

C&D Recycling in a Circular Economy



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Los Angeles

**LA Committee on the
Environment**

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A little history, we've been doing this for a while.



1776

In 1776 patriots pulled down a statue of King George the Third and melted it down to make more than 42,000 bullets during The American War of Independence



1897

In 1897 New York opened one of the first recycling plants



1904

In 1904 Chicago opened the first aluminum recycling facility



1916

In 1916 the US Government created the Waste Reclamation Service to help out the WWI War effort



1930's

In the 1930's scrap recycling became a way to make a living for many trying to survive the Great Depression



1940

In 1940 the US once again ramped up recycling to support the war efforts for WWII

A little more history, just because.



1970

In 1970 the Reduce, Reuse, Recycle mobius was created by Gary Anderson



1971

In 1971 Oregon became the first state in the Nation to enact a Bottle Bill



1981

In 1981` the first Curbside Recycling program was started in New Jersey



1989

In 1989 California passed AB-939 and started the push for tangible, quantifiable recycling and diversion in the state.



2006

In 2006 the EPA confirms that recycling helps to lower GHG emissions



2018

In 2018 China bans imports due to unacceptable levels of contamination found in most materials reaching their shores.



2019

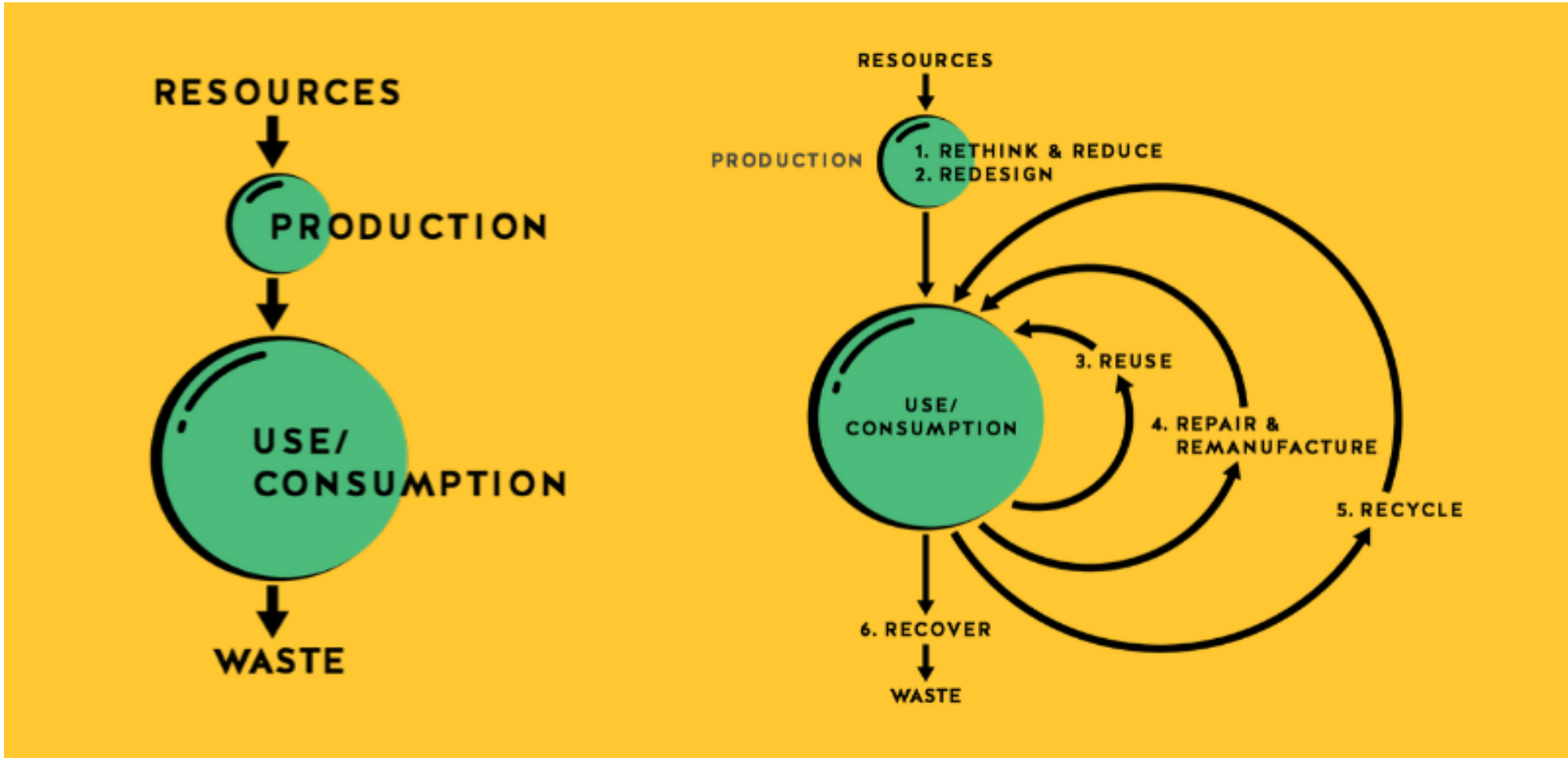
In 2019, due to China banning even more materials coming from the US, the US recycling industry suffers massive losses and plant closures, leading to the cessation of many recycling programs



Many names for similar concepts.

- In the 1970's we saw "INDUSTRIAL ECOLOGY", seeking to optimize resource use by mirroring natural ecosystems to create a closed-loop system.
- In the 1990's we got the "CRADLE TO CRADLE" concept. This suggested that products should be designed to be easily recycled or repurposed.
- More recently we turned to the phrase "ZERO WASTE", saying that we should have 90% diversion as our goal.

Circular Economy



This time
will be
different, I
promise!



A common mistake that people make when trying to design something completely foolproof is to underestimate the ingenuity of complete fools.

— Douglas Adams —

AZ QUOTES

Before we get started, remember, we can sort almost anything.

Recovery facilities are capable or sorting nearly anything, depending on contamination



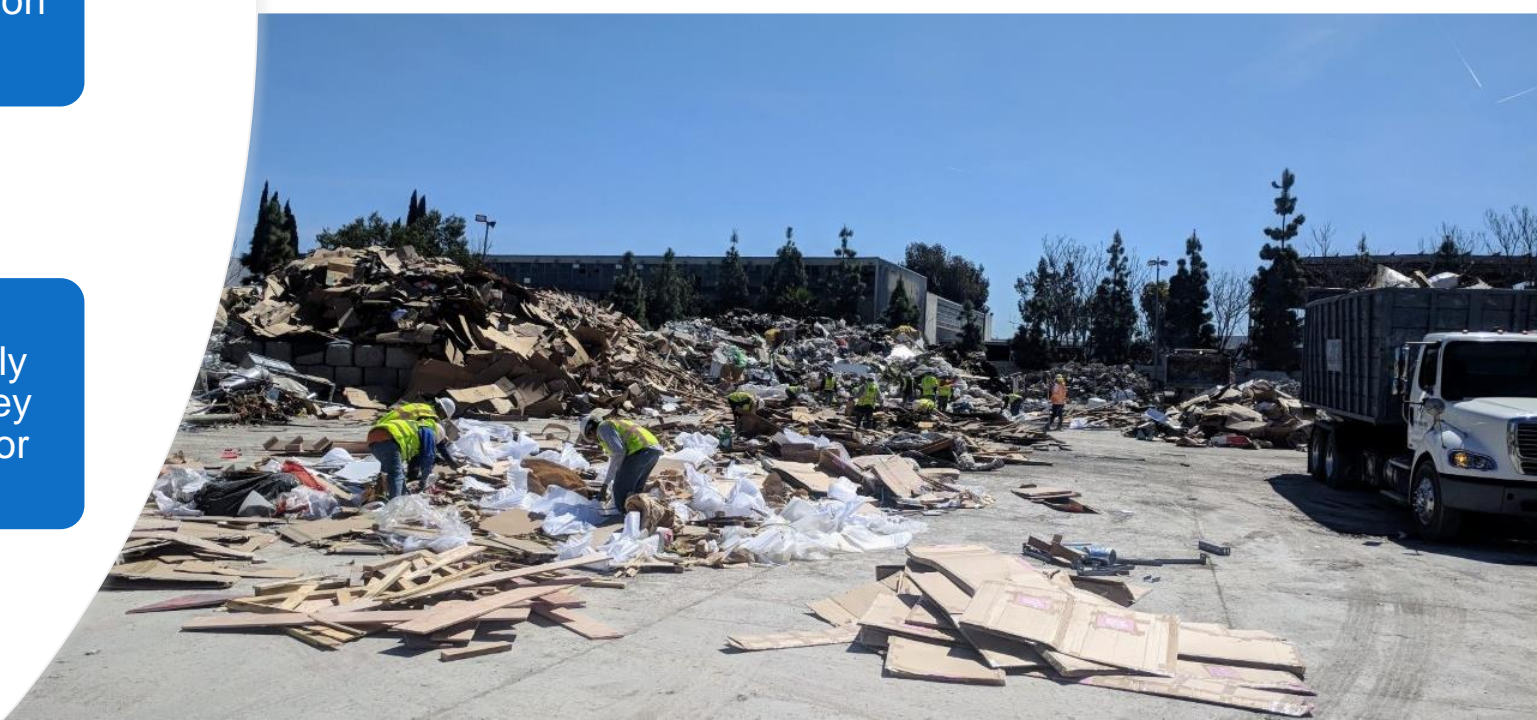
The more items you want to recover, the more you spend on labor



Nobody seems to be mandating markets



Facilities will only recover what they have a market for



US Population vs. Resources Used

There are roughly 333 Million people in the United States

That works out to about 5% of the population of the world

The US uses between 17% and 24% of the world energy, depending on what study you subscribe to

The US uses about 25% of total global resources

2018 Landfill Statistics

More than 146 million tons of MSW were placed in US landfills in 2018 (EPA)

Nearly 145 million tons of C&D were placed in US landfills in that same year (EPA)



There is a problem with spot reporting and no central oversight.

As a rule, coastal states, such as California, New York, Massachusetts, Washington, Oregon, have some of the most stringent reporting requirements.

As of 2021 there were more than 20 states that did not have statewide C&D recycling requirements.

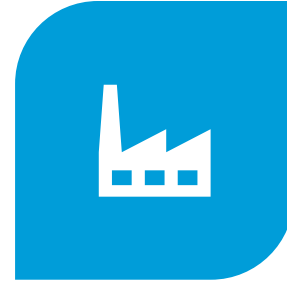
Highs and Lows

The national average C&D diversion rate for 2018 was only 27%

In California claims only about 25% of all C&D generated in the state went to landfill in 2018

The state of Alabama had 95% of all C&D debris generated in that state end up in landfill that same year

C&D Statistics



THE US GENERATED MORE THAN 600 MILLION TONS OF C&D WASTE IN 2018



C&D WASTE GENERATION INCREASED BY 342% FROM 1990 TO 2018



C&D WASTE GREW MORE THAN 10X FASTER FROM 2005 TO 2018 THAN FROM 1990 TO 2005



AS MUCH AS 30% OF ALL MATERIALS DELIVERED TO A JOBSITE CAN END UP AS WASTE.

C&D does not stand for Concrete and Dirt.

Concrete and asphalt made up 85% of all C&D waste in 2018 (EPA)

Over 95% of all asphalt and concrete waste was recovered in 2018 (EPA)

In 2018 76% of all C&D waste was recovered or recycled (EPA)

More than 75% of all construction waste from gypsum drywall, wood, brick, tile, and asphalt shingles end up in landfills. (EPA)

I know, you were told there would be no math...

- The US generated 600 million tons of C&D in 2018, and reported disposal of 145 million tons of disposal of C&D in that same year...
- If in 2018 76% of all C&D waste was recovered or recycled...(76% of 600 million is 456 million)
- If concrete and asphalt made up 85% of all C&D waste in 2018...(85% of 600 million is 510 million)
- And over 95% of all asphalt and concrete waste was recovered in 2018...(95% of 510 million is 484.5 million)
- And more than 75% of all construction waste from gypsum drywall, wood, brick, tile, and asphalt shingles end up in landfills...(25% of the 90 million tons left after concrete and asphalt is 22.5 million)
- $600 - 484.5 - 22.5 = 121.5$ million tons disposed of.
- $145 \text{ reported} - 121.5 \text{ measured} = 23.5$ million extra tons of C&D disposal.
- Where did it come from?

But wait, even that isn't correct.



A HUGE PERCENTAGE OF “RECYCLED” OR “REUSED” C&D IS SENT TO LANDFILL AS “ADC”



ADC IS “REUSE” FOR ABOUT 12 HOURS, AND THE ACTUAL AMOUNTS ARE NEARLY IMPOSSIBLE TO TRACK



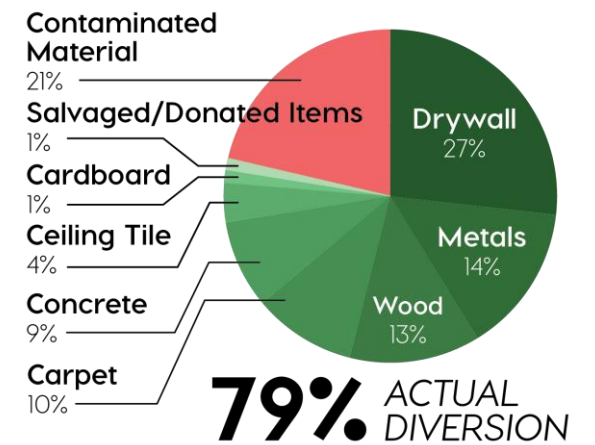
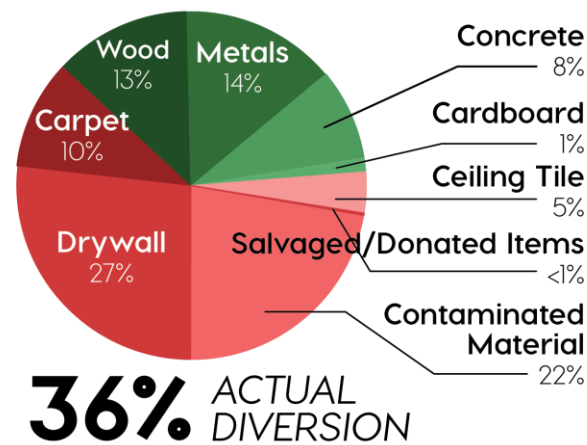
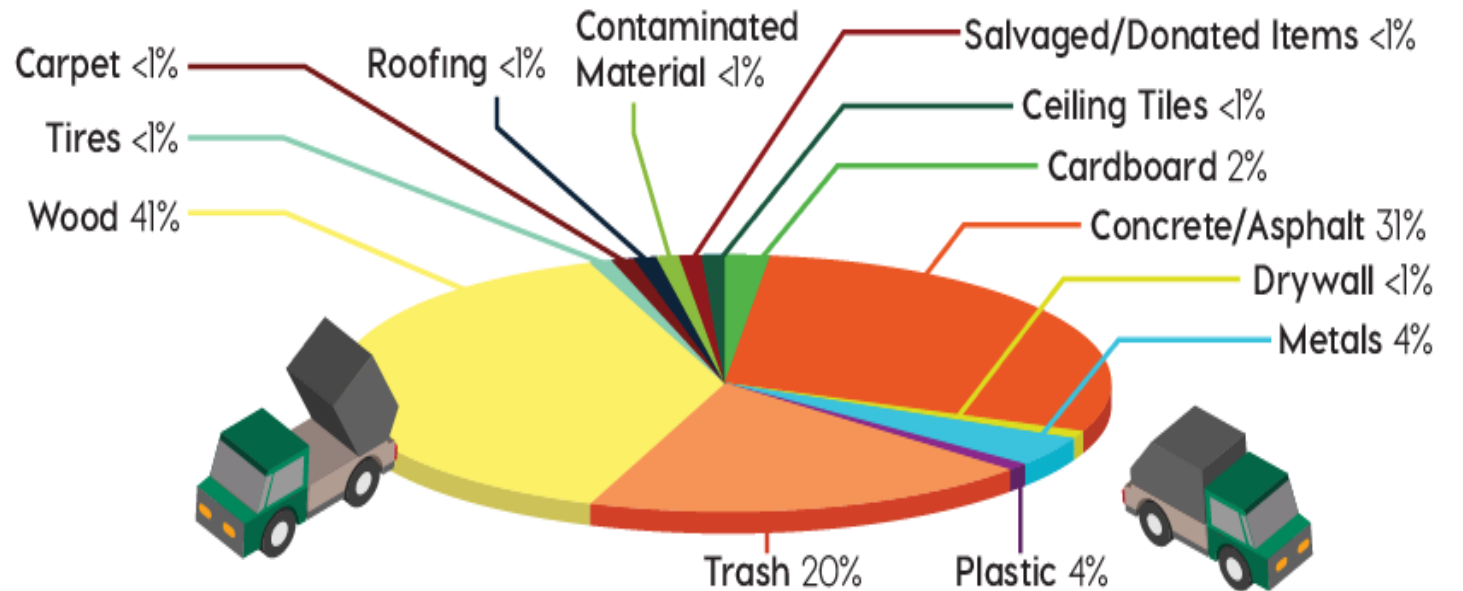
BECAUSE THE MATERIAL USED FOR ADC IS SO SMALL, IT INCREASES THE PRODUCTION OF H₂S BY UP TO A FACTOR OF 10

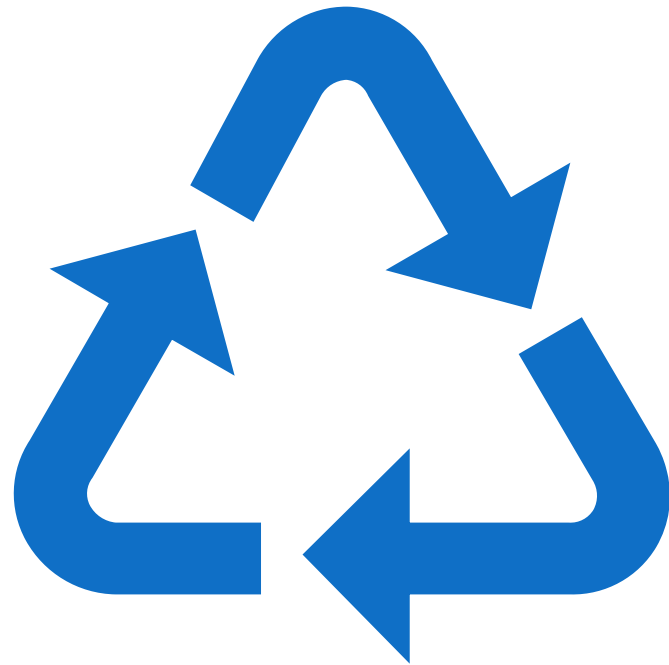
Deconstruction

- More expensive
- Longer process
- Limited infrastructure for salvaged materials
- Lack of demand for salvaged materials
- Difficulty in identifying hazardous materials



Mixed C&D
 Diversion by the
 numbers. Weight
 Based metrics do
 not tell the whole
 story





Universal Waste

- The federal government enacted a ban on universal waste disposal in 1995
- California is considered one of the most proactive states, but even in CA the final ban didn't become effective until 2006
- In Texas, handlers do not need to report to the state if they handle less than 5.5 tons of the material per month.

Metals Recycling

- Metals are the most universally recycled material from any C&D project.
- The biggest problem is keeping them from being commingled with other materials and lowering their value.



Gypsum in landfills

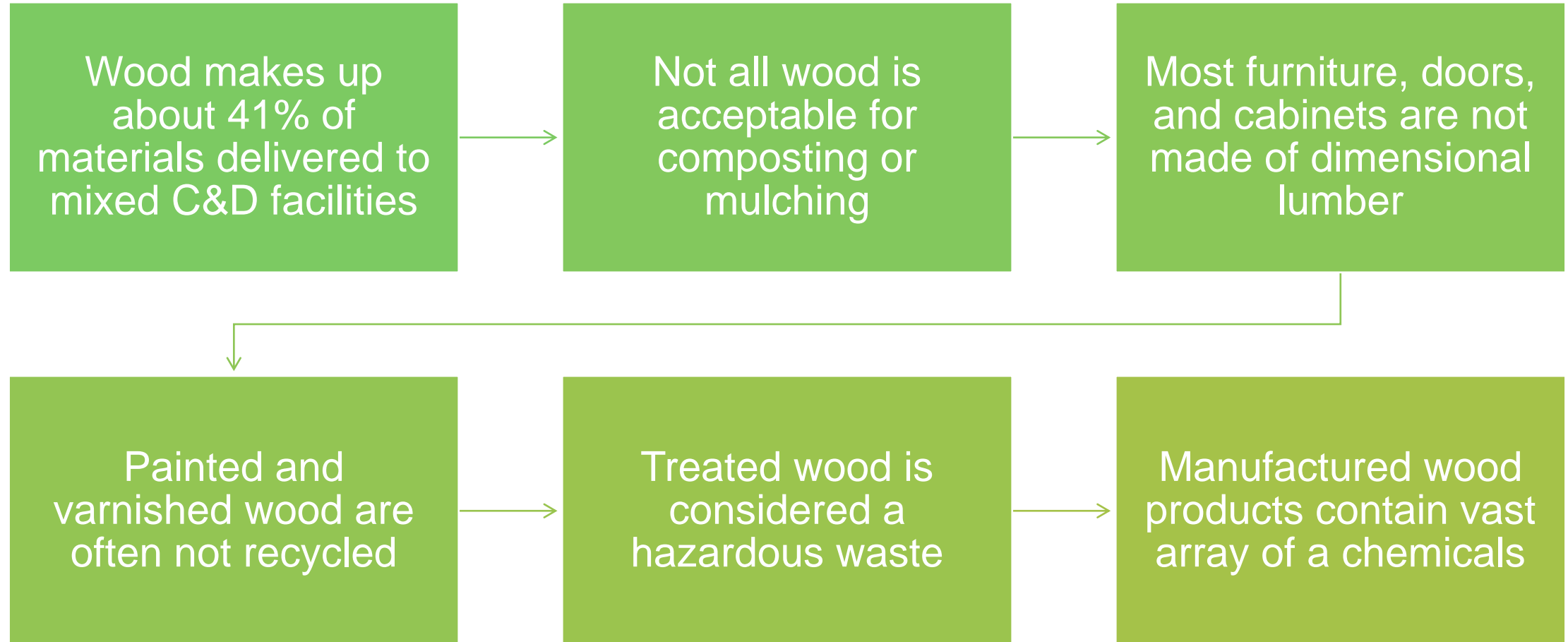
- The issue with gypsum in landfills is the conversion to hydrogen sulfide gas. This gas smells like rotting eggs and can be detected for miles at very low levels. It irritates the eyes, nose, and throat and in high enough doses it is lethal. The anaerobic conditions of a landfill are perfect for generating hydrogen sulfide from gypsum wallboard.
- Hydrogen sulfide presents steep costs to landfills. Turbines used to generate energy from landfill gases are sensitive to the corrosive effects of hydrogen sulfide, causing great reduction in the amount of energy produced
- 4 tons of gypsum in a landfill can create 1 ton of hydrogen sulfide gas
- One 20,000 SF floor plate in a high rise can generate nearly 24 tons of gypsum, enough to generate 6 tons of hydrogen sulfide gas.



Some ecosystems need gypsum to condition the soil.

- Gypsum Improves Soil Structure
- Gypsum Prevents Crusting of Soil and Aids Seed Emergence
- Gypsum Improves Low-Solute Irrigation Water
- Gypsum Improves Compacted Soil
- Gypsum Improves Water Runoff and Erosion
- Gypsum Increases the pH of Acidic Soils
- Gypsum Prevents Water Logging of Soil
- Gypsum Makes Excess Magnesium Non-Toxic
- Gypsum Corrects Subsoil Acidity
- Gypsum Improves Water-Use Efficiency
- Gypsum Makes it Possible to Efficiently Use Low Quality Irrigation Water
- Gypsum Decreases Dust Erosion
- Gypsum Helps Plants Absorb Plant Nutrients
- Gypsum Decreases Heavy-Metal Toxicity
- Gypsum Improves Fruit Quality and Prevents Some Plant Diseases
- Gypsum Multiplies the Value of Other Inputs
- Gypsum Decreases Loss Of Fertilizer Nitrogen to the Air
- Gypsum Can be a Source of Oxygen for Plants
- Gypsum Helps Earthworms to Flourish
- Gypsum Can Increase Water Retention in Soil
- Gypsum Can Increase Crop Yields

Wood and Wood Products



Ceiling Tile Recycling

- Armstrong Ceilings will take back ceiling tiles, regardless of manufacturer.
- Recycling 1 ton of ceiling tiles can save 1,100 tons of raw materials, up to 1,900 gallons of water, and energy energy to power a home for 1.4 months



Carpet Recycling

- Shaw, Interface, Mohawk, and several other manufacturers have recycling programs.
- CARE (Carpet America Recovery Effort), Carpet-Cycle, Recycle Force and other third-party entities also take back carpet for recycling.



Recycling 1 ton of carpet:



Saves up to 5,000 gallons of water



Saves enough energy to power an average house for up to 6 months



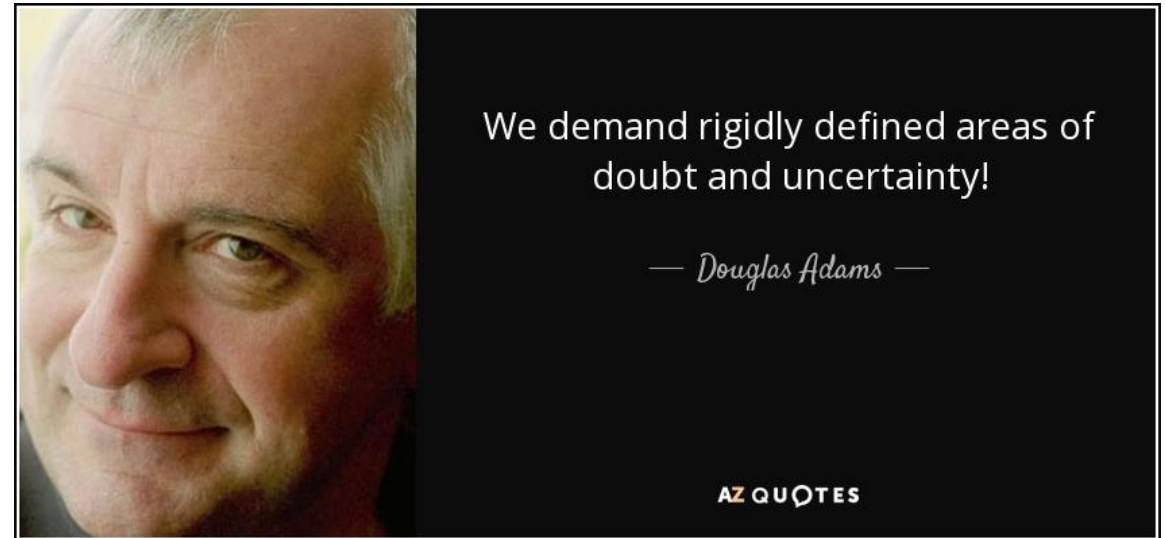
Saves about 40 cubic yards of landfill space



Saves up to 1.4 metric tons of CO2 emissions

So, what have we learned?

- We have been recycling for a very long time
- We are not very good at keeping track of what we have done
- There is no cohesion to the rules and regulations
- We can sort almost anything
- There are underutilized markets for some materials
- There are no markets for other materials.
- Money seems to be the key
- We are nowhere near where we need to be.

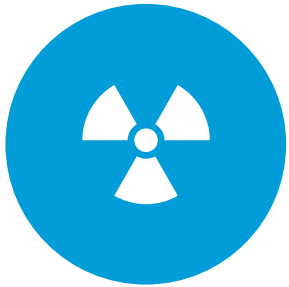


Demand accountability from recyclers

- Look at 3rd party verification of diversion rates, such as the Recycling Certification Institute:
<https://www.recyclingcertification.org/>
- Require data not just on HOW MUCH was recycled, but WHAT was recycled
- Destination of recycled materials
- Disclose use of processed C&D as ADC, and require diversion rates with and without



Stop putting all the pressure on the recyclers



Rethink how we look at diversion (percentages vs. toxicity)



Prioritize the use of recyclable materials in construction projects



Stop the waste before it is created (estimating, design, assembly)



Incorporate design for disassembly

Questions?

**GBCI Credits
can be obtained
using the
Course
Approval
Number
0090008016**



“ We don't have to save the world. The world is big enough to look after itself. What we have to be concerned about is whether or not the world we live in will be capable of sustaining us in it. ”

~ Douglas Adams

Thank You!



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