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**TIRE RECYCLING IN ROMANIA and INTERNATIONAL
EXPERIENCE**

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INTRODUCTION

Tires are made from natural rubber (truck tires) or artificial rubber (car tires). Depending on their design and application, tires vary in size and total weight. On average, the weight of a car tire is 7 kg. Average composition includes rubber hydrocarbon (48 %), carbon black (22%), steel (15%), textile (5%), zinc oxide (1.2%) and sulphur (1%). Once treated with sulphur, they become immune to breakdown from bacteria so that, when disposed of in landfills, they remain intact for decades.

The disposal of used tires generally and used passenger tires in particular has proven to be a difficult problem. The problem manifests itself in a number of ways. Mammoth tire piles exist where landowners freely accepted used tires hoping that one day the tires would have positive value. Tire piles pose a hazard from fires and attendant adverse environmental impacts as well as provide a breeding ground for rodents and insects. Used tires whose owners found no satisfactory means of disposal litter the landscape. Tires that are mixed with municipal solid waste tend to float to the surface where they collect rainwater and provide a breeding habitat for mosquitoes and other insects.

Several environmentally acceptable methods exist for disposing of used tires. Retreading is feasible for some tires. Burning¹ in cement kilns and other high temperature furnaces is another alternative, though the quantity that can be disposed of in this fashion is limited by high-temperature furnace capacity. Used tires may be shredded for use in a variety of consumer products and road surfaces, or chopped into larger pieces for use in drainage systems and as covering material at landfills. The economics of the environmentally acceptable methods of disposal are marginal to negative (i.e., a subsidy may be required to motivate these activities).

In EU countries as well as in US there are in place a variety of policy instruments to solve the problem of scrap tires (these experiences are described later in this paper).

¹ When tires are burned to recover energy for steam production, or as supplementary fuel in cement kilns, air pollutants are emitted. Although scrubbers remove zinc oxide and 90% of SO₂, incineration still produces 24 grams of CO₂ per million joules. This is the same amount emitted by a coal-fired plant. The energy content is estimated at approximately 63 kJ per tire. After incineration in a grate furnace fly ash (mostly zinc oxide) makes up approximately 4.5% of the total residuals and slag (mostly iron) between 13 and 18%.

In Romania, before 1989, scrap tire recovery was part of the state policy to recycle waste materials. Recovering scrap tires was based on strict regulation. As a condition for buying a new tire a person had to give back an old tire to a recovery center (called REMAT). In exchange, the center gave a symbolic amount of money (less than 0.1% of the value of a new tire) and a receipt allowing the person to buy a new tire. As a result of this policy, huge quantities of scrap tires have accumulated in designated places. A small portion² of the used scrap tires was retreaded and introduced again in circulation. For the rest (damaged scrap tires) no commercial solution was found.

After 1989, the system for recovering waste materials (paper, used oils, batteries, scrap tires, plastic, glass etc.) was almost abandoned because it was perceived as an economic restriction of the former regime. The exceptions were in the field of ferrous and non-ferrous metals and a few other materials with positive economic value.

At present, Romania is encountering a rapid increase in its auto and truck fleets, meaning more used tires will be generated.

The Pre Adherence Papers³ signed with EU lead to the same path: the necessity for Romania to introduce a coherent policy in recovering waste, in general, and tires in particular.

This paper is meant to give some arguments and guidelines regarding the use of economic instruments as an element of scrap tire recycling policy in Romania.

² At that time several technologies were used in order to recycle used tires: retreading, rubber regeneration, transforming rubber in powder, replacing conventional combustibles in cement mills etc. None of these solutions have come to a commercial result and have remained in a study or lab phase.

³ A condition for membership of the Union is that the candidate countries align their national legal systems with existing EU legislation in all areas, the so called Acquis Communautaire. This process of integrating EU law into national legal administrative systems is called the approximation process.

TIRE INDUSTRY IN ROMANIA

Tire Output

Overall tire output decreased in Romania from 4.3 million units in 1991 to 3.74 million units in 1996; however truck, tractor and aeroplane tire output increased (Table 1).

Table 1: Tires output in Romania (1991 - 1996)
(thousand)

	1991	1992	1993	1994	1995	1996
Tires, of which:	4363	3247	3821	3240	3473	3739
truck - tractor - aeroplane	2823	2877	3293	2780	3038	3304

Source: Statistical Yearbook of Romania, 1997, page. 516-517

The tire industry in Romania employs around 11,000 workers. Most employment is in the private sector, though public sector enterprises also participate in the industry (State Ownership Fund - SOF or FPS) (see Table 2).

Table 2: Economic situation of the main producers of tires, in Romania (1997)

	Ownership	Equity (bill. lei)	Turnover (meld. Lei)	Employment
SC VICTORIA SA Floreşti	private	137,73	526,26	4298
SC DANUBIANA SA Bucureşti	private	131,89	383,84	4242
SC SILVANIA SA Zalău	private	75,16	147,82	1439
SC ROTRANS SA Drobeta	public	73,45	49,34	482
SC OLTTYRE SA Caracal	public	25,09	15,20	199
SC ROMVELO SA Luduş	public	16,31	34,33	546
Total tires industry		459,63	1156,79	11.210

Source: Data from IPROCHIM, 1998

In the period 1989 - 1998 tire output declined for all producers. The main tire producer is Victoria SA with a share of 62% of total output in 1998; private output represents 85%.

Table 3: Tires output by producing companies, in Romania (thousands / year)

	1989	1992	1995	1997	1998
SC VICTORIA SA	2766	1580	1839	1911	1035
SC DANUBIANA SA	1180	928	843	642	354
SC SILVANIA SA	300	90	125	116	32
Private companies	4246	2598	2807	2669	1421
SC ROTRAS SA Drobeta	38	18,3	22,1	27	11,8
SC OLTTYRE SA Caracal	738	263	203	62	13,3
SC ROMVELO SA Ludu ^o	1770	369	435	354	230
Total	6792	3248,3	3467,1	3112	1676,1

Source: Data from IPROCHIM, 1998

In the period 1989 - 1998 the production structure changed significantly; the truck and bicycle shares went down by 50 and 35%, respectively, while tire share for cars grew by 14% (Table 4). It is important to note that share of tires for tractors (steering and traction wheel) almost doubled. This evolution should be taken into account in the recovery and recycling policy.

Table 4: The structure of the tire output, in Romania (1989 - 1998) (%)

Tires types	1989	1992	1995	1996	1997	1998
Bicycle - Motor bicycle	26,06	11,36	12,54	11,75	11,38	13,72
Cars	39,63	50,40	52,60	51,68	55,91	54,12
Tractor - steering wheel	4,06	6,77	5,91	6,50	7,29	8,65
Trucks	26,99	26,63	22,17	24,03	19,44	16,29
Tractor - traction wheel	3,15	4,83	6,69	5,94	5,88	7,22
Giant tires	0,10	0,01	0,09	0,11	0,10	0,06
Total	100,00	100	100	100	100	100

Source: Data from IPROCHIM, 1998

Table 5: Output of Romanian tire industry (1989 - 1998)

- thousands -

Tires types	1989	1992	1995	1996	1997	1998
Bicycle - Motor bicycle	1770	369	435	441	354	230
Cars	2692	1637	1824	1940	1740	907
Tractor - steering wheel	276	220	205	244	227	145
Trucks	1833	865	769	902	605	272
Tractor - traction wheel	214	157	232	223	183	121
Giant tires	7	0,3	3	4	3	1
Total	6792	3248,3	3468	3754	3112	1676

Source: Data from IPROCHIM, 1998

Tire exports

The export of tires decreased sharply in the period 1989 - 1998. In 1998 the export of tires was 382000 or 22.8% of total output (Table 6).

Table 6: Tire exports by the main producers

- thousands/year -

	1989	1992	1995	1996	1997	1998
SC VICTORIA SA	674	289	502	487	401	233
SC DANUBIANA SA	378	86	281	297	303	146
SC SILVANIA SA	59	1,5	1,7	3	1	3
SC ROTRAS SA Drobeta	5	0,2	4,1	4,1	4,3	2
SC OLTTYRE SA Caracal	72	0	0	0	0	0,7
SC ROMVELO SA Ludu ⁶	0	0	0	0	0	0
Total	1188	376,5	788,8	791,1	709,3	382

Source: Data from MIC, 1998

Table 7: Tire exports by type

- thousands/year -

Tire type	1989	1992	1995	1996	1997	1998
Bicycle - Motor bicycle	0	0	0	0	0	0
Cars	557	241	340	328	295	160,7
Tractor - steering wheel	104	23	125	142	160	89
Trucks	472	81,5	169,7	198	140	67,3
Tractor - traction wheel	52	31,2	153,1	121	112,6	64,3
Giant tires	3	0	1	2,1	1,7	0,7
Total	1188	376,7	788,8	791,1	709,3	382

Source: Data from MIC, 1998

Internal consumption of tires

In Romania, tires sales amount to 4 million pieces per year; the biggest part is for internal production (around 2.5 million/year) but import of new and used tires has an important share (Table 8). Sales of retreaded tires are small and decreasing.

The most usual type of tire sold in Romania is that of 13" and 14" for cars and 15", 16", 18", 20" and 24" for transport means, including military trucks.

Table 8: Tires sales in Romania (1989 - 1998)

- thousand pieces -

Sales	1989	1996	1997	1998 (sem. I)
Produced in Romania	3834	2522	2049	1064
Imports of new tires	36	770	758	435
Imports of used tires	-	1059	1358	1450 ^{*)}
Imports of retreaded tires	-	92	41	10
Total sales	3870	4443	4206	2959

Source: Data from MIC, Commerce Department., 1998

*) 12 months

It is important to notice that imports of used tires increased significantly while imports of new ones declined. This situation has its roots in the actual legislation that does not provide standards, tests or minimal conditions for importing used tires from EU countries⁴. There is a significant incentive in importing used tires: the price of a used tire is 4-5\$ while a new one is around 20\$. As a result of this situation, the value of imported used tires is estimated to be 17 million USD/year compared to 11 million USD/year of imported new tires.

Importing used tires means that more scrap tires will be generated each year.

⁴ Main sources of used tires are: Germany - 55%; Italy - 17%, Austria - 8%, the Netherlands - 5% etc.
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Recent trends

First, after 1989 the recovery and recycling of scrap tires virtually ceased in Romania. Specialised companies⁵ in recovering and recycling waste materials (paper, metals, glass, plastics etc.) do not have orders for scrap tires: in 1997 REMAT collected only 3100 tones of scrap tires and 1400 tones in 1998 (nine months).

Second, car ownership and auto traffic increased significantly;

- car output and ownership is up after a short period of decline (see ANNEX 1 and ANNEX 2). In the period 1991 - 1996 cars owned by individuals increased by 60% (despite this Romania has fewer cars/inhabitant than the average for Europe);
- in the period 1991 - 1996 the number of transport vehicles increased by more than one million (ANNEX 6);
- the volume of goods carried by road transport represents more than 80% from all goods carried in Romania in the last six years; rail transport is in decline (see ANNEX 7).

So, on the one hand, there is no collection or recycling scrap tires and, on the another hand, vehicle traffic is up producing more scrap tires. These two aspects are strong arguments for elaborating and implementing in Romania a policy for scrap tire recycling. To all these arguments it must be added the necessity of adopting EU regulations in this field.

Our paper will continue presenting the experience in recycling scrap tires in some EU countries and in US.

⁵ These companies called REMAT are present in each 40 Romanian judets, including the capital.
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EXPERIENCE WITH SCRAP TIRES IN EU AND IN US

EU experience⁶

General considerations

The Council Directive 75/442/EEC on Waste, as amended by Council Directive 91/156/EEC, provides the basic framework for waste management in the European Union. The Directive requires Member States to ensure that waste is recovered and disposed of without endangering human health or causing harm to the environment. Member States are required to prohibit the abandonment, dumping or uncontrolled discharge of waste.

To ensure that waste is managed in accordance with the principles of the Directive, national competent authorities are required to set up permitting procedures for the control of establishment and undertakings that dispose of or recover waste. Establishments and undertakings carrying out waste collection or transportation functions or acting as a dealer/broker/ of waste are not required to obtain a permit, but are required to be registered with the national competent authorities. To supervise these operations the Directive also requires waste disposal and recovery operators to make records of the operations available for the competent national authorities. The authorities are also required to carry out periodic inspections.

The Directive provides for common definitions of relevant terms such as "waste", "disposal" and "recovery" and sets the framework for Community Waste legislation as a whole. A non-exhaustive list of wastes, known as the European Waste Catalogue, was drawn up under the Directive in Commission Decision 94/3/EC.

The Directive sets out a hierarchy of waste principles according to which Member States are required to give priority to the prevention or reduction of waste and its harmfulness. Where this is not possible, Member States should encourage recovery of waste through operations such as recycling. Disposal by landfilling or incineration without energy recovery is on the lowest rung of the hierarchy.

In EU countries, once a tire is scrapped, it is considered a waste product by the authorities. Even retreadable carcasses which can be worth DM70 (\$39.5) each, or more, are defined this way, which means that anyone who handles them or transports them must be licensed, and must have effective paperwork to prove that the 'waste' is not dumped or otherwise disposed of illegally. The same applies to granulate made from scrap tires.

⁶ At the time being the legislation concerning used tires is under present Commission's activity.

Waste tires are the most significant source of waste rubber products in terms of volume and importance. They are generated when used tires are replaced and when vehicles are scrapped. Total volume of used tires released in the EU in tones per annum has been estimated at 1 955 000 tones on the basis of available figures for Member States. In EU countries the collection and recycling of scrap tires is improving: in 1996 only 28% of all European scrap tire went to a landfill, compared with over 34% in 1994 (ANNEX 11).

Despite this apparently modest improvement many countries in Europe have already banned tires from landfill disposal and now are close to the target of zero landfill. Collecting organisations believe that target is achievable throughout Europe, with the possible exception of Spain, where there is a more general waste disposal problem.

At the present, the main disposal route in the short - to medium - term will be through combustion. Currently around a third of all European scrap tire are burned for energy recovery. However, the development of more markets for physically recycled rubber would be welcome⁷. Available data show that the recycling rate is increasing -- from 8 % in 1994 to 12% in 1996.

At the European Tire Recycling Association (ETRA), there is concern that Europe is focusing too heavily on the energy option⁸ at the expense of physical recycling routes. Representatives of physical-recyclers have asked for a greater commitment to sustainable development by governments through the use of retreaded tires on their vehicle fleets, for example, and to offer tax incentives to encourage consumers to use products that contain recycled materials.

Using scrap tires as fuel in cement kilns was a short-term reaction to the threat five years ago of an EC directive on scrap tire disposal⁹. Several European governments regulated the use of scrap tires in cement kilns. As a result cement kilns developed very long contracts with used tire suppliers, which could preclude new developments in other material recycling (in some cases, those contracts can be 20 years or more). The danger of this approach is that the large collectors of scrap tires would send all their non-retreadable casings directly to a cement kiln or a tire-to-energy plant, with no thought or consideration for the material recyclers.

Whether carcass collectors will send the bulk of their tires to energy plants will depend on the prices available at the various disposal sites. If there is more money in the recycling stream than is available at the cement kilns then tires will

⁷ Tire manufacturers take a similar view - they also believe that the issue is now more or less resolved. Those directly involved in recycling tires, by contrast, still have some considerable concerns, and in the UK, where the car tire recycling sector is under siege, the mood has bordered on panic.

⁸ Only about 25% of scrap tires can be retreaded. Combustion and/or some form of tire derived fuel (TDF), has a valid role in the tire recycling industry.

⁹ Regulation for used tires is under present Commission's activity.

find their way to the recyclers. At present, cement companies pay about DM80 (\$45) for a ton of coal¹⁰. Twenty-five mm chips of rubber crumb can be a direct replacement for coal, and are in some respects better than coal. If the pricing is right rubber crumb can be a good business scrap tires companies.

Furthermore, in an industry where good applications and customers are hard to find, the long years developing those markets and customers have paid dividends. The volumes of scrap tires going into rubber granulate, sports grounds, brake pads and carpet underlay are now increasing as the customers have gained confidence in the product and found reliable suppliers who can deliver repeatable quality batch after batch.

Tires companies have expanded their recycling scope by reorganising the supply of both original compounds based on virgin rubber, and of recycled material from used tires and other rubber products, into integrated business. The European tire industry is now starting to use more recycled material in its products.

Among EU countries the part-worn trade is a large and significant part of the tire industry. ETRA claims that part-worn tires make up almost 20% of the whole tire trade. While that may seem high, this figures indicates just how significant the part-worn trade is, and how important it is to ensure that part-worn tires are properly inspected and marked¹¹.

Changes in exchange rates influence strongly the recycling of scrap tires. For example the strength of the pound has adversely affected the UK car tire retread industry¹². As retread sales declined in UK, the value of each retreadable carcass also has fallen. This has reduced substantially the revenues coming into the logistics sector. Simultaneously, so called 'gate fees' at disposal sites have increased. The price charged by Elm Energy, for example, to bring tires onto its premises has risen to over £40 per tone, and is likely to double once more to £90 per tone in the near future, according to retreading companies.

¹⁰ In Romania cement companies are using natural gas instead of coal so the problem of using scrap tires is more complex.

¹¹ This aspect strongly influenced the retreading industry in the UK, where sales of car retreads dropped as retreads became less competitive with imports of new tires and part-worn tires, due to the strength of Sterling.

¹² For instance, Monarch, a well-known car tire retreader in UK, has been forced out of business by the strength of the pound. Two other companies, RIAB and Retreads International, had also been forced out of business in 1997, while Technics Group has been the subject of a £30 million (\$50 million) management buy out. All these developments were blamed on a rapid change in the economics of collecting and disposing of tires in the UK. The UK situation is unusual in that the retreaders carry out most of the logistical function involved in the collection and disposal of tires. In other countries the collection is carried out by ordinary transport companies, funded by payments either from a central government fund, or more often, from a levy paid by consumers who replace their tires. The UK is also unusual in that it is the European leader in car tire retreading. Over the last few years, roughly 30% of UK scrap tires have been retreaded, compared with roughly 20% in the rest of Europe. This differential is largely due to several large, very competent car tire retreaders based in the UK. [2].

It is this large increase in disposal costs, combined with a rapid drop in revenue, that has prompted a major shake-out of retreaders and casing dealers in the UK. The response has been to introduce a collection charge at the European level of roughly 1 Euro per tire.

In some countries a retreader will call every now and then, sort out the retreadable casings and take them away, leaving the non-retreadable scraps to be disposed of by a logistics¹³ or transport company for a fee.

Applications for scrap tires

Apart from combustion, the biggest potential applications are in linear transport systems as roads, railways and the like. Usually these large projects are either managed or funded by governments as part of the commitment to sustainable development.

In Europe many roads were built using various types of rubber modification around ten years ago and the data from those trials is now starting to emerge. ETRA indicates that a road surface using rubber-modified asphalt would use around 2500 tires per kilometer. The EU expects around 300000 km of new roads to be built over the next 5 years.

Another application is sound barriers, which protect housing from noise generated by high-speed vehicles. These use up to 20 000 tires per km for a 3m high wall.

The most important factors affecting future development of collecting and recycling car tires are car ownership, car use, and the average life of car tires. According to current trends in car ownership and use, the number of waste tires is likely to increase in the next decade. The world market for tires is forecast to grow at 1.4 % for cars and 2.2 % for commercial vehicles. On the other hand, the average life of passenger car tires, as far as wear is concerned, has increased by 5 % over the last ten years.

¹³ In all countries except the UK, ordinary logistics companies play a role in the collection of scrap tires.
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Recycling used tire in the US

With economically viable options for dealing with less than one third of the used tires generated each year, and stringent bans on disposal of whole tires in landfills, it is not surprising that used tires have tended to accumulate in unwanted tire piles and to be littered about the landscape. While the federal Environmental Protection Agency has funded research on tire recycling, it is largely the responsibility of the states to manage solid waste. In the last ten years, most states have developed proactive programs for dealing with the used tire disposal problem.

States impose fees that range from \$0.25 to \$2.00 on the sale of new automobile tires. Truck tires typically have higher fees; for example Texas imposes a fee of \$3.50 on truck tires. Some of the fees are assessed as a percentage of sales price (*Scrap Tire News Legislative Report*). As shown in the Table 9, the federal government also imposes product charges on tires ranging from \$0.15 to \$0.50 per pound, but revenues from these charges are allocated to the Highway Trust Fund (Fullerton).

Table 9: Tire Product Charges in US

Taxing authority	Magnitude of tax	Uses of revenues
Federal Government	Tires 40-70 lbs: \$0.15/lb x weight exceeding 40 lbs Tires 70-90 lbs: \$4.50 + \$0.30 x weight exceeding 70 lbs >90 lbs: \$10.50 + \$0.50 x weight exceeding 90 lbs	Highway Trust Fund
State Governments (34)	\$0.25 to \$2.00	Tire recycling, tire disposal site cleanup, other similar activities

Source: Fullerton, p. A7; *Scrap Tire News Legislative Report*, pp. 18-19.

The intent of the tire charges is not to influence the purchase of new tires, as is the case with most environmental product charges. Rather, the funds are used to subsidize what are viewed as environmentally acceptable disposal options, options that without the subsidies would not be economically self-sustaining. The various state programs are similar in design and function. One of the better programs, that from Virginia, is described here.

The Virginia Waste Tire Management Program, is recognized throughout the country as a leader in the development, implementation and support of waste tire markets. Since 1990, the Virginia Department of Environmental Quality has received into its Waste Tire Trust Fund, collections from the state tire tax of \$0.50, which is imposed on the sale of new tires. The Fund is used to:

- a) clean up illegal waste tire piles;
- b) clean up waste tires at permitted landfills;
- c) establish local collection centers for waste tires;
- d) subsidize environmentally acceptable disposal methods through the End User Reimbursement Program.

The End User Reimbursement Program makes direct financial payments to what are deemed beneficial end users of Virginia-generated waste tire material. A end user of waste tire material may apply for the subsidy, currently set at \$22.50 per ton (equivalent to \$0.225 per tire). The Virginia DEQ reviews the application and decides whether the end use is environmentally beneficial.

Eligible uses or waste tires include:

- 1) civil engineering projects that use chopped waste tire material as a substitute for soil or gravel in construction of road bases and embankments, septic drainfields, and daily covering material at solid waste landfills.
- 2) combustion of waste tire materials for their energy content.
- 3) pyrolysis of waste tires to extract petroleum.
- 4) conversion of waste tires into products such as rubberized asphalt, mats, drainage systems, building materials, and recycled rubber products.

ANNEX 12 summarizes, for the period January 1995-December 1996, the subsidized uses of waste tires in Virginia, the recipient of the subsidy, and the amount of the subsidy. Some of the subsidies include additional amounts for establishing collection centers, cleanup at landfills, cleanup of illegal tire piles and other supported activities in addition to the \$22.50 per ton payment for the indicated beneficial use.

To receive a subsidy, end users of waste tires must demonstrate that the tires were generated in Virginia. Waste tire piles are eligible for subsidies if they existed prior to the effective date of the regulation or they represent accumulations of tires sold, traded or exchanged in Virginia. Tire haulers and end users are encouraged to complete official state forms to document the origin, hauler, processor and end user of waste tires. The minimum application quantity for a subsidy is 50 tons, for which a subsidy of \$1,100 would be given.

Exports are not subsidized. Between 5% and 10% of the waste tires now collected in Virginia are shipped to South Africa. Emanuel Tire Co. in Baltimore is the largest such exporter in the Mid Atlantic region. Exported tires generally have some useful life remaining as well as retreading potential. While retreading passenger tires is illegal in the United States, it is practiced elsewhere. Truck tires normally are retreaded at least once in the U.S.

By subsidizing end users of waste tires, the Virginia and other state programs create a demand for waste tires. This demand gives waste tires a positive value and helps to minimize illegal disposal. Between 1995 and 1997, over 19 million passenger tire equivalents were recycled in Virginia. A 1993 survey by the Virginia Department of Environmental Quality reported 731 abandoned tire piles containing over 17 million tires (reported in DEQ circular 102). These piles are being removed and tires recycled at the rate of about 1 million tires per year. The program is not only keeping current with the waste tires that are being generated daily, but it is also making substantial progress toward the goal of cleaning up tire piles throughout the state.

The various state programs have not been entirely free of problems. Texas, for example, has subsidized so much shredding of tires for asphalt additive that it faces a glut of the product. Washington State experienced problems with shredded rubber additives in asphalt pavement; at least one stretch of highway caught fire. But these problems are minor relative to the overall success of the programs in managing what had been a particularly difficult solid waste disposal problem.

POLICY INSTRUMENTS FOR RECOVERING SCRAP TIRES IN ROMANIA

Proposal of a scheme for recycling scrap tires

In Romania around 4 million tires are sold every year. The usual life for a new car tire is 60000 km but in practice the limit may be extended to 100000 km. In the last years the index of new tire replacement decreased from 0.68 new tire/car in 1996 to 0.45 new tire/car in 1998. This is owing to imports of used tires and contributes to more scrap tires generation.

For estimating the amount of scrap tire generation in Romania, we make the following assumptions: cars = 3 million (with 4 wheels); trucks and transport vehicles = 700,000 (with 6 wheels); average live of a tire = 80000 km; average travel/year/car = 16,000 km; average travel/year/truck = 24,000 km. With these assumptions it is estimated that *2.5 million scrap passenger car tires and 1.7 million scrap truck tires would be generated each year.*

An alternative method may be used for estimating the number of scrap tires generated each year. Take the number of tires sold per year in recent years (4.2 million), deduct the fleet growth for the past four years, which is enough time for the tires to wear out (assume 15% fleet growth). This suggests that about 3.6 million used tires should be generated this year.

For recovering scrap tires we propose a deposit - refund scheme (Figure 1). According to this scheme a charge¹⁴ of Euro 1 would be levied on the sale of each new tire. This charge would be paid at the moment when a new tire is sold and would be directed to a Recycling Fund under the supervision of the National Commission for Waste Recycling within the Ministry of Industries and Commerce. REMAT centres will accept scrap tires. From the Euro 1 per tire paid for a new tire Euro 0.25 will be reimbursed to the person returning the scrap tire. ECU 0.25 will remain with the REMAT. Another Euro 0.25 will be paid to the companies that use scrap tires (recycling shop, cement mill, construction company etc.). The final Euro 0.25 will remain with the Fund where it could be used to reduce tire piles and tire litter or to finance research for new technologies.

By this scheme end users of waste tires will receive a indirect subsidy that will create a demand and a market for scrap tires. This demand gives waste tires a positive value and helps to minimize illegal disposal.

¹⁴ The EU Waste Directive outlines that, in accordance with the polluter-pays principle, the cost of disposing of waste must be borne by holders of waste and/or producers of the products from which the waste came.

In the process will be involved MWFEP from the point of view of regulatory framework as well as the Ministry of Finance from the point of view of charging the tires buyer with 1 Euro, MIC for regulatory measures etc.

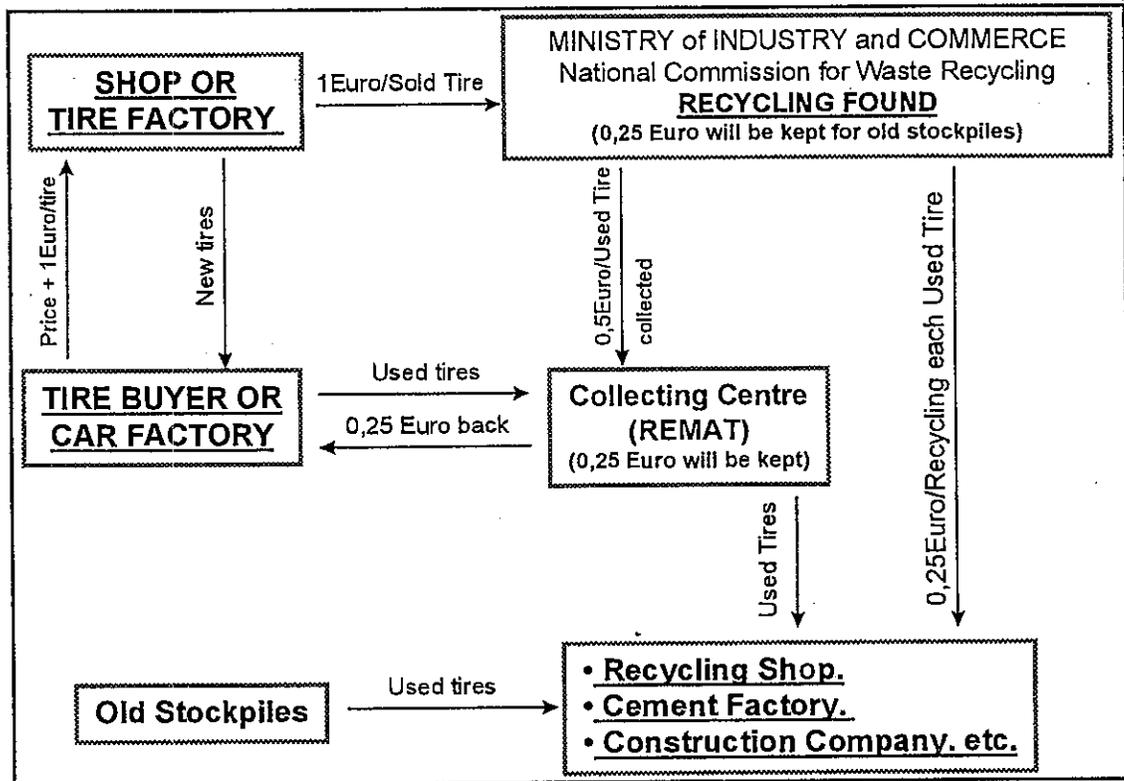


Figure 1: Scheme of the proposed mechanism for tire recycling in Romania

At the same time it is important to take steps for reducing imports of used tires. To do this it may be introduced a surcharge at the border as well as standards, norms and licenses for selling used tires.

In this way around 4 million Euro/year could be collected within the Recycling Fund: from this amount 1 million will be reimbursed to tire buyers, 2 million will be used for collecting and recycling and with the rest will be recycled old tire piles.

The mechanism proposed has several advantages.

First, it utilises the existing structures¹⁵ with experience in collecting scrap tires (National Commission for Recycling, REMAT centres etc.).

¹⁵ The EU waste management system presuppose adequate administrative systems on national, regional, and local levels, as well as adequate infrastructure for safe collection, sorting, transport, recycling, materials and energy recovery, and disposal of all types of waste.

Second, it will be raised the equivalent in lei of ECU 4.2 million, which should be enough to collect scrap tires generated every year and to eliminate old stockpiles of used tires.

Third, it will be in accordance with EU requirements for membership¹⁶.

Implementation steps in waste tires recycling

In order to help implement policy instruments and facilitate the creation of the market for scrap tires, several measures could be taken into account as:

1. MWFEP should take regulatory measures to prohibit the abandonment, dumping or uncontrolled discharge of scrap tires;
2. National competent authorities - MIC and MWFEP - should set up permitting procedures for the control of establishment and undertakings that dispose of or recover scrap tires; establishments and undertakings carrying out waste tire collection or transportation functions or acting as a dealer/broker/ of waste tires should not be required to obtain a permit, but a requirement should be imposed to be registered with the national competent authorities (MIC, Recycling Commission, EPAs etc.).
3. MIC and MWFEP should elaborate the methodology for supervising scrap tires collections and recycling. This will require:
 - a) instructions for waste disposal and recovery operators to make records of the operations; these should be available for the competent national authorities (Recycling Commission, EPAs etc.).
 - b) the authorities in charge will also be required to carry out periodic inspections (EPAs, Recycling Commission);
 - c) documents and forms to access the National Recycling Fund by the end users of waste tires; they must demonstrate that the tires were generated in Romania;
 - d) eligibility criteria for users or uses of waste tires; these could include:
 - i) civil engineering projects that use chopped waste tire material as a substitute for soil or gravel in construction of road bases and embankments, septic drainfields, and daily

¹⁶ For instance, EU Member States are required to establish an integrated and adequate network of disposal installations to enable the Community as a whole to become self-sufficient in waste disposal. Member States are also required to move towards self-sufficiency themselves.

Furthermore, the Waste Directive requires that the national competent authorities draw up waste management plans covering elements such as the type, quantity and origin of waste to be recovered or disposed of, identification of suitable disposal sites or installations and special arrangement for particular wastes.

- covering material at solid waste landfills;
 - ii) combustion of waste tire materials for their energy content as well as burning in cement kilns etc.;
 - iii) chemical processing as pyrolysis of waste tires to extract petroleum etc.;
 - iv) conversion of waste tires into secondary products such as rubberized asphalt, mats, drainage systems, building materials, and recycled rubber products;
 - e) Criteria for eligibility of recycling waste tire piles; a criteria for subsidies recycling waste tire piles could be if they existed prior to the effective date of the regulation or they represent accumulations of tires sold, traded or exchanged in Romania. Tire haulers and end users are encouraged to complete official state forms to document the origin, hauler, processor and end user of waste tires. The minimum application quantity for a subsidy should be established.
4. MIC, MWFEP and Research and Technology Agency should provide competing funding for research on tire recycling and processing;
 5. At the political level, a round table with public national and regional authorities and the tire industry should be organised by MWFEP, in order to elaborate a "Voluntary Agreement" in accordance with the main lines of the EU Draft Recommendation.
 6. MIC and MWFEP should establish a target recycling rate to 50% in 2002 with priorities given to reuse, recycle and use as fuel and a total collection of used tires.

In the next figure there are proposed several steps to be taken in order to implement a policy for recovering and recycling waste tires in Romania. (see Figure 2).

Actions	1999	2000	2001	2002
Regulations to prohibit the abandonment, dumping or uncontrolled discharge of scrap tires				
Permitting procedures for the control of establishment and undertakings that dispose of or recover scrap tires				
Registering waste disposal and recovery operators with the national competent authorities				
Methodology for supervising scrap tires collections and recycling <ul style="list-style-type: none"> • eligibility criteria for users or uses of waste tires; • eligibility criteria for waste tire piles; • periodic inspections carried out by the authorities in charge; • documents to prove the origin of the scrap tires; • miscellaneous 				
Introducing charge on new tires				
Round table with public national and regional authorities and the tire industry in order to elaborate a Voluntary Agreement to recover and recycle scrap tires				
Establish a target recycling rate				
Research programs for recycling tires technologies				

Figure 2: Proposed implementation actions for a recovering and recycling waste tires in Romania

ANNEXES

Annex 1: MEANS OF TRANSPORT OUTPUT (1991 - 1996)

	1991	1992	1993	1994	1995	1996
Cars (thou. pieces)	84	74	93	86	88	117
Autoutilitarians (thou. pieces.)	1626	2302	2316	1681	1320	1371
Buses (pieces)	930	565	368	378	452	420
Trolleybuses (pieces.)	75	68	52	84	80	72
Lorries, tractors etc. (pieces)	7529	4456	4433	3044	3098	3142

Source: Romanian Statistical Yearbook, 1997, CNS, București

Annex 2: CAR OWNED BY INDIVIDUALS (PIECES/1000 INHABITANTS)

	1991	1992	1993	1994	1995	1996
Cars to 1000 inhabitants	61,4	67,9	76,2	85,5	92,8	101,0

Source: Romanian Statistical Yearbook, 1997, CNS, București

Annex 3: SALES OF TIRES FOR CARS IN ROMANIA (1989 - 1998)

- thou. pieces -

Sales	1989	1992	1995	1996	1997	1998 (sem. I)
Produced in Romania	2135	1396	1484	1612	1445	746
Imports of new tires	15	341	621	714	639	335
Imports of used tires	-	...	564	953	1222	513
Imports of retreaded tires	-	...	90	85	40	8
Total sales	2150	1737	2795	3364	3346	1602

Source: Ministry of Industries and Commerce., 1997

Annex 4: SALES OF TIRES FOR TRUCKS IN ROMANIA (1989 - 1998)

- thou. pieces -

Sales	1989	1992	1995	1996	1997	1998 (sem. I)
Produced in Romania	1361	783	599	704	465	205
Imports of new tires	9	161	38	37	107	88
Imports of used tires	50	85	109	46
Imports of retreaded tires	7	7	1	1,4
Total sales	1370	944	694	833	682	340

Source: Ministry of Industries and Commerce., 1997

Annex 5: SALES OF TIRES FOR TRACTORS (BACK WHEEL) IN ROMANIA (1989 - 1998)

- thou. pieces -

Sales	1989	1992	1995	1996	1997	1998 (sem. I)
Produced in Romania	79	102	70	57	162	125
Imports of new tires	3	1,4	1	2	8	1
Imports of used tires	-	-	-	-	-	
Imports of retreaded tires	-	-	-	-	-	
Total sales	81	103,4	71	59	170	126

Source: Ministry of Industries and Commerce., 1997

Annex 6: MOTOR VEHICLES ENLISTED IN ROMANIA (END OF YEAR)

	number					
	1991	1992	1993	1994	1995	1996
Buses	25199	26847	28085	28862	30365	30950
Microbuses	5956	8232	9646	11155	11682	12275
Motor vehicles (including taxicabs)	1431566	1593029	1793054	2020017	2197477	2391869
Motor bicycles (including mopeds)	207473	214019	212854	204496	205032	209507
Motorcycles	108006	108737	113651	121205	122692	122527
Merchandise motor vehicles	259566	275487	298318	322417	343064	365390
Total means of transport	2039757	2228343	2457601	2710146	2912307	3134514

Source: Romanian Statistical Yearbook., 1997

Annex 7: GOODS TRANSPORT BY TYPE OF TRANSPORT

	1991	1992	1993	1994	1995	1996
	Goods carried (thou. tonnes)					
Total	1186947	865790	736737	756611	764843	795752
Railway transport	146273	111419	98961	99179	105131	105040
Road transport	993992	719226	593432	621257	616044	649746
River transport	8249	6198	7074	9405	14392	14142
Sea transport	22316	14133	23819	10669	13047	11936
Air transport	13	47	35	46	46	26
Transport through petroleum pipe-lines	16104	14767	13416	16055	16183	14862
	Goods travel (million tonnes-km)					
Total	171870	110574	141000	92714	126719	106758
Railway transport	37853	28170	25170	24704	27179	26877
Road transport	20692	15744	15354	18321	19748	19807
River transport	2030	1890	1592	1896	3107	3774
Sea transport	108089	62076	96305	44885	73636	53589
Air transport	26	136	108	107	113	49
Transport through petroleum pipe-lines	3180	2558	2471	2801	2936	2662
	Indices of goods travel 1990 = 100					
Total	84,2	54,1	69	45,4	62	52,3
Railway transport	66,1	49,2	44	43,1	47,5	46,9
Road transport	71,4	54,3	53	63,2	68,1	68,3
River transport	97,1	90,4	76,2	90,7	148,7	180,6
Sea transport	97,6	56	86,9	40,5	66,5	48,4
Air transport	45,6	238,6	189,5	187,7	198,2	86
Transport through petroleum pipe-lines	62,8	50,5	48,8	55,3	58	52,6

Source: Romanian Statistical Yearbook., 1997

Annex 8: EU Directives with implications for used tires

Landfill: If adopted by 1998, whole tire ban in 2000, shredded tires banned in 2005

End of life vehicles: Tires to be disassembled from vehicle.

Incineration of waste Low emission limit values for cement kilns, mainly for NO_x

National regulations on used tires

- **Denmark** - A law imposes a fee on every new tire for disposal of used tires.
- **Finland** - Entered into force in June 96, legislation lays on the producers the responsibility for organising the collection, transport and recovery of used tires.
- **Germany** - Three decrees, dated October 96, base supervision of waste destined for recovery operations on verification of the waste recovery and disposal and on the transposition of the European Waste Catalogue.
- **Italy** - Since 1998, a new decree considered co-incineration of municipal waste used tires as preferred recovery method.
- **The Netherlands** - Since 1996, 2 laws lay the responsibility for disposal on manufacturers and importers for ELVs (end-of-life-vehicles) and used tires providing take-back obligations.
- **Sweden** - In 1994 an ordinance was voted to organise collection and recycling of used tires.

National regulations on waste

Germany: Framework law—October 1996 - (following EU Waste Legislation) with one decree on the transportation of used tires, and one decree for the management of ELVs.

Belgium: In Flanders, the Viarea Regulation (16 April 98) creates a take-back obligation for waste tires free of charge for the consumer.

France: A Law passed on 9 September 1997 forbids the landfill of used tires after July 1st, 2002.

Italy: No landfilling of recoverables after 2000, push on co-incineration of municipal waste and used tires.

United Kingdom: General legislation governing waste management requires controlled disposal of used tires.

Existing Voluntary Agreements

Belgium On 9 February, 1998 the Brussels and Walloon regions signed a Voluntary Agreement with the industry concerning the collection and treatment of used tires which will enter into force in 1999.

The Netherlands Ministry of Environmental Affairs accepted a plan presented by a used tires association (with representation from tire producers and tire importers). The plan proposes actions in the following fields: monitoring of the replacement market, contracting and assisting the collectors of used tires, monitoring of the goals fixed by the law. The association is financed by its members, the consumer paying a non legally mandatory variable charge per tire.

Proposed Voluntary Agreements

Flanders Region, France, Italy, Spain

Annex 9: EU ORGANISATIONS DEALING WITH THE MANAGEMENT OF USED TIRES

Country	Organisation
Belgium	Rectyre
Finland	Tyre Recovery Ltd
France	APURE
Germany	GAVS
Italy	ECO.PNE.US
Spain	NEDES
Sweden	SDAB Ltd
The Netherlands	BEM
UK	Government/Industry Scrap Tyre Working Group

Annex 10: OVERVIEW OF THE USED TIRES NATIONAL SYSTEMS IN THE EU COUNTRIES (UPDATED JUNE 1998)

BELGIUM

An association, with representatives from the three regions, tire manufacturers, recycling transporters, car dealers and manufacturers, submitted recommendations to the three regions at the end of June 1997. The content of the proposal is to create a system for taking back used tires within the dealer network. The responsibility of the association would be to exert overall control without specified recovery targets.

On February 9th, 1998 the Brussels and Walloon regions signed a Voluntary Agreement with the industry concerning the collection and treatment of used tires which will enter into force in 1999.

The Flemish region, which is still engaged in negotiation with the sector on a voluntary agreement, published a law on April 16th, 1998 creating a take-back obligation for waste tires free of charge for the consumer.

FINLAND

After negotiations between producers (manufacturer and importers) and authorities in 1995, a law based on producer responsibility principle came into force in June 1996.

Producers are responsible for organising the collection, transport and recovery of used tires. To fulfill their obligations, the biggest tire producers established a company (Tire Recovery LTD) financed by a recycling fee on new tires.

The collected used tires should primarily be reused as material and secondly incinerated with energy recovery.

FRANCE

In January 1994, tire manufacturers created a non-profit association (APURE) that organises the collection and the further process of used tires and contributes financially when necessary. In France, local authorities organise the collection and elimination of waste, including scrap tires, on a regional basis. APURE signed partnership agreements in some regions.

The Environment Minister Mrs D. Voynet, from the Green Party, has launched discussion with the tire industry, to negotiate a voluntary agreement.

Although the French law on landfill foresees the ban of landfilling of tires for 2002, the government is pessimistic about reaching this target. Discussions are said to be difficult and slow.

GERMANY

The German legislation of used tires is based on three decrees dated October 1996, respectively on the:

- supervision of wastes destined for recovery operations,
- verification of the waste recovery and disposal and
- adoption of the European Waste Catalogue.

A decree on ELV's is expected to give the legislative frame for the 'voluntary self commitment' of the industries and some technical guidance for car recycling.

Two motions have recently been brought to parliament concerning ELV's and used tires, which would require the producers and importers to take back free of charge cars/tires and minimum quotes for recycling.

The tire industry is opposed to current government proposals.

ITALY

A Consortium (ECO.PNE.US) was set up in 1994 to deal with the used tire issue. It has estimated the used tires generation in each region, selected firms specialised in collection of used tires, and provided the parties with information and assistance.

Out of the nine regional areas, five are already operating for the reuse and disposal of used tires. For 1997 the Consortium planned to implement a certification programme for selected collectors and develop activities in less advanced areas.

A commission of the Italian Parliament would like to discuss used tires. As in France, the new minister for the environment represents the Green Party and this is likely to impact future developments.

In the past, many licences were granted for combustion projects. Since the end of 1996, a new law has considered used tires as secondary raw material.

THE NETHERLANDS

Two laws lay the responsibility on manufacturers and importers for ELV's (including used tires) and used tires on the replacement market. The tire producer and 20 big tire importers set up a used tire association (called BEM) to deal with their obligations under the law. This association made a plan accepted by the Ministry of Environmental Affairs covering:

- monitoring of the replacement market;
- contracting and assisting the collectors of used tires;
- monitoring of the goals fixed by the law.

The association is financed by contributions from its members, the consumer paying a voluntary charge per tire.

At the end of September 1997, a contract was signed between manufacturers and collectors. Negotiations are continuing with the government concerning the system of collection for used tires.

SPAIN

Manufacturers and importers set up a Used Tires Association (NEDES) in early 1993 (officially registered in December 1996) to find, develop, promote and implement solutions for the recovery and the elimination of used tires at minimum cost and under environmentally-friendly conditions.

Financial contributions of its members are proportional to their replacement market share.

At the political level, a round table with public national and regional authorities and the tire industry started in September 1993 in order to elaborate a "Voluntary Agreement" in accordance with the main lines of the EU Draft Recommendation. However the Ministry of Environment has not signed the final version yet because environment is of the 17 regional governments' competence.

SWEDEN

In 1994 an ordinance was voted to manage the collection and recycling of used tires. The tire industry established a non-profit company (SDAB) that represents tire producers vis-a-vis the authorities and is responsible for the overall supervision of the system.

This recycling system started in January 1995 and the association is financed by a recycling charge levied on the sale of new tires. Its targets are an increasing recycling rate to 80% in 1998 with priorities given to reuse, recycle and use as fuel and a total collection of used tires by the year 2000.

UNITED KINGDOM

An Industry/Government Scrap Tyre Working Group was formed in June 1995 to monitor the UK's performance against expected EU targets and to facilitate the emergence of new recovery and recycling projects. The tax on the landfilling of tires introduced since October 1996, the growing interest of cement manufacturers in tires-as-fuel and the numerous pyrolysis projects should help to increase recovery rates still further.

In 1995, 73% of the scrap tires were recovered physically but by 1997 it was difficult to maintain such level of recovery because of the high value of sterling and market competition from imported tires.

Annex 11: GENERATION, RETREADS AND RECYCLE OF SCRAP TIRES IN SOME EU COUNTRIES, 1996

Country	Generation		Retreads		Recycled		Energy		Landfill		Export	
	thou. tonnes	%	thou. tonnes	%	thou. tonnes	%	thou. tonnes	%	thou. tonnes	%	thou. tonnes	%
France	354	100	70	20	60	16	54	15	160	45	10.5	4
Germany	603	100	105	17.5	70	11.5	280	46.5	24	4	97	16
Italy	303	100	73	22	40	12	76	23	131	40	6	2
UK	378	100	118	31	61	16	102	27	88	23	9	2.5
Belgium	44.8	100	9	20	4.5	10	13.5	30	2.2	5	11.2	25
Finland	27	100	2.4	9	1.1	4	6.8	25	n.a.	-	n.a.	-
The Netherlands	25	100	15	60	3	12	7	28	0	0	n.a.	-
Spain	202	100	40	20	1	0.5	n.a.	-	152	75	n.a.	-
Sweden	55.5	100	2.7	5	6.9	12.5	35.5	64	2.7	5	3.8	7

Source: European Rubber Journal, Sept. 1998

**Annex 12: SUBSIDIES IN VIRGINIA'S END USER REIMBURSEMENT PROGRAM
(1995-1996)**

Recipient	Tons	\$ Payments	Use
BFI, Glen Bernie MD	20,521	581,128	Landfill cap
Atlantic Waste, Sussex Co. VA	19,322	550,766	Daily cover
Georgia Pacific, Bedford Co. VA	14,469	346,562	Tire derived fuel
USA Waste, Amelia VA	11,114	472,476	Daily cover
Ogden Martin, Fairfax VA	10,659	298,913	Tire derived fuel
USA Waste, Charles City VA	6,491	179,472	Daily cover
LeHigh Cement, Leeds AL	5,231	140,979	Tire derived fuel
Md. Environ. Services, Annapolis MD	5,000	112,500	Landfill cap
Env. Golf Systems, Pine Bluff NC	4,477	134,310	Drainage system
Tire Recyclers Inc., Charles City VA	4,019	200,950	Eco blocks
ESSROC Cement, Frederick MD	3,964	110,366	Tire derived fuel
SPSA, Portsmouth VA	3,207	86,941	Tire derived fuel
Brown Septic, Conway SC	2,997	84,396	Septic drainfields
Dodge Regupol, Lancaster PA	2,753	82,590	Recycled products
DuBrook Concrete, Chantilly VA	2,153	64,590	Noise barriers
NRB, Chamberburg, PA	1,977	44,483	Molded products
Merriman Concrete, Chesterfield SC	1,824	43,286	Septic drainfields
CRAFCA, Allentown PA	1,726	51,780	Pavement sealer
TIREC, Wilmington DE	1,693	47,693	Playground mat'l
Cromer Brothers, Sharon SC	1,656	34,068	Septic drainfields
Appomattox LF, Appomattox VA	1,630	40,988	Daily cover
Jones Construction, Longs SC	1,501	31,990	Septic drainfields
Mecklenburg LF, Mecklenburg VA	1,205	60,250	Daily cover
Bowater, Catawba SC	1,084	21,403	Tire derived fuel
ABEX Products, Winchester VA	802	24,000	Brake pads
Concrete Placement, Dubois PA	751	16,898	Tire derived fuel
Caroline LF, Caroline VA	547	16,410	Daily cover
Exeter Energy, Sterling CT	472	12,135	Tire derived fuel
Independent Cement, Hagerstown MD	366	8,235	tire derived fuel
Taylor-Murphy, Ashville NC	238	3,758	fill section
Emanuel Tire, Baltimore MD	222	4,995	arena materials
American Blasting Mats, Norfolk VA	213	6,390	blasting mats
Totals	134,356	\$3,915,771	

Source: Virginia Department of Environmental Quality, Waste Tire Program circular No. 170.

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