Guidelines for Environmentally Sound Facilities for Handling, Processing and Recycling of End-of- Life Vehicles (ELV)

January, 2019

Central Pollution Control Board

(Ministry of Environment, Forest & Climate Change, Government of India)

Parivesh Bhawan, East Arjun Nagar,

Shahdara, Delhi – 110032

INDEX

1.0 BACKGROUND

End-of- Life Vehicle (ELV) is a motor vehicle that has been abandoned, or is intended to be managed for the purposes of resource recovery. The management of ELVs includes collection, handling, transportation, storage, processing and channelizing materials or waste generated during processing to appropriate recycling or waste disposal facilities respectively. Such activities, if not carried out in environmentally sound manner, have significant potential of impact on human health and environment and, therefore, require environmentally sound management of the same.

Anticipating substantial increase in number of ELVs in coming years, CPCB in the year 2016 prepared "Guidelines for the Environmentally Sound Management of ELVs in India". The said guidelines outline handling, storage and transportation of ELVs; environmentally sound de-pollution of ELVs; environmentally sound dismantling & segregation; Environmentally sound Shredding & separation and processing of residues, and; ELV recycling facility and technologies for the ELV recycling process besides guidance on policy framework for ELVs in India.

Taking up issues of pollution caused during the scrapping of vehicles at Mayapuri, Delhi, the Hon'ble National Green Tribunal, Principal Bench, New Delhi, (in the matter of Original Application No. 996 of 2018; News items published in The Times of India Authored by Paras Singh Titled "In factory setting, Mayapuri's scrapping through") highlighted the need for proper scrapping policy and guidelines for scrap handling, processing and disposal and passed the following orders:

"*… 5. Accordingly, we direct constitution of a Joint Committee headed by Secretary, Ministry of Road Transport, Government of India with representatives from CPCB, MoEF&CC and Delhi Government to examine the matter and to prepare an appropriate scrapping policy. Such policy be prepared by concerned Authorities within three months. The nodal agency for this purpose will be the Secretary, Ministry of Road Transport.*

5. A copy of this order be sent to the Secretary Ministry of Road Transport, Government of India by e-mail for further follow up action. The first meeting of the Committee may be convened, as far as possible, within one month from today.

6. The report prepared may be furnished to this Tribunal on or before 31st March, 2019 by e-mail at ngt.filing@gmail.com. The report received may be put up for consideration before the NGT.

7. We further direct the Chief Secretary, Delhi, to take steps and prepare an action plan for shifting the scrapyards from busy localities of Delhi to other appropriate locations, within three months. After the scrap is shifted to a

suitable location, the same may be handled, processed and disposed of as per the guidelines of CPCB. Such guidelines may be issued by 31.01.2019, by the CPCB

8. The Chief Secretary, Delhi and CPCB may also furnish their separate report with regard to the action taken to this Tribunal on or before 31.03.2019.…"

In order to prepare guidelines on handling, processing and disposal of ELVs in compliance with said orders of the Hon'ble Tribunal, CPCB reviewed the said "Guidelines for the Environmentally Sound Management of ELVs in India" prepared in 2016. A consultation meeting was also held by CPCB on January 02, 2019, to seek suggestions/comments from various stakeholders such as Associations of Mayapuri; Automotive Component Manufacturers Association of India (ACMA); Society of Indian Automobile Manufacturers (SIAM), Ministry of Heavy Industries and Public Enterprises (MoHI&PE); Ministry of Steel; Ministry of Environment, Forest & Climate Change (MOEF&CC); Steel Research & Technology Mission of India (SRTMI); National Automotive Testing and R&D Infrastructure Project (NATRiP),; GIZ-India, Mahindra Groups; Tata Steel; Maruti Suzuki; Honda Cars India Ltd, Toyota Tsusho India Pvt. Ltd (TTIPL).

These guidelines are in continuation of the aforesaid CPCB guidelines prepared in 2016 considering comments received from the above stakeholders. Procedures and facilities required in dismantling of ELVs have been outlined in these guidelines along with various requirements under environmental regulations. These guidelines would be helpful in setting up and operation of ELVs management facilities in environmentally sound management manner.

2.0 INTRODUCTION

ELVs are broadly divided into Natural ELVs and pre-mature ELVs. Natural ELVs refer to those vehicles that have come to the end-of-life due to wear and tear. Premature ELVs refer to those vehicles that have come to end-of-life due to unnatural reasons such as an accident, fire, flood or vandalism damage (ASM 2015).

The global ELV generation is estimated to be 40 million ELV/ year; this accounts for 4% of total global automobile ownership. (Sakai et al. 2013). It is estimated that the number of vehicles to become ELV will be 2,18,95,439 by 2025. (CPCB report "Analysis of ELV sector in India", 2015).

ELVs are known to contain hazardous substances including waste oil, lubricants, lead acid batteries, lamps, electronic components, air bags, etc. The recovery of these materials is of concerns: firstly, their recovery is often

harmful to the health of the scrap recovery workers; and secondly, they cause environmental contamination if improperly dismantled or disposed. At present, nearly all of the automobile scrap yards in India are managed by the semi-formal sector. Semi-formal recyclers use crude methods to recover materials and are poorly organized among each other and with other stakeholders of the ELV value chain.

ELVs contain large quantities of metal and other materials that, if salvaged or recycled properly can be effectively fed back into the economy. This reduces the environmental impacts arising from mining of primary materials.

Secondary metals are processed using simple technologies requiring less energy in comparison to the primary processing of metals. This further reduces environmental impacts of resource use.

The reuse and recycling of vehicles provides an important opportunity for transforming the resource use of societies. In India, up to 70% of a vehicle are dismantled and directly reused or sold to other manufacturers'.

In the recycling process both ferrous and non-ferrous metals are recovered and directed to reuse. It has been estimated that passenger cars contain about 70% steel and 7-8% aluminum. The rest 20-25% is plastic, rubber, glass etc., which are also recyclable recycling one ton of steel conserves 1,134 kg of iron ore, 635 kg of coal and 54.4 kg of limestone (Sakai et al., 2013; Steel Recycling Institute 2014).

Finite resources are unlikely to fulfill the world economy's increasing demand for raw materials – unless production and consumption patterns around the world become more resource efficient and sustainable. An obvious symptom of increasingly scarce raw materials is rising prices. Copper prices for instance have seen a significant increase over the past years. These developments set additional incentives for ELV recycling, as improved ELV recycling can contribute to increasing the amount of recyclable material as well as to reduce waste volumes (Chen et al. 2010).

Metals (eg. copper, aluminum, etc) are mined; excessive extraction of primary materials harms the ecosystem services that are vital for human wellbeing. In order to avoid these issues, it is necessary to find ways how to "create more with less" (European Commission 2015a) and reduce negative environmental and social impacts throughout the life cycle of resources.

There are several challenges to be dealt regarding increasing the efficiency and sustainability of ELV recycling in India as some of the wastes are economically valuable materials. This matter is of larger concerns due to (a) the growing demand for vehicles and (b) anticipated huge growth of ELVs.

The resources present in these ELVs are significant and to address the existing regulations for the channeling of hazardous and other wastes include the Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016; Batteries (Management and Handling) Rules, 2001; E-Waste Management Rules, 2016; Solid Waste Management Rules, 2016 and Plastic Waste Management Rules, 2016.

3.0 ELV recycling activities: Environmentally sound de-pollution, dismantling, shredding, material recovery and disposal of ELVs

The environmentally sound recycling process of ELVs comprises four major stages and is depicted below:

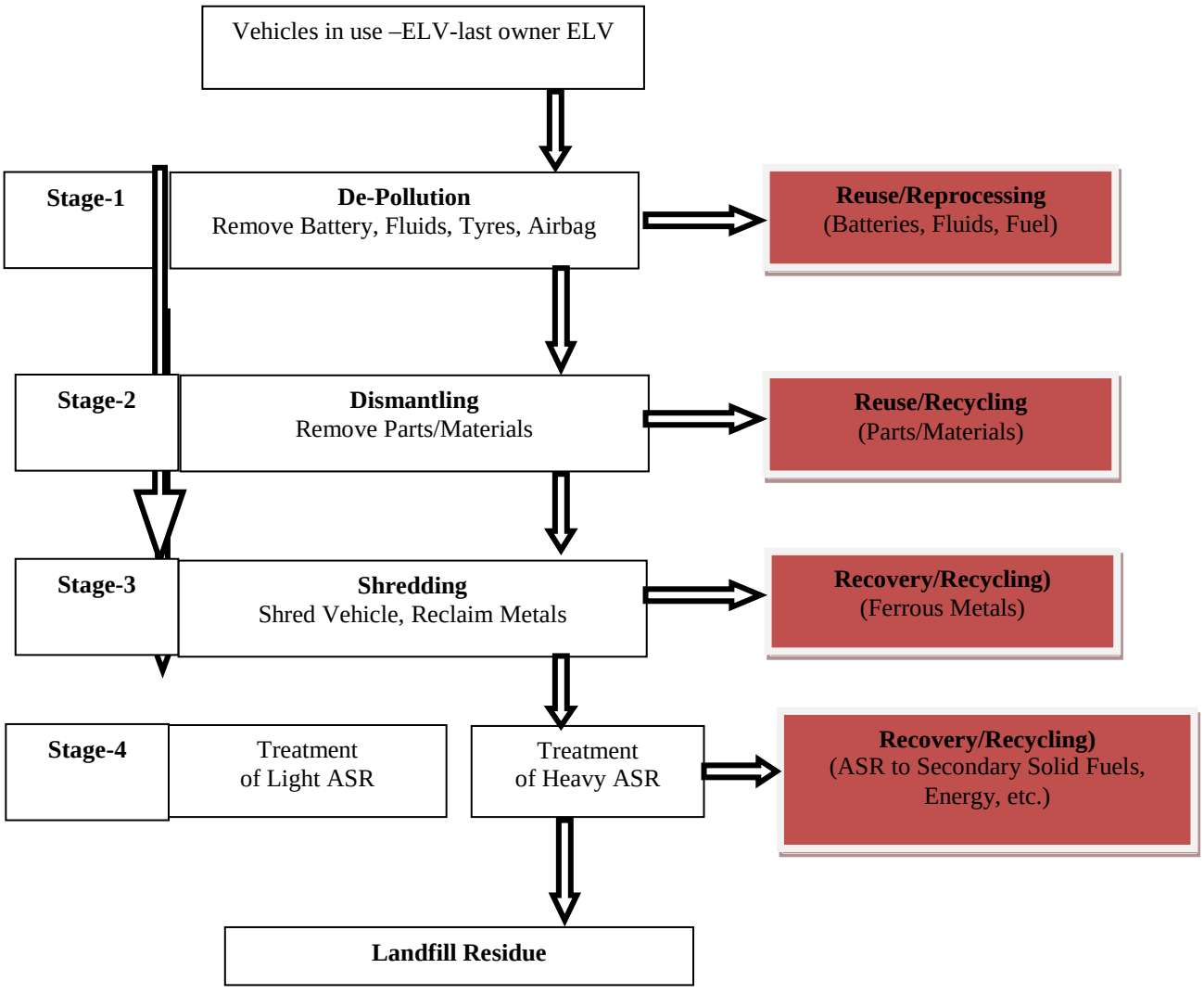

Figure 1: Stages of Environmentally Sound Management of ELV

1. De-pollution: The recycling of ELV process starts at the dismantling or treatment facility where it is first de-polluted and then dismantled (sometimes these two steps are summarized as “dismantling”). De-

pollution includes removing hazardous components and substances such as the battery, fuel, other fluids, airbags and any parts containing mercury. As the removed materials are hazardous in nature such as explosive/ corrosive/etc., de-pollution must follow strict health and safety rules and contamination of the environment must be prevented. This includes storing hazardous components and materials separately and providing adequate training for employees. (UK DEFRA 2011).

2. Dismantling: Once the vehicle has been de-polluted it is then dismantled. This process involves segregating and collecting recyclable and reusable components, including engines, tyres, bumpers, and other parts. The degree of mechanization of the dismantling process depends on the costs of labour and availability of large scale technology (Tian and Chen 2014). The recovered components and fluids are sold for reuse in other vehicles (motor parts, batteries, fuel, etc.) or for further recycling (tires, valuable metals, carpets, etc.). According to experiences from the EU and Japan the car hulks weigh approximately 55–70% of their original weight after dismantling (Sakai et al. 2014).

3. All waste water that is produced during the de-pollution and dismantling processes must be treated. Resulting waste material is sent to incinerators for energy recovery or to landfills for disposal. (Chen et al. 2010)

4. Shredding / Automotive shredder residue (ASR):

    a. ASR is a highly heterogeneous mixture of residual ferrous and non-ferrous metals (5–23%), plastics (20–49%), rubber (3–38%), textile and fibre material (4–45%), wood (2–5%), and glass (2–18%). Some of these components can be further processed: heavy ASRs are molten for the recovery of valuable non-ferrous metals such as aluminium and copper; combustible materials are used to make fuel substitutes; etc. However, these components are difficult to separate from other materials such as ash and heavy metals. Therefore, it is more common to either use ASR for energy recovery or to send them directly to landfills.
    b. According to experiences from the EU and Japan the car hulks weigh approximately 55–70% of their original weight after dismantling (Sakai et al. 2014). The remaining hulk of the vehicle is crushed so that it can be transported in a compact and cost-effective form to the shredder facility. There it is broken up into fist-sized pieces by large shredders. The shredded material is then separated into ferrous metals for material recovery as well as non-ferrous metals (heavy automotive shredder residue (ASR)) and other materials (light ASR). The separation process is realized by complex machinery such as magnetic separators, air classifiers, infrared

systems, etc. (Sakai et al. 2014; ARS et al. n.d.). Processing scrap in smelters usually produces secondary metal.

c. Several countries have high targets for the recycling rates of ELVs, the recycling of ASR thus becomes increasingly important.

5. ELV recycling facilities within the overall ELV recycling chain, the management of ASR is one of the most problematic steps and requires further technological advances. (Vermeulen et al. 2011)

   i. **In EU,** the recycling of ELVs is organized under an Extended Producer Responsibility Scheme, according to which manufacturers are responsible for increasing recyclability of vehicles, disseminating information on recycling procedures and providing free take-back of ELVs. (Sakai et al. 2013).

   ii. The **EU ELV** Directive determines that by 2015 all member states have to reuse, recycle or recover 95% of an ELV by weight. Out of this, energy recovery must not exceed 10%. The EU ELV Directive obliges all member states to ensure that all ELVs are transferred to authorized treatment facilities (European Parliament and Council of the EU 2000). In 2006, a total of 8,000 authorized ELV dismantlers operated within the EU-25 territory, complemented by 232 shredding facilities. At the same time, there remained a considerable number of illegal treatment facilities, particularly in those countries that did not have a sound ELV recycling system. Successful counter-measures include a national campaign launched by the UK Environment Agency in April 2008 that reduced the number of illegal ELV and scrap metal sites by 50% within one year. (EU 2010), With regard to ASR recycling the EU attempted to reduce the amount and hazardousness of ASR by intensive dismantling; another strategy is post-shredder treatment.

   iii. In **Germany**, dismantling facilities are responsible for de-polluting as well as dismantling of ELVs. In 2014, there existed approximately 1300 registered dismantling facilities (UBA 2014). They are under strict obligations with respect to organizing the process. These requirements relate to the dismantler's structure, equipment and operation, as well as to its documentation procedures. Additionally, dismantling facilities need to pass an annual certification by an external expert. Shredding is realized by shredding facilities which have to comply with similar obligations. (Kohlmeyer 2012)

   iv. In **Japan**, vehicle manufacturers and importers are required by law to take back and recycle air bags and ASR, and to ensure sound treatment of fluorocarbons. The recycling rates for air bags and ASR are 85% and 70%, respectively. The costs of

recycling the mentioned components are borne by vehicle users who, at the moment of buying a new car or handing in an old car, are required to pay a recycling fee. Collection of refrigerant gases is mandatory as well and falls under the responsibility of refrigerant gas processors. However, no recycling rate was determined for these gases. (Sakai et al., 2013; Wang and Chen 2013) The processing of other components or liquids is done voluntarily by dismantling and shredding facilities. In 2007, 5000 dismantling and recycling operators and 140 shredding plants were registered. There exists no recycling rate for the overall weight of the ELV. (Chen et al. 2010)

v. In **Korea**, ELV recycling is done by the dismantling and shredding facilities. For 2015 and onwards, a material and energy recovery of ELVs of 95% was determined. This includes a maximum energy recovery rate of 10%. (Serona et al. 2010) ASRs are land-filled or incinerated (Sakai et al. 2013).

vi. In **Taiwan**, ELV recycling is realized by dismantling and recycling operators. In 2009, there were 303 recycling operators and five shredding and sorting plants. These operators work along three different business streams: a) trading of scrap metal and reusable parts, b) trading of spare parts after the dismantling process, and c) export of ELVs and used cars. ASRs are disposed of in waste processors, incinerators or landfills. (Chen et al. 2010)

vii. In **China**, ELV recycling is realized by dismantling facilities. The reuse of five major vehicle assemblies (i.e. engines, steering, transmissions, axles and frames) is currently allowed only for selected pilot facilities. (Wang and Chen 2013) By the year 2017 the recycling rate of ELVs should reach at least 85% (Sakai et al. 2013).

viii. In the **U.S**. ELV recycling is voluntary and driven only by the economics of recycling. However, all steps of ELV recycling are subject to monitoring under environmental law (Sakai et al. 2013). While the processing of most components is organized in a de-centralized manner by the different actors of the ELV recycling chain, there exist nationwide efforts for the collection and recycling two particular contaminants, namely mercury switches and vehicle tyres. With respect to mercury switches, a broad coalition of federal, state, industry and environmental non-profit partners in 2006 have created the National Vehicle Mercury Switch Recovery Program (NVMSRP). The return of switches under the NVMRSP is rewarded financially, through a fund set up voluntarily by steel and auto manufacturers (U.S. Environmental Protection Agency 2013). ASR that results from ELV processing is land-filled.

4.0 Environment Policy- sustainable development includes waste management

The National Environmental Policy 2006 (NEP) focuses on sustainable development and the need to facilitate the reuse / recovery/ recycling of necessary material (resourceful) from waste, thereby contributing to the conservation of natural resources and the reduction of wastes destined for final disposal.

Eventually environmentally sound management (ESM) of all wastes needs to be ensured. NEP encourages legal recognition and strengthening of the informal waste sectors to be integrated into the mainstream waste management activities.

Considering the large recycle potential of ELVs, these should be recycled properly to recover valuable natural resources in an environmentally sound manner. At present there is no separate policy or law or regulation governing the management of ELVs. However, the environmental compliances for recycling activities could be in accordance with the prevailing laws such as The Water (Prevention & Control of Pollution) Act, 1974, (The Water Act), The Air (Prevention and Control of Pollution) Act, 1981 (Air Act) and the Environment (Protection) Act, 1986 (EP Act) and the rules made there-under.

5.0 Rules under Environment (Protection) Act 1986 having relevant provisions for regulatory framework applicable for ELVs

1. The wastes generated during environmentally sound recycling process of ELVs shall be managed in accordance with the various Rules notified by the Ministry of Environment, Forests and Climate Change under the Environment (Protection) Act, 1986. These rules have been notified in order to provide statutory provisions for regulating the handling and management of wastes without causing any adverse effects on environment and human health. The Rules are implemented through the State Government and State Pollution Control Boards or the Pollution Control Committees of the Union Territories. The following waste regulations have been notified by the Ministry that are applicable for the management and recycling of ELVs:

    a) The Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016.

    b) The Solid Waste Management Rules, 2016.

    c) The E-Waste Management Rules, 2016.

d) The Plastic Waste Management Rules, 2016.

e) The Ozone Depleting Substances (Regulation and Control) Rules, 2000.

All the above rules address environmental issues concerning waste management (recycling or disposal). The different rules cover industrial wastes, urban waste as well as post- consumer waste.

2. The concept of recyclability of wastes and regulating recycling activity has been introduced in all these rules with the goal to increase the recovery of resources thereby reducing the waste destined for disposal. Some of these rules include provision for the registration/authorisation of recyclers which have the capability to recycle wastes using environmentally sound technologies (ESTs).

3. The hazardous substances and hazardous fluids present in ELVs such as waste oil, transmission fluid, coolant fluid, brake fluid, power steering fluid, hydraulic fluid, gear oil, lead acid batteries and other materials arising from de-pollution shall be recycled or disposed of in accordance with the Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016. In addition to these substances, the hazardous solid wastes such as air filter, oil filter, brake shoe, asbestos in clutch discs, etc. are required to be disposed of in accordance with these Rules. Any recycling of these hazardous wastes recovered from the ELVs shall be carried out only by the registered recyclers notified under these rules. The residues containing hazardous substances arising from both manufacturing and recycling activities have to be disposed of in an environmentally sound manner and the disposal procedures shall be decided on the basis of the constituents present in the waste. All hazardous wastes generated from the ELVs shall be disposed of in accordance with the requirements under the Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016.

4. In compliance with the requirements under the Montreal Protocol the Ozone Depleting Substances (Regulation and Control) Rules, 2000 have been notified. These rules provide a control on the production, consumption, export and import of the 95 Ozone Depleting Substances listed in the Schedule 1 of these rules. All refrigerants containing ODS recovered from ELVs should be disposed off in accordance with these rules.

5. The plastic waste which can be recycled shall be channelized to registered plastic waste recycler in accordance with the Plastic Waste Management Rules, 2016.

6. The collection, recovery and disposal of the solid waste shall be in

accordance with the Solid Waste Management Rules, 2016.

7. Similarly, all electronic parts are to be treated and disposed of in accordance with the E-Waste Management Rules, 2016 to channel e-waste for recycling to registered recyclers.

6.0 Industry standard: Automotive Industry Standards (AIS: 129) on ELVs

The Automotive Research Association of India (ARAI) along with the Society for Indian Automobile Association (SIAM) and the Automotive Industry Standards Committee (AISC) under the Ministry of Road Transport & Highways have developed 'Automotive Industry Standards (AIS): AIS 129 addresses End-of-Life Vehicles' (ELVs) which were notified in July 2015 by MoRTH. The main objective was to enable automobile recycling to become an organized sector activity and to prescribe minimal operational standards for automobile recycling in-line with the European Directives of 2000 and 2005.

7.0 Collection and handling of ELVs

1. There is the need to develop a collection and channelization mechanism for ELVs from the source of its generation for recycling and recovery in an environmentally sound manner. The ELV collection system needs to be established to facilitate the movement of ELV in a regulated manner from its origin to the final destination for recycling, treatment and disposal. The stages involved in the process include establishing collection channels, setting up ELV collection & deposition facilities, providing financial mechanisms for collection, and organizing handling and storage.

2. Collection channels: There exist different collection channels for ELVs. Bulk generators or fleet owners such as public transport and tourist agencies (government and private) or offices (government and private) adopt different modes of disposal of ELVs depending upon the number of vehicles and their conditions. Bulk amounts of ELVs are usually auctioned off by public agencies. The buyer is the highest bidder and resale of automobile parts. The other mechanism that prevails is the replacement of old and used vehicles by new ones through dealers or the manufacturers.

   Many automobile companies and bulk generators of ELVs carry out regular sales of used vehicles which are conducted by private agencies. The buyers may be individuals who intend to further use the vehicle or auto scrap dealers or dismantlers. The Original Equipment Manufacturers (OEM) also sell their manufacturing defects (parts) to

auto scrap dealers or dismantlers in the semi-formal sector. Sometimes OEMs recall the vehicles with manufacturing defects and rectify the same themselves or may also put the defective components and equipment back into their own system by rectifying these. Individual owners channel ELVs through sale or exchange of old vehicles while buying new ones. In case of accidents and fire there are also cases of vehicles abandoned on the road sides from which parts and components are stolen.

Based on these common practices the ELV collection channels should close the gaps in the recycling loop and prevent the loss of potentially valuable material. In order to provide efficient collection systems for ELVs, the actors in the collection channels are to assess the materials for reuse and recycling in order to prevent improper recycling practices in the backyard recycling units. Effective collection channels would further enhance the availability of material for recycling and make the tracking of material and material components possible.

8.0 ELV collection & dismantling centres

1) In view of the large size and volume of automobile scrap the collection facility may need to be set up in large areas where the various types of ELVs could be handled. ELVs in India would include the small two and three wheelers, cars, large buses, trucks and trailers. Depending upon the area available, different locations to be assigned for different types of ELVs.

2) Take back could be provided by Collection and Dismantling Centers. These may be created by upgrading existing vehicle service centers, scrap yards or recycling workshops in co-operation with vehicle producers. In a collective system, producers may setup joint collection centers or collectively sign contracts with existing ELV recyclers to organize the collection on their behalf. In an individual collection each producer may have to set up his / her own collection facility or sign individual contracts with collectors.

3) Generally, the collection system needs to fulfill the criteria of an adequate area of coverage for collection. It is advisable to consider a 50 km radius around a take back facility. Collection points or centers can be established in designated places where ELVs are collected. Such collection points could also be linked to a centralized collection center where these could be stored and later sent to dismantling/recycling plants.

4) The ELV collector shall provide information as per the application/format prescribed by the Central Government, the moment disposed vehicles transaction is completed with the de-

polluter/ dismantler/recyclers.

5) The person involved in dismantling of ELV shall ensure that the vehicle has been declared as ELV (alongwith destruction certificate) and the registration of the vehicle has been cancelled as per Section 55 of the Motor Vehicle Rules, 1989.Such person shall apply for de-registration of the ELV in Form 20 A as per Rule 47a of Central Motor Vehicle Rules, 1989 to the registration authority.

6) It shall be ensured that ELVs dismantled at dismantling facility comply with Rules/guidelines/policy of Central Government or Government of State/UT where such facility is located.

9.0 Handling, storage and transportation of ELVs

1) Handling : ELVs are often large in size (for example trucks and buses) and require machines to handle them. Any vehicle that reaches end-of-life needs to be lifted using cranes and towed to the destination. At the Collection and Dismantling Centers facilities cranes / lifting equipment would be required to move ELVs within the unit. Adequate handling equipment should be required for any ELV collection, treatment and recycling facility.

   In accordance with AIS PART-1 para. 4.2.5 any person(s) operating Collection Centre(s) and Dismantling Centre(s) shall store the ELV (even temporarily) and treat in accordance with Annex A without endangering human health and without using processes or methods which could harm environment. ELVs should be stored in a way that protects their value and protects the surrounding environment. ELVs contain hazardous fluids and other components that can pollute the soil, water, and air. For example, when leaking fluids soak into the ground they contaminate the upper soil layers as well as the underlying groundwater. Likewise, storm water runoff from rainfall and snowmelt can be contaminated if it comes in contact with greasy, oily parts, or flows over contaminated soils or through puddles of vehicle fluids. Contaminated storm water runoff can spread pollution on one's property and onto neighbors' property. If refrigerants (such as Freon) are allowed to escape from air conditioning units in ELVs, they can spread to the upper atmosphere and destroy parts of the earth's protective ozone layer. In addition to storing ELVs in an environmentally protective manner, there are good reasons to also store these vehicles in an orderly, tidy manner. Organizing the vehicle storage area helps to keep track of one's inventory and thus to find a desired vehicle faster. Moreover, leaks and other potential

problems can be detected and dealt with more rapidly. (N.H. Green Yards BMP 2008).

The collection/dismantling/de-polluting/shredding facility shall take all the steps to :

a) contain contaminants and prevent accidents and limit their consequences on human beings and the environment; and
b) provide persons working in the site with appropriate training, equipment and the information necessary to ensure their safety.

2) Storage : Pre-conditions for storing ELVs

a) ELVs shall not be stored until the fuel, oil, antifreeze, and other fluids are completely drained, and the fuel tank, radiator, and other fluid containing parts have been removed. (Ensure that fluids do not leak or drip onto the ground.)

b) A written record shall be kept of the vehicles stored.

c) In order to prepare vehicles for storage a routine shall be established; this helps in knowing the condition of every vehicle stored.

3) An ELV shall not be stored without removing the battery, additional salient points on storage of ELVs :

i. ELVs shall be stored in dry areas where there is no water logging or water will not be flowing under the vehicle during rain or snow melt periods.

ii. ELVs shall be stored on impermeable surfaces, such as concrete or other feasible ground sealing.

iii. Storage areas shall be provided for spillage collection, decanting and degreasing;

iv. Storage facilities shall be provided for dismantled spare parts, including impermeable storage for oil contaminated spare parts;

v. Appropriate containers shall be provided for storage of batteries (irrespective of whether electrolyte neutralisation is conducted on site or elsewhere), filters and PCB / PCT-containing condensers;

vi. Storage tanks shall be provided for the segregated storage of ELV fluids;

vii. Equipment shall be provided for the treatment of water,

including rainwater in compliance with health and environmental regulations;

viii. Used tyres shall be stored appropriately, including the prevention of fire hazards and excessive stockpiling.

ix. If engines or greasy parts are exposed, they shall be covered with a tarpaulin or other covering to prevent rain.

x. ELVs shall not be stored in the flood hazard zone or in wetlands.

xi. ELVs shall not be stored along or over property boundaries, public rights-of-way, or easements.

xii. Authorization needs to be obtained from the concerned authorities for the storage of junk vehicles

xiii. The boundaries of the vehicle storage area shall be demarcated with a site drawing.

xiv. Vandals and other unauthorized persons shall be kept away from entering the vehicle storage area. If necessary, a fence shall be erected and "no trespassing" signs shall be posted.

xv. ELVS shall be parked in rows, with enough aisle space between the rows to allow individual vehicles to be inspected and removed as needed.

xvi. ELVs shall be stored in an upright position and shall not be stacked or piled on top of each other.

xvii. An inventory of the ELVs shall be maintained with detailed record of the make, model, and year of each vehicle, the date the vehicle arrived. The record shall be maintained on date of inspection for leaks, and any other relevant information needed to control the flow of the inventory.

xviii. The storage area shall be inspected regularly to ensure that there are no problems; a record shall be kept of the inspections.

4) Transportation of ELVs need specialized vehicles with a provision to lift and load the ELVs. If there are large numbers of ELVs it becomes economical to have dedicated vehicles for transportation. In case of small numbers it may be feasible to use public carriers. Large vehicles and lifts are also required for the onsite movement of ELVs.

5) The sites for ELV treatment and storage shall be designated and need to be prepared both for storage and treatment. These areas shall be provided with the following:

a. Impermeable surfaces for designated areas;

b. Spillage collection facilities;

c. Decanters and cleanser degreasers;

d. Equipment for the treatment of water, including rainwater;

e. Designated storage areas for dismantled spare parts;

f. Impermeable storage areas for oil contaminated spare parts.

g. Tanks/containers for segregated storage of fluids - such as fuel, motor oil, gearbox oil, transmission oil, Hydraulic fluid, cooling liquids, antifreeze, brake fluids, air conditioning fluids and other fluids.

h. Equipment and tanks/cylinders for safe de gassing and storage of gases and safe storage for pyrotechnics from air bags, ACs etc.

i. Appropriate Areas / containers for storage of solids, batteries, oil filters Unless crushed, PCB/PCT containing condensers, other hazardous components used tyres (prevent fire hazard due to excessive stockpiling)

10.0 Environmentally sound de-pollution of ELVs

1) According to AIS PART-1 para. 4.2.6 any person(s) operating Collection Centre(s) and Dismantling Centre(s) shall carry out operations for de-pollution of end-of-life vehicles as mentioned in Annex A as soon as possible. Further, handling, storage and transportation of ELVs during the de-pollution activity shall be as per Section 15 given below.

The processes involved in de-pollution of the vehicle are important as the ELV is made free from the liquid and hazardous substances and the further processing becomes safe. De-pollution activities should be carried out using appropriate equipment that is specifically designed for carrying out the required de-pollution operations. Most of it is used in automobile service centres and workshops and is commercially available. Such equipment is usually pneumatically operated. The use of such equipment ensures that a high level of de-pollution (removal, as far as reasonably practicable, of most fluids contained in the ELV) can be achieved in a relatively short timeframe (20-30 minutes per ELV). In case that a de-pollution in a completely mechanized system is not possible alternative methods of manual operations could be used, ensuring the same levels of de-pollution without compromising on health and safety requirements. Since the Indian semi-formal sector is based in manual operations an assessment of the risks involved

in using such methods of de-pollution must be carried out. Based on this assessment adequate measures, necessary to comply with relevant health and safety legislation/ regulation, must be put in place. If alternative methods are used it should ensure the same level of de-pollution.

2) The de-pollution or decontamination operations comprise of a number of steps according to which the ELVs are to be treated (see figure 2). The steps are based on the materials contained in the ELV. There are certain minimum standard practices that need to be followed. Additionally, vehicle specific requirements are given by automobile manufacturers.

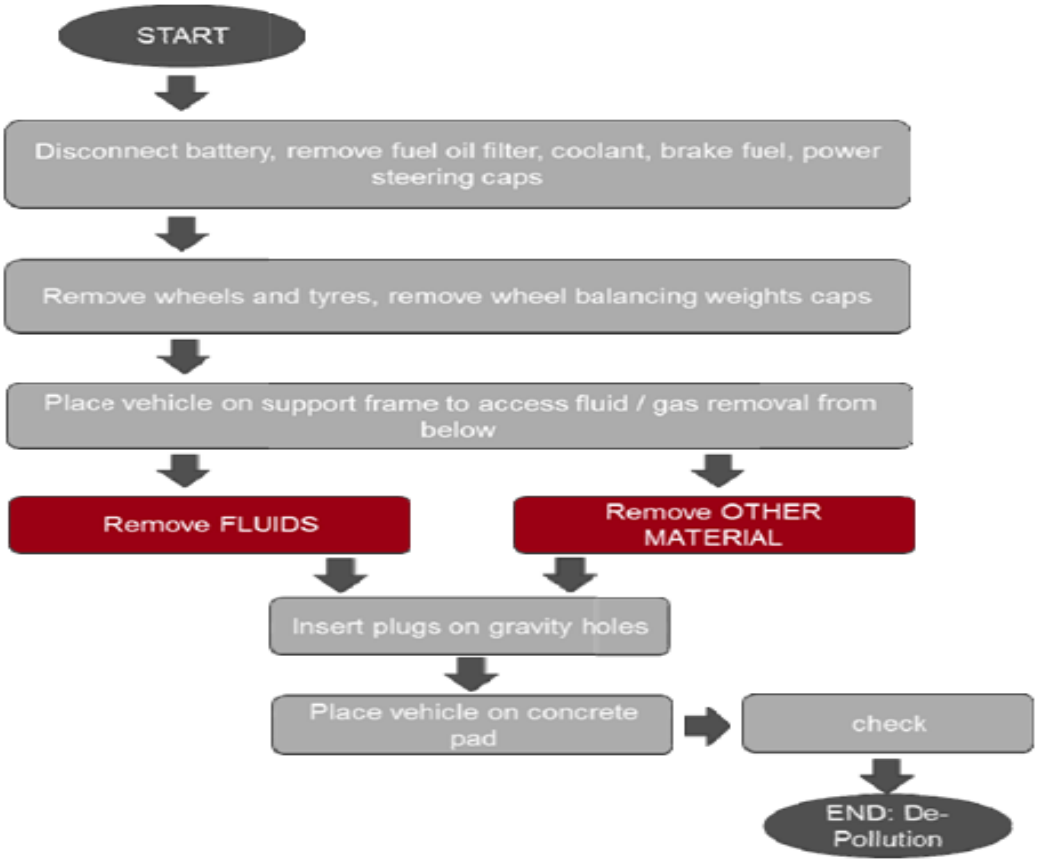

Figure 2: De-pollution process

3) The sequence of the operations is given in the table below where it is also indicated whether an individual operation is best conducted from above (A) or below (B) the ELV. The specific sequence of operations, however, may be evolved as per the requirement of the ELV and equipment available at the treatment facility. The objective should be to completely de-pollute / De-contaminate the ELV before it can be passed on to further treatment, i.e. shredding and material recovery. At least 20 minutes should be given for gravity draining of the engine oil.

Table 1: De-pollution sequence

Operation	**De-pollution Sequence**
A. Before Lifting the vehicle	
Remove Battery	A
Remove fuel filter cap & oil filler	A
Set heater to maximum	A
Remove wheels and tyres and separate balance weights	A
Remove any parts identified as containing mercury	A
B. Lift the vehicle on de-pollution frame or lifting device	
Degas air conditioning unit (if fitted)	A
Drain engine oil and remove oil filter for crushing or disposal	B
Drain transmission oil, including rear differential	B
Drain coolant	B
Drain brake fluid	B
Remove catalyst (if fitted)	B
Drain washer bottle	A
Drain brake/clutch reservoir(s)	A
Drain power steering reservoir (if fitted)	A
Drain fuel tank	B
Drain shock absorbers or remove suspension fluid	B
Replace drain plugs/fit plastic stoppers	B
C. Remove vehicle from de-pollution frame or lifting device	
Deploy airbags and other pyrotechnics in-situ (if fitted and able to conduct this operation)	A
Remove air bags and other pyrotechnics (if fitted, and cannot be deployed in-situ)	A

For the removal of hazardous substances certain rules have to be complied with. Some of the basic steps have been given below based on the common hazardous materials that are likely to be present in all vehicles

4) **<u>Hazardous substances (fluids)</u>**

Hazardous substances (fluids) such as engine oil, gear oil, transmission fluid, hydraulic fluid, brake fluid, power steering fluid, coolant fluid, present automobiles need to be de-contaminated while processing ELVs as per the norms prescribed in the relevant regulations and guidelines.

a. <u>Waste oils</u>

i. Used and waste oils shall be sent to registered recycling or re-

refining unit.
ii. If uncontaminated, these shall be sent for burning for energy recovery.

b. Transmission oil
i. Transmission oil contained in gearboxes can be gravity drained through the drain plug. Drilling a hole in the bottom of the gearbox shall drain those without drain plug.
ii. In rear axle differentials of rear wheel drive vehicles, the drain plug shall be drilled or differential flange shall be loosened to allow the oil to drain.
iii. Oil shall be collected in a container and stored and then sent for disposal.
iv. The power steering fluid has to be extracted from both reservoir and connecting hose using similar equipment for reservoir and by piercing the hose and sucking out the fluid or cutting.
v. Transmission oil/fluids shall be managed like used oil by direct reuse or re- refining in registered recycling units, or by burning it for energy recovery.
vi. Transmission fluid must not be disposed in a storm drain, septic tank, on the ground, the sewer system or dumpster.

c. Brake fluids & cleaners
i. Brake fluid is typically contaminated with chlorinated solvents from brake cleaners.
ii. Brake fluid shall be collected in a separate container marked, "Hazardous Waste - Brake Fluid".
iii. Brake fluid must not be burned for energy recovery.
iv. Brake fluid must not be disposed of in a storm drain, septic tank, on the ground, sewer system or dumpster.
v. Brake and carburetor cleaner shall be closed when not in use.
vi. Brake/carburetor cleaners must not be mixed with other solvents, like solvents from parts washers.
vii. Spent cleaners and solvents shall be disposed of as hazardous waste.

d. Fuel and fuel filters
i. Fuel shall be removed from fuel tanks by siphoning or suction as soon as the vehicle enters the facility.
ii. Fuel reusability shall be determined - it shall be labeled "Reusable Gas (or Fuel)" if reusable; if the fuel is not reusable it shall be labeled as "Hazardous Waste - Gas (or Fuel)"
iii. All fuel shall be stored in closed, leak proof containers.
iv. Reusable fuel shall be used at the facility or given away.
v. Fuel must not be mixed with any other waste streams.
vi. Excess fuel shall be drained from filters into a proper fuel container.
vii. Used fuel filters shall be kept in a separate fireproof container marked "Hazardous Waste Fuel Filters Only". Fuel filters shall be treated as hazardous waste and disposed of as required. (Florida Department of Environmental Protection 1999)

e. Coolant (Antifreeze)

Coolant can be gravity drained removing the bottom hose from the radiator or using suction and a minimum of 10 litres is collected and reused.

5) **Hazardous substances (solids)**.

a. Lead acid batteries present in the automobiles are one of the major sources of toxic and hazardous substances. They contain sulphuric acid that is corrosive and lead plates that are highly toxic.

i. Lead-acid Batteries shall be removed and tested for reusability.

ii. Leaking batteries shall be drained and acid stored in containers safely.

iii. Intact or drained batteries shall be stored indoors avoiding heat and rain.

iv. Batteries shall be sent for recycling in registered recycling units.

v. Battery terminal metal parts sold as scrap for recycling shall contain acid which causes pollution

b. Air filter contains foam and ferrous parts that pose a potential hazard if burnt in case it cannot be directly used.

c. Oil filter contains filter paper and residual oil which is toxic when burnt, it also contains metallic parts which is sold by scrap dealers

d. Hot tank solutions and sludge from cleaning ELVs (and ELV parts) in auto recycling units could be a major issue as it shall be contaminated with the process effluents and residues. These need to be treated as hazardous wastes.

e. Mercury switch shall contain mercury, copper and brass that makes it attractive to recycle.

f. Brake shoe clutch plates/discs contain asbestos that is carcinogenic and hazardous to human health. Asbestos are crushed with the vehicle and are not removed for reuse in vehicle recycling. If brake shoes and clutches are not removed, asbestos particles shall become airborne while shredding. Sometimes these are stripped and dumped on ground. The best way is to limit exposure and health damage by providing proper controls to contain brake dust and prevent its release in the air:

i. Brakes or clutches must not be cleaned with air hoses, dry brushes, wet brushes, rags, garden hose, liquid squirt bottles, solvent spray or ordinary shop vacuums.

ii. Brake shoes or clutches shall be removed using specially designed low pressure spray equipment that wets down brake or clutch dust and properly catches the runoff to help prevent asbestos from being released.

iii. It is not recommended to eat in asbestos work areas. It is recommended to wash hands before eating.

iv. Before going home clean clothes shall be put on. Asbestos particles can become embedded in clothing and carried into the house.

g. Rubber parts are usually sent for recycling in furnaces as they have the potential to emit toxic fumes.

h. Glass parts, essentially the windshield and other glasses fitted in the doors, are toughened glass with a PVC sheet pressed between the two layers of glass. If the glass is intact it can be reused. Recycling options are limited and it can only be recycled into construction aggregate. If the PVC is removed, then it can be recycled like normal glass. If recycling automotive glass is not an option, it shall be handled as solid waste.

i. Electronic parts are fitted in modern cars. Such electronic waste shall be disposed of in accordance with the E Waste Management Rules, 2016.

j. Refrigerant gases present in ELVs need to be removed before processing ELVs as these have the potential to cause adverse effects on environment and health. The two types of refrigerant that are used in vehicle air conditioning systems are R12 and R134a. The type of refrigerant is marked on the vehicle. The refrigerant must be removed using specialist equipment which allows airtight operations in order to avoid any gas leakage, and two collection cylinders are required; one for R12 (a CFC) and one for R134a (an HFC).

k. Airbags contained in most of the modern vehicles contain explosives and shall be handled in accordance with the handling and deployment procedure prescribed by the manufacturer.

l. Catalyst: All modern vehicles contain catalytic converters in the exhaust for both diesel and petrol vehicles. These catalysts contain precious and rare metals which are valuable for recycling.

11.0 Environmentally sound dismantling & segregation

1) In the next step, the de-polluted and decontaminated ELVs are dismantled to separate different parts of the vehicle into their

components so that these could be segregated for further processing. Dismantling is one of the important steps in the processing of ELVs. The dismantling process could be manual or mechanical depending upon the type, size of the vehicle and numbers being handled. Small vehicles can be easily dismantled and manual dismantling is preferred. The larger vehicles that are not easy to handle manually can be dismantled using machines or are subject to mechanical dismantling. Manual dismantling helps to identify and remove parts that can be reused.

2) Some common components of automobiles during recycling are: (Automotive Recyclers Association 2014)

   i. Engines and transmission systems removed from vehicles can often be directly reused; they shall be stored under a permanent roof on an impervious surface, or in an outdoor covered, weatherproof container.

   ii. Engines and transmissions that can be re-manufactured and/or recycled shall be stored under a permanent roof on an impervious surface, or in an outdoor covered, weatherproof container or on an impervious surface that drains to an oil water separator or equivalent treatment device.

3) In line with AIS PART-1 Para 4.2.8 any person(s) operating Collection Centre(s) and Dismantling Centre(s) shall not sell the components mentioned in clause 4.2.8.1 and 4.2.8.2 below to any person(s) for reuse in the after sales market and shall dispose of in an environmentally friendly manner.

   i. Para 4.2.8.1 In the case of M1 category vehicles: i) all airbags including cushions, pyrotechnic actuators, electronic control units and sensors ii) automatic or non- automatic seat belt assemblies, including webbings, buckles, retractors, pyrotechnic actuators iii) seats (only in case where safety belt anchorage and / or airbags are incorporated in the seat) iv) steering lock assemblies acting on the steering column v) immobilizers, including transponders and electronic control units vi) emission after treatment systems (e.g. catalytic converters, particulate filters) vii) keys and lock components viii) sections of bodywork bearing the vehicle identification number ix) electronic brake components. AIS-129 4/48

   ii. Para 4.2.8.2 In the case of Ll and L2 category vehicles: i) Steering lock assemblies acting on the steering column ii) Immobilizers, including transponders and electronic control units iii) Emission after treatment systems (e.g. catalytic convertor, particulate filters) iv) Keys and lock components v) Sections of bodywork bearing the

vehicle identification number vi) Engine parts bearing the engine number vii) Electronic brake components viii) Suspension system ix) Any item other than those recommended for reuse by the vehicle manufacturer in the dismantling information.

12. Environmentally sound Shredding and separation and processing of residues

After de-pollution and dismantling of ELV, the remaining structure of ELV i.e. hulk shall be shredded in the shredder. Such shredding facility may be installed at the premise where de-pollution and dismantling activities are carried out or the hulk may be sent to a common shredding facility. Common shredding facility may complement numbers of facilities who carry out de-pollution and dismantling of ELVs. However, hulks may be treated as hazardous waste, unless it is established that the same do not qualify for hazardous waste, and, therefore, various provisions of HOWM Rules, 2016, with regard to storage, transportation, record maintenance, etc. would be applicable.

1) When an ELV is shredded, the residue is usually separated into four fractions: ferrous metals (using magnetic separation), non-ferrous metals (using mechanical separation), heavy shredder residue and the light fraction, which is separated by air suction. Ferrous metals are not being processed further, and arc considered ready.

2) After dismantling and recovering parts from the ELV, the remaining part is known as car hulk. This hulk is compressed and flattened and sent to a shredder for scrap metal recovery. The shredder essentially pulverizes. the vehicle into fine sized pieces of materials, which are then sent by conveyors for separation using magnetic separation, eddy current, laser and infrared systems (depending on the availability of the systems). Shredding and separation plants are capital intensive and technically complex. The metal recovered from these plants becomes raw material feedstock for steel mills, electric arc furnaces, aluminum and other nonferrous metal smelters to manufacture a variety of products, including new vehicles -(Recycle Guide 2014). The automobile recycling rate is almost 100% and is the most recycled commodity.

3) Along with ELVs, shredders may also process ether metal rich scrap, such as construction scrap and waste, large end-of-life appliances such as white goods. During the shredding process, the vehicle is broken down into much smaller pieces, and the metals are extracted. Both ferrous metals - iron and steel - and

non-ferrous metals, such as copper, zinc and aluminum, are recovered. Ferrous metals make up about 70% of a vehicle, while non- ferrous metals make up about 6%. These are separated using magnetic separators. The amount of recyclable material that is removed from an ELV via shredding is generally calculated to be about 75% by weight. By far the greatest share (by weight) of recycled material is the scrap metal.

4) Treatment of automobile shredder residue (ASR): The final processing of ELV by shredding generates many fractions and a residue also known as automobile shredder residue (ASR) containing a variety of materials that could not be recovered by any of the processes employed. This residue has been a major concern in many countries and a lot of research has been going on to assess how this residue could be used. The two fractions identified in ASR are the light fraction representing 10-24% of the weight of the original vehicle and the heavy fraction representing 2-8% of previous vehicle weight. A gross estimate of ASR generated from ELV recycling in relation to the original vehicle weight is 15-17%. Initially ASR was being land filled. Recent findings show that the light fraction of ASR could be used for energy production while only the heavy fraction needs to be land filled. In Japan mixed ASR is used for thermal energy production. Today it is still being debated whether some amount of ASR needs disposal.

   The schematic diagram shown below has been presented in an international comparative study on ELV recycling systems (Sakai et al. 2013). It depicts the steps required for a systematic recycling process but also indicates the percentage recovery rates of resources at different stages in the ELV recycling process.

   The de-pollution removes 3-5% of weight, dismantling 5-35% of weight, and remaining car hulk is about 60-90% of the previous car weight. The ferrous metal share after shredding is 35-65% while the non-ferrous share is 1-5%. Substantial amounts of non-ferrous parts enter into heavy ASR fraction (2-8%) while the light fraction of ASR is around 10-24%.

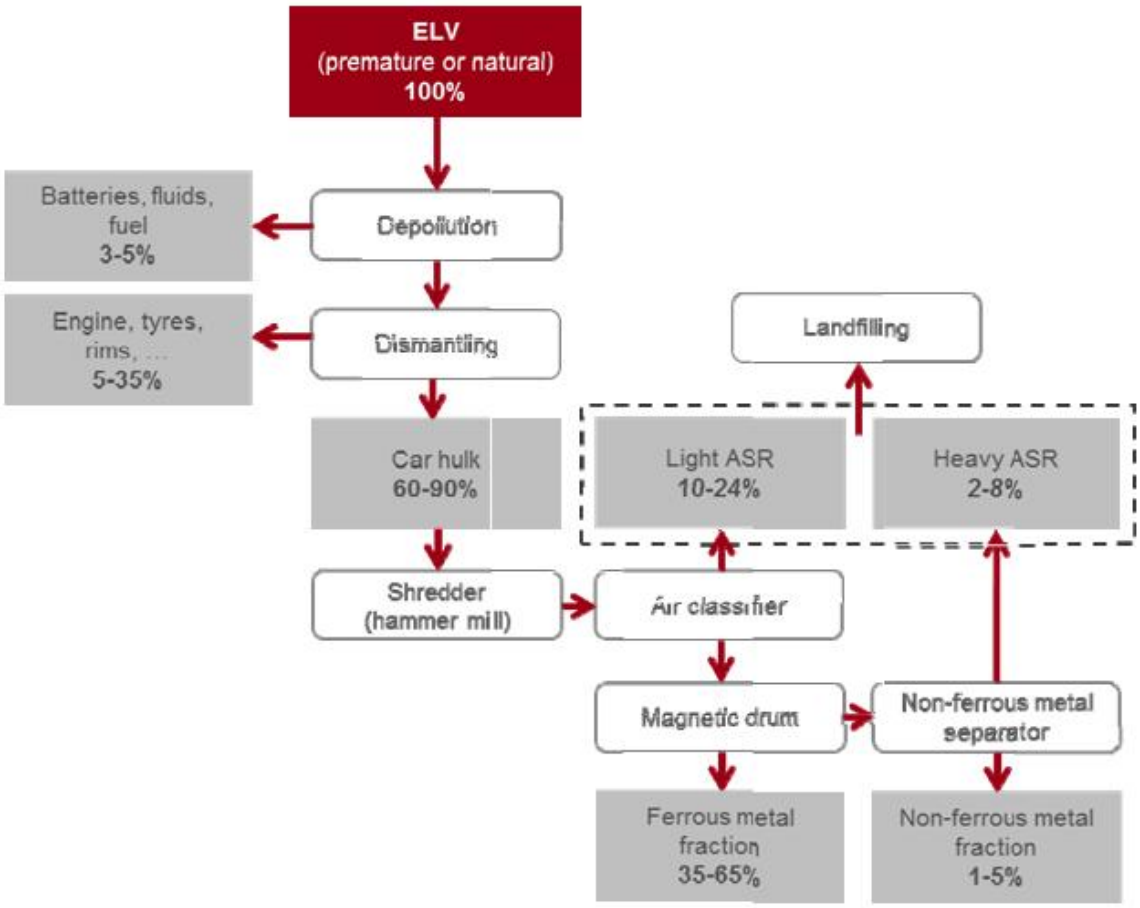

Figure 3: Typical ELV processing

13.0 Technologies for the ELV recycling process

The technologies required in the recycling process of ELVs are presented below:

a. Technologies for de-pollution, dismantling and segregation

i. For the lifting of vehicles during the de-pollution process the recycling facility needs a de-pollution frame or lifting device.

ii. Pneumatic tools and electrical screwdrivers are required for detaching the parts to be recycled from the ELV.

b. Technologies for shredding: Dry/moist shredding: Vehicle hulks are fed to the shredder/hammer mill with varying amounts of water. In case of dry shredding, extensive dust is sucked from the shredder by suction air streams. For moist shredding a small amount of water is sprayed into the shredder to eliminate airborne dust emissions from the shredder and from the product transfer points (Gesing 2006).

Most shredders worldwide process ELVs alongside other consumer products including white goods, light iron and metallic manufacturing and construction waste (Forton et al. 2005).

c. Technologies for processing residues - Segregation of light ASR
Air classifiers, cyclone separators: After shredding, all material is injected into a chamber which normally contains a column of rising air. Light ASR, fluff and dust is lifted up by the air drag and removed by cyclone separators. There exist various types of classifiers that can separate particles of different sizes and weight classes. Air classification can be repeated until material is sorted to a satisfactory degree (Christensen 2011).

d. Technologies for processing residues - Segregation of ferrous metal fractions: Magnetic separators: Once light material has been separated, the remaining residue is transported to magnet separators / drum magnets for segregation of ferrous metals. Magnetic separation can be repeated until material is sorted to a satisfactory degree. This could be beneficial if, for example, small ferrous particles were covered and held back by other non-ferrous materials during the first magnetic separation process (Forton et al. 2005).

e. Technologies for processing residues - Segregation of non-ferrous metal fractions:

i. Eddy-current separators (ECS): In the next step, non-ferrous metals (aluminum, copper, zinc, etc.) are separated from non-metal materials using eddy-current separators (ECS). The ECS is installed at the end of a conveyer belt and creates a magnetic field to throw conducting metals forward from the belt into a product bin, while non-metals simply fall off the belt (Mastermag, n.d.). Modern ECS can also eliminate small arts of ferrous metals left from the sorting with magnetic separators (Cogelme, n.d.). The separation process can be repeated until material is sorted to a satisfactory degree.

ii. Heavy media separation / sink-and-float separation: Another technology for segregation of non-ferrous metals is by heavy media separation, also called sink-and-float separation. Material is introduced into a heavy medium mixture of water and very fine and dense powder). Denser particles will sink, while lighter particles will float on top of the medium (Encyclopaedia Britannica Online). Compared to ECS, wet separation methods have the major disadvantage of having long wait times for settling and drying. Furthermore, they produce large amounts of waste water (Lee 2012).

f. Other technologies

There exist other technologies for separating metals from specific non-metal materials. For example, polymers can be removed using electrostatic separators (Lee 2012).

i. Sorting of non-ferrous metal fractions: Sensor-based/manual color sorting: Non-ferrous metals are then sorted by color. Sensors based on color recognition can be applied to differentiate copper and brass (red/yellow particles) from aluminum/ magnesium (white/grey particles). Color sorting of different nonferrous metals can also be done by hand (Margarido et al. 2014).

ii. Sorting of ASR - Air classifiers, cycle separators: Non-metal residues (glass, fibre, rubber, plastics, dirt, etc) can again be separated into light and heavy fractions using air classifiers.

g. Technologies for treatment of segregated materials

After the shredding and separation process, there are the ferrous metal, non-ferrous metal, and light and heavy ASR fraction. The ferrous and non-ferrous metal fractions are commonly treated in metal smelters. There are different options for treating the ASR fractions.

i. Thermal treatment: ASR has a calorific value of 14 - 30 MJ/kg rendering it a valuable energy source. However, high chlorine content, brominated flame retardants, ash content and high heavy metal concentrations make it difficult to actually use it as fuel (UNIDO et al. 2012). In addition, it has varying moisture content (Jody et al. 2010). To limit the amount of hazardous substances released from burning ASR, it may be co- incinerated in Municipal Solid Waste (MSW) incineration plants not exceeding a certain share in the fuel (in Switzerland the ASR fraction may not exceed 5 %, in Sweden up to 20 % were co-incinerated in MSW incinerators). Testing the flue gas emissions showed that the flue gas emission composition did not change significantly. However, concentrations of heavy metals increased in boiler and fly ash (UNIDO et al. 2012).

ii. Another option is to improve the quality of the ASR. By removing the finest fraction of the ASR through screens, shaker tables, rotary drums or float/sink separation techniques the ASR fuel quality can be improved. Removing PVC from the ASR can lower the chlorine concentration of ASR. Density separation with a bath density of 1,100 - 1,200 kg/m^3 can remove up to two-thirds of chlorinated plastics from the ASR (UNIDO et al. 2012).

iii. Although ASR could be used as a fuel for cement kilns, tests using 50 % of ASR as fuel in the kilns had a negative effect on clinker as the concentrations of heavy metals in the material increased significantly. In addition, more ash is formed, clogging of the fuel injection zone happens and increased concentrations of hazardous elements are found in the kiln dust (UNIDO et al. 2012).

h. Metal recovery: For recovering metals from the recycling process, the obtained materials can be treated in different smelters. Ferrous metal junks can be fed into electric arc or blast furnaces (Kumar and Sutherland, 2008). The different metal fractions can be treated in copper or integrated smelters. As integrated smelters are high-tech installations only 5 - 10 smelters fit to adequately and environmentally-sound treat the ELV fractions exist, among them smelters in Belgium, Canada, Germany, Japan and Sweden (UNIDO et al. 2012). Light residues from a car shredder can be treated in secondary aluminum smelters (UNIDO et al. 2012).

i. Chemical recycling: There is the option of converting the organic content of ASR to liquid and gaseous fuels via pyrolysis or gasification (Jody et al. 2010). Through chemical recycling processes, materials such as monomers, lighty hydrocarbons, liquid and gaseous fuels could be extracted from the hydrocarbon- based fraction. The main sources of such products will be plastics and rubber. Processes that may be employed for chemical recycling include most prominently pyrolysis and gasification. Other processes are hydrolysis, selective dissolution, hydrogenation, and de-polymerization (Jody et al. 2010). Pyrolysis is the thermal decomposition of organic materials (such as wood, coal, plastics, tires) to produce fuels and chemicals (Jody et al. 2010). Gasification is a process that converts the organic component of a material in a gaseous mixture of CO, H2 and CO2 and reduced metals. Gasification reactors commonly used are moving bed, fluidized bed and entrained flow reactors (Jody et al. 2010).

j. Plastics recovery: Technologies that could be used to separate plastics from the ASR are heavy media separation, froth flotation, jigging, cryogenic grinding, use of magnets, air knives and vibrating tables (Forton et al. 2006). Plastics would have to be separated in different types to be reused (Forton et al. 2006). As the thermoplastics content in the plastics fraction in ASR is rather high (70 - 80 %) it can be recovered, heated and remolded in products such as park benches, lamp posts, road side furniture, etc. Separation technologies that could be used for this task include water elutriators and gravity separators (Jody et al. 2010). Conventional MSW recycling separators could be adjusted for the application to ASR (Jody et al. 2010).

k. Incorporation into other materials: ASR can also be recycled or stored by including it in composite, concrete or asphalt (UNIDO et al. 2012).

l. Land-filling: Land-filling of the ASR is still the most common treatment approach for this fraction as the other technologies described above are either too expensive or have significant negative environmental impacts.

14.0 Requirements for setting up of ELV recycling facility

1. The establishment of an ELV recycling facility to be based on the guidelines published, best practices adopted and regulatory requirements in India for establishing and operating "Recycling and Disposal Facilities". Such facilities shall only be set up by the formal, formalized or organized sector. The activities presently taking place in the semi-formal sector need to be integrated. They shall provide a support and channelization system for the integrated facilities that are to be established. With the increasing vehicular population a suitable infrastructure for large scale operations is needed to deal with a large number of vehicles. This would facilitate semi-formal sector into the main stream of the ELV management activities and ensure environmental compliance. The proposed mechanism for the ELV recycling facility is only an illustrative model and may need upgradation as we progress.

2. ELV Facility and operation requirements: In order to provide an infrastructure for recycling ELVs there is a need to identify large areas of land where adequate space is available for storage, handling, and recycling of ELVs. ELVs requiring treatment range from small two wheelers to large trucks and trailers. It may be possible to have different facilities for different types of vehicles but one major facility in every region catering to a number of States would be advantageous. However, the interstate movement would need to be streamlined.

3. Procedures for Setting up & Management of ELV recycling facilities

   Steps required for setting up ELV recycling facility are the following:

   i. A license shall be obtained to set up the ELV recycling industry from the appropriate authorities.
   ii. Land shall be produced in an industrial estate/area to set up the facility. Requisite layout and design approvals shall be obtained from the concerned SPCB/PCC.
   iii. In accordance with AIS PART-1 para. 4.2.4 any person(s) operating

Collection Centre(s) and Dismantling Centre(s) shall fulfill the minimum requirements in accordance with Annex A.

iv. Environmental Clearances (EC), wherever applicable, shall be obtained based on the scale of operations as prescribed in the Environmental Clearance notification dated 14 September 2006.
v. An Environmental Management Plan (EMP) shall be prepared and put in place.
vi. Facility shall obtain consents under the Water Pollution (Control & Prevention) Act, 1974 and Air Pollution (Control & Prevention) Act, 1981 from the concerned SPCB/PCC.
vii. Facility shall have authorization under HOWM Rules, 2016, from the concerned SPCB/PCC for handling, storage, packaging, transportation of hazardous to authorized recyclers and treatment and disposal facility operators. The facility shall have membership or agreement with authorized recyclers and treatment and disposal facility operators. Further, authorization under Solid Waste Management Rules, 2016 and Plastic Waste Management Rules, 2016 shall also be obtained for management of solid waste and plastic waste generated during de-pollution/dismantling /shredding activity.
viii. Requisite methodologies shall be planned for acceptance of ELVs and distribution of destruction certificates (at the end of destruction of ELVs) among the stakeholders in accordance with guidelines or policy prescribed by the concerned Transport Department.
ix. Facility shall have a written plan describing the facility's risk management objectives for environmental performance and compliance and its plans for attaining these objectives based on a "plan-do-check-act" continual improvement model.
x. Regular evaluation of Environment, Health and Safety (EH&S) objectives and monitoring of progress toward achievement of these objectives shall be conducted and documented in the facility.
xi. Facilities shall take sufficient measures to safeguard occupational and environmental health and safety. Such measures may be indicated by local, state, national and international regulations agreements, principles and standards, as well as by industry standards and guidelines.
xii. The guidelines of CPCB for storage and transportation of hazardous waste shall also be compiled with.
xiii. Training & Capacity Building for employees at different levels.
xiv. Environment, Health & Safety (E H & S)

    a. An up-to-date, written hazardous materials identification and management plan to address the specific hazardous materials

that would be handled.

b. Where materials are shredded or heated, appropriate measures to protect workers, the general public and the environment from hazardous dusts and emissions.

c. An up-to-date, written plan for reporting and responding to exceptional pollutant releases, including emergencies such as accidents, spills, fires, and explosions.

d. Liability insurance for pollutant releases, accidents and other emergencies.

e. Completion of an EH&S audit, preferably by a recognized independent auditor, on an annual basis.

xv. Facility to have a regularly implemented and documented monitoring and recordkeeping program that tracks key process parameters, compliance with relevant safety procedures, effluents and emissions, and incoming, stored and outgoing materials and wastes.

xvi. Facility to have an adequate plan for closure and shall be updated periodically and financial guarantees shall ensure that the necessary measures are undertaken upon definite cessation of activities to prevent any environmental damage and return the site of operation to a satisfactory state, as required by the applicable laws and regulations.

xvii. Finally, as laid out in AIS PART-1 para. 4.2.12 any person(s) operating Collection Centre(s) and Dismantling Centre(s) may accredit their centers/units as per ISO 14001 (Environmental Management System)

4. Registration and authorization of Recyclers processing ELVs

Basic requirements to be eligible for recycling ELVs are as follows:

a. The ELV recyclers and their facilities shall have authorization from the respective State Pollution Control Board

b. In Accordance with AIS PART-1 para. 4.2.1 any person(s) operating Collection Centre(s) and Dismantling Centre(s) shall obtain an authorization in accordance with the procedures prescribed in AIS PART-1 para. 5 "Procedure for authorization by Government certifying agency" from the concerned Government Certifying Agency (see Annex B) or as per procedures prescribed by the concerned Govt. agency.

c. Only registered and authorized recyclers shall be allowed to recycle.

ELVs Recycling shall be carried out using environmentally sound technologies and as per this document, *'Guidelines for Environmentally Sound Facilities for Handling, Processing and Recycling of End-of- Life Vehicles (ELV)".*

15.0 Management of various wastes generated during de-pollution, dismantling and shredding of ELVs

Besides obtaining useful scraps which can be channelized for reuse or recycling; de-pollution, dismantling and shredding of ELVs will generate light and heavy fractions ASR and several categories of wastes such as hazardous wastes, E-wastes, Solid wastes and plastic wastes which requires to be managed in an environmentally sound manner in compliance with provisions stipulated under Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016; E-Waste Management Rules, 2016; Solid Waste Management Rules, 2016 and Plastic Waste Management Rules, 2016, respectively.

The light ASR and heavy fractions ASR may be considered as hazardous wastes and in case authorized resource/energy recovery facilities are not available, the same shall be disposed in authorized common hazardous waste treatment, storage and disposal facility (TSDF) where the same may be imparted incineration or secured landfilling depending upon characteristics of the ASR.

(a) Management of Hazardous Wastes

Various hazardous waste generated during de-pollution/dismantling/shredding of ELVs such as Used Oil, Waste Oil, Transmission oil, brake fluid, coolant fluid, lead acid batteries, brake shoe, clutch plates, ASR, etc. requires to be managed in accordance with provisions stipulated under the Hazardous and other Wastes (Management and Transboundary Movement) Rules, 2016.

i. Application made to SPCB/PCC for grant of authorization for handling, generation, collection, storage, transportation, packaging, offering for sale, transfer, disposal, etc. under Rule 6 of the said Rules shall clearly mention categories of hazardous waste, their quantity, method of recycling/recovery/disposal, etc. which shall be carefully be examined by the SPCB/PCC. Upon assessment of the same and verification during inspection by SPCB/PCC, authorization for management of hazardous waste may be granted by SPCB/PCC stipulating categories of hazardous waste, their quantity, method of recycling/recovery/disposal, etc. and other conditions as prescribed under Form 2 of the said Rules.

ii. The storage period of hazardous wastes shall be in accordance with the Rule 8 of the Hazardous & Other wastes (Management and Transboundary Movement) Rules 2016.

iii. The wastes generated during the de-pollution/dismantling/shredding activity shall be stored under a dedicated covered storage shed.

iv. Proper slope with collection pits be provided in the storage area so as to collect the spills/leakages.

v. The de-polluting/dismantling/shredding facility shall ensure that wastes are packaged in a manner suitable for safe handling, storage and transportation. The labelling on packaging shall be readily visible and material used for packaging shall withstand physical and climatic conditions.

vi. Labelling of the hazardous waste container shall be in accordance with the provisions laid down under the HOWM Rules, 2016 and shall include the information with regard to waste type, the origin (name, address, telephone number of sender), hazardous property (e.g. flammable), and the symbol for the hazardous property (e.g. the red square with flame symbol).

vii. Drums containing wastes stored in the storage area should be labeled properly indicating mainly type, quantity, characteristics, source and date of storing etc.

viii. The collection center/de-polluting/dismantling/shredding facility shall ensure that the wastes generated during dismantling be sent or sold to an authorised collection center/ recycler/utilizer or authorised disposal facility, as case may be.

ix. The de-polluting/ dismantling/shredding facility shall maintain a record of wastes managed by him as per the format given in Form 3 of the said Rules and prepare and submit to the State Pollution Control Board, an annual return containing the details specified in Form 4 on or before the 30th day of June following the financial year to which that return relates in accordance with the said Rules.

x. Handing over of the hazardous waste to the authorised actual user shall be only after making the entry into the passbook of the authorised recycler/utiliser. Further, such authorised recycler/utiliser shall also maintain records of wastes purchased in a passbook issued by the State Pollution Control Board/Pollution Control Committee along with the authorization.

xi. The transport of hazardous waste containers shall be in accordance with the provisions of the Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 and the rules made by the Central Government under the Motor Vehicle Act, 1988 and other guidelines issued from time to time.

xii. Manifest System shall be followed for movement of wastes. The flow of manifest document (which contains details of waste description & quantity, senders, transporters, receivers, acknowledgements by transporters and senders, etc.) as prescribed under the Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016, are as below:

Copy number with colour code	**Purpose**
(1)	**(2)**
Copy 1 (White)	To be forwarded by the sender to the State Pollution Control Board after signing all the seven copies.
Copy 2 (Yellow)	To be retained by the sender after taking signature on it from the transporter and the rest of the five signed copies to be carried by the transporter.
Copy 3 (Pink)	To be retained by the receiver (actual user or treatment storage and disposal facility operator) after receiving the waste and the remaining four copies are to be duly signed by the receiver.
Copy 4 (Orange)	To be handed over to the transporter by the receiver after accepting waste.
Copy 5 (Green)	To be sent by the receiver to the State Pollution Control Board.
Copy 6 (Blue)	To be sent by the receiver to the sender.
Copy 7 (Grey)	To be sent by the receiver to the State Pollution Control Board of the sender in case the sender is in another State.

(b) Management of Ozone depleting substances

The refrigerant gases used in vehicle air conditioning systems may contain ozone depleting substances and may require to be regulated as per Ozone Depleting Substances (Regulation and Control Rules), 2000, or other policies/directions issued by Central Govt. from time to time. The collected refrigerant gases shall be channelized for recovery/reuse

to such registered recovery/reuse facility, as applicable. In case such recovery/reuse is not feasible or available, the same shall be destroyed in destruction facility recognized by Central Government or the appropriate authority, as applicable.

(c) Management of E-Wastes

Air conditioners, display unit, circuit board, music system, etc., which are not in usable condition, shall be treated as E-waste during de-pollution/dismantling/shredding of ELVs. Such E-wastes shall be channelized to dismantlers/recyclers authorized under the E-Waste Management Rules, 2016. Records of such E-wastes generation and storage shall be maintained along with authorized dismantlers/recyclers to whom the same have been channelized. Manifest system for transportation of such E-wastes as prescribed under the said Rules shall be followed. Further, Annual Returns be submitted to the concerned SPCB/PCC by 30th June following the financial year to which that return relates, as stipulated under the said Rules.

(d) Management of Plastic Wastes

The plastic waste generated during de-pollution/dismantling/shredding of ELVs shall be channelized to registered recyclers authorized under the Plastic Waste Management Rules, 2016. Records of such plastic waste generation and storage shall be maintained along with registered recyclers to whom the same have been channelized. Further, Annual Returns be submitted to the concerned SPCB/PCC by 30th April of every year, as stipulated under the said Rules.

(e) Management of Solid Wastes

The solid wastes, which are not hazardous, shall be segregated, stored and the segregated waste be handover to authorized waste pickers or waste collectors in accordance with Solid Waste Management Rules, 2016. Records of such solid waste generation and storage shall be maintained along with authorised waste pickers to whom the same have been channelized. Further, Annual Returns be submitted to the concerned SPCB/PCC by 30th April of every year, as stipulated under the said Rules.

ANNEX-A
MINIMUM TECHNICAL REQUIREMENTS FOR COLLECTION AND DISMANTLING CENTRE

A.1 Sites for storage (including temporary storage) of End-of-Life Vehicles prior to their dismantling

The Collection and Dismantling Centers shall have:

A.1.1 impermeable surfaces like concrete flooring, etc for appropriate areas (including areas where vehicles are stored prior to de-pollution as necessary) with the provision of spillage collection facilities, decanters and cleanser-degreasers.

A.2 Sites for dismantling

The Collection and Dismantling centers shall have:

A.2.1 impermeable surfaces like concrete, etc for appropriate areas with the provision of spillage collection facilities, decanters and cleanser-degreasers,

A.2.2 appropriate storage for dismantled spare parts, including impermeable storage for oil-contaminated spare parts,

A.2.3 appropriate containers for storage of batteries (with electrolyte neutralization on site or elsewhere), and filters/ PCB/PCT-containing condensers (if applicable),

A.2.4 appropriate storage tanks for the segregated storage of End-of-Life Vehicle fluids: fuel, motor oil, gearbox oil, transmission oil, hydraulic oil, cooling liquids, antifreeze, brake fluids, air-conditioning system fluids and any other fluid contained in the End-of-Life Vehicle,

A.2.5 appropriate storage for used tyres, including the prevention of fire hazards and excessive stockpiling.

A.3 Dismantling operations for de-pollution of End-of-Life Vehicles:

The Collection and Dismantling centers shall possess the equipments and facilities required for:

A.3.1 removal of batteries,

A.3.2 removal of liquefied gas tanks,

A.3.3 neutralization of potential explosive components, (e.g. air bags),

A.3.4 removal and separate collection and storage of fuel, motor oil, transmission oil, gearbox oil, hydraulic oil, cooling liquids, antifreeze, brake fluids, air-conditioning system fluids and any other fluid contained in the end-of-life vehicle, unless they are necessary for the re-use of the parts concerned,

A.3.5 removal, as far as feasible, of all components identified as containing heavy metals as identified in Annex A of AIS-129 : Part - 2 A.

A.4 Dismantling operations in order to promote recycling:

The Collection and Dismantling Centers shall possess the equipments and facilities required for:

A.4.1 removal of catalysts, to facilitate further extraction of noble metals by recyclers.

A.4.2 removal of metal components containing copper, aluminum and magnesium in such a way that they can be effectively recycled as materials, if the End-of-Life Vehicle is not going to be treated in a shredder.

A.4.3 removal of tyres and large plastic components (bumpers, dashboard, fluid containers, etc) in such a way that they can be effectively recycled as materials.

Note: removal of large plastic components is recommended only if they can be dismantled and recycled in an economical and profitable manner.

A.4.4 removal of glass in such a way that it can be effectively recycled as materials.

Note: removal of glass is recommended only if the glass can be dismantled and recycled in an economical and profitable manner.

A.5 Storage operations shall be carried out to avoid damage to components containing fluids or to recoverable components and reusable parts.

A.6 **Recommended Tools & Equipment for Pre-treatments (Draining and Dismantling):**

Shredder/ Bailing press for compacting / any suitable device

AC gas Recovery unit

Vehicle Lift

Auto Shear machine for cutting catalytic converter

Air Bag Deployment unit

Filter wrench/ Oil Filter Removal Tool

Wheel Popper

Piercing equipment for damper oil

Suction equipment for fluid

Bleeding system for brake fluid

Dedicated fluid collection container

Hydraulic tube cutter

Pneumatic saw

Portable power tool

Draining Tray

Pry bar/Spanner/Ratchet/ Mallet

Screw driver/Slot screwdriver/ Impact screwdriver

Cutter/cutting pliers/ Special Plier

Center Punch & bag (for glass breakage & collection)

Windshield removal tool

Pneumatic air gun Water supply

ANNEX-B

FORM —1

(See clause 5.1)

APPLICATION FOR OBTAINING AUTHORIZATION FOR COLLECTION AND DISMANTLING OF END-OF-LIFE VEHICLE

From:

To

The Government Certifying Agency

…….

……

Sir,

I/We hereby apply for authorization/renewal of authorization under CMVR, Rules 1989 for collection and dismantling of End-of-Life Vehicle.

To be filled in by Applicant

1. (a) Name and full address, telephone nos. e-mail and other contact details of the unit :

   (b) In case of renewal of authorization previous authorization no. and date

2. (a) Total capital invested on the project :

   (b) Year of commencement:

   (c) Date of grant of the Consent to Establish:

   (d) Date of grant of the Consent to Operate:

   (e) Mode of storage within the plant:

   (f) Method of dismantling and disposal:

   (g) Installed capacity of the plant:

3. Detailed proposal of the facility (to be attached) to include:

(i) Location of site (provide map)……

(ii) Details of processing technology……

(iii) Quantity of waste to be processed per day……

(iv) Site clearance (from local authority, if any)……..

(v) Method of disposal of residues (details to be given)……..

(vi) Quantity of ELV to be processed or disposed per day……..

(vii) Methodology and operational details…….

(viii) Measures to be taken for prevention and control of environmental pollution including dismantling of leachates.....

(ix) Investment on Project and expected returns…….

(x) Measures taken for safety of workers working in the plant…….

Place: _____ Signature _____

(Name_____)

Date: _____

Designation: _____