft Desired End State and identify gaps that need to be addressed in order to achieve this vision; and

4) Revising the draft vision statement to incorporate the feedback provided.

EPA Region 4 sees the Desired End State as an idealized long-term vision for integrated solid waste management on which states can base advances to their own existing ISWM plans and programs. A supporting project being undertaken by the Region is the development of a Guide to Integrated Solid Waste Management Accounting and System Funding, to assist states and local governments with making a business case for recycling, composting and encouraging waste reduction, and to provide information on how to assess opportunities for lowering costs and developing sustainable funding.

EPA Region 4 acknowledges that different states within the region, and even different areas within each state, have made varying degrees of progress in transitioning to an ISWM system that supports SMM, and that while a regional vision is presented herein, each state is expected to have unique priorities and methods for making progress toward the Desired End State. Further, while the vision described herein is a lofty yet desired outcome, there are many challenges that will need to be overcome to achieve the vision, including funding constraints and information gaps, such as the lack of complete information regarding LCA impacts. Lastly, the Desired End State is not intended to place responsibility of achieving the Desired End State solely on the states' environmental agencies. Rather, it is recognized that multiple stakeholders have a role to play in achieving this vision.

Vision Statement

A circular economy exists, where inputs to products and packaging are optimized and the materials that are used are treated as valuable resources. Citizens, businesses, and other organizations have convenient access to information and services that help them make sustainable product and packaging sourcing, design, purchasing, use and end-of-life management decisions, thus facilitating the highest use for materials throughout and at the end of their useful life. Governmental entities leading SMM take a holistic approach in managing materials and ensuring sustainable policies and programs exist, and are pro-active in developing and enhancing the circular economy and coordinating collaboration and information-sharing among stakeholders. Managing materials at the end of their useful life is a shared responsibility among all stakeholders – including governmental entities, producers/brand owners, retailers and consumers, with a result of sustainable financing of recovery programs at the state and local levels that contribute to the optimized life cycle of materials.

Desired End State Description

The Key Principles of the Desired End State Vision Statement are listed separately below with details more concretely describing each principle.

1. **A circular economy exists where inputs to products and packaging are optimized and the materials that are used are treated as valuable resources.**

As such:

- Products and packaging are selected, designed, manufactured, used, recycled/ composted and otherwise managed at the end of their useful life to achieve the lowest negative environmental and social impacts, and to re-enter the economy in such a way as to maximize resource and economic values where appropriate. Technological advances ensure that processes to optimize resource use are in place, as well as to recover material value at the end of its useful life.
- A cost-effective, convenient means of managing residual materials is in place for all generating sectors, which includes reusing, sharing and repairing as feasible and appropriate, and recycling/composting and processing for energy recovery, when needed. The amount of waste disposed is minimal. This holds true for durable and non-durable goods, packaging, household hazardous waste, organics, industrial byproducts, electronics, construction and demolition debris, and pharmaceuticals.
- Resources are optimized and not wasted during the product/packaging manufacturing and transport/retail processes.
- Technological advances result in processes that minimize resource use to recover material value at the end of its useful life.
- Product prices reflect environmental and social costs associated with production and consumption.
- Jobs are created in the recycling, reuse, repair, composting, and energy recovery arenas, thereby strengthening local economies.
- Adequate end markets are encouraged and exist for recyclable materials as manufacturers have transitioned to increased use of secondary instead of virgin feedstocks where feasible.
- The circular economy intrinsically directs materials in such a manner that demand for recovered materials is strong and sustained, supporting a healthy economy.
- Recovery of materials often results in "upcycling," where products made of the recovered material are higher in value, quality and/or functionality than the original products from which they result.

2. **Citizens, businesses, and other organizations have convenient access to information and services that help them make sustainable product and packaging sourcing, design, purchasing, use and end-of-life management decisions, thus facilitating the highest use for materials throughout and at the end of their useful life.**

   As such:

   - Clear information about "upstream" and "downstream" impacts is available to consumers; institutional, commercial and industrial (ICI) establishments; and product manufacturers, thereby having a positive impact on product design, manufacturing, and consumption choices. This pertains to environmental as well as social impacts.

- Consumers and therefore generators of discarded goods and materials have information about management options and are inclined to reuse, share, and repair goods, thereby reducing resource consumption, and to recycle or compost when discarded materials are at the end of their useful life.
- A consistent and clear set of materials generation and recovery methodologies and metrics is available to decision makers to guide them in developing appropriate programs, policies, and approaches.
- Information is shared such that generators of residuals have access to markets for users of residuals, either directly or indirectly.
- Manufacturers and brand owners source feedstock materials sustainably, considering environmental impacts across the full life cycle and attributes such as renewability, recycled content, and the design of packaging considering its potential to be recovered, re-used, and recycled/composted in a way that maintains the value of the materials while providing for functionality and to the extent that these attributes result in reduced impacts.
- Consumers have access to non-toxic substitutes for products they purchase, and seek them out.
- Consumers select long-lasting products, as appropriate, and consider repairing instead of replacing them, as well as participate in the sharing economy.
- Unified information systems exist to help empower the public to make good decisions about material choices and inform the public about how to accurately recycle.

3. **Governmental entities leading SMM take a holistic approach in managing materials and ensuring sustainable policies and programs exist, and are pro-active in developing and enhancing the circular economy and coordinating collaboration and information-sharing among stakeholders.**

   As such:

   - Governmental entities have established policies and programs to encourage and facilitate the highest use of materials, promoting sustainable packaging and product design, environmentally preferable purchasing and product use, and management of materials at end of life in accordance with sustainability principles. These programs and policies are based on knowledge about environmental and economic impacts of products from life cycle analyses and other fact-based information.
   - SMM professionals and those involved in advancing SMM have access to training and information that help them understand and apply best practice approaches to designing and implementing effective programs and policies supporting SMM.
   - Environmental agencies, particularly state agencies, aspire to and have made substantial progress toward achieving waste minimization, to the extent that it also supports the reduction of life cycle impacts and related objectives.

- Responsible state agencies are no longer referred to as "solid waste" management agencies, but have a name reflecting broader and more holistic resource management responsibilities. Responsible agencies set goals and establish metrics, and put performance tracking systems in place to enable accurate measurement and continuous improvement toward meeting SMM goals. Such information is made public.
- SMM metrics consider environmental, social and cost impacts at all stages of a product's life, and are not limited to traditional solid waste management metrics.
- State agencies responsible for SMM measure and publicize the economic impacts (job creation, tax revenues, etc.) of the SMM policies and programs.
- State agency progress in implementing SMM principles is measured, progress is made and communicated to the public, and the state and local agencies/departments serve as an example to residents and the ICI sectors.
- Environmentally preferable purchasing policies are in place to encourage state agencies and local governments to purchase products that have lower environmental impacts, including but not necessarily limited to consideration of toxicity, transportation impacts, product longevity, and resource extraction impacts.
- Policies and programs exist to encourage innovation in developing technologies and infrastructure that help advance SMM in accordance with sustainability principles addressing environmental, social responsibility and economic viability objectives.
- ISWM policies and other environmental/sustainability policies and programs support each other and, as appropriate, are integrated through collaboration and partnerships.
- Ongoing collaboration and partnerships exist among economic development agencies and other stakeholders, including private industry and research institutions, to effectively enhance economic benefits of the circular economy within the region as appropriate, as well as to consider, develop and/or improve innovative technologies to enhance ISWM activities supporting SMM.

4. **Managing materials at the end of their useful life is a shared responsibility among all stakeholders – including governmental entities, producers/brand owners, retailers and consumers.**

   As such:

   - All stakeholders share in the responsibility of ensuring that programs and infrastructure exist to manage materials sustainably – product manufacturers/brand owners, retailers, consumers, and government. This includes difficult-to-manage materials.
   - There is a cooperative relationship that fosters the sharing of ideas and information among brand owners/manufacturers, governmental entities, and consumers regarding ISWM policies and programs that support SMM and the circular economy.
   - U.S. EPA, states, and other stakeholders adopt policies and develop tools to advance SMM and the circular economy.

- Sustainable funding mechanisms that incentivize the highest use of materials and goods with the least environmental impact are in place to ensure full funding of end-of-life management programs.
- Funding mechanisms incentivize SMM behaviors by consumers and members of the supply chain.
- State and local governments, along with other stakeholders, apply systems thinking in designing a flexible and diverse set of solutions.
- There is investment in research and development that helps create an economically favorable environment for SMM and continues the advancement of technologies and products that minimize the use of resources. Funding mechanisms exist to help repair environmental impacts that result from materials management, fostering a restorative economy.
- Sustainable financing exists at the state and local levels to support optimization of recovery efforts through the use of best management practices, appropriate technologies, and organizational approaches that maximize program effectiveness and efficiency.

Desired Outcomes

As a result of establishing an ISWM system that supports the principles of SMM, the following are achieved in the Desired End State:

- Energy recovery is utilized only for materials that cannot otherwise be reused, repaired, or recycled/composted, with a preference for technologies and applications that have demonstrated life cycle benefits.
- Materials quality is protected and materials are used in a manner that retains their highest possible value throughout their life cycle.
- Human and environmental health are protected by SMM policies and programs. The nutritive value of soil is enhanced, in turn enhancing human and environmental health and contributing to CO_2 sequestration.
- Energy and natural resource use is minimized and resources are used more efficiently and are renewed/replenished before being consumed again.
- Human exposure and environmental risks associated with the use of toxic materials in product manufacture and use are eliminated to the maximum extent possible.
- The need for disposal facilities is increasingly less necessary, with associated releases of methane and carbon dioxide minimized.
- Local economies are strengthened.
- Materials management programs and systems are funded in an equitable fashion with sustainable funding sources.