ZERO WASTE ALLIANCE IRELAND

Towards Sustainable Resource Management

Submission to the Department of the Environment, Community and Local Government

on

Tyres and Waste Tyres

30 January 2014

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1. INTRODUCTION

The Review of the Producer Responsibility Initiative Model in Ireland, of which Section 9 addresses the problem of tyres and waste tyres, provides the basis for this consultation.[1]

The Department has invited comments on this Review from interested parties, and on the issues raised in connection with the problem of waste tyres, and **Zero Waste Alliance Ireland** is pleased to have the opportunity of making the following submission.

The Review, dated November 2013, contains a number of disturbing comments on the existing situation. For example:

- the percentage of waste tyres unaccounted for in Ireland has been estimated at 51 % by the EPA, compared with 4 % for the 27 EU member states plus Norway and Switzerland (i.e. 96% of waste tyres are accounted for in these countries);
- Ireland's performance is significantly below the EU average, and the current system of collecting used tyres is clearly not functioning as intended;
- In comparison with other Producer Responsibility Initiatives (e.g., the PRIs for packaging and WEEE), the PRI for tyres has a much smaller budget for information and awareness raising (less than €40,000) compared with packaging (€880,000) and WEEE (€2.9 million) in 2011;
- the existing Producer Responsibility Initiative schemes for tyres do not fund or subsidise the collection and treatment of tyres or provide for specific recycling or recovery targets;
- in 2011, nearly 3.4 million tyres were placed on the market in Ireland, and a 600,000 tyres were imported on vehicles, i.e., approximately 4.0

[1] Review of the Producer Responsibility Initiative Model in Ireland -- Section 9: Tyres and Waste Tyres. RPS, Draft Final Report to the Department of Environment, Community & Local Government, November 2013.

million tyres were brought into the country in that year alone, the great majority of these being motor car tyres;

- The All-Ireland Used Tyre Survey estimated that the tonnage of tyres placed on the market in Ireland in 2010 was 48,341 tonnes, but the producer responsibility organisations (PROs) reported that 35,147 tonnes of tyres were placed on the market by their members in 2010, leaving a gap of 13,194 tonnes of tyres (27%) of unknown origin[2];
- importation into Ireland of part worn tyres may account for 10 to 20% of tyres placed on the market, and when these tyres are used by vehicles on roads they are a source of significant concern for road safety;
- in 2011, approximately 53.7 % of waste tyres were exported (mainly to South Korea) and 40.6 % were chipped;
- The review refers to cement kilns as a potential outlet for waste tyres, noting that there are two facilities in the country authorised to burn waste tyres, and that these could provide significant capacity to deal with a large amount quantity of waste tyres – but the review does not consider the atmospheric emissions which result from this combustion process; and,
- Reporting on used / waste tyres is described in the review as creating an additional administrative burden for waste collectors and recovery operators.

However, the review contains a number of useful recommendations, including:

- ✓ The review recommends that a centralised electronic producer registration system should be established, similar to the WEEE Register, and this register should record the quantities of tyres put on the market; it should be managed centrally by one organisation which would provide information on tyres placed on the market by producers participating in the compliance schemes and would provide country-wide data required for the monitoring of targets;
- ✓ The review recommends that the DECLG should change the 2007 Tyres and Waste Tyre Regulations to make producers and importers responsible for financing the collection of waste tyres from tyre suppliers as a matter of priority; and, to prevent trade distortion with Northern Ireland, the system should be implemented on an All-Ireland basis; and,
- ✓ The waste tyre market is a single geographic market in Ireland; and therefore only one Producer Responsibility Organisation (PRO) should serve this market, thereby providing the dual benefits of improving the monitoring of the PRI performance and holding the PRO to account.

[2] Review of the Producer Responsibility Initiative Model in Ireland -- Section 9: Tyres and Waste Tyres. RPS, Draft Final Report to the Department of Environment, Community & Local Government, November 2013; section 9.10.1, pages 42-43.

2. ZERO WASTE ALLIANCE IRELAND (ZWAI)

In our submission to the department of the Environment, Community and Local Government on the subject of household waste collection, we described the background to the establishment of Zero Waste Alliance Ireland, our origin and early activities, the basic principles which guide us, and our current activities. Therefore there is no need to repeat this information, except to say that ZWAI is an environmental NGO, and is best described as a community organization focused on the development and implementation of systems where the world's materials and resources that are finite would be efficiently reused and recycled to maintain a more sustainable Irish economy.

A significant number of strategically finite virgin resources are becoming exhausted, and we believe that many viable long term jobs can be created in Ireland by considering discarded items and materials as resources to be collected, repaired, recycled and transformed or processed to create medium to high value products. We believe that this policy should have the highest priority.

One of our basic principles is that used tyres should not be considered as "waste" in the accepted sense, but as useful raw materials for other purposes. Addressing the problem of what to do with used tyres should begin at the design stage, with tyres being designed and manufactured so that, at the end of their useful lives, they may be re-used, or their components re-manufactured or re-cycled.

However, in the case of used tyres, we have to deal with a very specific type of product, manufactured to ensure a high standard of safety for their users. Any re-design of motor vehicle tyres to render them more suitable for recycling would have to take account of this primary purpose for which the tyre is manufactured. This primary aim places certain limitations on alternative designs and alternative materials. For example, a tyre made from biologically degradable or compostable material currently available would almost certainly fail to achieve the necessary standard of safety and reliability throughout its life. What is therefore urgently needed, and appears to be absent, is any evidence of significant innovation aimed at producing new types of tyres which would be environmentally friendly, reliable, safe, and have a reasonably long service life (see section 3.1 below).

3. ADDRESSING THE PROBLEM OF USED TYRES – ZWAI SUBMISSION

3.1 Need to Conserve Scarce Raw Materials and Energy

A conventional motor vehicle tyre is a product with a complex structure and composition, highly resistant to biodegradation, photochemical decomposition, chemical reagents and high temperatures.[3]

Approximately 80% of the weight of car tyres and 75% of truck tyres consists of rubber compounds, including natural rubber and synthetic elastomers such as butyl rubber and styrenebutadiene rubber. Other materials include carbon black (approximately 22%), steel (approximately 16 to 25%); textile (approximately 5%), zinc oxide (1% to 2%), sulphur (approximately 1%) and other additives (approximately 7.5%).

Additional toxic components include copper compounds (used as an alloy in the steel reinforcing), cadmium, lead, organohalogen compounds and poly-aromatic hydrocarbons (PAHs). In addition to carbon black, oil is used as a plasticiser in tyres. Hardening and vulcanising agents, various booster chemicals and protective agents are also used in the rubber compound. The presence of chlorine in the chlorinated butyl rubber liner, used to slow the leakage rate of air from the tyre, gives rise to toxic emissions to the atmosphere when tyres are burned or when shredded tyres are used as fuel.

Tyre Component	Energy value (kWh/kg)
Energy required to manufacture a tyre	32.0
Energy required to produce tyre rubber compound	25.0
Energy content of tyre-derived fuel (TDF)	9.0
Energy consumed to produce crumb rubber from tyres	1.2

Table 3.1 **Specific energy values of tyre-related materials** (adapted from "Scrap Tyre Recycling", Kurt Reschner, Waste Management World, online article, 01 July 2003).

As shown in Table 3.1, the energy recovered from tyre-derived fuel (TDF) is only a fraction of the energy invested into the production of tyre rubber. This correlation is clearly reflected in the market prices for TDF (US $30-50 per tonne in 2003) and crumb rubber from scrap tyres (US $180-300 per tonne in 2003). More recent data is likely to show a similar substantial difference in price between TDF and crumb rubber.

[3] Review of the Producer Responsibility Initiative Model in Ireland -- Section 9: Tyres and Waste Tyres. RPS, Draft Final Report to the Department of Environment, Community & Local Government, November 2013; section 9.3.2, page 12. However, on page 16 of the Review, it is incorrectly stated that "Tyres are not biodegradable because the time they take to decompose is indeterminate".

It will be clear that the manufacture of tyres uses a significant amount and number of raw materials, of which only the natural rubber component may be described as renewable. Steel, textiles and synthetic rubbers also use large amounts of energy to manufacture.

As we are now past the point of "peak oil", we should aim to achieve the maximum recovery rate of waste tyre resources in Ireland. The extraction of new virgin materials from our finite planet, such as oil, for the manufacture of new tyres should be minimized. Given that some 40% of tyres are derived from oil, and that we have now passed "peak oil"; we submit that this is a very important national sustainability goal. Re-using tyre rubber for its originally intended purpose is our preferred option, both environmentally and economically. Reuse and recycling is much more desirable than burning waste tyres to extract a small proportion of the embodied energy which went into their manufacture.

Despite undertaking some research in this area, we have seen no evidence of any innovation, in design, materials or production processes, which would make used or worn tyres more recyclable or easier to repair or re-use, despite the obvious advantages of being better able to achieve an environmentally acceptable and safe product. Instead, the manufacture of tyres continues to focus solely on performance and price, with very little or no thought being given to the ultimate fate of a used or worn tyre. However, there are innovations in the technology for re-processing used tyres in order to extract usable rubber and steel, and we will refer to these in section 3.4 below.

Notwithstanding the development of these innovations, we would submit that the lack of any concerted effort to design, produce and place on the market a more eco-friendly type of vehicle tyre represents a failure to comply with the recommendation in Article 8 (2) of the EU Directive 2008/98/EC on Waste[4], which states that "*Member States may take appropriate measures to encourage the design of products in order to reduce their environmental impacts and the generation of waste in the course of the production and subsequent use of products*".

3.2 Minimise the Use of Toxic Materials in the Manufacture of Tyres

As pointed out in section 3.1 above, tyres contain a significant proportion of toxic materials, and these cause problems when used tyres are stored, recycled or used as a source of fuel (see sections 3.5 to 3.8 below).

Therefore we submit that Ireland should take the lead in Europe in requiring tyre manufacturers and distributors, i.e., "producers" who place tyres on the market in Ireland, to minimise the types and quantities of toxic components in tyres. An incentive could be provided by applying a lower VAT rate to tyres which confirm

[4] Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives. OJ L 312/03-30; 22-11-2008.

to an agreed low toxicity standard, and a higher VAT rate to tyres containing a higher proportion of toxic materials.

Tyres certainly contain toxic and hazardous substances, and therefore it is not true that "*Tyre components have no hazardous properties and are therefore not intrinsically hazardous*", as stated in the Review of Producer Responsibility Initiative for Tyres and Waste Tyres.[5]

Ireland should also be pro-active in pushing for and enforcing the new REACH obligations with regard to the manufacture of tyres. We need to further reduce toxic materials (especially PAHs) in tyres to improve the safety of products made from recycled crumb rubber; and we need to minimise and, where possible, avoid these potentially toxic chemicals from entering our environment.

This is particularly important because of concerns which were expressed by the German Federal Environment Agency. In November 2012, the Agency issued a press release pointing out that extender oils containing polycyclic aromatic hydrocarbons (PAHs) were used legally in car tyres until 2009; but in January 2010 an EU-wide threshold value for PAH-containing extender oils in car tyres came into effect (Regulation (EC) No. 1907/2006). This restriction bans the use of extender oils for producing car tyres or tyre parts if these contain more than 1 mg/kg of benzo[a]pyrene, or if the overall contents of all PAHs listed is more than 10 mg/kg. If tyres (including re-treaded tyres) exceed the specified limits, they may no longer be marketed. However, the restriction does not apply to tyres of bicycles, children's scooters and other products.

The purpose of the Regulation is to reduce air pollution by PAH-contaminated dust produced by abrasion of tyres in road traffic, but it also reduces the PAH contamination of dust produced by abrasion of surfaces made from recycled tyres. Given that up to 20% of used tyres are recycled in Germany, this is an important step.

While recycling of tyres is certainly environmentally desirable (as we will show later in this submission), it may have the harmful effect of keeping in use over a longer period of time some material produced before 2010 which contains harmful substances, and may even contain high concentrations of PAHs. For example, recycled rubber granulate from used tyres is processed into floor coverings for lounges, corridors and recreation rooms, while the surfaces of sports fields are also made from recycled granulate. Synthetic surfaces for sports fields are not resistant to abrasion; and athletically active individuals, especially young people, may become exposed to PAHs via skin contact with abraded dust from the surface. In the construction industry, building protection strips and mats contain material from recycled tyres, and these could have the effect of exposing workers to PAHs.

At that time, the EU did not yet have an overall strategy aimed at protecting humans and the environment systematically from PAHs, including those PAHs

[5] Review of the Producer Responsibility Initiative Model in Ireland -- Section 9: Tyres and Waste Tyres. RPS, Draft Final Report to the Department of Environment, Community & Local Government, November 2013; section 9.3.5, page 16.

derived from used tyre reprocessing. Therefore, to provide better protection for humans and the environment, the Federal Institute for Risk Assessment (BfR), the Federal Agency for Industrial Safety and Occupational Medicine (BAuA), the Federal Environmental Agency (UBA), the Federal Ministry of Consumer Protection, Food and Agriculture (BMELV), and the Federal Ministry of Economics (BMWi) launched an initiative in the summer of 2010 aimed at limiting the PAH content in consumer products throughout Europe. The German authorities proposed a binding limit for carcinogenic PAHs in consumer products, whether manufactured in, or imported into, Europe.

The German proposal was to restrict the use and marketing of contaminated products such as shoes, sporting goods, and aquatic toys containing more than 0.2 milligrams per kilogram of eight listed PAHs classified as carcinogenic. However, a year later, in June 2011, the European Commission presented its own proposal: only toys and products for children up to 14 years of age are to be restricted by PAH limits, and the proposed upper limit is 1 milligram of PAH per kilogram. Following submissions by Germany and some other member states, the Commission amended its proposal, and the restriction now includes most products that were to be regulated according to the German proposal.

Under the EU REACH Regulations, PAHs are identified as substances of very high concern, the use of materials containing PAHs should be subjected to prior authorization, and the use of such materials is permissible only if there are no alternatives.

While ZWAI has always supported the idea of recycling, it is also obvious that there will be a need to minimise the toxins remaining in re-manufactured products, in accordance with the REACH obligations; and to provide essential information about these toxic substances, as required by the Århus Convention on access to environmental and public health information.

There is no doubt that new tyres with lower levels of PAH will make the use of recycled crumb rubber products safer to use by the public. Our argument is for much tighter accounting of the waste tyre resource and a more focused co-ordination of measures to expand the recycling industry – however the comments above by the German authorities highlight the need for more inspection and regulation of recycled products made from waste tyres, including products imported into Europe.

ZWAI is very concerned that recycled rubber mats from the existing stock of older specification tyres should not be used indoors in an enclosed building environment. A reputation that the use of a recycled product was harmful to health would be disastrous to our efforts to grow the recycling industry.

It is therefore our submission that Ireland should add its voice to the German call for tightening and reduction of levels of PAH's in all products sold in the EU – including products made from recycled tyres.

Another area of concern is the use of lead weights for balancing car wheels after fitting new tyres. Although they are not a part of the tyre – the use of lead weights for balancing wheels is another example of an avoidable toxin that is

entering the environment. We recommend that the use of lead weights be discontinued in favour of a non-toxic material.

3.3 Data on Numbers of Tyres Imported, Used, Reused, Recycled and Exported

It is extraordinary, and very disappointing, to learn from the November 2013 Review of the Producer Responsibility Initiative (PRI) for tyres in Ireland that the percentage of waste tyres unaccounted for has been estimated at approximately 51 % by the EPA, compared with 4 % for the 27 EU member states plus Norway and Switzerland (i.e. 96% of waste tyres are accounted for in these countries). There appears to be no doubt that Ireland's performance is significantly below the EU average, and the current system of collecting used tyres is clearly not functioning as intended.[6]

A further problem identified in the Review is that certain types of tyres are not subject to the 2007 Tyres and Waste Tyre Regulations, and these include new and re-treaded aircraft tyres, bicycle tyres and other re-treaded pneumatic tyres.[7] It would therefore appear that these tyres are not included in any of the above statistics.

In addition, the number of tyres imported on vehicles appears to be largely unknown, especially as the Review states that "*logistics companies also import tyres for the own use*". The number of logistics companies may not be known, but the number of Irish registered heavy trucks (16,700 above 10 tonnes unladen weight in 2012)[8], and the fact that nearly 26% of road freight was international (when measured in tonne-km), suggests that there are frequent opportunities for Irish vehicles to purchase new tyres on the European mainland and to bring them back to Ireland for fitting in their company's premises.

To make matters even more confusing, the Review of Producer Responsibility for waste tyres provides no information on the number or quantity of waste tyres generated in the North of Ireland, nor is it clear whether the partial data in the report refers only to used or worn tyres produced as waste in the entire country or only in the Republic of Ireland. Given that any vehicle may be registered in one jurisdiction, and may drive across the border to have its worn tyres replaced in the other jurisdiction, and that truck-loads of used or waste tyres may pass in either direction across the border (all of these activities depending on the changing economics of tyre prices), it makes the utmost sense to consider the waste or used tyre "market" as a single All-Ireland market.

[6] Review of the Producer Responsibility Initiative Model in Ireland -- Section 9: Tyres and Waste Tyres. RPS, Draft Final Report to the Department of Environment, Community & Local Government, November 2013; executive summary, page v.

[7] Review of the Producer Responsibility Initiative Model in Ireland -- Section 9: Tyres and Waste Tyres. RPS, Draft Final Report to the Department of Environment, Community & Local Government, November 2013, section 9.3.1.

[8] CSO Road Freight Transport Survey, 2012.

This problem is referred to briefly in the Review, where it is stated that "*there is an extensive cross-border movement of waste tyres*".[9]

No data appears to be available, and perhaps this is understandable, despite the fact that an All-Ireland Freight Forum has been in existence since January 2010, having been established in response to an agreement made at the North South Ministerial Council (NSMC) Transport Sector meeting in April 2009. One of the reasons for the lack of data on waste tyres in the North of Ireland is most likely to be the result of there being no system for collection of data on waste tyres.

At a session of the Northern Ireland Assembly Committee for the Environment, which enquired into used tyre disposal, the reply was given by Mr Norman Kerr that "*we are not regulated or licensed; there are no laws or legislation to say what we should do with our tyres*", while Mr Graham Byrne stated that his concern was "*the tyres that are not recycled but stored in large areas such as landfill sites*".[10]

However, that dire situation may be due to improve very soon, as the Northern Ireland Assembly has produced a very detailed and lengthy interim report on the committee's inquiry into used tyre disposal. The report includes minutes of proceedings, minutes of evidence, written submissions, research papers and recommendations. One important recommendation is that "*a strict producer responsibility scheme would be counterproductive unless introduced in both jurisdictions*".[11]

When RPS carried out a survey of used tyres in both jurisdictions in Ireland, the response rates by retailers, collectors, authorised treatment facilities and tyre recyclers on both sides of the border were very low (only 20% average in the North, and 3% average in the Republic), and were not sufficient to provide meaningful data.[12]

An immediate requirement must be to improve the quality of data available, especially data on what happens to motor vehicle tyres when they come to the end of their useful life on roads, in which part of the country these used or waste tyres are generated, what other uses are then made of these tyres, and when these uses come to an end, what finally happens to the tyres. This matter, we

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[9] Review of the Producer Responsibility Initiative Model in Ireland -- Section 9: Tyres and Waste Tyres. RPS, Draft Final Report to the Department of Environment, Community & Local Government, November 2013, section 9.3.1, page 10.

[10] NI Assembly, Committee for the Environment, Session: 2011/2012, Thursday, 01 December 2011: Inquiry into Used Tyre Disposal. Official Report. http://www.niassembly.gov.uk/Assembly-Business/Official-Report/Committee-Minutes-of-Evidence/Session-2011-2012/December-2011/Inquiry-into-Used-Tyre-Disposal-/

[11] Committee for the Environment: Interim Report on the Committee's Inquiry into Used Tyre Disposal, Together with the Minutes of Proceedings, Minutes of Evidence and Written Submissions Relating to the Report. Ordered by the Committee for the Environment to be printed, 19 April 2012. Report: NIA 11/11-15.

[12] RPS, 2013. All-Ireland Used Tyre Survey. Report to the Department of Environment Northern Ireland (DOE) & the Department of Environment, Community & Local Government (DECLG). January 2013.

suggest, should be the topic of a research project, commissioned possibly by the EPA or jointly by the Department of the Environment, Community and Local Government and the Department of the Environment in Northern Ireland, with EPA involvement.

3.4 Re-use, Repair and Recycling

It is fair to say that rubber recycling - in one form or another - is as old as the industrial use of rubber itself. In 1910, natural rubber cost nearly as much as silver, and it thus made perfect sense to reuse as much as possible of this valuable commodity. During this time, the average recycled content of all rubber products was over 50%.

By 1960, the recycling content in rubber products dropped to around 20%; and in subsequent decades, the combination of cheap oil imports, more widespread use of synthetic rubber and the development of steel-belted radial tyres have all contributed to a steady decline in rubber recycling.[13]

In the early 1990s, the established tyre and rubber industry used only around 2% of recycled material. However, in recent decades the tyre recycling industry has experienced a significant growth, both in the United States and in Europe, primarily as the result of a legal framework requiring the safe disposal of waste or scrap tyres, the availability of reliable rubber particle size reduction technologies, and the emergence of innovative and economically viable applications for recycled rubber.

Waste tyre activity	Quantity (tonnes)	Percentage
Exported	10,253	53.7 %
Chipped (presumably made into crumb rubber, though this is not stated)	7,754	50.6 %
Ballast (presumably for agricultural use, covering silage pits)	843	4.4 %
Baled and processed into concrete blocks (further use not stated)	207	1.1 %
Re-treaded (remoulded)	35	0.2 %
Total	19,092	100 %

Table 3.4.1 Waste tyres recycled in Ireland and exported from Ireland in 2011 (source: November 2013 Review of Producer Responsibility, and EPA, 2013)

[13] "Scrap Tyre Recycling"; Kurt Reschner, Waste Management World, online article, 01 July 2003).

In Ireland, used tyres with the tread depth near or below the minimum depth required by legislation may be re-used on other road vehicles, re-treaded, remoulded or exported. It is not clear from the 2007 Tyres and Waste Tyre Regulations when a used tyre becomes a 'waste tyre', as the Regulations do not define explicitly what is a 'waste tyre'. This uncertainty further complicates the difficulty of estimating the annual production of waste tyres in Ireland. The November 2013 Review of Producer Responsibility estimated that 38,673 tonnes of waste tyres were generated in 2011; but in our opinion this is a very crude estimate, given the uncertainties in the data to which we have referred above.

The principal destinations to which waste tyres were exported from the Republic of Ireland in 2011 were South Korea, Britain, and the North of Ireland.

Our concern is that some waste collectors are tempted to export tyres rather than sending them to the crumb rubber plant in Ireland (see section 3.5 below) for recycling; and there is some evidence that this exporting is taking place. In the interest of expanding the Irish recycling industry, waste tyres should be much more tightly accounted for to ensure that all of them (at least 95 %) are sent to a crumb rubber plant in this country. We believe, from the evidence available, that an excessively loose system of regulation and tyre traceability is resulting in the loss of tyres from the Irish recycling economy and the loss of Irish jobs.

The remanufacture of new tyres from partly worn tyres, also described as remoulding or retreading, uses the same process as the manufacture of new tyres, with the exception that it begins with a scrap tyre or worn tyre with an intact casing (the steel and polyester belts, sidewall and steel rims). The remoulded tyre is made by refurbishing the casing where necessary, adding new sidewall and rubber tread which is then vulcanised to the casing. For a small number of old tyres in good condition this is probably the best practice we can apply to tyre recycling.

However, we would also point out that there appears to be no information on the number of remoulded or retreaded tyres imported into Ireland, as distinct from the importation of new tyres. According to the 2013 Review of the Producer Responsibility Initiative Model for Tyres and Waste Tyres, carried out by RPS for the Department of the Environment, Community and Local Government, tyre manufacturing activity in Ireland "*consisted only in the rethreading* [sic] *of truck tyres but this activity stopped in 2013*".[14] Before that time, the quantity of tyres retreaded was quite small, amounting to only 35 tonnes in 2011.

Provided that safety and environmental standards are prescribed and adhered to, it is unfortunate that retreading has ceased in Ireland. Since about 60% of the tyre material is in the casing, retreading can make a significant impact. A quality car tyre can be retreaded about three times, and larger vehicles can be

[14] Review of the Producer Responsibility Initiative Model in Ireland -- Section 9: Tyres and Waste Tyres. RPS, Draft Final Report to the Department of Environment, Community & Local Government, November 2013, section 9.4, page 17; and table 9.10, page 38.

re-treaded as many as 12 times. Unfortunately only 10% of cars and light trucks are re-treaded in the United States. If this were to change, the result would be a major reduction in tyre waste, according to Energy Justice, a citizens' organisation which advocates a clean energy, zero-emission, zero-waste future for everyone.[15]

In fact, the Northern Ireland Assembly Committee for the Environment has commented that "*retreading used tyres has become highly specialised and improved technology ensures a safe product*" and has recommended that "*the industry should now endeavour to make the concept of retread tyres more acceptable to the public by developing and marketing accredited retread tyres as an economically viable and safe option*".[16]

Other uses of whole waste tyres in Ireland include:

- Weighing down or ballasting plastic sheeting used to cover silage in silage pits (though the information we have received from contact with farmers is that this use has significantly decreased, and is likely to reduce further, as plastic-wrapped silage bales have now become the normal way of preserving silage);
- As an engineering material in certain types of construction where damping of vibrations is required (this use is less frequent now, with the development of much improved materials for this specific use);
- In the manufacture of concrete blocks (this use is mentioned only in section 9.8.6, page 39, of the Review of the Producer Responsibility Initiative Model for Tyres and Waste Tyres, but we have failed to find any company in Ireland which currently undertakes this process);
- As protective barriers along roads, particularly when used for motor sports;
- In some sports, such as karting, where barriers of tyres are placed to form a convoluted course; and,
- As fenders for boats.

The principal problem associated with tyre recycling arises from the fact that tyres are built to be tough and durable. The very properties which ensure a long service life and safe road-holding make size reduction by shredding or granulation both difficult and costly. Since the steel-belted radial tyre has become commonplace since the 1970s, grinding scrap tyres into steel-free and fibre-free crumb rubber requires fairly complex and expensive machinery.

We understand that one of the largest and most modern waste/scrap tyre recycling plant in Europe is based at Asamer Holding's tyre recycling facilities in the upper Austrian town of Gmunden since 2003. Covering an operating area

[15] http://www.energyjustice.net/tires/solutions

[16] Committee for the Environment: Interim Report on the Committee's Inquiry into Used Tyre Disposal, Together with the Minutes of Proceedings, Minutes of Evidence and Written Submissions Relating to the Report. Ordered by the Committee for the Environment to be printed, 19 April 2012. Report: NIA 11/11-15

of 20,000 m^2, up to 40,000 tonnes of scrap tyres can be processed each year in a two-stage or three-stage operation.

In the first stage, truck, car and tractor tyres are pre-shredded into strip-like pieces, to a size of 100 mm x 150 mm. A conveyor feeds two large bunkers with a total volume of over 2000 m^3, where the pre-shredded truck tyres and car tyres are stored, temporarily separated from each other.

The second process takes place in several granulating lines, the end product of which is a largely textile-free and steel-free rubber granulate, less than 3 mm in size. High-value products are made from this granulate for a range of different manufacturers.

The typical product yield from scrap tyres is shown in Table 3.4.2.

Product	Yield by tyre type		
	Car tyres	Truck tyres	Earth mover tyres
Crumb rubber	70%	70%	78%
Steel	15%	27%	15%
Fibre and scrap	15%	3%	7%

Table 3.4.2 **Typical product yield from scrap** tyres (adapted from "Scrap Tyre Recycling", Kurt Reschner, Waste Management World, online article, 01 July 2003).

The Asamer plant also contains a further production area, where a third process is carried out, in which rubber granulate is used to produce a high-value rubber powder. At a cryogenic temperature of -120°C, the granulate becomes glass-hard, and can then be ground to a fineness of 50-250 µm (0.05-0.25 mm) in special mills. The technology produces a high purity rubber powder, and it is understood that there is a demand for this powder from a variety of industrial and chemical processes, for the production of anti-corrosives and other substances.

Rubber granules produced from waste or scrap tyres can be used in agriculture, horticulture, construction, equestrian sports and other areas. The steel reinforcing extracted during the shredding or granulation process can be smelted to produce metal to be re-used. The textile cord can be used as a raw material for the production of thermal insulation.

Crumb rubber also serves as a very acceptable filler in virgin rubber products, and many tyre manufacturers add this recycled material into their compounds. Aside from the savings in material costs, adding crumb rubber to the virgin rubber compound offers the following processing advantages:

- better mixing properties and improved stability;
- improved degassing during the vulcanization process;

- improved mould release; and,
- reduced curing times.

Since crumb rubber from scrap tyres consists of a random mix of compounds (depending on manufacturer, type of tyre, etc.) there is an upper limit as to how much recycled material can reasonably be used in a new tyre without compromising quality, safety and performance characteristics. This limit is commonly thought to be at around 5% for passenger car tyres, but significantly higher for less safety-critical products.

There is also a steady development of new product applications for rubber crumb and powder.

More recently, an Ontario-based company, *Environmental Waste International* (EWI)[17], claims to have developed a microwave tyre recycling process that offers significantly lower carbon dioxide emissions. According to a report prepared for EWI by a Canadian environmental consultancy, Pinchin Environmental, the microwave process produces significantly lower carbon dioxide emissions compared to crumb rubber recycling. The process is based on the application of high intensity microwave energy in an oxygen free atmosphere (a nitrogen-filled tunnel), reducing all organic compounds to their simplest form -- in the case of tyres, to carbon black, steel, hydrocarbon gases and oil. The company states that nitrogen prevents the formation of hazardous by-products such as dioxins and furans that can form when oxygen is present.

According to EWI, the carbon black produced is of high enough quality to be used in new rubber production or other feedstock, while the steel is sold for recycling. From a 9.1 kg tyre, 3.18 kg of carbon black and 0.91 kg of steel are recovered.

While we have not obtained independent verification of this process, it would appear to be better than the existing crumb rubber manufacturing, both environmentally and in terms of material recovery; but we would stress that this is an “end-of-pipe” technology which does not address the inherent difficulty of re-processing waste tyres into useful materials.

Whatever methods and technologies are employed to repair or recycle tyres, we must be sure that they avoid or minimise toxic emissions from tyre recycling and reprocessing that might have long term adverse effects on public health.

[17] See: http://ewi.ca/technologies/reverse-polymerization/ and http://www.waste-management-world.com/articles/2014/02/video-microwave-energy-cuts-tyre-recycling-ghg-emissions.html

3.5 The Particular Case of Crumb Rubber Production in Ireland, and Its Actual and Potential Uses

The production of crumb rubber from used tyres receives only a very brief mention in the Review of Producer Responsibility for Waste Tyres in Ireland.[18] However it is our submission that this product can be used to provide raw materials for a wide range of new products, and therefore our existing Irish crumb rubber industry needs to be further encouraged and developed, with the added benefits of creating jobs and avoiding the need to export used tyres.

There is only one plant in Ireland which produces crumb rubber from used or worn tyres[19], and it is reasonable to suggest that only one such facility is permanently needed, given the quantity of used tyres generated annually in Ireland.

Established in 2003, *Crumb Rubber Ireland Limited* is the only facility of its kind in the country, and we understand that the company operates a recycling plant which takes tyres of any size, from car to large earth movers, and recycles them into granulate and matting products. The plant can process up to 1,000 tonnes per hour of waste tyres, and the company states that it has worked with University College Cork and the EPA to make the recycling activity energy efficient and to utilise all of the material released when the tyres are put through the process.

Crumb Rubber Ireland collects tyres from customers on all over Ireland; and, after granulation and screening for quality control, some of the product is segregated into a granulate for the equestrian, garden, sports and child care sectors, while other granulate is further processed to make safety matting for the construction, equestrian, agricultural, child care, rail, industrial, pet and home sectors. For example, Dundalk's new state of the art all-weather racecourse was constructed using 2,000 tonnes of crumb rubber. In 2010, *Crumb Rubber Ireland* was given the award of Green Entrepreneur of the year.

It is our belief that an Irish business such as *Crumb Rubber Ireland* is a good example of a resource recovery operation providing employment in the waste resource added value sector. However, despite its environmental credentials, it appears that the company has difficulty in obtaining sufficient raw materials, i.e., used or worn tyres. According to a news item published the Irish Trucker in 2010[20], the company stated that while "*approximately 6,000 tonnes of tyres are recycled on a yearly basis in Ireland", "a massive 29,000 tonnes of tyres are not being recycled annually"* and the *"inability of policing waste laws has left thousand of tonnes of tyres being stockpiled throughout the country".*

[18] Review of the Producer Responsibility Initiative Model in Ireland -- Section 9: Tyres and Waste Tyres. RPS, Draft Final Report to the Department of Environment, Community & Local Government, November 2013, section 9.8.3.2.

[19] Crumb Rubber Ireland Ltd., Mooretown, Dromiskin, Dundalk, Co.Louth. http://www.crumbrubber.ie/

[20] http://www.irishtrucker.com/news/louth-rubber-plant-highlight-lack-of-tyre-recycling.

3.5.1 The Use of Crumb Rubber to Make More Durable Road Surfaces

We would point out that one of the most environmentally efficient uses of waste-tyre-derived crumb rubber not employed in Ireland is for the production of rubberized asphalt for road surfacing. Many more of the waste tyres in Ireland could be recycled if crumb rubber were to be used for road construction and road repair, but we have found no evidence of any significant interest in this technology; instead, it appears that local authorities have failed to grasp the concept of rubberized asphalt.

If the National Roads Authority were to approve the use of rubberised asphalt, and if County Councils specified this material for road construction, they would be contributing to the recycling effort and also obtaining a 20 year extra life span to their road networks.

By contrast, in many other countries, particularly the United States, the use of recycled rubber in road construction is well known. It is not a new process, as engineers and chemists have been incorporating rubber into asphalt since the 1920s. In the 1960s, Charles McDonald, a former Federal Bureau of Highways (now FHWA) employee and later the Engineering Supervisor Materials Testing Section for the city of Phoenix, Arizona, developed the first successful time-temperature formula for incorporating scrap tire rubber into an asphalt paving material. This process is often referred to as the McDonald process, the "Arizona" process, or the "wet" process.[21]

In the production of asphalt-rubber road surfacing material, at least 15% by weight of crumb rubber (in some cases up to 20%) in the total blend is mixed into the hot asphalt for a sufficient length of time and at a high enough temperature to cause swelling of the rubber particles and a chemical reaction to take place between rubber and asphalt, causing the two principal components to become firmly bonded.

The Rubber Pavements Association estimates that a two-inch thick overlay of asphalt-rubber hot mix uses about 2,000 tyres per lane-mile, i.e., for a one-mile section of a four-lane highway, anywhere between 2,000 and 8,000 tyres can be used in creating a safer, quieter, longer-lasting road. The benefits of using asphalt-rubber are:

1. Reduction in the quantity of asphalt used in road construction, especially as the cost of this material has been risen very sharply since the early 1990s as a consequence of the increasing price of crude oil, whereas the cost of recycled tyre rubber has held steady over the same period;

2. Reduction in the quantity of asphalt used results in less oil – a non-renewable resource from which asphalt is derived – being used in road

[21] The information in this section of our submission is taken mainly from the website of the Rubber Pavements Association, a non-profit industry association comprised of crumb rubber producers, asphalt-rubber contractors, equipment manufacturers, engineering consulting firms, testing laboratories, crack sealant manufacturers, and asphalt suppliers. See: http://www.rubberpavements.org/, http://www.asphaltrubber.org/ and also http://www.youtube.com/watch?v=mlr7BTaOZiE.

construction; though a significant amount of oil is used as a softening agent in some of the rubber-asphalt mixes;

3. There is no need to purchase new paving machines, as the conventional paving equipment can be used to apply the asphalt-rubber and aggregate mix; the only specialized equipment required is the "rubber plant" which blends crumb rubber with asphalt at the asphalt plant (these units are portable and are set up and operating on site in as little as one to three days);

4. Because of the better flexibility and strength of asphalt-rubber paving used in road surfacing, the thickness of the pavement layer required is less than the regular asphalt mix, and therefore less aggregate is needed to resurface a road, thereby saving the diminishing reserves of yet another resource, and reduced impacts of transporting aggregate to the road construction site;

5. The chemicals contained in the rubber retard the aging and oxidation of the asphalt, preventing it from becoming brittle and cracking; and the flexibility of the rubber in the asphalt mix also resists and reduces cracking and rutting (cracking of the road surface allows water under pressure to act on the road sub-surface, creating the many pot-holes and deterioration of the road surface seen on nearly all rural roads in Ireland, while rutting is caused by softening of the road surface on hot summer days);

6. Asphalt-rubber road surfacing has a longer service life and less maintenance than regular asphalt mix, with a consequential reduction in road maintenance costs (in the United States some asphalt-rubber road surfaces have been in service for 20 years);

7. Better flexibility of the asphalt-rubber road surface results in less cracking, and the rubber-asphalt mixture provides a “thermal blanket” which helps to preserve the underlying material (thermal stresses can be just as damaging to the road structure as traffic loads, and any method to mitigate these stresses will lead to a longer life of the investment);

8. As Ireland’s climate begins to change, with colder winters and much higher summer temperatures, there will be an increasing need for better materials to be used in road surfacing, particularly those materials which have the flexibility to withstand increased fluctuations in seasonal temperatures;

9. In addition to surviving hot climatic conditions (in Ireland’s case, during July 2013, when melting tarmac could be seen on many rural roads), asphalt-rubber road surfacing is used in Sweden, where engineers have developed a special grade which has proven to be very resistant to wear from tyre chains and snow ploughs; while asphalt-rubber road surfacing is used also in Alaska, New Jersey, Massachusetts and the Provinces of Ontario, Nova Scotia and Saskatchewan in Canada;

10. Asphalt-rubber road surfacing provides better traction between vehicle tyres and the road surface, and therefore better skid resistance and improved vehicle braking and deceleration;

11. Another benefit is the reduction of traffic noise, as international studies have shown that asphalt-rubber pavements can reduce traffic noise by 50% to 85%, and less traffic noise can also reduce the cost of constructing sound barriers (as early as 1981, a Belgian study found that an asphalt-rubber hot mix reduced noise by 8 to 10 decibels or 75 % when applied to the Brussels Loop[22]);

12. Atmospheric emissions caused by using tyre rubber in asphalt are no greater than from conventional asphalt;

13. From an environmental perspective, the most important benefit of using asphalt-rubber is that it consumes scrap tyres, and can recycle very significant amounts of the rubber in these tyres; and,

14. Asphalt-rubber road surfacing may be recycled and re-used at the end of its normal service life (for example, the City of Los Angeles recycled a 12-year old asphalt-rubber road surface, and performed an air quality impact assessment of the effects of grinding, transporting and processing the asphalt rubber; the results of the testing showed that the reclaimed asphalt-rubber passed all the required tests and is recyclable using either microwave technology or conventional technology.

Despite the advantages listed above, the use of asphalt-rubber road surfacing has not been adopted by all States in the USA, primarily for reasons of cost and resistance by traditional road surfacing contractors who remain sceptical about the cost/benefit analysis of asphalt-rubber, despite the evidence that it can be more cost-effective when applied correctly.[23]

In Europe, asphalt-rubber road material is variously referred to as “crumb rubber modified bitumen” (RMB) or “rubber-modified asphalt” (RMA), and is used in Sweden, Spain[24], Poland[25], Germany and other countries. We also understand that there is significant interest in the technology in Barbados, Brazil, China, Colombia, Italy, Mexico, Pakistan, Portugal, Saudi Arabia, Slovenia and South Africa.

ZWAI therefore strongly recommends that:

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[22] Michael Fickes, 2003. The Asphalt Rubber Phenomenon. Hot Mix Asphalt Technology, July/August 2003.

[23] http://www.bitumenengineering.com/pressreleases/46-library/press/144-asphalt-rubberovercoming-the-obstacles.

[24] Juan José Potti. Crumb rubber modified bitumen; another way to recycle. Probisa, Spain. http://congress.cimne.upc.es/rilem04/admin/Files/FilePaper/p330.pdf

[25] Asphalt rubber as an alternative of polymer modified bitumen. Piotr Radziszewski, Jerzy Piłat, Michał Sarnowski, Karol J. Kowalski, Jan Król and Zbigniew Krupa. Road Materials and Technology Division, Institute of Road and Bridges, Faculty of Civil Engineering, Warsaw University of Technology, Warsaw, Poland; and Polski Asfalt Sp., Pruszków, Poland.

a) The Department of the Environment, Community and Local Government should consult with the National Roads Authority, the EPA and County Councils to develop guidelines and criteria for the use of asphalt-rubber road surfacing material or crumb-rubber-modified-bitumen in Ireland;

b) A life-cycle cost-benefit analysis should be undertaken to determine the financial, environmental (taking into account the benefit of eliminating the stockpiles of waste tyres in various locations throughout the country) and employment benefits of using asphalt-rubber road surfacing for new roads and repair of existing roads which have become damaged, or simply need repair and maintenance;

c) Financial assistance should be given to County Councils using this material, in order to offset any additional expenses which might be incurred in the short term; and,

d) Consideration should be given to the temporary installation of an additional waste tyre processing plant to produce crumb rubber asphalt for road use, in order to more quickly eliminate the stockpiles of old tyres at various locations.

3.6 Use of Used Tyres as an Alternative Fuel in Cement Kilns

There are at least three and possibly four cement kilns in Ireland authorised to burn shredded waste tyres, but the quantities of waste tyres destroyed in this way for their calorific value is not known. In order to obtain and compile this information, it would be necessary to consult the Annual Environmental Reports for each of the cement plants.

The net calorific value of a tyre is between 26 and 34 GJ/tonne which is similar to or slightly better than coal[26]. According to the Unites States EPA however, the heating value of used tyres is 25-50% higher than coal and 100-200% higher than wood. Tyres are not burned whole, but as “tyre derived fuel” (TDF) in the form of shredded or chipped material with most of the metal wire from the tyre’s steel belts removed.

In the United States, tyre-derived fuel (TDF) was the first and primary market for scrap tyres from 1979 until 1992. Beginning in 1992, whole scrap tires came into use as feedstock for ground rubber, and processed tyres began to be used in civil engineering applications. Based on over 15 years of experience with more than 80 individual facilities, the US EPA recognises that the use of tyre-derived fuels is a viable alternative to the use of fossil fuels.[27]

The high temperatures (typically around 2600°F) and long residence times inherent in the operation of cement kilns are considered to provide an effective

[26] MWH New Zealand Ltd (June 2003). *"Development of a Regional Waste Recovery / Processing Sector".* A report prepared for the Wellington City Council, Ministry for the Environment and Ministry of Economic Development.

[27] http://www.epa.gov/wastes/conserve/materials/tires/faq-tdf.htm

disposal technique for waste tyres, resulting in a lowering of emissions in some cases where TDF has replaced other fuels, while the solid ash constituents and steel belts remaining from the combustion process are integrated into the product.[28]

State and Federal studies have shown that using waste tyres to generate energy is environmentally sound when used in appropriate applications that ensure complete combustion, have proper air pollution controls in place, and conduct all required testing, monitoring, and other regulatory requirements. Even though there is considerable potential for much greater use of waste or worn tyres in the production of rubber crumb for asphalt-rubber road surfacing material (see section 3.5.1 above), finding other uses for waste or used tyres is apparently challenging, given that approximately 290 million scrap tires are generated annually in the United States.

TDF is classified into several grades. Tyres contain about 30% of metal wire and fabric; removal of the wire is an expensive process, which requires fine shredding and the use of powerful magnets, and therefore wire-free TDF is a much higher grade. The lowest grade of TDF consists simply of tyres cut into fragments about 2.00 – 3.00 mm in size. We could not find any information on-line about which type of TDF is burned in Irish cement plants, but it should be possible to obtain such information by direct contact with cement manufacturers.

A tyre burns almost completely at 650°C, producing principally carbon dioxide and water, plus inert resides such as ash and slag. Nevertheless, ZWAI has significant concerns about emissions from facilities which use TDF, especially cement kilns.

In February 2009, Irish Cement Ltd received planning permission (Meath County Council Reference SA/803066) for co-firing at the Platin Cement Works a maximum of 30,000 tonnes per annum of chipped used tyres (together with traditional fuels: coal and petroleum coke). In 2012, the company sought and obtained a variation of the planning permission (Meath County Council Reference SA/120301) to increase the annual quantity of solid recovered fuels to 120,000 tonnes per annum, without any change in the existing permitted maximum quantity of 30,000 tonnes per annum of chipped used tyres.

Irish Cement Ltd also requested and obtained a technical amendment to Schedule A of the company's IPPC licence (EPA Reference P0030-04) to allow the acceptance of up to 120,000 tonnes of solid recovered fuel (SRF), including 30,000 tonnes per annum of "chipped tyres" as a thermal energy substitute for coal and petroleum coke. In both cases (planning permission variation and IPPC Licence amendment), the company stated that these changes would not

[28] Technology Evaluation and Economic Analysis of Waste Tire Pyrolysis, Gasification, and Liquefaction. Produced under contract by the University of California Riverside, for the California Environmental Protection Agency, Integrated Waste Management Board, March 2006.

result in any increase in emissions to the atmosphere, and by replacing fossil fuel would further reduce the plant's CO_2 emissions.[29]

While accepting that the burning of chipped tyres will replace fossil fuels, ZWAI is concerned that this use is much lower on the environmental scale (e.g., lower in the waste hierarchy) than the use of waste or worn tyres for road surfacing or for the production of rubber crumb for a wide range of uses as described in section 3.5 above. Furthermore, as with any incineration process, the useful heat recovered is only a fraction of thermal energy which went into the manufacture of the product, i.e., the embodied energy.

It may be relevant to note that the US EPA has stated that dioxin and furan emissions from cement kilns are primarily a function of exhaust gas temperature in the air pollution control device, which is typically either a fabric filter or electrostatic precipitator. The EPA has previously determined that the type of fuel used (e.g., coal vs. alternative fuels) is not to affect dioxin and furan emission rates. Regardless of the fuel used, cement kilns must comply with stringent limits on dioxin/furan emissions (0.2 ng TEQ/dscm or 0.4 ng TEQ/dscm and limited air pollution control device inlet temperature). Dioxin/furan emissions at cement plants can vary widely within the allowable range, regardless of whether TDF is used, and the limited data available to the US EPA suggests that use of TDF in cement kilns does not adversely impact dioxin and furan emissions.

While the US EPA accepts that TDF is a useful alternative fuel, our concerns about this use of TDF are shared by Clean Air Revival Inc.**,** a non profit educational organisation registered with the Registry of Charitable Trusts in the State of California, USA. According to this organisation's website:[30]

> *Tyres are manufactured from petrochemical feedstocks such as styrene and butadiene, which are both classified as human carcinogens. Styrene is a benzene derivative, and burning tyres releases styrene and several benzene compounds. Other benzene derivatives found in tyre-derived-fuel (TDF) include xylenes which are also carcinogenic.*
>
> *Butadiene is a highly carcinogenic compound that may also be released from styrene-butadiene (SBR) rubber during combustion. Polybutadiene is another polymer used to make synthetic rubber for tyres, and older tyres used to be made from chloroprene, a chlorine-containing petrochemical. Aromatic extender oils comprise about 25% of most tyres today, and are known to cause cancer in laboratory animals as well as being suspected human carcinogens. These are highly aromatic chemicals; petroleum waste materials with complex ring structures that are even more difficult to burn than benzene, which has a highly stable ring structure that makes good combustion far more difficult than burning natural gas or straight chain carbon compounds.*

[29] Letter dated 14 November 2012 from Irish Cement Ltd to the Environmental Protection Agency. Ref: IPPC Licence P0030-04 - Irish Cement Platin Works Increase in Annual SRF Fuel Maximum Intake.

[30] http://burningissues.org/car-www/additional_information/tire_burning.html.

> *Any compound based on benzene will require higher combustion temperatures, higher residence times and higher oxygen levels to break apart the six-carbon ring with electron clouds above and below, which protect the ring from easy chemical breakdown. The thick black oil and black smoke seen when tyres are burning outdoors is due solely to the aromatic extender oils; they too require higher combustion temperatures, higher residence times and higher oxygen to break down fully to CO_2 and water.*

Clean Air Revival is not the only organization concerned about emissions from the combustion of tyre-derived-fuel. Energy Justice, a United States based citizens' organisation which advocates a clean energy, zero-emission, zero-waste future, considers that burning tyre-derived-fuel is inherently dangerous:[31]

> *Tyre manufacturers, Tyre Derived Fuel producers (tyre shredders) and TDF users (burners) and government agencies promote burning TDF as a solution to the dire problem of waste tyres. What they fail to mention in their promotional materials is that tyre incineration under any circumstance creates pollution that makes the air dangerous to breathe.*
>
> *It is common knowledge that burning tyres in the open is extremely harmful to human health and the natural environment. The fumes emitted are packed with the many toxic chemicals that tyres contain (including volatile organic compounds such as benzene, metals such as lead, polycyclic aromatic hydrocarbons such as benzo(a)pyrene, and synthetic rubber components such as butadiene and styrene). Additionally, the chlorine content in tyres leads to the creation of dioxins and furans (which are extremely toxic chemicals) when tyres are burned.*
>
> *Yet, users of Tyre Derived Fuel are confident that their machinery (which usually is not even designed for burning tyres) and the combination of tyres with traditional fuels (like coal) will render the incineration process harmless.*

Given these conflicting opinions, between the US EPA and the University of California Riverside report on the one hand, and at least two environmental NGOs on the other, ZWAI remains very concerned about the use of tyre derived fuel in cement kilns. The chemical composition of tyres inevitably results in the generation of biologically hazardous toxins, and there is no guarantee that:

a) the emission of these toxic substances to the atmosphere is adequately prevented by the currently installed air pollution control equipment;

b) there is adequate monitoring of emissions; and,

c) there is adequate monitoring of the downstream environmental and human health effect of emissions from the use of TDF in cement kilns in Ireland.

[31] http://www.energyjustice.net/tires

As noted earlier in this section, burning of chipped tyres as TDF is much lower in the waste hierarchy than the use of waste or worn tyres for the production of rubber crumb, and well below the preferred option of re-treading or remoulding as suggested by Energy Justice (mentioned in section 3.4 above).

However, there is yet a further problem connected with the use of waste tyres as TDF, and burning this fuel. Ireland has recently ratified and transposed into domestic law the Stockholm Convention which imposes on this country an international obligation to reduce and eliminate emissions to the atmosphere of Persistent Organic Pollutants (POPs)[32]. Article 5 of the Convention requires that:

> *"Each Party shall at a minimum take the following measures to reduce the total releases derived from anthropogenic sources of each of the chemicals listed in Annex C, with the goal of their continuing minimization and, where feasible, ultimate elimination:*
>
> *(a) …*
>
> *(b) Promote the application of available, feasible and practical measures that can expeditiously achieve a realistic and meaningful level of release reduction or source elimination;*
>
> *(c) Promote the development and, where it deems appropriate, require the use of substitute or modified materials, products and processes to prevent the formation and release of the chemicals listed in Annex C, taking into consideration the general guidance on prevention and release reduction measures in Annex C and guidelines to be adopted by decision of the Conference of the Parties."*

It is therefore our submission that any combustion of material which may lead to an increase of these pollutants in the atmosphere, or failure to reduce such emissions by not substituting combustion by some other process which does not involve combustion, is a breach of the Convention. Granting planning permission and an IPPC licence for burning chipped tyres as TDF would therefore appear to be significantly in conflict with Article 5.

The Stockholm Convention also requires us to go further in cases where data is lacking or uncertain, and especially where there is disputed evidence about the levels of emissions and the effects of these on human health and the environment, as pointed out above. In such cases, Article 11 of the Convention applies:

> *"1. The Parties shall, within their capabilities, at the national and international levels, encourage and/or undertake appropriate research, development, monitoring and cooperation pertaining to persistent organic pollutants and, where relevant, to their alternatives and to candidate persistent organic pollutants, including on their:*
>
> *(a) Sources and releases into the environment;*

[32] http://www.pops.int/documents/convtext/convtext_en.pdf

(b) Presence, levels and trends in humans and the environment;

(c) …

(d) Effects on human health and the environment;

(e) …

(f) Release reduction and/or elimination."

It is therefore our submission that research should be undertaken in Ireland to examine alternative methods and processes for re-using or recycling waste tyres, such as those described earlier in this report. This research should be in addition to the necessary monitoring prescribed by Article 11, including health monitoring of any population which may be exposed to elevated levels of atmospheric contaminants caused by the burning of tyres or TDF. The results of such monitoring should also be accessible to members of the public, and the monitoring programme should be discussed with persons likely to be affected by such emissions, before the programme is fully designed and implemented. Public consultation and access to monitoring data are required not only by the Stockholm Convention, but (more importantly) by the Århus Convention, to which Ireland is also a Party.

The view of ZWAI is that Ireland must promote waste management policies that comply with the goal of avoidance and "ultimate elimination" of dioxin and furan emissions. Secondly, we should manage waste tyres by methods and strategies that minimise greenhouse gas emissions in order to mitigate the impacts of climate change.

Thirdly, the view of ZWAI is that tyre burning in incinerators or cement kilns could potentially cause long term adverse health effects on local populations living downwind, and therefore we must choose methods and technologies which will avoid or minimise all toxic emissions from tyre recycling and reprocessing that might have such effects.

3.7. Pyrolysis, Gasification and Liquefaction

Pyrolysis, gasification, and liquefaction (PGL) are further alternatives for the disposal of waste tyres. These processes differ from each other, but all are thermochemical processes whereby carbonaceous feedstocks are transformed into useful products at elevated temperatures.[33]

Pyrolysis is thermal degradation or volatilization of the tyres without the addition of air or oxygen. Gasification is a process that utilizes a reactive agent such as air, oxygen, hydrogen, or steam. Gasification tends to have a slightly higher temperature range than pyrolysis, with the resulting products being primarily

[33] Technology Evaluation and Economic Analysis of Waste Tire Pyrolysis, Gasification, and Liquefaction. Produced under contract by the University of California Riverside, for the California Environmental Protection Agency, Integrated Waste Management Board, March 2006.

gaseous in nature. Liquefaction operates in a lower temperature range than either pyrolysis or gasification and produces a predominantly liquid product.

By using one or other of these processes (or a combination of them), waste tyres are thermally decomposed into oil (which may be used or sold as a fuel), gas (which also has a calorific value), carbon char and steel. No combustion is involved, but significant amounts of volatile hydrocarbons are produced which have the potential to cause air pollution and damage to health. Although the application of PGL to tyre feedstocks is limited worldwide, no significant technical barriers to the use of these technologies for processing waste tyres seem to exist.

3.7.1 Gaseous Products and Atmospheric Emissions from PGL

However, the potential environmental impacts may be significant, and include emissions to the atmosphere, liquid wastes, and solid residues. Generally, the environmental impacts of all three technologies are similar.

Air emissions are be the greatest environmental concern in PGL operations using waste tyres. The output gases of pyrolysis and gasification reactors (and subsequent combustion processes, if applicable) can contain a variety of air pollutants that must be controlled prior to discharge into the ambient air. These include particulate matter (PM), oxides of nitrogen (NO_x), oxides of sulfur (SO_x), dioxins and furans, hydrocarbon (HC) gases, metals, carbon dioxide (CO_2), and carbon monoxide (CO). The absence or the low levels of oxygen present in pyrolysis and gasification helps to inhibit the formation of dioxins and furans; and, since tyres do not contain a significant amount of chlorine, it is considered that tyre use in these conversion processes will not cause any significant dioxin emissions.

Furthermore, the volume of the output gases from a pyrolysis reactor or gasifier is much less per tonne of feedstock processed than the volume from an equivalent incineration or TDF burning process.

Subsequent combustion of low-molecular-weight producer gases from pyrolysis and gasification processes is much cleaner than combustion of raw feedstocks (in other words, a PGL process is more similar to combustion of natural gas than the combustion of coal). Pyrolysis and gasification processes use very little or no air or oxygen; all of these factors make control of air emissions less costly and less complex than required for incineration, and the cleaned synthesis gas can be conveyed to engines, boilers, or turbines for electricity production. Alternatively, the gas can be converted to higher molecular weight fuels such as diesel fuel.

3.7.2 Liquid Products

The primary liquid products from tyre PGL processes are pyrolysis oils and any residual scrubber solutions from the air pollution control equipment. Pyrolysis oils from tyres are complex mixtures of hydrocarbons, and can contain a range of substances including acids, alcohols, aldehydes, aromatics, ketones, esters, heterocyclic derivatives, and phenols, along with varying amounts of water.

These oils typically contain a number of substances that can be considered toxic, but can be handled safely using typical industrial practices.

PGL systems can generate oil, similar to No. 6 fuel oil, derived from the organic content of the tyre feedstock, and this may be converted to a synthetic diesel fuel.

3.7.3 Solid Waste Residues

The solid residue remaining from PGL processes is typically an inorganic ash or a char containing carbon and steel. The inorganic ash is the residue from the 3 to 5 % of inorganic material in the tyre that cannot be converted to energy or products through PGL. The ash contains non-volatile trace metals that are more concentrated in the ash than in the feedstock, but with proper management can be treated and disposed of in a manner that does not pose a very significant environmental threat. In some cases, metals can be recycled from the ash.

Thermal processing of scrap tyres is one method of recovering steel with little or no rubber contamination, while another useful product in some processes is carbon black (finely divided carbon) derived from pyrolysis of the rubber.

Fibre is another product from the liquefaction of waste tyres, and the potential uses for this material include mixing with concrete, soil amendment, sound deadening, insulation, mulch, and recycling into plastics. There is very little demand for this fibre because of contamination by rubber.

3.7.4 Attempts to Establish Waste Tyre Pyrolysis, Gasification or Liquefaction Plants in Ireland

Given the difficulty experienced by the existing crumb rubber processing plant in Dundalk (see section 3.5 above), it is not surprising that there have been very few attempts to construct plants in Ireland for the pyrolysis, gasification or liquefaction of end-of-life tyres. In fact, we are aware of only two such attempts.

On 04 October 2007, Cavan County Council issued a notification under the Air Pollution Act, 1987, that the Council had decided to grant a licence to Environmental Solutions Ireland Ltd to operate an industrial plant at Omard, Kilnaleck, Co. Cavan (Cavan County Council Licence Number SS / A 002 / 07). The proposed plant was described in the application as a waste recovery facility for "*the acceptance of plastics packaging waste and tyres for on-site treatment and conversion into kerosene grade fuel oil and carbon black for use off-sit*e".

The process to be utilised would be thermal cracking or pyrolysis, and the products would include a hydrocarbon oil condensed from the hot exhaust gases; low molecular weight hydrocarbons (methane, propane, and butane); a solid residue consisting of carbon, steel wire and other non-organic materials; exhaust gases from a heat exchanger; water vapour; treated process water, and sludge from a proposed waste-water treatment plant.

The application for a licence to operate this industrial plant and to generate emissions to the atmosphere aroused considerable public concern, leading to the formation of the *Omard Environmental Group*. The decision to grant a licence to Environmental Solutions Ireland Limited was appealed to An Bord Pleanála by Environmental Management Services[34], and an appeal was also submitted by the Shannon Regional Fisheries Board. On 27 June 2008, the Board refused permission on the grounds that:

> "*insufficient information has been submitted with the application to allow for an adequate assessment of the impact of discharges to the atmosphere on the surrounding environment. Furthermore, it is considered that adequate plans and particulars necessary to describe the industrial plant in question, including the stack from which the discharges are proposed and adequate data on the variability of the waste load composition and on the throughput of waste to be treated, have not been submitted with the application"* (An Bord Pleanála Reference 02.LA.0068).

We are also aware of a proposal prepared by Alexander Samoylenko, director of Sazar Ltd., for a "Scrap Tyre Recycling Plant", as part of an application under the "DIT Hothouse New Frontiers Programme" (www.hothouse.ie) organised by DIT and the Bolton Trust at the Docklands Innovation Park, Dublin. The proposed plant would use scrap tyre recycling technology developed by the Astor Company, Perm, Russia.

The proposed technology is based on rubber liquefaction under high pressure, but under comparatively low temperature (below 90°C), and has apparently been in operation on a pilot scale by Astor since February 1995. The products would include crumb rubber (under 2mm), steel wire (separated by magnet) and shredded textile fragments.

The proposal stated that 6,000 tonnes of waste tyres would be recycled annually, producing 4,000 tonnes of rubber powder, 900 tonnes of textile cord and 1,100 tonnes of recovered metal annually. Potential uses of these products were described in the proposal.

No further details of this business proposal are available, and it does not appear to have been successful.

Nevertheless, ZWAI considers that the technology of waste tyre pyrolysis, gasification or liquefaction (PGL) should be investigated as a potential strategy to dispose of accumulated scrap tyres which are stockpiled in a number of places around the country. The technology could be used in conjunction with crumb rubber production already in place to further reduce the quantity of tyres stockpiled. To promote PGL technologies, incentives could be provided for the development of PGL facilities at or near existing tyre processing facilities, or in a

[34] Appeal to An Bord Pleanála against the Decision by Cavan County Council to grant a Licence (Reference *Number SS / A 002 / 07)* to ESI Environmental Solutions Ireland Limited to Operate an Industrial Plant for the Production of Hydrocarbon Oil and Other Materials, at Omard, Kilnaleck, County Cavan. Environmental Management Services, Tullynally, Castlepollard, County Westmeath; 02 November 2007.

location zoned for this type of industry. Developing PGL processes that produce a range of products could add to the marketability and viability of a PGL system.

3.8 Devulcanisation

In chemical terms, devulcanisation means returning rubber from its thermoset, elastic state back into a plastic, mouldable state, and is accomplished by selectively severing the sulphur bonds in the molecular structure. This processing step enables rubber manufacturers to use a much lager percentage of recycled material without compromising quality, appearance or performance characteristics.

The processes which accomplish devulcanisation are less well known than pyrolysis, gasification and liquefaction, but they have very significant potential to ensure that more rubber is recycled. There are three principal processes, in which heat, mechanical treatment of the rubber, and ultrasound are used.

In the thermal devulcanisation process, vulcanized rubber is exposed to elevated temperatures over an extended period of time in order to break the sulphur bonds as well as the polymer 'backbone'. This process was first patented by H.L. Hall in 1858, but is not widely used today due to environmental concerns and relatively severe degradation of the material. There are some commercial applications in Asia and Eastern Europe.

In mechanical devulcanisation, vulcanized rubber is exposed to intense mechanical work (mastication) in order to selectively break the sulphur bonds in the polymer matrix. Mechanical devulcanisation does not alter the chemical composition is any way, and yields material with excellent physical properties and commercial value.

Devulcanisation using ultrasound is a specific type of mechanical devulcanisation, in which the rubber is exposed to high intensity ultrasound. The process is not yet commercial, but research results are encouraging.

The ability to devulcanise rubber without damaging the polymer 'backbone' now makes it possible to truly close the loop in the rubber industry. Based on the excellent savings potential for rubber manufacture, this technology may become more widely accepted in the future, especially for the processing of higher-value rubber compounds and factory scrap. It is therefore our submission that this technology should be the subject of a research report and pilot scale testing in Ireland.

3.9 Disposal of Used Tyres in Landfills

Up to a decade ago, it was not uncommon to see quantities of used tyres on landfill sites in Ireland, stored for use as "engineering materials". Even if used in this way, and not simply landfilled as waste, the result is the same – the ultimate fate of these tyres is to become embedded in the waste mass where

they are exposed to chemically aggressive landfill leachate, microbial attack, and to small amounts of other hydrocarbons present in the landfill.

Tyres used in this way will eventually generate a leachate containing toxic compounds, adding to the leachate generated by the surrounding municipal wastes, and (if the landfill is not fully lined) contributing to pollution of groundwater resources.

Landfilling whole tyres can consume a large volume of landfill space since the tyres are relatively incompressible, and about 75 % of the space a tyre occupies is void, providing a potential site for gas collection. Scrap tyres can also "float" upward, sometimes piercing the landfill cover. Tires must therefore be cut apart in some manner before being deposited in a landfill.

In any event, the disposal of used tyres by utilising them in a landfill is a waste of a potentially valuable resource; and it is therefore our submission that used or waste tyres should never enter a landfill site, for whatever purpose.

Furthermore, the EC Landfill Directive (1999/31/EC) has forbidden the landfilling of shredded end-of-life tyres in all European Community countries, and the End-of-Life Vehicles Directive (2000/53/EC) limits the disposal routes for end-of-life tyres coming from scrapped cars and vans.

3.10 Storage or Stockpiling of Used Tyres – Potential for Water and Air Pollution

Suppliers of tyres to the Irish market normally take back waste tyres, and these must then be transferred to a collector who holds an appropriate waste collection permit. Tyre retailers are allowed to store waste tyres for no more than 6 months on the premises where these waste tyres are accepted and are awaiting collection. The amount of waste tyres which can be stored must not exceed 180 cubic metres, and only those waste tyres which are accepted from customers purchasing replacement new tyres can be stored.

However, it appears that these legal requirements are not complied with in practice, and there are many places throughout the country where large quantities of used tyres are illegally stored or stockpiled. For example in 2009, three premises in Galway, Mayo and Kerry were found to have illegally stockpiled an estimated 100,000 tonnes of tyres. An All-Ireland used tyre survey reported data from 17 local authorities which identified 181 locations where used tyres were stored, dumped or burned.

In contrast, countries where a full Producer Responsibility Initiative has been operating for more than 10 years (e.g., the Nordic Countries) tend to have no stockpiles, and waste recovery rates are 100 per cent.

ZWAI considers that the existence of waste tyre stockpiles in Ireland creates a significant environmental and public health hazard, caused by:

- compounds leaching from the tyres and contaminating soil, groundwater and surface water;
- tyre stockpiles catching fire, leading to uncontrolled open air burning of tyres and release of pyrolytic oils and other compounds into the soil and groundwater as well as large plumes of black smoke and other contaminants into the air; and, in addition, water used to extinguish tyre fires is likely to become contaminated with tyre compounds (see section 3.10.1 below);
- tyre piles may become breeding grounds for insects, rodents and other animals (diseases such as encephalitis and dengue fever have been reported around scrap tyre piles, particularly in warmer climates where tyre piles are ideal breeding grounds for disease-carrying mosquitoes); and,
- piles of waste tyres give rise to an adverse visual impact.

Factors which affect the rate of leaching and/or the concentration of tyre leachate compounds in soil, surface water and groundwater include:[35]

- **tyre size**: leaching from whole tyres is likely to be slower than leaching from tyre chips or shreds -- because of the differences in the surface area to volume ratio;
- **amount of exposed steel**: if steel is exposed, e.g., in chipped or shredded tyres, there is more likely to be faster leaching of manganese and iron than from whole tyres where the steel is not exposed;
- **chemical environment**: leaching of metals is likely to be more rapid under acidic conditions while leaching of organic compounds is likely to be more rapid under alkaline conditions;
- **permeability of soil**: leaching is likely to be faster in locations where the soil is permeable;
- **distance to groundwater table**: the vertical distance to the groundwater table will influence the extent of contamination of groundwater;
- **distance from tyre storage site**: at distances further downstream from the tyre storage site, the contaminant concentration in the soil and groundwater is likely to be lower;
- **contact time with water**: the longer tyres are in contact with water, the greater the risk of groundwater contamination;
- **vertical water flow through soil**: the greater the water flow through the soil (e.g., from rainfall), the greater the dilution of contaminants;
- **horizontal groundwater flow**: in areas of strong horizontal groundwater flow, the spread of the contaminant plume will be greater; and,
- **leached compounds at site**: levels of manganese, iron, aluminium, zinc and organic compounds may be elevated in groundwater; while levels of zinc, cadmium and lead are more likely to be elevated in soil.

[35] https://www.mfe.govt.nz/publications/waste/end-of-life-tyre-management-jul04/html/page1.html

3.10.1 Uncontrolled Fires at Tyre Stockpiles and Tyre Storage Sites

Tyres are not subject to spontaneous combustion, but when a store or stockpile of scrap or waste tyres catches fire (for whatever reason), the consequences are nearly always very serious. When a tyre pile catches fire, it is very hard, if not impossible, to extinguish quickly. In some instances, tyre piles have been burning for several months, with the black fumes being visible for many miles.

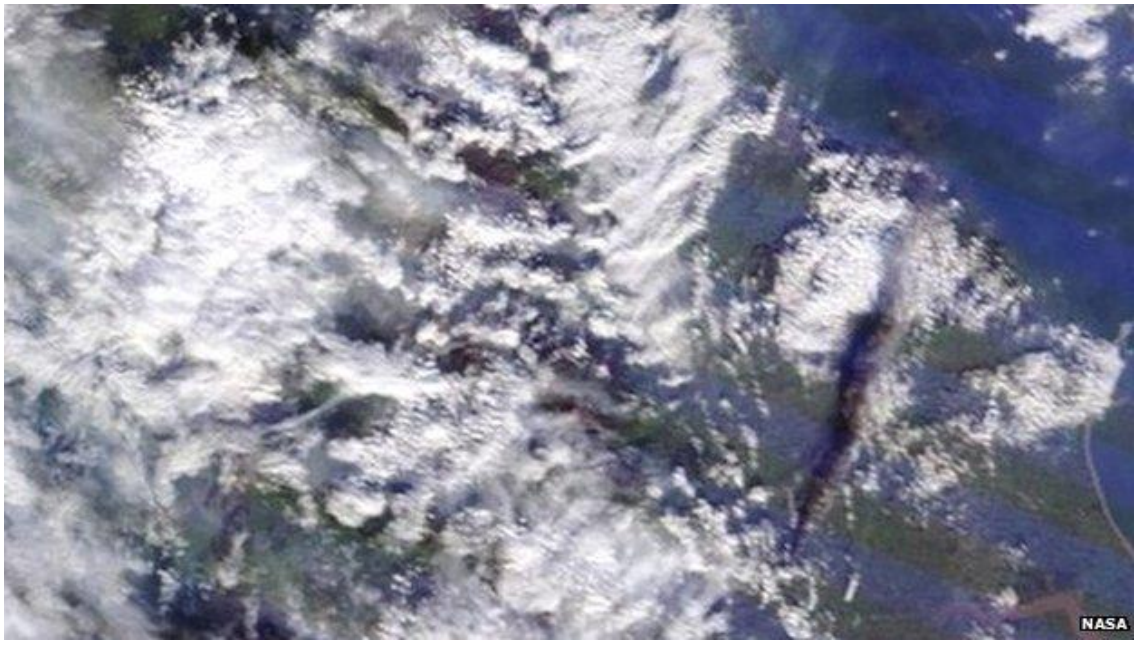
Fires occurring in piles of whole tyres tend to burn down into the middle of the pile where air pockets allow continued combustion; and, as the fire grows in intensity, it generates higher temperatures, allowing the fire to spread and producing large plumes of dense smoke and other combustion products. The health risks caused by the emissions are not completely localised and can extend for many kilometres downwind of the fire.

The photograph above shows a fire at a tyre recycling facility operated by Newgen Recycling in Sherburn-in-Elmet, North Yorkshire, England, where 15,000 tonnes of tyres burned in mid-January 2014. The fire was so large that the plume of black smoke from it reached a height of 2,000 metres, and was seen from above the Earth's atmosphere by a NASA satellite (see photo on next page).

Burning tyres at lower temperature gives rise to very significant air pollutants, and the principal products of incomplete combustion generated during scrap tyre fires include:

- ash (typically containing carbon, zinc oxide, titanium dioxide, silicon dioxides, etc);
- sulphur compounds (carbon disulphide, sulphur dioxide, hydrogen sulphide);

- polynuclear aromatic hydrocarbons (such as benzo(a)pyrene, chrysene, benzo(a)anthracene, etc), usually detected in runoff;
- aromatic, naphthenic and paraffinic oils;
- oxides of carbon and nitrogen;
- particulates; and,
- various light-end aromatic hydrocarbons (such as toluene, xylene, benzene, etc).



View of the dark plume of smoke from the fire at the Newgen tyre recycling facility in Sherburn-in-Elmet, North Yorkshire, in mid-January 2014 (centre right of the image).

Most surface tyre fires are caused by either by lightning strikes, tyre shredding or arson. When a fire starts it will spread quickly, becoming uncontrollable within a few minutes. Tyres burn by the incomplete combustion of the vapour they give off when heated, and the tyre will also melt, forming an oily burning liquid, which flows under gravity to the bottom of the pile, from where it will then spread laterally. Adding water to the pile merely hastens the flow of burning liquid away from the original seat of the fire, as it floats on top of the water.

Smoke from tyre fires has some very damaging properties; it consists mainly of particles of unburned carbon, and the combination of hot carbon and the presence of atmospheric moisture has the effect of slightly activating the unburned carbon. In tyre fires, this fugitive activated carbon adsorbs toxic emissions, including dioxins and furans, onto the surface of the particles. The particles are extremely small, but with a very large internal surface area of around $60m^2$ per gram upon which to adsorb the toxins. These very small smoke particles, of less than 2.5µ (2.5 millionths of a metre in diameter), can be inhaled and pass directly into the bloodstream. A significant proportion of tyre smoke falls within this category, known as $PM_{2.5}$. By this means, the worst emissions are carried far from the fire.

These emission products are extensive and varied, depending on a variety of factors, including:

- ► tyre type;
- ► burn rate;
- ► pile size;
- ► ambient temperature; and,
- ► humidity.

The principal environmental impacts of uncontrolled tyre fires include:

air pollution*:* black smoke and other substances such as volatile organic compounds, dioxins and polycyclic aromatic hydrocarbons are released into the atmosphere.

water pollution*:* the intense heat allows pyrolysis of the rubber to occur, resulting in an oily decomposition product which is manifested as an oil runoff. This runoff can be carried by water, if water is used to put out the fire. Other combustion residues (such as zinc, cadmium and lead) can also be carried by fire water off the site.

soil pollution*:* residues that remain on the site after the fire can cause two types of pollution; these are immediate pollution by liquid decomposition products penetrating soil, and gradual pollution from leaching of ash and unburned residues following rainfall or other water entry.

It is our submission that the storage or stockpiling of used tyres is unnecessary and creates an unacceptable environmental and public health hazard and risk, for the reasons stated above. Furthermore, as most stockpiles of used tyres appear to be unauthorised and/or in contravention of the relevant planning permission, we would advocate that the Department of the Environment, Community and Local Government should strongly encourage Planning Authorities to take enforcement action against these sites, while at the same time providing an environmentally appropriate outlet for the collected tyres, i.e., recycling or reprocessing in Ireland, and not exporting for recycling in another country.

3.11 Dumping of Tyres on Roadsides

Though not as serious a problem as the stockpiling of tyres described in the previous section of this submission, we consider that the casual dumping or disposal of small quantities tyres on roadsides and other locations (as shown in the photograph on the next page) should be subjected to enforcement action by local authorities.

Cleaning up these minor dumping sites will take time and effort, and we suggest that the cost should be borne by tyre importers and distributors as a contribution to the common good.

In order to make dumping of tyres more difficult, and offenders more likely to be identified and fines, we suggest that all tyres imported into Ireland (or manufactured in Ireland) should be stamped with a unique identification number which would be recorded when a tyre is fitted to a vehicle or purchased. If that tyre is subsequently found abandoned or dumped at the end of its service life, it may then be traced to its owner, and appropriate action taken.

Waste tyres dumped on the side of a quiet lane in County Louth – 2 miles from the border with Northern Ireland.

3.12 Potential Employment in Remoulding and Recycling Used Tyres

In the past there has been not enough recognition in Ireland of the jobs potential in the "back end of the economy" in recycling and resource recovery. We now need to set in place the most comprehensive national system of waste tyre recovery; so as to assure a stable raw material supply to the growing Irish tyre recycling industry. In such a system every tyre entering the Irish market should be ideally accounted for.

We need to achieve the maximum number of jobs in the management of tyres and the recycling of tyres to create value added products in Ireland, and this should be done by creating a more tightly regulated system for the accounting and the collection of all our waste and used tyres so that an Irish tyre recycling industry will be economically stable and can expand.

3.13 Suggestions for Administrative Changes

We have referred earlier to the need for changes in the Waste Management (Tyres and Waste Tyres) Regulations 2007 (S.I. No. 664 of 2007), and to the welcome recommendation by the Northern Ireland Assembly Committee for the Environment that a strict producer responsibility scheme should be introduced in both jurisdictions (section 3.3 above).

We would also suggest that there is a need for a new national body, established specifically for the co-ordination of extended producer responsibility initiatives, enterprise development and job creation in the waste sector

The Waste Management (Tyres and Waste Tyres) Regulations 2007 makes local authorities responsible for the safe management of tyres; but in our opinion this Local Authority model is too regionally fragmented.

We need to go beyond the collection of waste tyres and instead to create a viable tyre recycling industry in Ireland. We need a much more dedicated and focused national authority for the collection and recycling of waste or scrap end-of-life tyres with the specific goal of enterprise and job creation. This body, not the local authorities, and not the EPA, should be charged with the regulation and coordination of a national effort to grow an indigenous Irish recycling industry with added value and employment creation. The Waste Management (Tyres and Waste Tyres) Regulations 2007 should therefore be amended to provide for the establishment of a new agency with a new focus on the management of a waste resource such as tyres for the creation of added value products and jobs.

While REPAK has been active in the funding of waste collection infrastructure, it has failed to fully complete a closed circle for various waste streams. An example would be the dumped tyres, the cans, the plastic containers and glass bottles that still litter our roadways.

The Resource Recovery Fund Board (RRFB) Inc in Nova Scotia, Canada is an example of the type of scheme we would like to see in Ireland. This is a single national co coordinating body with its focus on the creation of jobs in solid waste recycling, including tyre recycling.[36]

[36] https://www.novascotia.ca/nse/waste/strategysummary.asp

4. CONCLUDING SUMMARY AND STATEMENT

1. As recommended by the November 2013 Review of the Producer Responsibility Initiative Model in Ireland for waste tyres, we would support the proposal for the establishment of a centralised electronic producer registration system, similar to the WEEE Register, and this register should record the quantities of tyres put on the market; it should be managed centrally by one organisation which would provide information on tyres placed on the market by producers participating in the compliance schemes and would provide country-wide data required for the monitoring of targets;

2. The proposed centralised electronic producer registration system should be responsible for ensuring that all tyres imported into Ireland (or manufactured in Ireland) would be stamped with a unique identification number (or barcode) which would be recorded when a tyre is fitted to a vehicle or when it is purchased separately;

3. As recommended by the November 2013 Review of the Producer Responsibility Initiative Model in Ireland for waste tyres, we agree that the DECLG should change the 2007 Tyres and Waste Tyre Regulations to make producers and importers responsible for financing the collection of waste tyres from tyre suppliers as a matter of priority; and, to prevent trade distortion with Northern Ireland, the system should be implemented on an All-Ireland basis;

4. The Waste Management (Tyres and Waste Tyres) Regulations 2007 should be amended:

   a) to include all tyres (with no exceptions);

   b) to define explicitly what is a ‘waste tyre’ or an “end-of-life” tyre; and,

   c) to require producers to take responsibility for their products, including eco-design of tyres, improved reusability and recyclability, and the provision of publicly available information on these features of their products (in accordance with Article 8 (2) of the EU Directive 2008/98/EC on Waste);

5. The waste tyre market is a single geographic market in Ireland; and therefore only one Producer Responsibility Organisation (PRO) should serve this market, thereby providing the dual benefits of improving the monitoring of the PRI performance and holding the PRO to account;

6. An independent, dedicated and focused national authority or agency for the collection and recycling of waste or scrap end-of-life tyres with the specific goal of enterprise and job creation should be established; and this body, not the local authorities, and not the EPA, should be charged with the regulation and coordination of a national effort to grow an indigenous Irish recycling industry with added value and employment creation;

7. The Waste Management (Tyres and Waste Tyres) Regulations 2007 should be amended to provide for the establishment of this new agency;

8. The current excessively loose system of regulation and the absence of any tyre traceability are resulting in the loss of tyres from the Irish recycling economy;

9. There appears to be no information on the number of remoulded tyres imported into Ireland, as distinct from the importation of new tyres, and this gap in the data should be filled;

10. The current system of collecting used tyres is clearly not functioning as intended; an unacceptable percentage of waste tyres are unaccounted for; Ireland's performance in tyre recycling is significantly below the EU average, and there is an urgent need to address this problem in the context of a single All-Ireland market for both new tyres and used tyres;

11. There is also an urgent need to improve the quality of data available, especially data on what happens to motor vehicle tyres when they come to the end of their useful life on roads, in which part of the country these used or waste tyres are generated, what other uses are then made of these tyres, and when these uses come to an end, what finally happens to the tyres;

12. Obtaining much improved data should be the topic of a research project, commissioned by the EPA or by the Department of the Environment, Community and Local government with EPA involvement;

13. End-of-life tyres should not be considered as "waste" in the accepted sense, but should serve as useful raw materials for other purposes;

14. Addressing the problem of what to do with used tyres should begin at the design stage, with tyres being designed and manufactured so that, at the end of their useful lives, they may be re-used, or their components re-manufactured or re-cycled; and this is an issue which Ireland should address at EU level;

15. Re-using tyre rubber for its originally intended purpose is our preferred option, both environmentally and economically; and much more desirable than burning waste tyres to extract a small proportion of the embodied energy which went into their manufacture;

16. Ireland should take the lead in Europe in requiring tyre manufacturers and distributors, i.e., "producers" who place tyres on the market in Ireland, to minimise the types and quantities of toxic components in tyres;

17. Ireland should also be pro-active in pushing for and enforcing the new REACH obligations with regard to the manufacture of tyres and products made from recycled tyres, as there is a definite and serious need to

further reduce toxic materials (especially PAHs) in tyres in order to improve the safety of products made from recycled crumb rubber; and to minimise and, where possible, avoid these potentially toxic chemicals from entering our environment and affecting human health;

18. New methods and technologies are becoming available to repair or recycle tyres, and to recover their component materials, and these should be examined with a view to their eventual use in Ireland; but we must be sure that they avoid or minimise toxic emissions from tyre recycling and reprocessing that might have long term adverse effects on public health and the environment;

19. The existing Irish crumb rubber industry needs to be further encouraged and developed, with the added benefits of creating jobs and avoiding the need to export end-of-life tyres;

20. One of the most environmentally efficient uses of waste-tyre-derived crumb rubber is for the production of “rubberized asphalt”, “crumb rubber modified bitumen”, or “rubber-modified asphalt” for road surfacing, an application which has resource management, engineering, road maintenance, road safety, environmental and financial advantages; yet is not used in Ireland;

21. The Department of the Environment, Community and Local Government should consult with the National Roads Authority, the EPA and County Councils to develop guidelines and criteria for the use of asphalt-rubber road surfacing material or crumb-rubber-modified-bitumen in Ireland;

22. A life-cycle cost-benefit analysis should be undertaken to determine the financial, environmental (taking into account the benefit of eliminating the stockpiles of waste tyres in various locations throughout the country) and employment benefits of using asphalt-rubber road surfacing for new roads and for repair of existing roads which have become damaged, or simply need on-going repair and maintenance;

23. Financial assistance should be given to County Councils using this material, in order to offset any additional expenses which might be incurred in the short term;

24. Consideration should be given to the temporary installation of an additional waste tyre processing plant to produce crumb rubber asphalt for road use, in order to more quickly eliminate the stockpiles of old tyres at various locations;

25. ZWAI remains very concerned about the use of tyre derived fuel in cement kilns, especially as:

    a) emission of these toxic substances to the atmosphere may not be adequately prevented by the currently installed air pollution control equipment;

    b) there is inadequate monitoring of emissions; and,

c) there is inadequate monitoring (or a complete absence of monitoring) of the downstream environmental and human health effects of emissions from the use of TDF in cement kilns in Ireland;

26. Combustion of material which may lead to an increase of persistent organic pollutants (POPS) in the atmosphere, or failure to reduce such emissions by not substituting combustion by some other process which does not involve burning, is a breach of Article 5 of the Stockholm Convention which Ireland has recently ratified and transposed into domestic law;

27. Article 11 of the Stockholm Convention requires Parties, in cases where data on POPs emissions is lacking or uncertain, and especially where there is disputed evidence about the levels of emissions and the effects of these on human health and the environment, to encourage and/or undertake research on alternatives;

28. It is therefore our submission that research should be undertaken in Ireland to examine and adopt more appropriate methods and processes for re-using or recycling waste tyres, as an alternative to burning tyre-derived-fuel in cement plants;

29. ZWAI strongly advocates the establishment of a programme for health monitoring of any population which may be exposed to elevated levels of atmospheric contaminants caused by the burning of tyres or TDF; the results of such monitoring should be accessible to members of the public, and the monitoring programme should be discussed with persons likely to be affected by such emissions, before the programme is fully designed and implemented;

30. The view of ZWAI is that Ireland must promote waste management policies that comply with the goal of avoidance and “ultimate elimination” of dioxin and furan emissions;

31. ZWAI considers that the technology of waste tyre pyrolysis, gasification or liquefaction (PGL) should be investigated as a potential strategy to dispose of accumulated scrap tyres which are stockpiled in a number of places around the country, provided that this technology can be shown to be environmentally safe;

32. Devulcanisation of rubber (which can apparently be carried out without damaging the polymer ’backbone’ and which produces a high value product for re-use) is a relatively new technology which should be the subject of a research report and pilot scale testing in Ireland;

33. Disposal of used tyres by utilising them for “engineering purposes” in a landfill is a waste of a potentially valuable resource; and therefore used or waste tyres should never enter a landfill site, for whatever purpose;

34. The continuing existence of waste tyre stockpiles in many locations throughout Ireland creates a significant, unnecessary and unacceptable environmental and public health hazard, and a high risk of fire with potentially serious public health consequences;

35. Most (if not all) of these stockpiles of used tyres appear to be unauthorised and/or in contravention of the relevant planning permission, and therefore we strongly recommend that the Department of the Environment, Community and Local Government should encourage Planning Authorities to take urgent and immediate enforcement action against these sites;

36. Casual dumping or disposal of small quantities tyres on roadsides and other locations should be subject to enforcement action by local authorities;

37. We need to achieve the maximum number of jobs in the management of tyres and the recycling of tyres to create value added products in Ireland, and this should be done by creating a more tightly regulated system for the accounting and the collection of all our waste and used tyres so that an Irish tyre recycling industry will be economically stable and can expand.

No resource recycling or reprocessing industry can survive or grow if its raw material supply is insufficient or unreliable. The supply of a reliable supply of feedstock for the growing recycling industry is of paramount importance if we want to create jobs. The establishment of a state organization focused on the development of Irish jobs in resource management should replace the old thinking of simply managing waste. A new organization with this new agenda should be formed to do this job of co-ordination. It is necessary and urgent. We have other international models that can be considered. Other countries recycle paint, operate deposit back schemes for beverage containers, wash and reuse glass bottles – we need to develop our tyre recycling industry to its full and optimum potential.

Ollan Herr and Jack O'Sullivan

Zero Waste Alliance Ireland

30 January 2014