

# **TECHNICAL GUIDELINES ON USED TYRE MANAGEMENT IN SRI LANKA**



**Central Environmental Authority  
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**Ministry of Environment and Natural Resources**

**TECHNICAL GUIDELINES ON  
USED TYRE MANAGEMENT  
IN SRI LANKA**

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## **Technical Guidelines on Used Tyre management**

### **4 Introduction:**

The Cabinet of Ministers had given their attention in order to prevent adverse impacts on health and environment caused by the emission from incomplete burning from used tyres as well as their improper disposal. In pursuance of the decision taken by the Cabinet of Ministers, the CEA sent Directives to all Local Authorities under the provisions of the National Environmental Act (NEA) concerning the actions to be taken to streamline the management of used tyres.

It was noted that lack of capacity to identify and dispose of end-of-life tyres can lead to serious health and environmental problems. Lack of technical guidelines on the management of used tyres was hitherto noticed as a drawback for the environmentally sound management of used tyres in the country.

Comprehensive guidelines prepared in the developed countries are far from its ability to be adhered to in counties like Sri Lanka. Considering this situation and as a measure of giving effect to the Cabinet decision the Central Environmental Authority, with the assistance of experts in the field developed the following guidelines. It is expected that these guidelines would assist national authorities, industries and users to manage and dispose of these waste tyres in an environmentally sound way.

More details with respect to general technical information of tyres including Tyre identification, other uses of end-of-life tyres in whole, cut or stamped form and products which can be manufactured from rubber granulates are given in the Annexure I, II and III separately.

### **5 General Instructions**

- 5.1 Used tyres should not be burnt in uncontrolled manner in any place.

- 5.2 Used tyres and end of life tyres should not be stored in places without a shelter from rain as it would lead accumulation of rainwater inside creating breeding places for mosquitoes.
- 5.3 Used tyres and end of life tyres should not be used for other purposes in a manner in which water can get into the cavity and be retained for prolong periods creating breeding grounds for mosquitoes.
- 5.4 All users must bring their used / end of life tyres to the designated collection centres<sup>1</sup>.
- 5.5 All the industries dealt with tyre manufacturing /rebuilding or any other approved activities should obtain Environmental Protection Licence (EPL) in accordance with the provisions contained in the NEA and the relevant regulations made there under and should confirm to the National Environmental Quality Standards prescribed therein.

## **6 Specific Instructions**

### **6.1 Collection:**

- The collector should sort the tyres and send them to the requisite places (Reuser / recycler / disposer) according to the quality /quantity.
- Collected tyres have to be stored according to the guidelines given in the section 3.2 – Storage

### **6.2 Storage**

#### **6.2.1 Storing**

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<sup>1</sup> The private sector industries are in the process of establishing Collecting Centres island wide with the assistance of the Local Authorities. Please note that currently only a few such Centres are available in designated locations.

- a. Scrap tyres should not be stored on wetlands, flood plains, ravines or on steeply graded surfaces. Ideally, the site should be flat with a concrete or hard packed clay surface.
- b. No open-air burning should be allowed within 300m of the tyre pile and no welding or other heat-generating devices allowed within 60m of the pile. Smoking should only be permitted in designated areas well clear of the pile.
- c. Lightening rods should be placed away from the tyre piles.
- d. All necessary approvals should be taken from responsible institutions including the approval from the relevant Local Authority and the site clearance from the CEA.
- e. Tyres should be stored in a properly covered place.
- f. Tyre piles should be limited to serviceable height and perimeter .The edges of the pile should be at least 10m from the perimeter fence, and this area should be clear of debris or vegetation unless it is covered fully.
- g. An area extending 10m from the outside perimeter of the pile(s) should be totally void of trees, plants or vegetation. All exposures, including buildings, vehicles or flammable materials should be at least 10m away from the tyre stockpiles
- h. Piles or storage racks should not be located near or below power lines.

### **6.2.2 Fire Precautions**

- b. Precautions must be taken against the deliberate or accidental igniting of tyre stock piles in the storage. The major risk is that a fire could spread into adjoining areas without it being possible to contain to the point of origin. In such an eventuality, several different types of pollution of the air, water and soil can occur.
- c. Adequate buffer zone has to be maintained in the storage premises in order to isolate the deliberate or accidental fire.
- d. Each tyre storage yard or pile should be provided with emergency vehicle access routes.
- e. There should be gates protecting each access point that can be locked when the facility is closed. All gates should have a 7m open width and remain unobstructed at all times. The gates should have rapid entry design compatible with Fire Department requirements.
- f. Adequate number of Fire fighting equipments should be installed at suitable places in accordance with Fire Department requirements.
- g. Since tyres tend to slide down from the sides of the pile and close off the fire breaks, all interior fire breaks should be at least 10m wide.
- h. A water supply sufficient to combat fire should be made available.

### **6.3 Reuse**

The reuse of tyres entails no specific guidelines except for their storage. Please refer to the section 3.2 for the guidelines and Annexure IV regarding some users of the used tyres.

### **6.4 Recycling**



When tyres have reached the end of their useful life and the re-use as a part-worn tyre is not possible, the tyres enter a waste management system. The recovery and eventual final disposal should take place in an environmentally sound manner. This means that an appropriate collection system should take care of these tyres. In most cases the separately collected end-of-life tyres are still valuable for other applications.

The details of the management of end-of-life tyres are given in the Annex V and following are the Guidelines should be followed by the recyclers.

- a. Tyres collected for recycling have to be stored according to the guidelines given in the section 3.2 – Storage
- b. Unusable tyres or parts and buffing dust have to be sent to the designated Collection Centres or directly to the disposal facility
- c. The direct disposal of end-of-life tyres should be done only when economically viable alternatives for the materials or energy recovery are not available.

#### **4. General Instructions for Tyre Users**

With increasing numbers of vehicles on the road, reducing the use of tyres is an almost impossible task. However, reducing the amount of tyre waste generated is possible by prolonging the life of the tyre being used.

It can be achieved with new tyre technology and with better care of tyres during use. Following are some of the easy-to-use care guidelines.

- a. Avoiding potholes and kerbs as it will minimise the risk of damaging the tyre.
- b. Careful driving as the driving at speed, heavy braking and sharp cornering will take their toll on tyres.

- c. Check tyre pressures regularly. As under and over-inflated tyres wear more quickly and are more susceptible to blow-outs.
- d. Align or balance the tyres regularly as it will ensure that they wear evenly.
- e. Proper maintenance of the vehicle as it will ensure that the vehicle is running well and not putting any unnecessary strain on the tyres.

## **Annex I**

### **A) General information**

Tyres are designed to accommodate a variety of vehicles, surfaces and weather conditions. For example, truck tyres tend to have a higher percentage of steel to reinforce the structure. Tyres still have the same basic design and, despite variation, there is enormous potential for reuse or recovery due to the vast quantities of waste tyres generated each year.

A tyre is a rubber article with a complex structure. The tyre transmits to the road the motor forces necessary for propulsion. Together with the suspension the tyre dampens the unevenness of the road surface and thus ensures driving comfort. The tyre serves as a container to keep air under pressure. Passenger car and truck tyres represent about 85% of the total number of tyres manufactured.

Depending on their size and utilization, tyres vary in design, construction and total weight. Approximately 80% of the weight of car tyres and 75% of truck tyres is rubber compound.

Tyres contain about 1.5% by weight of elements or compounds listed in Annex 1 of the Basel Convention. These are encased in the rubber compound or present as an alloying element. (Y22-Copper Compounds, Y23- Zinc Compounds, Y26-Cadmium, Y31 Lead & Lead Compounds, Y34-Acidic solutions, Y45-Organohalogen compounds ).

The net calorific value of a tyre is between 32 and 34 MJ/kg (Millions of Joules /Kilogram). A ton of tyres is equivalent to a ton of good quality coal or 0.7 ton of fuel oil. It is therefore, an excellent potential as a fuel, which is not surprising since tyres are mainly composed of oil products. A tyre is very difficult to ignite. The temperature at which the ignition induced by the pilot flame may be maintained was 330°-350°. There is no possibility

of self ignition for tyres. The tyre burns completely at 650° and only ash and slag remain.

Tyres are designed to last and are therefore difficult to break down and separate into their constituent parts. Adding to this problem, disposal releases potentially harmful compounds into the environment, e.g. polyaromatic hydrocarbons (PAHs), benzene and phenol which have suspected carcinogenic properties. Landfill disposal and incineration also release these harmful substances.

Most countries have relied on land filling to dispose of tyres but the limited space and the potential for reuse has led to many countries imposing a ban on this practice. Landfills are not leak-proof which means that hazardous substances generated during the decomposition of material can filter down through the site and into the surrounding area. In this way it has the potential to pollute water courses and affect living organisms. Tyres tend to rise to the surface of landfill sites and restrict the future use of the land.

## **B) Situation in Sri Lanka**

According to the data in 2002 total number of tyres imported and manufactured in Sri Lanka is 2.1 million per year. This indicates that large amount of tyres is being discarded in different ways. As there is no proper management system exist tyres find their way into the environment and create a number of problems to the community.

- Tyres will not deteriorate for hundred of years and therefore may remain in the environment for a long time and will occupy large amount of space.
- Under the climatic conditions in Sri Lanka waste tyre dumps or stockpiles can become the breeding grounds for insects, such as mosquitoes, which are capable of transmitting diseases to humans (especially Dengue).
- In large volumes tyres also represent a substantial fire risk. The high energy content of tyres means they can

burn for long periods. For example in Wales, a tyre fire started in 1989 in a covered tip containing 10 million tyres was still burning nine years later.

- Uncontrolled open-air burning is not an environmentally sound or acceptable management practice. Burning tyres can have a serious environmental impact as it produce vast quantities of harmful emissions that will pollute the atmosphere and water courses through run-off. Such practices can release potentially hazardous levels of carbon monoxide and mono – and polyaromatic hydrocarbon in the smoke plume. After open-air burning, organic compounds, like pyrolytic oils, rest in the soil and can cause environmental damages to the flora and fauna.
- No significant market value

There is a good collection system exist in Sri Lanka for rebuilding of tyres. But there is no proper collection mechanism and no proper management system for end of life tyres.

Since mismanagement and disposal of end-of-life tyres can lead to serious health and environmental problems, these technical guidelines are meant to assist the users, dealers and industries to manage and dispose of these waste tyres in an environmentally sound way.

## **Annex II**

### **Identification of the different categories of used tyres**

The identification of the different categories of used tyres is important in Management of Used tyres.

#### **(a) Part worn Tyres.**

The used tyre that is re-used for its originally intended purpose is called Part worn tyres. This tyre may have further

use as a tyre because a minimum of residual tread depth remains and, subject to examining of the structural soundness, the tyre does not show wear affecting its safe and proper functioning.

(b) Retreaded tyres

The used tyre that cannot be re-used for its originally intended purpose but that is suitable for retreading. The used tyre may or may not have residual tread depth sufficient for further use as a part-worn tyre, but subject to an examination of the structural soundness of the casing, it can be reprocessed whereby new tread is vulcanised to the casing and the used tyre becomes a retreaded tyre.

(c) End of life Tyres

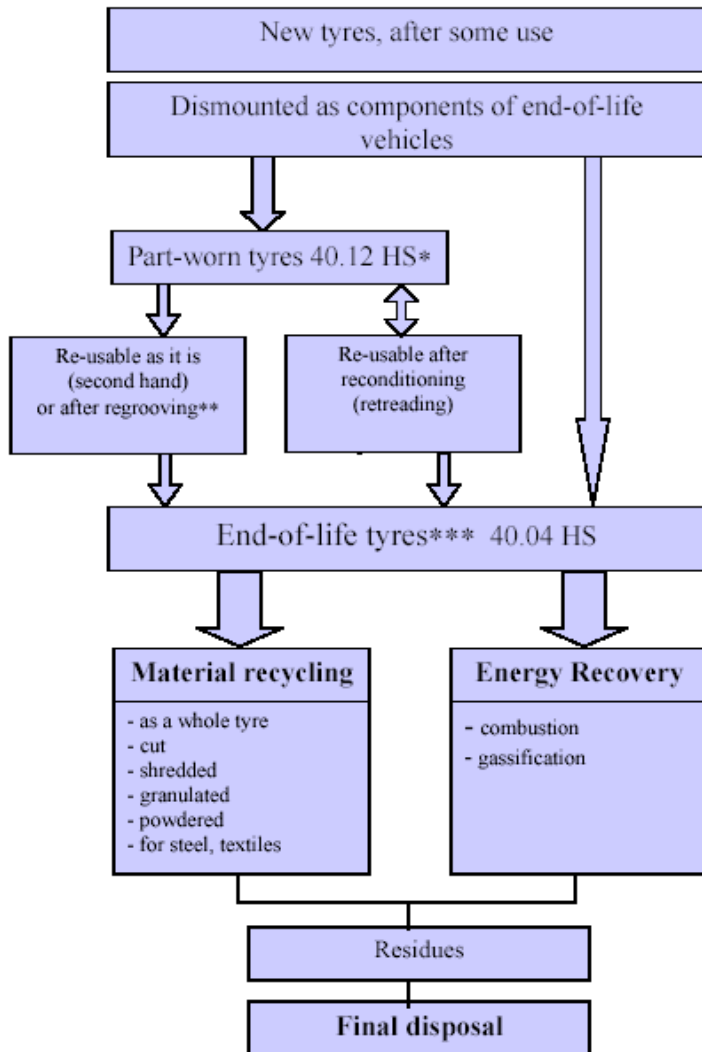
The used tyre that cannot be re-used for its originally intended purpose, and that is not suitable for retreading, is worn out. Such a tyre is called end-of-life. This describes used tyres which fail the technical examination to determine their suitability for re-use or retreading. Such tyres may have been rejected due to age or tyre carcass damage or deterioration beyond certain limits. While such tyres are not suitable for re-use or retreading, they may have further use as a raw material for other processes or be destined for final disposal.

This distinction is in accordance with the Harmonised Customs Code System (HS) that uses separate entries for used tyres. The first two situations would be covered by entry 4012: Retreaded or used tyres of rubber. The Explanatory Note of this entry reads: This heading includes retreaded pneumatic tyres of rubber and used pneumatic tyres of rubber, suitable either for further use or for retreading. The second situation would be covered by 4004: rubber waste, parings, powders and granulates obtained thereof. The Explanatory Note of this entry reads: This category includes worn-out rubber tyres not suitable for retreading and scrap

obtained from such worn-out rubber tyres rubber goods rendered unusable because of cutting up, wear or other reasons.

The various stages in the life of a tyre are summarized in the Figure 1.

**Fig 1 Various stages in the life of a tyre**



\* HS stands for harmonized customs code system \*\* Regrooving for truck tyres only

### Annex III

**List of products which can be manufactured from rubber granulates.**



Granulating is the basis for many material recuperation projects. Some of the many products which can be manufactured from different sizes of rubber granulates are as follows;

- compounding material in rubber industry for various applications;
- flooring and surface for indoor and outdoor sports;
- solid tyres;
- roofing materials;
- carpet underlay;
- underlay for artificial sports turf;
- thermoplastic and rubber blends;
- road surfaces (modification of bitumen with rubber);
- component in friction material;
- Sami's, road joints, and roadway filter drains;
- porous drainage pipes;
- children's playgrounds, tennis courts, soccer pitches, etc.;
- train and tram line beds and track guards;
- road furniture including crash barriers, speed bumps, among others;
- outdoor sports and camping equipment;
- as a composting material for heavily trafficked areas; etc.

## **Annex IV**

### **A) Reusing Options available for Part-Worn Tyres**

Only the part worn tyres could be reused. The following treatments are exist to prolong the life of a used tyre:

- Regrooving (truck tyres only)
- Retreading (all tyres)

## I Regrooving

Regrooving can prolong the life of truck tyres. This practice is not admissible for car tyres because the tread depth in the grooves is not adequate.

## II Retreading

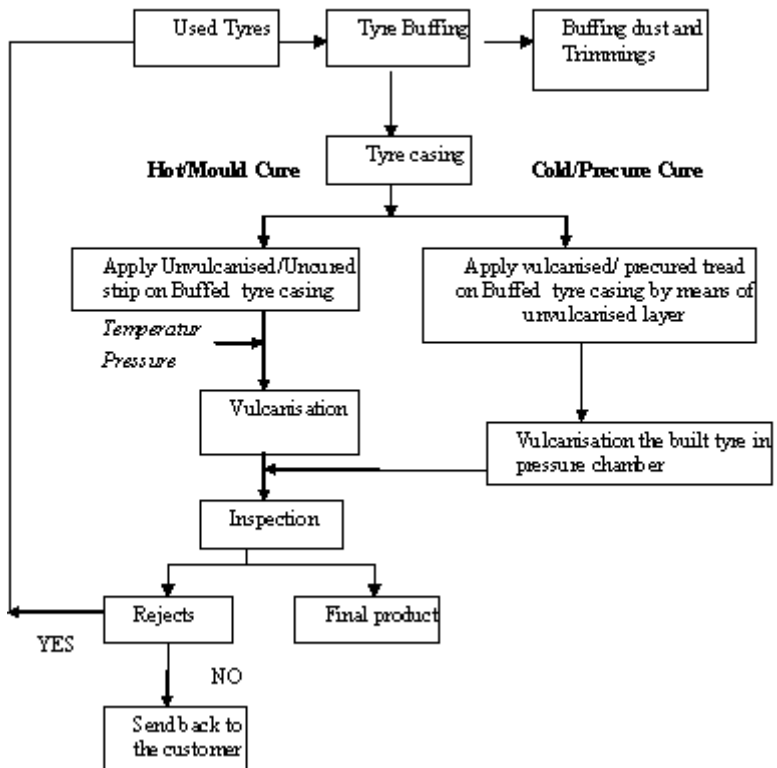
Retreading maximises tyre utilisation and is considered desirable to the extent that it is a practical option. Via retreading, 80% of the original material value is available for reuse. Selected undamaged car and truck tyre casings are sold to rethreading companies. Whatever is left of the original tread is removed by a buffing process and a fresh, patterned tread is vulcanised to the casing.

There are two main methods of rereading of tyres and the industrial process is depicted in the Figure 2.

- a. Hot/Mould Cure
- b. Cold/Precure Cure

### **Figure 2. Tyre Retreading process**

### Tyre Retreading



**B) A list of some of the uses of end-of-life tyres in whole, cut or stamped form.**

**End-of-life** tyres can be used for environmentally safe applications as shown below in whole, cut or stamped form.

- in civil engineering works: e.g. highway crash barriers, sound absorbing walls, boat fenders on harbour walls;
- as coastal protection and off-coast break waters;
- Whole tyres are used frequently in coastal protection projects.
- as insulation in building foundations and road base material;
- to consolidate steep slopes on roadway side
- as cover material in agriculture applications and for landfills;
- as artificial reefs to provide shelter or breeding grounds for sea life;
- as material to be cut up into mats, floor ties, dock fenders, muffler hangers support pads for back hoes, well chocks, brake pads, light weight and flexible tanks, and after the beads are removed, as clothing accessories such as belts, handbags, shoe soles and buttons;
- as temporary roads for moving heavy construction equipment;
- in irrigation systems as reservoirs or to channel water

As a particular example, whole tyres have been used with considerable success to create artificial reefs and erosion barriers, sea-walls and off-coast breakwaters. Artificial reefs have proven to be inexpensive means of protecting sea life by providing shelter while improving water circulation. Cement filled tyres are often used to provide base.

In both sea and fresh water harbours, tyres are used as boat fenders, absorbing the shock

from moving boats to protect the hulls and sea walls, particularly during storms. Used tyres are an inexpensive remedy because there is little heavy construction involved and the materials are relatively reasonable in cost. Tyres generally do not require expensive pilings and preparatory work before installation. It is important to note that cut, chunked and shredded tyres also used as a principal material on building riverbank protections, reversing and preventing erosion particularly in swift water areas.

## **Annex V**

The details of the management of end-of-life tyres depends very much on local economic and industrial conditions:

- Product recycling
- Material recycling
- Energy recovery
- Landfill

## **A) Product recycling**

End-of-life tyres in whole, cut or stamped form can be used in many environmentally sound applications to take advantage of their shape, sound and impact absorption properties and/or material characteristics. Annex 01 contains a list of some of the uses of end-of-life tyres in whole, cut or stamped form.

## **B) Material Recycling**

### **a. Shredding**

Shred End-of-life tyres can be shredded to facilitate transport, as a first step towards granulation, or for use in several applications. The tyres are fed into a shredder and in most circumstances, the steel and textile are not removed, but may include the additional process of material separation. The shredder can be mobile or fixed. Mobile shredders are used to facilitate the movement of end-of-life tyres from place to place for another treatment.

Regions which permit land filling of end-of-life tyres often require that they are shredded in order to minimise the space requirements and to reduce the potential of the tyres rising to the surface once the landfill has been capped. Tyre shred can be used as a secondary fuel for incineration or as a first step in the granulation process, or may be utilised as daily cover for landfills.

### **b. Granulation**

Granulate End-of-life tyres and tyre buffing can be used to produce rubber crumb or granulate. There are two principal methods of granulating end-of-life tyres. Grinding at ambient temperature: end-of-life tyres are shredded and then fed into a

grinding mill. After grinding, the material is separated into rubber granulate, steel and textile; the granulate can be sieved into different particle sizes. Peels and buffings obtained from rethreaded tyre manufacturing processes are currently ground and the rubber obtained can be directly recycled into compounds used to produce new and rethreaded tyres.

Grinding at very low temperature (cryogenic method). In this process the end-of-life tyre and chopped rubber has to be cooled to below the freezing point, after which it is ground in a hammer mill. This process enables rapid separation of fibres, metal and rubber.

Rubber granulate can be used in many product applications.

Some of the many products which can be manufactured from different sizes of rubber granulate.

- compounding material in rubber industry for various applications;
  - flooring and surface for indoor and outdoor sports;
  - solid tyres;
  - roofing materials;
  - carpet underlay;
  - underlay for artificial sports turf;
  - thermoplastic and rubber blends;
  - road surfaces (modification of bitumen with rubber);
  - component in friction material;
  - road joints, and roadway filter drains;
  - porous drainage pipes;
  - children's playgrounds, tennis courts, soccer pitches, etc.;
  - train and tram line beds and track guards;
  - road furniture including crash barriers, speed bumps, among others;
  - outdoor sports and camping equipment;
- as a composting material for heavily trafficked areas; etc.

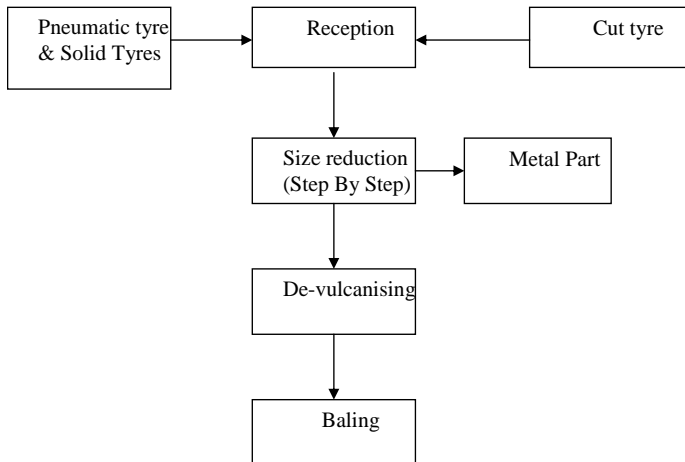
### **c. Reclaim**

Rubber reclaim is produced by the chemical processing of a mixture of size reduced end of-life tyres, oil, water and chemicals. The resulting compound is submitted to a further thermomechanical process where additives can be incorporated depending on the final product requirements. The material is extruded into slabs, cut and wrapped for shipment. Reclaim rubber blends in with virgin compounds can be used in a wide range of moulded articles. Details in respect of the production process is given in Figure 3.

**Figure 3- Tyre Reclaiming process**



## Tyre Reclaiming



### **d. Pyrolysis**

Pyrolysis is the chemical conversion or breakdown of organic compounds by heating in the total or partial absence of oxygen. Carbon black, oil (which must be refined) and scrap steel can be obtained from the pyrolysis of end-of-life tyres. The 'pyro-oil' may be used as fuel

or

mixed in equal proportion with diesel oil. After refining, the 'pyro-carbon' may be used as a semi-reinforcing filler or as an active carbon. Even if recent technological advances have improved product quality, it is still unclear whether there is a market demand for this product.

C) Energy recovery

There are several controlled energy recovery methods which are environmentally sound. End-of-life tyres represent an alternative supplementary non-fossil fuel. End-of-life tyres provide the same heat energy commonly achieved by coal. Whole or shredded end-of-life tyres can be used as a principal or secondary fuel source in the production of steam, electricity, cement, paper, steel and in the incineration of garbage. The addition of end-of-life tyres is environmentally safe and does not release additional emissions in the atmosphere of sulphur oxides or nitrogen oxides when appropriate emission control devices are properly installed and maintained. The high operating temperature in the kiln allows for complete combustion of the tyres and oxidation of the steel beads without adversely affecting kiln operation. Therefore, the steel reinforcement does not need to be removed.

#### **D) *Land fill***

Each fuel-fired vehicle operating at the storage yard should be equipped with higher portable fire extinguisher. By way of example, the following measures have been taken in a dump mainly containing tyres:

- Stacking limited to layers up to 2.5 m high.
- Where there are successive layers, each layer separated by a layer of inert material (earth, hard core) at least 0,3 m thick
- Start with the biggest tyres (civil engineering, agricultural, HGVs) and fill in the remaining gaps with an inert material or waste.
- Pack each layer as much as possible, using compactors if necessary, to prevent subsequent movements.
- Try to reduce to a minimum the quantity of tyres left uncovered, particularly at the end of the day.
- Create an adequate reserve of hard core, which may be used to smother a fire in its early stages.

- Once the dump is full, cover it with a minimum thickness of hard core and then a layer of earth to allow vegetation to be grown on top. Tyres are inert in landfills. Whole or substantially whole tyres in thin layers can contribute usefully to the permeability of leachate drainage layers within the structure of the landfill.
- Fragmented tyres can act as useful inert substrate for the biochemical activity which will lead to the stability of the landfill site.

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