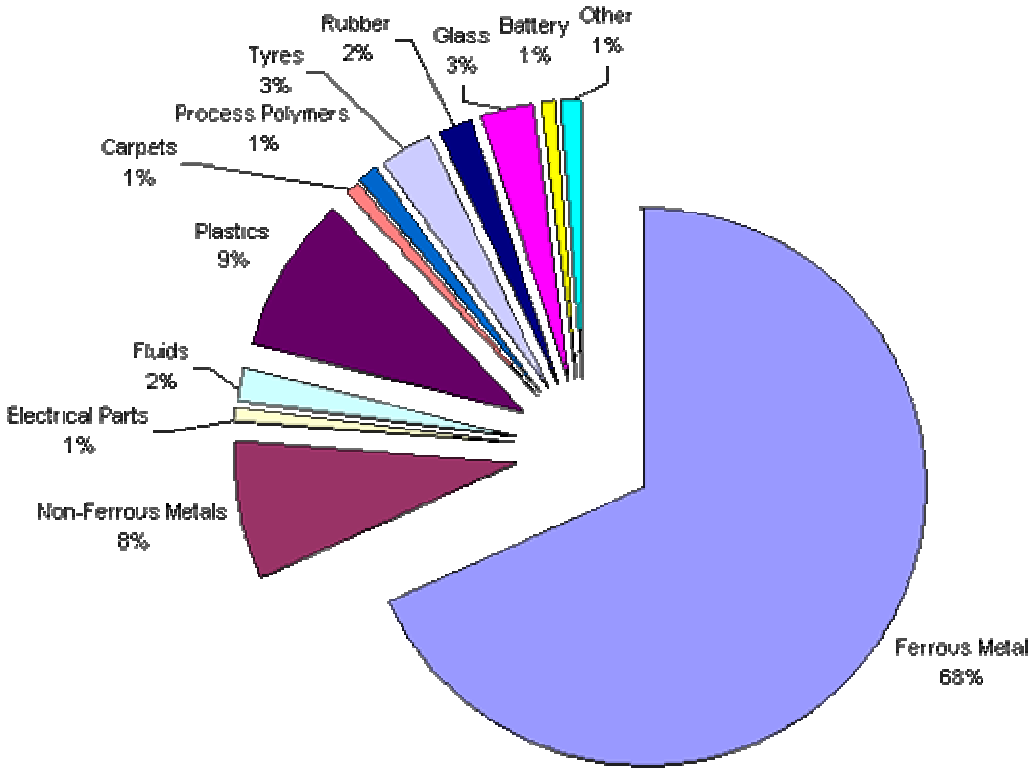
End of life vehicle and tyre recycling information sheet

There were around 30 million motor vehicles in use within the UK in 2002. Every year, approximately 2 million new vehicles are registered and a similar number are scrapped. The average lifespan of a car is 13.5 years and in 2000, just over 2 million cars and vans reached the end of their useful lives, either because of old age or due to accident.

The composition of a typical car has changed substantially in recent years. For example, ferrous metal content has decreased significantly as lighter; more fuel-efficient materials such as plastics are incorporated into vehicle design. An analysis of vehicle manufacturer data for around seventy popular 1998 car models shows the following breakdown of materials (by weight).



Over 50 million tyres (just over 480,000 tonnes) were scrapped in the UK in 2001 and around 80,000 tonnes was disposed of in landfill.

Tyres consist mainly of steel, rubber compound and textiles (often in the form of cotton). The typical composition of tyre rubber is as follows:

Tyre Composition	Number of parts containing the material	% Weight
Rubber hydrocarbon	100	51
Carbon black	50	26
Oil	25	13
Sulphur	2	1
Zinc Oxide	4	2
Other chemicals*	15	7

* Includes inorganic fillers, organic vulcanisation activators and accelerators, and processing aids.

Why bother?

The quantity of used vehicles that are not resold equates to over 2 million tonnes of material to be recovered or disposed of. 1.85 million Cars are recycled every year in the UK, and approximately 80% of waste automotive materials (mainly metal) are recycled, with the remainder going to landfill. As car ownership continues to increase it is important that the proportion of each end-of-life vehicle (ELV) being recycled is maximised, so that the environmental impact is reduced.

It is estimated that up to 50% of the 20,000 tonnes of oil removed from vehicles by motorists is handled improperly. If oil finds its way into sewers and water courses it can cause significant contamination -

one litre of waste oil is sufficient to contaminate one million litres of water and oil poured onto the ground will affect soil fertility.

When disposed of in landfill sites, tyres in large volumes can cause instability by rising to the surface of the site, affecting its long term settlement and therefore posing problems for future use and land reclamation. Rubber materials contain proportions of organic chemicals and little is known about the long-term leaching effects of these materials.

It is estimated that around 13 million stockpiled cars are currently being held in dumps with the number of tyres being illegally dumped increasing. It is thought that higher charges levied on producers for legal disposal, coupled with generation of more waste tyres because of stringent tread requirements are key causes of this. Recently, problems have arisen with collectors who are paid to collect and remove tyres for recycling purposes and who then merely dump or store the tyres with no intention of recycling them. Illegal disposal of tyres is seen as a serious offence with possible imprisonment and unlimited fines.

How's, what's and where's of recycling vehicles and tyres

The reuse of parts and the reclamation of materials from motor vehicles is not a new industry. Metal parts in particular have for a long time had a value, either in terms of reuse or recycling. Nowadays there are many parts that can be recycled, from the oil and its filter to plastic bumpers.

When a car reaches the end of its useful life it is usually sold to a vehicle dismantler. The dismantler will remove parts that can be sold for reuse, remove the potentially environmentally polluting materials such as operating fluids and batteries, and then sell the hulk on to a shredding operation. Shredders are high capacity hammer mills that break the hulk in to fist-sized parts. Ferrous metals are then removed by magnetic separation and non-ferrous metals are sorted both mechanically and by hand. The proportion of ELVs currently recycled is much greater than any other consumer product; even so, around 408,000 tonnes of remaining material is buried in landfill sites each year. This material is mainly made up of plastics, rubber, glass, dirt, carpet fibres and seat foam.

What you can do?

- Walk, cycle, go by public transport and use cars as little as possible. These options have many other environmental and health benefits as well!
- Car share, even if only part of the way and occasionally, to reduce congestion, pollution and cost.

- Drive at speeds not exceeding 50 - 60mph. This not only reduces wear on tyres and makes them last longer but gives fuel savings as well.
- Drive smoothly at constant speed where conditions allow. Harsh acceleration or braking cause increased wear on tyres and other parts of the vehicle.
- Keep tyre pressures to recommended levels to ensure even wear. Under-pressured tyres can have fuel implications, increase tyre wear and are generally dangerous

- Change up to a higher gear as soon as traffic conditions allow.
- Recycle your old oil and batteries at local authority recycling sites
- If replacing your car, choose a more fuel efficient one than at present.
- Buy retread tyres.
- Don't use tyres below the legal tread limit - it is dangerous, and the tyres cannot be retreaded if over-used.
- Look out for products made from scrapped tyres, e.g. porous hosepipes, carpet underlay, pencil cases etc.
- If you have no further use for your car - take it to a registered scrap yard or contact your local council.
  Your Trading Standards office will provide a list of registered scrap yards and vehicle dismantlers who will dispose of the car in the most environmentally sound way - there are around 4000 of these across the country. Many councils will take your car away for nothing, or a relatively modest charge - typically £20-£50 - although there may be a wait for collection. You may get little or nothing for your clunker, but if it runs, has relatively new tyres or other parts that can be removed and sold, then you might get a few pounds for it.
- Inform the DVLA that you have passed your vehicle to an Authorised Treatment Facility (registered scrap yard) by completing the section on your registration document for disposal to a motor trader. If you have a car or light van you should receive a Certificate of Destruction from the scrap dealer, who will pass the information to DVLA for the vehicle record to be closed. You may still wish to ensure that DVLA are informed by completing the "scrapped" box on the registration certificate.

Recovery and disposal of individual components

Metals

Approximately 76% by weight of the average car is metal, most of which is comprised of sheet steel. The overall metal content of cars has declined rapidly during the past 20 years accompanied by an increase in the proportion of non-ferrous metals used in their manufacture, such as aluminium and magnesium. Currently about 98% of the metals in a car are recycled. These metals are recovered by the vehicle shredding industry and subsequently utilised by the steel industry and re-smelting plants.

Plastics

Plastics used in the car industry have risen considerably, where an average new car in 1984 contained 8.5% by weight of plastics a similar car today contains around 11%. Plastics are used for their distinctive qualities, such as impact and corrosion resistance, in addition to low weight and cost. Due to its lightweight properties, the use of plastics can lead to considerable energy savings, with a car weighing 1.3 tonnes without plastics consuming approximately an extra 1000 litres of fuel during its life compared to a car weighing 1.1 tonnes with plastic. Despite the relatively high recycling rate for ELVs, the proportion of plastics from ELVs being recycled is extremely low. One reason for this is the wide variety of polymer types used. Identification, by marking components at production or by improved sorting technologies, will be vital if the practice of recovering plastic parts is to become viable. One of the few plastic parts currently being recovered from ELVs is battery cases, accounting for 5,000 of the 14,000 tonnes of automotive plastics recycling in 1998. There is an estimated further 121,000 tonnes of automotive plastics which is currently landfilled.

The most common automotive plastics types are polypropylene (PP), polyethylene (PE), polyurethane (PU) and polyvinylchloride (PVC). PP accounts for approximately 41% of all car plastics (common in bumpers, wheel arch liners and dashboards), and like PE and PU (most common in seat foam) it is easily recycled. Viable markets for PP, PE and PU from non-automotive sources already exist.

PVC makes up about 12% of the plastics content of an average 1990s European car. PVC, by contrast, is relatively difficult to recycle, and there are currently no large-scale recycling schemes operating for post-consumer PVC. Alternative disposal methods such as incineration have raised a number of environmental concerns including dioxin emission during incineration and the use of phthalate plasticisers, which are thought to be disrupters of hormone systems. Nevertheless, this is likely to change due to proposals for a European Directive on the disposal of PVC. Car manufacturers are currently looking for alternatives to PVC.

Vehicle operating fluids

This is one of the areas of greatest concern regarding motor vehicles. Although the disposal of fluids from ELVs is a major issue, the effects of inappropriate treatment of fluids removed during servicing are also significant. Increasing amounts of engine oil are being recovered and recycled however less than a third of waste oil produced by the DIY motorist is recycled. Lubricating oil has the greatest pollution potential.

Much of the waste oil collected for recovery in the UK is processed (by removing excess water and filtering out particulates) and used as a fuel burnt in heavy industry and power stations. However, stricter emission limits and fuel quality controls resulting from environmental legislation could mean a reduction in the amount of waste oil used in this way. The preferred option for lubricating oils is re-refining for reuse as a base lubricant, although this doesn't currently occur on a large scale in the UK.

Waste oil from nearly 3 million car oil changes in Britain is not collected. If collected properly, this could meet the annual energy needs of 1.5 million people.

There are 1,500 Oil Recycling Bins in Britain for lubricating oil only. Call the Oil Care Campaign on 0800 66 33 66.

When removed, oil filters can retain large amounts of oil and this may be discarded with the filter leading to further pollution. Vehicle dismantlers leave oil filters on the engines and they are recycled along with them. Oil can be recovered using special oil filter presses which squeeze out the oil and the remaining flattened metal filter can be recycled with other steel. Oil filter crushers are available for use on site at garages, although this is currently not common practice. Nevertheless, it is hoped that oil filter crushers will be increasingly introduced into civic amenity sites as an added service to the DIY car mechanic.

Catalytic Converters

Catalytic converters ('cats') have only been fitted as standard in new petrol injected-engine cars since 1992, so the business of their recovery is still developing. In the US, there is a well-established network of agents who collect the cats and a similar system is developing in the UK. The steel from the exhaust and the precious metals from the cat can be recovered when the cat is replaced. Platinum, rhodium and palladium can be recovered for reuse, either in new auto cats or for some other purpose, and as 68% of platinum and 90% of rhodium used in Western Europe go into the production of catalysts, this business is extremely viable. The ceramic casing is also recovered as a powder for refining.

Batteries

EC Directive 91/157/EEC requires the separate collection of certain batteries, including those containing more than 0.4% lead by weight, which includes vehicle lead acid batteries. There is a well-established system for the recovery of lead acid car batteries with many local authorities and garages having collection points. The recycling rate for car batteries is estimated to exceed 90%. However, a significant number of batteries are still not recovered and recycled (for example, many scrap cars still contain batteries when they are shredded). A revision of the existing battery legislation is currently being undertaken. EU proposals include a 70 - 100 % collection target for automotive lead acid batteries with a recycling target of 50 - 80%.

Secondary Restraint Systems

Secondary restraint systems used in vehicles consist of airbags and seat belt pre-tensioners. Air bags became standard components in UK-produced vehicles in 1993. Some air bags are only activated as a result of certain types of collisions, so occasionally the bag is undetonated and in the absence of manufacturers' deployment instructions, a strict procedure should be followed in order to disarm the bag safely. Air bags do not contain high value materials, so reclamation is not a viable option. In addition,

because of the high product specifications and specialist installation procedures required to fulfil their safety purpose, reuse is not currently an option either.

Glass

In 1999, ELV arisings reached 1.8 million. With glass constituting approximately 3% of a vehicles weight, in excess of 55,000 tonnes of automotive scrap glass were theoretically available for recycling. This figure is likely to be increasing with the rise in ELVs. Currently, in the UK the majority of ELV glass is sent to landfill and only a small proportion is recycled.

There are two types of glass used in the auto industry, toughened and laminated. Toughened glass is easy to remove from vehicles after shattering. Laminated glass, however, doesn't shatter and will need to be removed manually, which is time-consuming. In addition, as the value of glass is relatively low (approximately £0.48 per ELV), it is currently not possible to recover the cost of removal glass.

Tyres

Tyres account for around 3.5% of the weight of an average ELV, and as a controlled waste under the Environmental Protection Act 1990, a Duty of Care is placed upon waste producers to ensure that waste material is disposed of safely through registered carriers to licensed sites. According to the Used Tyre Working Group's 2001 survey 22% were recycled, 8.3% went to energy recovery, 9.9% were retreaded, 16% were reused and 3.3% were used in landfill engineering. The remainder (approximately 40%) will have been land filled, stockpiled or illegally disposed of.

Tyre disposal options:

Waste prevention is a primary objective when looking for future developments in scrap tyre options. Ongoing research into improvements in tyre design and construction has resulted in the life expectancy of tyres continuing to lengthen.

- **Reuse of part-worn tyres**

  Extracting the maximum safe life from a tyre saves valuable resources (oil, rubber, steel etc). Before the tyre can be resold it must be checked. Part-worn-tyres must have a minimum of 2mm tread remaining and be marked as part-worn on both sides at the time of sale. A survey in the northwest of England showed that 40% of part-worn tyres were illegal, in northwest London the figure was 20% of tyres sold.

- **Reuse through landfill engineering**

  Whole tyres can be used in the preparation/construction of landfill sites, where they are used as leachate draining systems. Tyres used for this purpose are exempt from the landfill tax. Between 1998 and 1999 there was a 20% growth in the use of tyres for landfill engineering.

- **Recycling through retreading**

  Tyre retreading is a major industry in the UK. Colway, now C-Tyres (www.colwaytyres.co.uk/) , processed 1 million tyres in 1999. Retreading involves either replacing only the tread section or replacing rubber over the whole outer surface of the tyre. Manufacturing a retread tyre for an average car takes 4.5 gallons less oil than the equivalent new tyre and for commercial vehicle tyres the saving is estimated to be about 15 gallons per tyre. Car tyres can only be retreaded once but truck tyres can be retreaded up to three times.

  Despite the improved quality of retreads, there has been a continuing decline in the passenger car retread market. While the truck retread market remained steady at about 1 million tyres in 2000,

car retread fell by 800,000 to 2.2 million tyres. The emergence of the budget tyre, leading to the disappearance of the price differential previously enjoyed by retreads has been one cause. It isn't always possible to retread tyres, for example some imported tyres are of a quality which is unsuitable for retreading and 60% of replaced tyres in the UK have been subject to excessive wear beyond the (UK) 1.6mm tread depth limit, which then makes them unsuitable for retreading. The Retreaders Manufacturers Association (RMA) would like to see enforcement of the tread depth law and the raising of public awareness to the dangers of driving on illegal tyres as this would result in tyres being recovered from vehicles before they suffer too much damage.

The RMA believes it can meet a European Union retread target of 25% through a major publicity campaign to dispel the poor image retreads currently have with domestic car drivers. As an example to the general public and organisations which have fleets of cars, Government Departments have been requested to give equal consideration to retreads when replacing fleet vehicle tyres.

- **Recycling through grinding**

Grinding is the most widespread materials recovery process in the UK. In 1999 it is estimated that 83,000 tonnes of tyre were granulated. This process produces a range of crumb sizes through the progressive size reduction process with the energy used to break up tyres increasing as the particle size decreases. Crumb is used in sports and play surfaces, brake linings, landscaping mulch, carpet underlay, absorbents for wastes and shoe soles. Crumb can also be recycled in road asphalt. Rubberised asphalt can increase road elasticity, temperature range and resistance to oxidation, which can result in fewer ruts, potholes and cracks in the surface. In 2000 a crumb road was laid near Battle in East Sussex.

Some crumb can be used in formulations with virgin rubber, but this is less than 5% of the total. Salford University in conjunction with Pirelli and Corus has produced a crumb 0.4mm in diameter, small enough to be recycled in tyres. Pirelli plans to increase the 5% rubber crumb content currently used in manufacture to 20% in 2006. Corus hopes to use the steel innards for smelting. For contact details of UK based companies involved in rubber crumbing and other recovery methods visit the Used Tyre Working Group website: www.tyredisposal.co.uk

- **Recycling through cryogenic fragmentation**

During cryogenic fragmentation, tyres are shredded and cooled to below minus 80 degrees C. A hammer mill then pounds the chips to separate the components. The resultant rubber granules can be used for athletics tracks, carpet underlay, and playground surfaces and rubberised asphalt for road surfaces. The energy input required for such low temperatures is relatively high.

- **Recycling through de-vulcanisation**

Treating vulcanised rubber with heat or chemicals can produce devulcanised rubber, which can be used to replace part of the virgin material in automotive and cycle tyres, conveyor belts and footwear. The variety of uses for this rubber has been limited due to its unreactive nature leading to poor bonding/strength. However Australia's Commonwealth Scientific and Industrial Research Organisation (CSIRO) has recently developed a process that alters the molecular bonding properties of the rubber and produces a material similar to PVC with a 50% recycled rubber content. Possible uses are for automotive components, building products, coatings, sealants and containers for hazardous waste. The developers believe it provides a valuable option for waste tyres.

- **Recycling through microwave technology**

Advance Molecular Agitation Technology (AMAT) have developed a prototype using microwave technology. This breaks the tyres into their original components. The steel is of grade A quality and can therefore be sold for recovery, the carbon and oil are also reusable. The amounts of emissions produced are minimal. The first commercial scale prototype has a capacity of 2,000 tonnes of tyres a year.

- **Energy Recovery**

Tyres have a high calorific value, about 20% greater than that of coal, which on burning can be harnessed to produce energy.

- **Energy Recovery through pyrolysis**

Compared to recovery of energy by direct burning, pyrolysis is a self-contained process, which avoids the release of large volumes of combustion gases. This saves on the cost of cleaning or "scrubbing" systems needed with normal incineration to remove pollutants from the gases. It also means that the process can be controlled to recover products for resale.

Coalite, based in Bolsover, Derbyshire intends to install six pyrolysis plants, each with a capacity to process up to 15,000 tonnes of tyres annually. At January 2002, one plant had been installed. Bevan Recycling based in Oxfordshire runs a small mobile plant which can be moved to large tyre dumps, rather than vast quantities of tyres having to be transported to the plant. Energy Power Resources (EPR) also hopes to complete a pyrolysis plant by 2004 which will have an annual capacity of 60,000 tonnes providing electricity for 28,000 domestic customers.

- **Energy Recovery through incineration in cement kilns**

Tyres are able to replace up to about 25% of the coal which would otherwise be used in cement kilns, and reduce nitrogen oxide emissions. Cement kilns could provide a recovery option for up to half of the UK's total waste tyre arisings. The Used Tyre Working Group (UTWG) believe this recovery route will be key to achieving 100% tyre recovery by 2006. There is however some concern regarding dioxins, particulates and other airborne pollutants that are produced by these kilns. Rugby Cement had been trialling tyre burning however plans were halted over the health risks associated with these emissions. The risks are assessed before a site is approved to burn tyres. It can take up to 2 years for kilns to get a permit to burn tyres.

- **Other uses of waste tyres**

Other uses account for about 20,000 tonnes of waste arising. These include:

  - boat and dock fenders
  - under road surfaces
  - sports tracks
  - weights on silage sheeting on farms
  - crash barriers at motor racing circuits
  - children's play surfaces and furniture
  - protection for young plants and trees
  - compost heap containers
  - roof tiles
  - noise control products
  - structural support for earth walls
  - motorway embankments
  - artificial reefs and coastal defences

Around 10,000 tonnes of tyres are exported to other countries for use as part-worns or in overseas retread operations.

Tyre Industry Council (TIC)

The TIC has developed a 'Responsible Recycle Scheme'. The scheme is designed to ensure that the reuse and recycling of used tyres complies with legal requirements.

What does the law say?

The European Union End-of Life Vehicles (ELV) Directive

The End-of-Life Vehicles Directive (2000/53/EC) came into force on 21 October 2000 and Member States should have enacted legislation to comply with the Directive by 21 April 2002. The Directive will require EU Member States (including the UK) to:

- Ensure that all ELVs are only treated by authorised dismantlers
- Provide free take-back of all ELVs for new vehicles put on the market after 2002; from 2007 provide free take-back for all vehicles including those put on market before 2002
- Restrict the use of heavy metals in vehicles from July 2003
- Ensure that a minimum of 85% of vehicles are reused or recovered (including energy recovery) and at least 80% must be reused or recycled from 2006, increasing to a 95% reused or recovered (including energy recovery) and 85% reused or recycled by 2015

It also requires the 'de-pollution' of vehicles before being recycled. This involves extracting petrol, diesel, brake fluid, engine oil, antifreeze, batteries, airbags, mercury-bearing components and catalysts.

Improvements required

In a report reviewing industry performance during 2000, the Automotive Consortium on Recycling and Disposal (ACORD) stated that the total recovery rate for vehicles scrapped in the UK is currently 80% (69% materials recycled and 11% parts reused). The report also outlined some of the areas that will require improvements in order to meet the 85% recycling rate by 2006. These include:

- Increased plastics recovery through better separation processes
- Development of applications/markets for recycled plastics
- Increased recovery of fluids by more effective de-pollution
- Improved tyre recovery processes
- Initiation of other rubber recovery processes
- Reduction of residual metallic content of shredder residue
- Initiation of glass recovery processes
- Development of energy recovery processes for automotive shredder residues (ASR)
- Development post-shredder material recovery processes

Tyres

EU Landfill Directive

The Landfill Directive (1999/31/EC) became law in July 2001. This states that whole tyres must be banned from landfill by no later than 2003, and shredded tyres no later than 2006. Some UK landfills may however escape the ban until 2007 when they are brought under the new pollution prevention and control regime. Because thousands of landfills need permitting under the directive, the Environment Agency will phase this work over 2002-2007. For more information on ELV legislation see our legislation affecting waste and recycling information sheet available on Waste Online.

Waste Incineration Directive

This requires that cement kilns, which use tyres as a secondary fuel, must comply with more stringent air emission limits that currently apply to other types of facilities. New dry kilns have until 2006 to comply. Old wet kilns have until 2008. This may impact current operations and further development.

These changes in legislation will obviously place increased pressure on the industry to find alternative uses for scrap tyres, and government ministers have suggested that if the 100% recovery/recycling rate is not met, they may be forced to legislate for compliance.