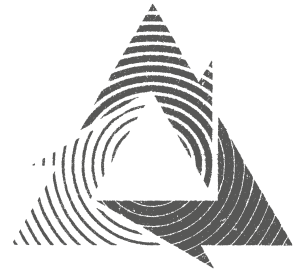

12 TRAINING MODULE 12

Waste and Recycling



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The products of our consumption

Community wood recycling enterprises work with just one part of the waste stream, but dealing with *all* the waste we produce is a huge challenge. It involves enormous volumes of materials and highly complex systems to collect and transport it; and then there is the issue of what to do with it, where to put it, and how to control it, in order to protect ourselves and the environment from its potential dangers. The whole process is called waste management.

According to the Environment Agency, a generally accepted definition of waste is:

“any substance or object that the holder discards, intends to discard or is obliged to discard”.

Thankfully, waste is now being seen for what it really is—a resource that should be better used, reused or recycled.

In **Section 1** we define the broad categories of waste. In **Section 2**, we will have a look at the recycling of key materials. **Section 3** outlines the main disposal methods and in **Section 4** you will have questions to answer.

The learning outcomes of module 12

After successfully completing this module, you will be able to understand:

- What main types of waste are generated
- What happens to waste
- How some waste can be recycled
- The benefits of recycling waste

Section 1—Categories and volumes of waste

Humans have been burying their waste in pits since the Bronze Age (1500 BC), so the concept of waste management is not new. It is just that with ever-increasing population and more consumption (and technology that produces things like plastics that do not biodegrade) the problem of managing the products of our consumer society has become much more pressing. Because waste, if not dealt with properly, will damage us and our environment, it has become highly regulated.

Although our most recent waste and recycling legislation comes out of the EU in the form of ‘Directives’ (that are likely to remain the same post-Brexit), current waste law was framed by the **Environmental Protection Act 1990** and built on by the **Controlled Waste Regulations 1992**.

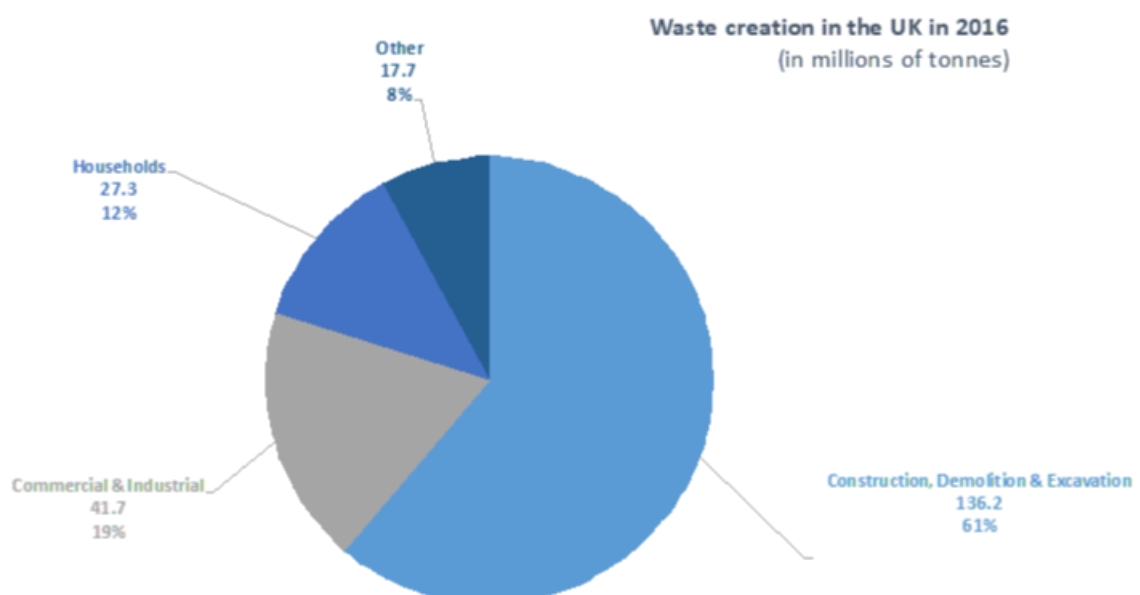
The Act defined what sorts of things were to be described as waste (and therefore what was to be covered by the regulations). A word of warning! In waste legislation/statistics, lots of additions, amendments, exemptions, subcategories and overlaps exist. Waste legislation is complex and open to interpretation and consequently much of the waste data (if available at all) is ambiguous, estimated, extrapolated—or just seems like guesswork.

It is the Environment Agency that is responsible for ensuring the regulations are adhered to and for policing the waste industry.

How much waste and where does it go?

In 2016 (the latest available figures), around 222.9 million tonnes (mt) of mixed waste was handled by licensed waste facilities in England and Wales. With England responsible for 85% of the total. That year a bit less than half of this mixed waste ended up in landfill—glorified holes in the ground where the waste is simply buried (see section 3).

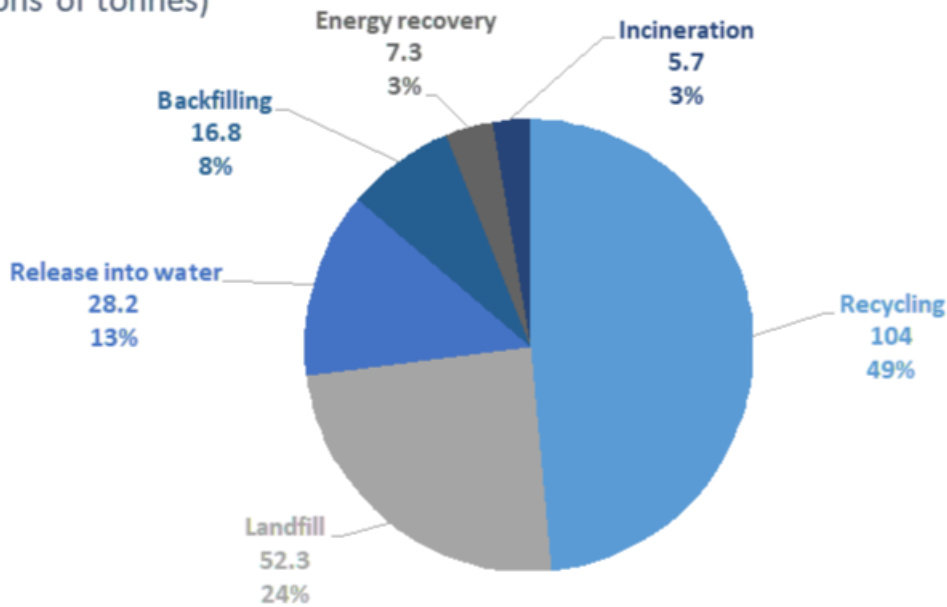
On average, 412kg of waste was created per person in 2016.



▲ Waste generation split by source, UK, 2016 (DEFRA 03/19)

So what happened to the rest of the waste?

Waste treatment in the UK in 2016
(in millions of tonnes)



▲ Waste treatment split by destination, UK, 2016 (DEFRA 03/19)

Well, a lot was burnt in ‘Energy from Waste’ (EfW) and ‘Energy Recovery Facilities’ (ERF) that produce biogas from the waste or at least capture the heat to generate electricity. Around 17mt got used as backfill cover for landfill (usually low grade woodchip used to prevent smells or waste being blown around) or spread on the land as a soil improver (usually food/crop waste or treated sewage). Thankfully, an increasing amount (104mt in 2016) was recycled (see section 2).

As well as landfill sites, to sort, process and dispose of this waste, by 2017, the UK had 2,164 waste transfer stations/treatment sites, 1,251 metal recycling facilities and 40 EfW plants. The proportion of waste that we recycle is rising, but different categories of waste have different recycling rates. The main categories of waste are:

Municipal waste



▲ Municipal waste includes all household waste collected at the doorstep

Municipal waste (known as municipal solid waste or MSW) is a bit of a vague category. It consists of any waste that the Local Authority is obliged to sort out. This includes the waste from homes, schools, some shops and offices, parks and gardens and road sweepings.

The biggest proportion of this type of waste is household waste—all the stuff we throw away at home. More than 26mt of this is generated annually (more than half a tonne per family each year) and unfortunately even with such a focus on recycling, 55% of municipal waste generated in the UK is still sent to landfill or incineration. The good news is that the proportion being recycled is up from only 11% thirteen years ago to more than 45% in 2017.

The recent increase in the recycling rates for municipal waste is in part due to the fast growth in the composting of household green waste.

Industrial and commercial (I&C) waste

In 2017 we generated an estimated 37.9mt of industrial and commercial waste. Industrial and commercial wastes are often categorized together. Industrial waste comes from factories, mills, mines and quarries and from the energy, chemical and power generation sectors. Commercial waste comes from business premises—such as shops, offices, wholesalers, sports, recreation or entertainment venues. Like the municipal waste stream, a high proportion (20%) is paper and card, metals and materials that are potentially valuable and easy to recycle. 52% of the combined total of I & C waste was recycled in 2016.

Construction, demolition and excavation waste (CD&E)



▲ Sorting and processing CD&E waste is an ongoing challenge for the industry

The construction industry is *the* major source of waste in the UK and produced an estimated 119.65mt in 2018. In the same year the building industry used more than 400mt of building materials, so it is easy to understand why they generate so much waste. It is the stream in which community wood recyclers work and we have an insight into how much of their waste is potentially reusable; we fill our premises with it and sell it back to the public week by week.

The biggest proportion of CD&E waste is the ‘heavies’—such as brick, concrete and soil. Most brick and concrete waste is generated by the demolition process and an increasing amount gets crushed and used for hardcore. Soil from excavation is valuable and usually screened (sieved) at the waste transfer station and sold for landscaping.

Clinical waste

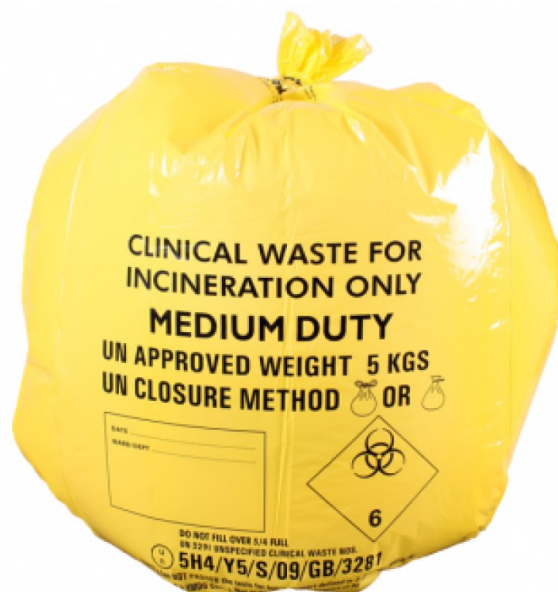
Clinical waste is human parts/tissue, blood and other fluids, excretions, sharps, drugs or any other pharmacological substance from hospitals, clinics, doctors’ surgeries and nursing homes. Clinical waste is mostly hazardous waste (see below) and although some gets landfilled, it is usually incinerated.

Agricultural waste

This is waste generated by agriculture and horticulture and consists of things like empty pesticide containers, silage wrap, veterinary medicines and surplus milk.

Until 2006 waste from this sector did not fall under waste legislation—so it usually just got burnt on farms.

▼ A clinical waste bag for incineration only



Hazardous waste

Waste from any of the above streams is further classified into **non-hazardous** and **hazardous waste**. Hazardous waste has one or more of four characteristics. It is:

- Ignitable (blow up or easily combust);
- Corrosive (burn like acid);
- Reactive (react with other stuff, creating potentially dangerous substances) or
- Toxic (poison to either animal or plant life).

Plasterboard is considered a hazardous waste because the gypsum used in its manufacture can react with organic matter and water to produce hydrogen sulphide gas—which is toxic and smelly. It can be recycled by specialist recyclers; otherwise it must go to one of a small number of landfill sites that are licensed to accept hazardous waste.

Section 2—Recycling our key resources

The amount of waste we produce definitely seems daunting, but forced by ever-tightening legislation, increasing disposal costs and moral disquiet over seeing so much potentially precious resource wasted, the UK has increased its recycling rates quite dramatically over the last few years. But we still lag well behind some of our European neighbours; in 2016 the Germans managed more than 60.1% - and the Scandinavians do even better (In 2014, Sweden had a diversion from landfill rate of 99%).

Some materials are much easier and cheaper to recycle than others, but recycling and reusing materials from the waste stream is generally far more cost-effective and energy efficient than using virgin resources. The key recyclables include the following:

Paper

The demand for paper and card is putting immense pressure on the world's forests and although an increasing amount of wood used in the industry comes from FSC (Forestry Stewardship Council) accredited forests or other sustainable sources, it is still putting pressure on large areas of virgin forest. Paper recycling in the UK became popular during the 1990s and in 2017, 3,75mt was recycled in the UK. However, because the paper fibres break down, paper cannot be recycled indefinitely and eventually most ends up as toilet paper.

Some key paper facts include:

- Around 12.5 million tonnes of paper and cardboard are used annually in the UK.
- It takes 24 average trees to make 1 tonne of paper.
- Producing paper products from recycled paper reduces air pollution by more than 70% compared to making it with wood fibre.

Plastics







Although there are manifold types of plastic, there are 6 different types that are most commonly found in items used in our daily lives. Each type has different qualities and is used in different products. PVC (polyvinyl chloride) is, among other things, used in window and door manufacturing; PETE (polyethylene terephthalate) is used in bottles and polypropylene (PP) is used for making toys, sacks and string.

It is an extremely versatile and useful material—and is completely ubiquitous. Making plastic is highly energy-intensive and uses around 2% of world oil consumption. It is also highly polluting! The extent of plastic pollution, especially in our seas and oceans, has become terrifyingly apparent; scientists have found evidence of plastics on every water body in the world, including in the Antarctic. It kills enormous numbers of wildlife, and is ingested by fish, accumulates in their tissues and ends up being eaten by humans, with unknown long-term consequences to our health.

Thankfully this has all been recently highlighted (especially by David Attenborough on TV) and the world has woken up to the problem.

To help reduce pollution and the reliance on oil in manufacture, some plastics are now made from natural materials such as corn starch, agar and gelatine. Because making new plastics is so resource-hungry, recycling it has great environmental gains including reduced energy and water use.

To assist in their recycling, the EU has implemented a voluntary identification system for the most common plastics. Check out some plastic packaging at the enterprise and see which carry a description.

EU Number	Symbol	Chemical name	Uses
1		Polyethylene Terephthalate	Polyethylene Terephthalate sometimes absorbs odours and flavours from foods and drinks that are stored in them. Items made from this plastic are commonly recycled. PET(E) plastic is used to make many common household items like beverage bottles, medicine jars, rope, clothing and carpet fibre.
2		High Density Polyethylene	High-Density Polyethylene products are very safe and are not known to transmit any chemicals into foods or drinks. HDPE products are commonly recycled. Items made from this plastic include containers for milk, motor oil, shampoos and conditioners, soap bottles, detergents, and bleaches. It is NEVER safe to reuse an HDPE bottle as a food or drink container if it didn't originally contain food or drink.
3		Polyvinyl Chloride	Polyvinyl Chloride is sometimes recycled. PVC is used for all kinds of pipes and tiles, but is most commonly found in plumbing pipes. This kind of plastic should not come in contact with food items as it can be harmful if ingested.
4		Low Density Polyethylene	Low-Density Polyethylene is sometimes recycled. It is a very useful plastic that tends to be both durable and flexible. Items such as cling-film, sandwich bags, squeezable bottles, and plastic grocery bags are made from LDPE.
5		Polypropylene	Polypropylene is occasionally recycled. PP is strong and can usually withstand higher temperatures. It is used to make lunch boxes, margarine containers, yogurt pots, syrup bottles, prescription bottles. Plastic bottle caps are often made from PP.
6		Polystyrene	Polystyrene is commonly recycled, but is difficult to do. Items such as disposable coffee cups, plastic food boxes, plastic cutlery and packing foam are made from PS.

Some key facts about plastic include:

- Like paper, plastics can only be recycled a limited number of times before its fibres become too short.
- The UK produces about 5mt of mixed plastic waste each year.
- In 2016 only around 24% of plastic was recycled.
- Around 2.4 million tonnes is packaging; 1.7mt from households, the rest from commercial and industrial companies.
- Of the 1.7 million tonnes of packaging bought by households each year, about a third is plastic bottles.
- Approximately 13 billion plastic bottles are used annually in the UK and only 7.5 billion are recycled.
- In 2014, supermarkets gave away 7.6 billion plastic carrier bags. Since the introduction of legislation in 2015, mandating a 5p charge, this has dropped by 85%.
- Most families throw away in excess of 40kg of plastic per year, the majority of which could be recycled.
- Plastic can take up to 1000 years to decompose in landfill sites.

Metal

Metal can be recycled repeatedly without altering its properties. Steel (an alloy of iron and other metals/materials) is the most used and recycled material on the planet. In fact, more than 50% of all products made from steel are made from recycled steel. Other highly recycled metals include aluminium, copper, brass, silver and gold.

Around two-thirds of all metal waste generated in the UK comes from food/beverage cans and foil and 50% of this comes from aluminium drink cans. As with other materials, making products with recycled metal saves huge amounts of energy, water and other resources. When making cans, the energy saving can be as much as 72%, and metal can be recycled indefinitely without any loss of quality.

At present, around 70% of aluminium is recycled. For iron and steel (a high proportion of which comes from scrap vehicles, cookers, fridges, freezers and other kitchen appliances) the recycling rate is around 60%.

Some key metal facts include:

- The UK uses about 12 billion metal cans each year. If placed end to end they would stretch to the moon and back.
- If all cans in the UK were recycled, we would need 14 million fewer dustbins.
- Producing steel from recycled material saves 75% of the energy needed compared to using iron ore.
- Estimates suggest that £36m worth of aluminium is thrown away each year.
- Europe-wide, around 55% of all steel products are made from recycled steel.

Glass

Glass is made from sand so is classed as an 'inert' waste—meaning that it won't biodegrade or react with other materials/substances. The UK is estimated to use around 3.6mt of glass each year.

Approximately 7% of UK household waste is comprised of glass jars and bottles. To encourage the reuse of bottles, the Scottish Government is planning to implement a deposit scheme on glass later in 2019—similar to one that

operated until the 1980s when soft drink and beer bottles carried a deposit of a few pence—keeping many an entrepreneurial school child in pocket money by the collection and return of deposit-carrying bottles.

Most glass is now recycled through municipal collections from households or through one of the 50,000 bottle banks found in the UK.

For every ton of glass recycled, 30 gallons of oil is saved. The largest producer of waste glass is the hospitality industry (hotels and pubs). Around 50% of glass is currently recycled.

Some key glass facts include:

- Each UK family uses an average of 500 glass bottles and jars annually.
- The largest glass furnace produces over 1 million glass bottles and jars per day.
- Glass is 100% recyclable and can be used again and again.
- Glass that ends up in landfills will never decompose.

Organic household waste

About 10mt of organic kitchen and garden waste are generated each year, making up around 37% of household waste in the UK. However, it can easily be separated from other rubbish and therefore should be very easy to recycle into compost.

Although Council collections of kitchen waste are rare, most now provide regular collections of non-food green waste—such as grass and hedge cuttings and more than 1 million households now have home composters. Most of the collected material is composted and ends up on local farms as soil conditioner, but some Councils are bagging and branding their products for sale in garden centres and at their waste recycling centres—elegantly completing the cycle of residents buying back and reusing the organic matter they discarded in the first place. A great example of what is known as the ‘circular economy’!

Some key food waste facts include:

- We throw away 7.2 million tonnes of uneaten food each year in the UK, worth (at shop prices) £13 billion.
- We throw away more food than packaging from our homes.
- The average family discards more than £470 worth of food each year.
- The reduction in CO₂ achieved by eliminating food waste would be equivalent to taking 1 in 5 cars off our roads.
- 1 tonne of food waste can generate up to 900 cubic meters of biogas.

Section 3—Final waste disposal: landfill and incineration

Landfill

Landfill is the second most used waste treatment in the UK, with almost a quarter (52mt) of all waste ending up at landfill in 2016. For municipal waste however, a shocking 43% ends up in this horrible hole in the ground. This is a huge amount, but thankfully landfilling has fallen by 46% since 2000. Although we have around 500 landfill sites in the UK, at current rates, by 2022, they will all be full.

Although burying our waste can seem like an easy solution, there are negatives associated with this form of waste disposal.

A big one is long-term pollution, especially from complex human-made waste such as plastics, which can take centuries to biodegrade; we do not yet know how this waste will interact with the environment over time.

A more immediate problem is methane, a potent 'greenhouse gas' that is produced by any organic (plant or animal) matter as it decomposes. Landfill sites must have sophisticated systems to capture the gas for decades after the waste is buried. The collected gas can be used to drive turbines to produce electricity, but landfill sites are still a major source of methane released into the atmosphere.

Leachate is also a problem. This is the liquid that is formed when rain percolates through the landfill site and gets contaminated with organic matter and chemicals. If not managed correctly it can seep into and contaminate water supplies.

Even long after sites are full, covered over and 'returned to nature' they have to be managed—as they can go on producing gasses and leachate for many decades. Other problems associated with operating landfill sites include noise, dust and litter and increased traffic around neighbouring areas.

In addition, landfill is running out; we only have until 2022 until all UK sites that are currently operating are filled. As they fill up, waste contractors have to haul our non-recycled rubbish further and further afield, increasing both the environmental impact and the financial cost. The Landfill tax, which rises every year (£91.35 in 2019/20), was introduced to raise the cost of landfill to incentivise the waste industry to look for more sustainable methods, such as recycling. It has certainly worked, as since 2000, land-filling has diminished substantially. However there is a lot more to do.

Energy from waste (incineration)

To move away from our dependence on landfill, more and more EfW plants are being built, and they currently burn nearly 9 million tonnes of our rubbish each year. This equates to 42% of all waste in the UK.

Although the concept of producing electricity from materials that we can do nothing else with might seem sound,



▲ Despite a huge surge in recycling in the past few decades, almost 40% of waste processed in the UK still ends up in the ground or oceans



▲ Waste-to-energy plants—not always as green as they seem

replacement for earth, sand or aggregates for block making or for road building. Recent studies conclude that if treated correctly, there is no increased risk to health from using such products, but bottom ash can contain dioxins, heavy metals and other harmful substances.

Fly ash collects in the chimneys of incinerators and contains far higher concentrations of toxic chemicals than bottom ash. It has high levels of dioxins and heavy metals that, if not ‘scrubbed’ from the incinerator smoke, could end up falling to earth on homes and gardens. To help deal with this potential pollution, compounds of lime are sprayed on to the smoke. This waste is classed as hazardous waste and therefore ends up at one of the few hazardous waste landfill sites.

No waste disposal method is without its risks and issues, so the very best thing we can do is to reduce our consumption and reuse and recycle everything possible to help ensure that these precious resources are available for longer.

(All stats from Defra 2019).

Section 4—Trainee exercises and questions

There are some questions for you to complete on the following pages.

Note that you will need to do some research to answer questions 20 and 21. Try searching on the internet for information to assist you.

Remember: don't hesitate to ask for help from your Trainer.

Module 12: Exercise 1

1. How much waste was processed in UK facilities in 2016?	
2. What is municipal waste?	
3. What is the percentage of municipal waste generated in the UK that ends up in landfill or incineration?	
4. How many tonnes of commercial and industrial waste were generated in 2017?	
5. How much construction and demolition waste was generated in 2018?	
6. What are the 4 characteristics of hazardous waste?	1.
	2.
	3.
	4.
7. Which industry is the biggest producer of waste?	
8. How many tonnes of building materials were used by the construction sector in 2017?	
9. As of 2017 what % of household waste is recycled?	
10. Around how many tonnes of paper and card do we use annually in UK?	
11. How many trees does it take to make a tonne of paper?	
12. How many tonnes of plastic waste are generated in the UK each year?	
13. What % of metal waste comes from cans and foil?	
14. How many times can metal be recycled?	
15. Making steel from recycled materials saves what % of energy usage?	

16. How many gallons of oil are saved per tonne of 'new' glass made, if made from recycled glass?	
17. What are the main drawbacks of landfill?	
18. Why was landfill tax introduced?	
19. What are the main drawbacks of incineration?	
20. What % of municipal waste in your local area is recycled?	
21. What happens to the remainder? (e.g.: landfill, incineration etc.)	

Office use only		Number of correct answers required to pass Module 12: 17			
Passed:		Retake:		Date:	
Trainer's signature:					