

CHAPTER 1 MATERIALS MANAGEMENT

INTRODUCTION

Oregon's Vision

Imagine a day when Oregonians live well and prosperously, producing and using materials responsibly, conserving resources, and protecting the environment. Imagine a day when we recognize that the earth's resources are finite, and we begin living within those limits, ensuring that future generations have the same opportunities as we do.

Is such a future impossible or possible only with tremendous sacrifices? The short answer is no. We are in the midst of an important transformation with respect to how we think about and manage materials. This transformation will have its challenges, to be sure, but it is possible and economical given current technology and systems. Proper **materials management** will enable a future in which we all live sustainably and well, responsibly using and managing all the materials we depend on.

The Department of Environmental Quality (DEQ), Oregon's regulatory agency responsible for protecting our environment, convened a diverse group of stakeholders that resulted in the adoption in 2012 of a vision and framework for rethinking waste and discards. Their report, *Materials Management in Oregon: 2050 Vision and Framework for Action*, lays out four key transformations:

1. Recognizing that Earth's resources are finite, Oregonians live within the limits of our sustainable share of the world's natural resources.
2. We take into account the full impacts of materials throughout their life cycle.
3. We use renewable resources at levels that can be sustained in perpetuity while maintaining the resiliency of natural systems.
4. All Oregonians have access to the knowledge, capabilities, resources and services required to use materials responsibly.

We have done the impossible before!

Carbon emissions in Multnomah County are



25% lower

than they were in 1990.

TERM

Materials management: *the use of materials based on the environmental and social impacts associated with the materials across their entire life cycle. (EPA)*



DEEP DIVE

Learn more about materials management at DEQ's website.

TERM

Paradigm shift: *an important change that happens when the usual way of thinking about or doing something is replaced by a new and different way.*

These aspirational statements were collaboratively generated by businesses, non-profits and local governments from all over the state. The stakeholders worked together to identify current challenges and create a compelling vision for the future. Many of the environmental challenges facing Oregon and the world, such as pollution and greenhouse gas emissions, are related to how materials are produced, used and managed. In DEQ's long-term vision:

- Producers make products sustainably, so every option is a sustainable option.
- People live well and consume sustainably.
- Materials have the most useful life possible before and after discard.

In June 2015, the Oregon Legislature passed SB 263 and SB 245, which will turn our state and cities towards a robust implementation of the 2050 Vision. They provide goals, requirements and a revenue stream to help make the vision a reality. In June 2021, they furthered this commitment with SB 582 which required that producers of certain products help with the financing of some of these goals.

In the rest of this chapter we'll more fully explore this **paradigm shift** from discards management to materials management, outlining key stages in the life cycle of materials and their environmental and social impacts. We will explore how Oregon law will alter how we measure and prioritize practices to meet this Vision. We'll also begin to lay out how you as a Master Recycler might play an important role in this shift.

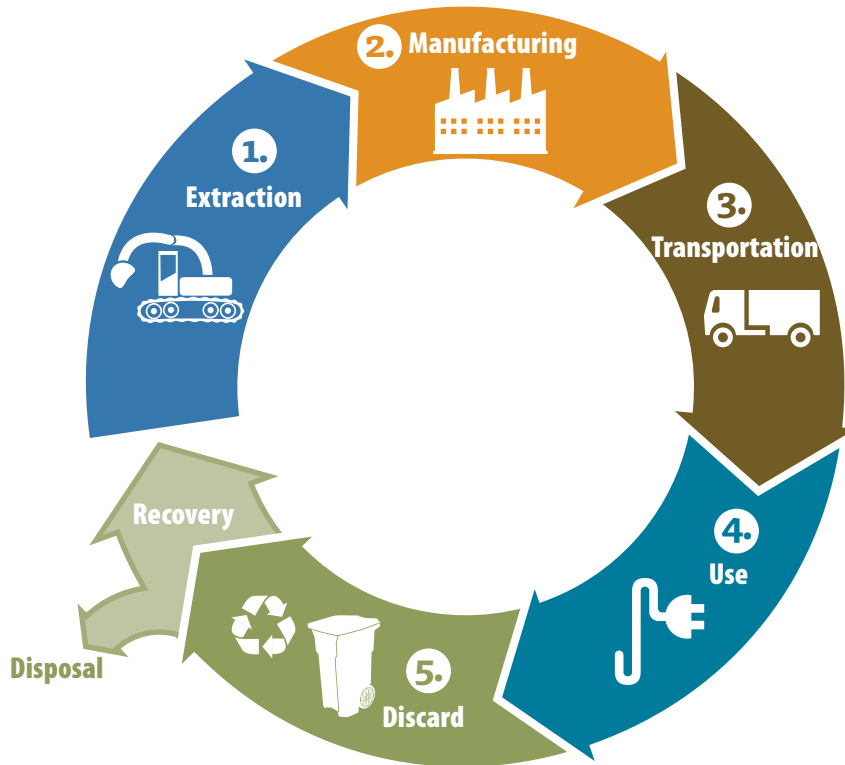
WHAT IS MATERIALS MANAGEMENT?

Materials management takes a holistic view of environmental and social impacts across the full life cycle of materials as they move through the economy and around the world. We can use materials management to identify actions needed to reduce negative impacts. Materials management includes the analysis and management of all of the steps it takes to make products.

The steps in the life cycle of materials typically include:

- Extraction
- Manufacturing
- Transportation
- Use
- Discard (reuse, compost, recycle and energy extraction)

MATERIALS MANAGEMENT LIFE CYCLE



This Materials Management image shows the cycle of materials from extraction to disposal (or recovery).

Materials management recognizes that there are environmental, economic, and social impacts in each and every stage of the life cycle of the material. Trees, minerals, water and food are gathered to make products. Oil, natural gas, water, wind, the sun and wood are used for energy for transportation, manufacturing and during the use phase. Waste is generated during just about every stage in the form of water and air pollution, carbon emissions and solid waste.

Each stage along the life cycle also has economic impacts (negative and positive). Workers extract, transport, design, manufacture, recycle, and reuse materials sometimes at a living wage, sometimes as slaves. Corporations produce the products made from raw materials. The recycling and reuse industry mines discarded materials for reuse.

Materials also affect our social wellbeing and health. People who work in and live near mines, factories and landfills can face health risks. Americans often report feeling overwhelmed by having to gather, store and maintain all our stuff. But materials make up the products that meet basic human needs such as food, medicine, clothes and shelter. Materials also enable human creativity from music and art to the sharing of ideas on the Internet and in books.

CREDIT

Much of the language and ideas in the next three sections come from a presentation by David Allaway, Senior Policy Analyst in the Materials Management Program of Oregon's Department of Environmental Quality (DEQ). David coordinates DEQ's Waste Prevention Strategy and has contributed to several projects involving life-cycle analyses, including e-commerce packaging, water delivery systems, residential construction, end-of-life management of paint, community-scale recycling, and an economy-wide carbon footprint for all consumption in Oregon. David co-leads the Inventory Workgroup of the West Coast Forum on Climate and Materials Management and was an invited member of the Steering Committee of Walmart's Packaging Sustainable Value Network. David is also on the Master Recycler Advisory Committee.

MATERIALS MATTER

Materials matter, and our current use of materials is deeply unsustainable. The extraction, transportation, use and discarding of materials produce significant negative environmental impacts and have social and economic costs.

By looking at the full life cycle of materials, we can begin to understand the magnitude of their impacts.



Extraction: The products that we use every day are made from natural materials (such as wood and metal) that are found in the environment and then extracted. This stage has substantial environmental impacts that are most often not directly seen by consumers.

To obtain metal for new products and coal for manufacturing them, large mines permanently scar landscapes and leave behind acid drainage that pollutes the water and kills wildlife. Many of our nation's Superfund sites are abandoned mines. In the southeastern U.S., coal is mined by dynamiting mountain tops and pushing the rubble into nearby streams. Mining devastates large tracts of tropical rainforest. Mining often requires smelting onsite, poisoning the nearby rivers and villages.

Eight thousand years ago our planet had 1.5 billion acres of forest; today close to half of this is gone, and the rate of destruction is increasing. In Oregon and Washington over 90 percent of old-growth forests have been cut. Loss of forests leads to loss of wildlife and erosion of soils that disturb rivers.

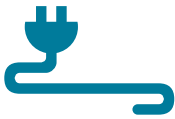


Manufacturing: Most of the materials that we use must be transformed through manufacturing processes into final products. Metal and paper manufacturing are major contributors to air pollution, including acid rain. Plastic manufacturing is one of the largest contributors to hazardous waste. Manufacturing requires large volumes of water that are then returned to the environment polluted and at temperatures incompatible with the native habitats. Construction of a new home creates about 2.5 tons of wood waste.



Transportation: After raw materials are extracted they almost always need to be transported somewhere, usually to sites of manufacture or consumption.

Evidence is mounting that the noise produced by ships at sea negatively impacts the sea life dependent on sound for communication and navigation. Roads used to transport materials between each step of the life cycle of materials damage the land. The normal use of cars and trucks release significant heavy metals that drain into our waterways. Brakes release copper, while tire wear releases zinc. Smaller amounts of many other metals, such as nickel and cadmium, come in contact with motor oil that then drips onto roads. These metals are also emitted in exhaust.



Use: Many everyday products and devices continue to require natural resources for their use and maintenance.

Small appliances, computers, phones, automobiles and homes are all powered by energy, usually made from coal and oil. Even our clothes require significant energy to keep them clean.



Discard: Eventually most of our materials and products reach the end of their useful lives, at which point they typically end up in landfills. While landfills monitor and contain toxins and pollution better than they did in the

past, their maintenance still requires resources and land. Recycling and energy recovery also require resources. Even reusing a product in the same form often requires transportation, cleaning and possibly fixing, all of which require resources.

Now that we've painted a somewhat bleak picture by outlining the negative environmental impacts that accumulate at each and every stage of the materials life cycle, we'd like to explain how the shift to materials management can offer a solution.

TERM

Solid waste: Any discarded or abandoned materials. Solid wastes can be solid, liquid or containerized gas.

Discards management: The policies, decisions and processes regarding materials that prioritize environmental and social impacts associated with products after the consumer has used them.

RESOURCE

For more on landfill and recycling capacity see the *Solid Waste and Recovery Infrastructure* chapter.

FROM MANAGING DISCARDS TO MATERIALS MANAGEMENT

Until 2012, when the Materials Management vision for Oregon was approved, DEQ's Materials Management program was called the **Solid Waste** program, because it traditionally focused on managing products and materials at the end of their useful life, when they were considered solid waste. This resulted in programs, priorities and measurements of success based almost entirely on how we manage materials when we discard them, and so, is often called a **discards management** approach.

DEQ's historic focus on planning for materials based on their end-of-life is largely a consequence of problems identified — and legislation passed — in the 1990's. At that time, many landfills were poorly located, operated and regulated, and new federal standards made the closure of many landfills imminent. These factors added to a perception of a *garbage crisis* — that we were running out of places to dispose of our waste.

Oregon's current solid waste system is quite different. We now have ample disposal capacity, in landfills that are better operated and less polluting than their predecessors. Recycling programs are firmly established, conserving resources, reducing pollution and providing green jobs. Some producers are even sharing responsibility for managing their products at end-of-life and for reducing the presence of toxic chemicals in products that enter consumers' homes and eventually become solid waste. Recycling is now second nature for Oregonians, and interest in *reduce and reuse* is growing.

Discards management and materials management are concerned with different stages of the life cycle of materials. In contrast to discards management, materials management focuses on the entire life cycle of materials, attending to the social and environmental costs at all stages from extraction, manufacturing, and use to disposal or reuse.

To understand the difference, it is helpful to look back at the steps of the life cycle of materials from the perspective of the consumer. The extraction, transportation, design and manufacturing of materials all take place before the consumer uses that material. If we were to use a river as an analogy, they could be thought of as *upstream* from the consumer. Collection, processing, landfilling, recycling and reuse are all activities that take place *downstream* from the consumer. The time that the consumer is actually using the product is the *use phase*.

Discards management focuses on actions downstream of the consumer to reduce emissions from waste facilities and also to conserve resources through recovery. Materials management addresses all stages of the life cycle and all associated pollutants and resources. The old model of discards management is not wrong. In fact it is very much a part of materials management. Materials management, however, offers a much broader view

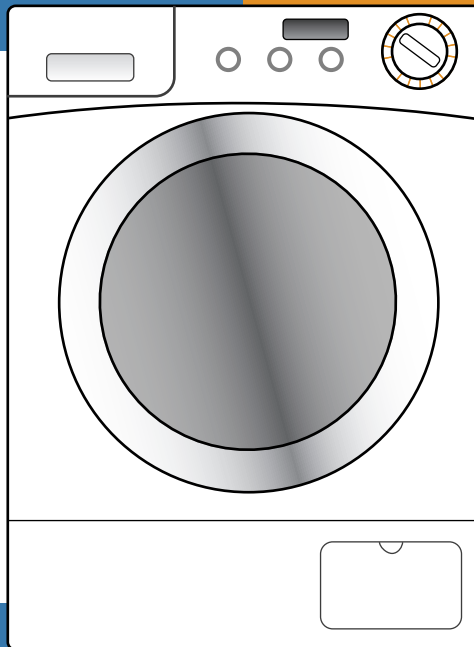
and, with the bigger picture in mind, helps individuals and policy makers make better choices, because often the biggest impacts can be in the upstream and use phases rather than the discards phase.

Along with shifting the focus and analysis of the problem, shifting to material management will drive innovation to solve the problem. For instance, these two approaches to materials engage different sets of partners. Discards management primarily involves waste generators and the waste collectors, landfill managers, and the recycling and reuse industries. Materials management involves those partners along with everyone else involved in the life cycle of materials — which is everybody!

TYPES OF QUESTIONS WE MIGHT ASK IN DISCARDS MANAGEMENT VS. MATERIALS MANAGEMENT

Discards Management

- Can I recycle the material from this washer when I am done with it?
- Will it be safe to take it apart for recycling?
- Will it add toxins to our landfills?
- How long will it last?
- Can someone else use it when I am done with it?



Materials Management:

- Where did the materials they used to make the washer come from?
- Is it designed with minimal materials and toxins? Who made it?
- How much energy will it need to run?
- How long will it last?
- Can I recycle it when I am done with it?
- Will it be safe to take back apart for recycling?
- Is it better to recycle the washer when I am done with it because it is now an energy hog?
- Will it add toxins to our landfills?

CASE STUDY: DRINKING WATER

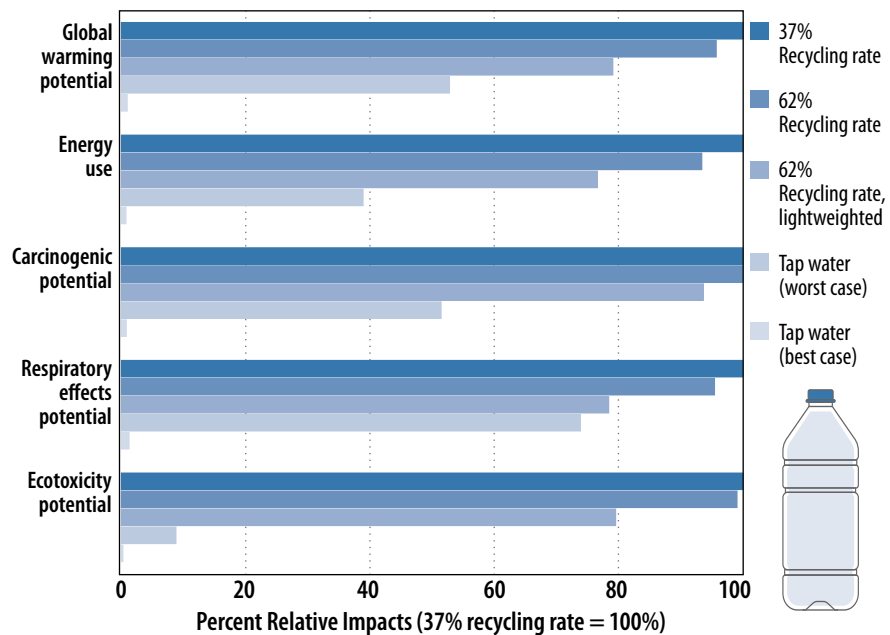
To more fully understand the powerful, holistic approach of materials management, let's consider how we drink water, whether in single-use bottles, bottles that we reuse, or directly from the tap. In 2008, the Oregon Department of Environmental Quality (DEQ) commissioned life cycle analysis that compared various ways to reduce the environmental impacts associated with the delivery of drinking water.

This Water Delivery graphic shows five different types of impacts: global warming potential, energy use, carcinogenic potential, respiratory effects and ecotoxicity. The darkest bar shows the baseline which is the impacts of delivering drinking water in a single-use PET bottle, where the bottle is recycled at a rate of 37 percent (which was the current recycling rate of water bottles). All of the impacts are set to a common index of 100 for easy comparison.

The next lighter bars show the impacts of the same water in the same bottle, recycled at a higher rate, about 62 percent. You can see that increasing the recycling of PET bottles is one way to reduce environmental impacts, although not by nearly enough.

Fortunately, there are actions that producers and consumers can take that go beyond just changing how we manage our discards. Producers, for example, can make their bottles thinner. Many already have, and we see those impacts in the middle bar. That's a form of **product stewardship** where manufacturers take action to reduce impacts of their products; it's also waste prevention. And you can see that this reduces impacts more significantly than just recycling.

WATER DELIVERY



Baseline = PET, half-liter, 13.3 grams, 0% post-consumer recycled content (PCR), on-site molding, purified municipal water (reverse osmosis, ozone and uv), 50 miles to retail, 5 miles home-to-retail, co-purchase w/24 other products, no chilling.

Source: Oregon DEQ (2013)

TERM

Product stewardship:

The principle in which everyone involved in the lifespan of a product is called upon to take responsibility to reduce its environmental, health and safety impacts.

Consumers can also take action. They can drink from the tap, in a reusable bottle. DEQ explored this scenario in contrast to water delivered in a bottle. The fourth bar in the chart is a worst case scenario of reuse, where the consumer drinks from a reusable bottle and washes it every day in a home dishwasher which, by the greatest margin, failed EPA's Energy Star Program.

Use an Energy Star dishwasher and wash your bottle once a week, and the impacts are there in the fifth bar. Can't see them? That's because they're about 98 percent less than using and recycling a single-use bottle.

If we look beyond recycling, we can identify more strategies, and sometimes more effective strategies, for reducing impacts. That's the power of materials management.

As a side note, the drinking water delivery graph also illustrates the hazards of promoting recycling as a method of landfill avoidance. The hierarchy — reduce first, then recycle — is an imperfect but powerful tool. It says that we should reduce first, then recycle, because reducing our consumption is the most effective way of lessening our environmental impacts. Recycling is better than disposal, but waste prevention is best of all. In this example, recycling PET water bottles at 100 percent results in no new landfill material, and yet it still produces very significant and unsustainable environmental impacts.

MATERIALS MANAGEMENT ON A NATIONAL LEVEL

Oregon is not the only place shifting from discards to materials management. In 2009, U.S. Environmental Protection Agency (EPA) created a materials management vision. It is described in *Sustainable Materials Management: The Road Ahead*.

The EPA states that a materials management strategy would be an important shift of emphasis where policy and practice would be focused on:

- Knowing and reducing the life cycle impacts across the supply chain.
- Using less material inputs (reduce, reuse, recycle).
- Using less toxic and more renewable materials.
- Considering whether services can be substituted for products.

Upcoming chapters explore each of these topics in greater depth.

Shifting to a materials management approach refocuses the way our economy uses and manages materials and products.

It is certain that a thoughtful materials management strategy is essential to realizing a future of less waste, fewer toxics and greater prosperity.



Materials Management
Find EPA's vision in the
*Sustainable Materials
Management: The Road
Ahead (available online).*

The EPA asks:

“What kind of world will we actually inhabit in 20 years? Some predict that it will be better than the present — where products and materials will be less toxic and reusable, and where resources will be used more efficiently so that far less waste is produced. Others predict we will experience a bleaker future — where harmful chemicals will be more prevalent throughout our environment and may seriously affect groundwater, drinking water, and food supplies. While we can't know which of these scenarios—or others—will exist in 20 years, considering the future now makes sense if we want a chance to shape it positively.”

CONCLUSION

A future in which we use and manage materials sustainably is possible and very much within our reach. *Materials Management in Oregon: 2050 Vision and Framework for Action* aims for a future in which people live well and sustainably. Key to realizing such a future is shifting from a paradigm of discards management to materials management.



We have learned that materials management takes a holistic view of environmental and social impacts across the full life cycle of materials as they trace their course through the economy and through natural and built environments. This broader view empowers us to make better decisions, individually and collectively, and helps us move beyond simply focusing on waste reduction or recycling. So, what's next?

Chapters 2 through 4 use a systems perspective to explore how the materials we use every day relate to global issues such as sustainable consumption, climate change and equity.

Then, Chapters 5 and 6 will explore the economies and processes of recovery (reuse, recycling, compost, incineration) and disposal from a holistic materials management perspective.

This larger systems approach introduced in the early chapters of this handbook will empower you as a Master Recycler with a conceptual foundation so that you can answer questions that relate to the everyday choices people make about materials at work and home. Master Recyclers are important agents in the transformation from discards management to materials management. You can help promote positive activities such as recycling, reuse, sharing, fixing, and maintaining materials and toxics reduction (all of which are powerful strategies for sustainable consumption).