White Paper
Iowa Waste Management Hierarchy – Intent and Limitations

The original mandates of both Federal (1976 Resource Conservation and Recovery Act) and state (1987 Groundwater Protection Act, and 1989 Waste Reduction and Recycling Act) laws related to solid waste were designed primarily as a system of controls to protect human health and the environment. Iowa's waste management hierarchy was enacted in 1987, as part of the solid waste management policy set out in Iowa Code 455B.301A. The declaration of solid waste management policy states:

> *The protection of the health, safety, and welfare of Iowans and the protection of the environment require the safe and sanitary disposal of solid wastes. An effective and efficient solid waste disposal program protects the environment and the public and provides the most practical and beneficial use of the material and energy values of solid waste. While recognizing the continuing necessity for the existence of landfills, alternative methods of managing solid waste and a reduction in the reliance upon land disposal of solid waste are encouraged. In the promotion of these goals, the following waste management hierarchy in descending order of preference, is established as the solid waste management policy of the state*:
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> a. *Volume reduction at the source.*
> b. *Recycling and reuse.*
> c. *Waste conversion technologies.*
> d. *Combustion with energy recovery.*
> e. *Other approved techniques of solid waste management including but not limited to combustion for waste disposal and disposal in sanitary landfills.*[1]

The waste management hierarchy is referenced several times in Iowa Code as a guide for decision making, setting priorities, developing solid waste comprehensive plans, and awarding financial assistance. When established, the waste management hierarchy was expected to protect public health, conserve natural resources and save energy. Established now for over 30 years, the waste management hierarchy continues to provide value as a guide for managing discarded waste. The "*Reduce, Reuse, Recycle*" component of the waste management hierarchy has also been particularly useful in providing public awareness and education to foster behaviors that reduce reliance on sanitary landfills for management of end-of-life materials.

While the waste management hierarchy provides overarching beneficial guidance in managing waste, the hierarchy is not without shortcomings. Taking place in the solid waste industry is a shift to a more holistic approach through sustainable materials management. Sustainable materials management incorporates perspectives regarding the impacts on health and the environment a material has throughout its full life cycle (cradle to grave). A material's life cycle impact begins with extraction of raw materials and continues through product manufacturing, distribution, use and ultimately end of life management rather than simply as a waste being managed under a waste management hierarchy perspective. It looks at a range of inputs and effects, such as energy use, greenhouse gas emissions, water use, toxicity, etc. and the environmental impacts at each stage of its life. Such considerations are critical when making management decisions, setting law and policy, investing in programs and infrastructure and taking action.

<u>End of Life Focus</u>

The waste management hierarchy provides guidance on managing end of life waste but does not sufficiently address public health and environmental impacts occurring at each step in a material's complete life cycle.

Considering the full life cycle provides a clearer and more complete picture of health and environmental impacts for each material management alternative.
An example commonly used to demonstrate the waste hierarchy end of life focus is that of packaging. From a waste hierarchy perspective cardboard packaging is preferred to that of plastic film packaging. Cardboard is readily recyclable through programs across the state. Plastic film recycling on the other hand is limited, if offered at all. For this reason the waste hierarchy prefers cardboard packaging. A sustainable materials management perspective would look at raw material inputs and environmental impacts throughout the life of the plastic packaging. From a resource and energy savings perspective, the non-recyclable plastic film packaging may outperform recyclable cardboard packaging. Plastic film may require fewer resource inputs and less energy to produce and oftentimes is smaller and significantly lighter than its recyclable counterpart to transport. Fewer resources, less energy, and efficient transportation of the non-recyclable plastic film packaging may surpass the benefits of recycling the cardboard packaging.

Defining Waste

When do materials become a waste and require end of life management? From a waste management hierarchy perspective, a material or product becomes a waste when it fulfills its intended use at which point it requires end of life management via one of the hierarchy preferences. From a sustainable materials management perspective waste is generated at each stage of a material's life cycle beginning with raw material extraction. In other words, managing waste begins with raw material extraction and waste is managed at each subsequent stage of a material's life (manufacture, distribution, use and discard). Management alternatives at each stage are considered in terms of health and environmental impacts.

Actions that fall at the top of the waste hierarchy (i.e. reduction, reuse, recycling) should not be considered waste management. Reduction is not creating waste. It is reducing the amount of a material generated. Reuse of a material is not waste, it's maintaining or extending the productive life of a material. Recycling a material is not waste, it is a feedstock for creating new items.

The Iowa Waste Exchange Program (IWE) provides an excellent example. IWE matches "waste" from one entity with another entity that views this same waste as a raw material or a product usable in their operations. Materials are being exchanged for continued use, not waste. As another example, the term e-waste is used to describe unwanted electronics when in fact, e-waste electronics contain valuable materials that serve as feedstock for other processes. In some cases, computer e-waste can be upgraded and put back out on the market as a new product. E-waste is an often used term that is not accurate when considering the full life cycle under sustainable materials management.

Reduce, Reuse and Recycling Limitations

There are cases where management alternatives within the waste hierarchy do not align with sustainable materials management. Reducing inputs on the front end (waste reduction) may have negative overall impacts when considering the full life of the materials used.

Oregon DEQ used the following examples to demonstrate where following the waste management hierarchy may conflict with sustainable materials management.

Reduce: During the construction phase of a new home with thin walls and little insulation, source reduction is employed by reducing the amount of materials used, less waste is created and less energy is used. However,

while the home is occupied greater energy and resource inputs will be required to warm and cool the house far surpassing the savings of materials and energy during construction.

Reuse: An example of where reuse, a preferred waste hierarchy alternative, does not align with sustainable materials management would be that of an old refrigerator. From a materials management perspective it may be less impactful to recycle the old, inefficient refrigerator and purchase a new energy savings model. Over the life of the new refrigerator, the benefit of reduced energy use may be greater than the resources needed to manufacture it.

Recycle: Glass is an example that from a greenhouse gas emissions perspective, glass to glass recycling is favored over glass to fiberglass production which in turn is typically preferred to using glass in local asphalt paving projects. Transporting glass even long distances to a glass manufacturer is preferable in spite of transportation impacts on greenhouse gas emissions when looking at it from a life cycle perspective. Following the waste management hierarchy, recycling is recycling. There is no preference in the manner to which glass is recycled whether the glass is recycled back into glass, into fiberglass or reused in asphalt paving.

Toxics

The waste management hierarchy does not account for public health or environmental benefits with regard to managing toxic substances. In fiscal year 2017, the state's household hazardous materials collection program diverted over 6.8 million pounds of household hazardous waste from landfilling. From a landfill diversion aspect the 3,413 tons (about 1% of waste landfilled in Iowa annually) does not seem significant. But the public health and environmental benefits of this program go beyond landfill avoidance. Landfill diversion under the waste hierarchy favors reuse and recycling of household hazardous materials. Alternatively, removing these toxics from the production stream could be a priority under a sustainable materials management system.

Weight

While the waste management hierarchy does not address measuring program success directly, the waste hierarchy is very much tied to these measures. The mechanism in place to measure program success is the weight of solid waste as it is landfilled. The investment of resources (time, money, policy development, etc.) for proper management of solid waste is based on which solid waste components weigh the most and action is then taken to divert materials from the landfill following the waste management hierarchy.

Several factors impact the weight of landfilled solid waste. Product packaging that ends up in the landfill, for example, has undergone considerable change over the past several years. Changes in packaging materials and the packaging itself has become lighter, both affect the weight being landfilled without any reduction or diversion of materials from the landfill. From a public health, environmental protection and sustainability perspective, alternatives to weight based measures are needed.

Iowa's solid waste management policy is to protect public health and the environment. Implementing waste hierarchy based on solid waste management programs, investing in infrastructure and measuring the resulting impacts on landfill tonnage, may be misdirected and do not adequately reflect public health and environmental protection. In addition to measuring solid waste landfilled tonnage, alternative measures of policy and program effectiveness and identifying targeted solid waste materials, measuring impacts on such things as greenhouse gas emissions, water use, and energy use over the life of solid waste materials should be investigated as a truer measure of public health and environmental protection.

Summary

The waste management hierarchy continues to serve a useful purpose by providing guiding principles for solid waste management and as a communication and education tool. It identifies general principles illustrating reduction at the source as most preferred and landfilling as least preferred end of life management options.

While the waste hierarchy provides some benefit, it falls short of providing the highest protection of public health and the environment and the necessary detail upon which to create new or update existing laws, policies and programs. The hierarchy does not take into account the health and environmental impacts of a material or product over the course of its life by focusing on end of life management. Supporting the waste hierarchy with an overarching consideration of environmental, economic and social sustainability components of the sustainable materials management model would provide greater benefit to Iowans. Current waste management perspectives are changing. Supported by the US EPA, other states and many countries throughout the world, assessing materials management sustainably and for each phase of a material's life from extraction through end of life management, will further enhance waste management hierarchy benefits. Sustainable materials management recognizes the environmental impacts and public health impacts beginning with extraction and continues with each subsequent stage in a material's life (production, transportation, use, and disposal).

Following the waste management hierarchy benefits Iowans and the environment and should continue to be used as a general guide for action and as a communication tool. But for reasons outlined above, the hierarchy should be enhanced by implementing a sustainable materials management system. Material management decisions, enacting new laws or policies, developing new or revising existing waste management programs, setting priorities and guiding investments should be grounded on the impact materials have throughout their full life cycle, not simply what to do with end of life discards.