

PricewaterhouseCoopers

PricewaterhouseCoopers Pvt. Ltd
2/5, Sarat Bose Road
Kolkata 700 020
Ph.: 91 (33) 24748523, 24752910, 2476
0420
Fax: 91 (33) 24858897

JUTE ECOLABEL

Disposal Protocol



www.jute.com/ecolabel
THE GOLDEN NATURAL FIBRE

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Context and Objective

Jute is accepted world over as a biodegradable product that has originated naturally from plant source. However, no formal disposal protocol was available so far to ensure the disposal pathways of jute products. One of the objectives of the present study was to develop a disposal protocol for USA and two other EU countries based on legal requirements in these countries. The physical, chemical and biological properties of jute and the possible environmental impacts of jute disposal by various means were also considered while designing the disposal protocols.

The study had several sub objectives and they are:

- To understand the regulatory and other requirements for the disposal of biodegradable matter in USA and two EU countries;
- To analyse the physical and chemical properties of jute and the end products of its disposal through various methods such as incineration, land-filling, waste to energy, recycle etc.
- To develop the disposal protocol for different jute products like Jute Hessian, sacking, Food grade jute (Hessian or sacking), floor covering and shopping bag by analyzing different options for end of life disposal of respective jute products.
- To explore different alternative options for disposal permitted by regulations, and
- To recommend the disposal options that are permissible from environmental standpoint. The economic and commercial aspects of jute disposal were beyond the scope of the present assignment and were not considered while recommending the disposal options.

This document describes the disposal regulations that apply for jute waste (such as jute) in two countries in Europe (Germany, the UK and France) and in the United States. All routes of disposal applicable for biodegradable packaging waste currently practiced and proposed such as: landfill disposal, incineration with energy recovery, mechanical biological treatment, recycling (including composting and anaerobic digestion) have been considered. For each country, the document delineates the current waste treatment options and its recycling and recovery objectives to comply with the regulations. A list of the existing waste recyclers in the UK is also presented.

Summary recommendations

Disposal options→ Product↓	Recycle and reuse (Note 2)	Landfill (managed, with methane recovery)(Note 3)	Composting	Incineration with energy recovery (Note 4)
Jute yarn	√√	√√	√√	√√
Jute Hessian	√√	√	√	√
Food grade quality jute Hessian or sacking	√√	√√	√√	√√
Floor covering	√√	√	√	√√
Jute Geotextiles (woven and non woven) (Note 1)	NA	NA	NA	NA
Jute shopping bag	X	√	√	√√

√√ : most preferred, green disposal option, may be followed without any adverse environmental impacts

√ : may be followed with some mitigation measures

X: should not be followed

Note 1: The intended application of jute geotextile is as soil saver. With time the JGT merge with the soil without any harmful environmental impacts and hence no separate disposal is required. The ecolabel criteria for JGT ensures that there are no significant environmental impacts of Jute geotextiles blending with soil.

Note 2: According to the German Packaging Ordinance, 80% of waste packaging is to be collected by industry by 1995, with specific targets established for certain types of packaging (an interim collection target of 50% from January 1993 is in force). Reuse and recycling is the most preferred option.

Compliance with the recovery requirement within EU :

All packaging, including reusable packaging, must fulfil at least one of the following:

1. Recoverable through material recycling;
2. Recoverable through energy recovery;
3. Recoverable through composting;
4. Biodegradable.

The last two options are not advised for crop/food packaging such as tobacco, potato, coffee, cocoa and other food items.

Note 3 :Under the EU landfill directive, the aggregate heavy metal limits apply to cadmium, mercury, lead and hexavalent chromium. The total by weight should not exceed 100 ppm on or after 30th June 2001. Jute products comply with this criteria (Reference : The Packaging (Essential Requirements) Regulations 2003 (S.I. 2003 No 1941)).

In both Germany and in the UK, legislation permits biodegradable materials for landfill provided the landfill gas is captured and flared or used for energy. However, the trend is to send lesser quantities of biodegradable material to landfills. Jute is accepted as biodegradable material under The Packaging (Essential Requirements) Regulations 2003 . (Reference : _Report from the commission to the council and the European parliament on the national strategies for the reduction of Biodegradable waste going to landfills pursuant to article 5(1) of directive 999/31/ec on the landfill of waste, SEC 2005, 404 Commission of the European Communities).

Note 4 : Jute products have a net calorific value that is comparable to that of coal (18.6 Mj/kg). Jute is a natural fibre containing almost 40% of carbon. The CO2 emission from jute is considered to be carbon neutral since the product is from plant source and can be considered a biomass (Reference : http://www.greenfloors.com/HP_Linoleum-Index.htm).

In Germany, no incineration without energy recovery is permitted. Jute has a good calorific value and the ash after incineration does not have any hazardous constituent exceeding permissible limits. Jute is a natural fiber and ecolabled jute does not allow addition of hazardous material during manufacturing and hence incineration with energy recovery is possible (Reference : EU Directive on Incineration of waste , 2000 ; Renewable Energy Sources Act, Federal Law Gazette I, page 1872, 22 July, 1976 and Ordinance on the

Generation of Electricity from Biomass (Biomass Ordinance), Federal Law Gazette I, page 1234, 21 June 2001).

Moreover, jute, being a natural fibre, cultivated and processed through green practices as delineated in the Ecolabel document would present more positive environmental footprints throughout its life cycle phases. The various approaches for jute disposal bring about an opportunity for jute products not only to create positive life cycle impacts, but also to create opportunity to reduce the impact on the global environment as a whole.

Selection of country of interest

In the periodic consultation meeting¹ with the Jute Manufactures Development Council and industry representatives, India USA and two other EU countries viz., UK and Germany were selected as the target audiences for the disposal protocol. Inclusion of Germany, having significantly stringent environmental rules and regulations, as one of the two EU countries, would ensure that the outcome of the study remain effective for most of the EU countries from an environmental legal standpoint. UK and USA are important markets and have emerging green consumers in those countries who wish to know disposal protocols.

¹ It was suggested in the Inception meeting held on 15th February, 2005, that the target export markets for consideration of disposal protocol were identified to be: USA and two EU countries (Germany, UK or Netherlands). Further it was reported in First quarterly Report (May, 2005) that among two EU countries, other than UK, Germany may be included. Germany has an emerging market as well as some very stringent rules and regulation regarding disposal, for which ecolabel may be able to position jute. Therefore, UK and Germany was accepted as target country for disposal protocol (Refn. JMDC Letter dated 20th July, 2005)

Waste management routes

Background Information

Waste management routes in European countries

The European legislation applies to all individual country members of the European Union². However, each Member State is responsible for transposing and enforcing the European regulation locally. Thus, in spite of common objectives, the waste management systems are quite different from one country to the other.

The following paragraph sets out the two main Directives that concern biodegradable packaging waste – **The Landfill Directive and The Packaging Directive**. This is followed by each country's waste management system, the current situation and the country's objective (if more stringent than the European targets).

The European legislation

The Landfill Directive: Council Directive 1999/31/EC.

The Landfill Directive stipulates that waste shall be pre-treated prior to their landfilling and includes reduction targets for the landfill of biodegradable waste.

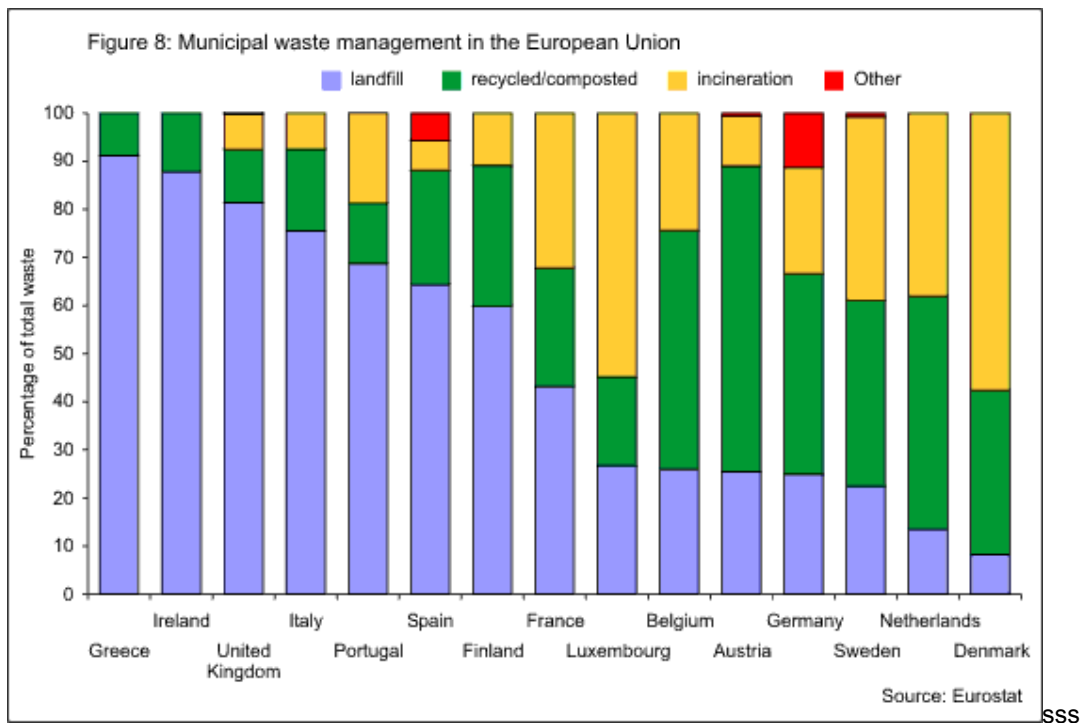
Article 5 of the Landfill Directive sets out a schedule for Member States to reduce the amount of biodegradable municipal waste landfilled. This has to be reduced in the following manner:

time frame	quantities of biodegradable municipal waste disposed in landfill in % of the total amount (by weight) produced in 1995
by 2006	75%
by 2009	50%
by 2016	35%

² List of member states, applicants and non-members can be found at http://europa.eu.int/abc/governments/index_en.htm

Some Members States such as the UK and Ireland, who were landfilling more that 80% of all municipal waste in 1995, have a 4 year derogation period.

However, other EU countries have already fixed national regulations which are more stringent. Some national restrictions on landfilling of combustible/organic waste are in effect in some countries such as France and Germany (see specific paragraphs).



source: <http://www.defra.gov.uk/environment/statistics/waste/kf/wrkf08.htm>

The Landfill (England and Wales) Regulations, 2002

The Landfill (England and Wales) Regulations, 2002 implement the bulk of the Landfill Directive in England and Wales. Article 5 of the Directive, which sets challenging targets to reduce the amount of biodegradable municipal waste (BMW) being sent to landfill, is being implemented in the UK through the Waste and Emissions Trading (WET) Bill.

The Packaging and Packaging Waste Directive: Directive 2004/12/EC amending the Directive 94/62/EC

The Packaging Directive deals with the minimisation of waste and the amount of packaging material that should be recycled. It promotes energy recovery, re-use and recycling of packaging. Another aim of the Directive was to harmonise national measures of all Member States. The Directive 2004/12/EC amending the Directive 94/62/EC has increased the recycling targets for the Member States to be met,

	Recovery	Recycling
Time frame	Percentage by weight of packaging waste that are recovered or incinerated at waste incineration plant with energy recovery	Percentage by weight of packaging waste that are recycled
by 30/06/2001	between 50 and 65%	between 25 and 45%
by 31/12/2008	60% minimum	between 55 and 80%

Regarding the European terminology for packaging, jute packaging should be considered a part of the “other packaging” category. The specific categories for which targets are clearly defined in EU regulation are Glass, Paper and board, Plastic, Wood and Metal.

The Landfill Directive is an Extended Producer Responsibility regulation: In all Member States economic operators within the packaging chain (manufacturers, packers, distributors, importers) are responsible for packaging waste management.

The industry has built up organisations in all Member States to comply with this legal obligation. Those organisations -called Compliance Schemes- co-ordinate the collection and the recovery of waste and play an interface role between the different actors of the life cycle of the packaging products (industries, consumers, public legal entities, recyclers). It should be noted that generally economic actors can choose between transferring their obligation to the compliance scheme or fulfilling their obligations by themselves. Compliance scheme are carried out in all Member States but to a very different extend (see specific paragraph for each country).

At European level, the Compliance schemes are part of PRO-Europe (<http://www.pro-e.org/>).

The recovery and recycling treatments in Europe

The main recovery and recycling treatments for biodegradable waste that have been developed in Europe are the following:

1. Thermal treatment

- Incineration with energy recovery:
 - mass burn incineration,
 - Incineration of refuse-derived fuel: waste are shredded and either burned directly or pelletised prior to combustion.
 - Fluidised bed incineration: operation with a bed of hot sand (a pre-treatment is required to obtain wastes that are all of the equal size).
- Pyrolysis and Gasification with energy recovery: relatively new methods for treatment of municipal solid waste. Relatively unproven in Europe usage compared to other treatments.

2. Biological treatment

- Mechanical Biological Treatment (MBT): treatment designed to recover materials and to stabilise the organic fraction or residual waste. The process includes the shredding/crushing and screening of materials and then the segregation and conditioning (drying) of waste. Depending on the process configuration, the residues can be incinerated (Refuses Derived Fuel or RDF) or landfilled (if residues are Stabilised Organic Fraction, a low grade form of compost not suitable for agricultural purposes)
- Separate collection and Recycling options including Anaerobic digestion and Composting:
 - Composting (biodegradation of organic matter through a self heating, solid phase, aerobic process). Good separate collection is required to produce compost of a consistent and reliable quality.
 - Anaerobic Digestion (bacterial decomposition of organic material in the relative absence of oxygen. The digestate (semi-solid residue) after further treatment may be used for agricultural purposes. This process requires a pre-treatment(separation) and a post-treatment (separation of solid and liquid fractions)

A potential benefit of the property of the Jute material is its suitability to be treated by all of the above processes, which is not the case of alternative materials (plastics). The suitability of the MBT, composting and AD processes for Jute would need to be investigated further.

Situation in the UK

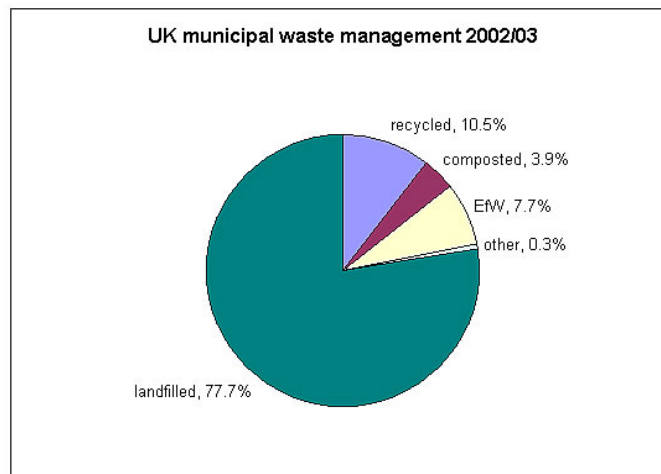
Landfill

The following table show the progress from 1995 to 2004 in the UK regarding municipal waste treatment: If recycling has increased significantly over the last few years (from 7% in 1996 to 20% in 2004), progress in reducing landfill has been slower.

Kg per person per year	1995/6	2001/2	2003/4
Waste not recycled	423	456	425
Waste recycled/composted	27	60	87
Total waste	450	516	512

Source: DEFRA

The current repartition of the route for municipal waste is detailed below:



Source: <http://www.wasteonline.org.uk>

Packaging waste management and compliance scheme

The following table shows the current percentages and the UK government business targets for recycling and recovery of some packaging waste set by DEFRA (the Department for Environment, Food and Rural Affairs) for the following years.

Material	2004	2005	2006	2007	2008
Overall recovery	63%	65%	67%	69%	70%
Paper recycling	65%	66%	68%	69%	70%
Plastic recycling	21.5%	22%	22.5%	23%	23.5%
Minimum recycling	94%	94%	94%	95%	95%

Source: <http://www.valpak.co.uk/nav/page1025.aspx>

Note: Minimum recycling represents the percentage of Overall Recovery that must be met by recycling rather than recovery.

Compliance scheme: the PRNs

In UK, the Packaging waste recovery Note (PRN) concept has been developed as a means of providing evidence of compliance. The reprocessors sell the PRNs to compliance schemes and individual producers. The profit made on the sale of those PRNs should cover all costs for the collection, recovery of the various packaging materials.

The list of UK compliance schemes can be found in appendix.

The Landfill (England and Wales) Regulations 2002:

The Landfill (England and Wales) Regulations 2002 implement the bulk of the Landfill Directive in England and Wales. Article 5 of the Directive, which sets challenging targets to reduce the amount of biodegradable municipal waste (BMW) being sent to landfill, is being implemented in the UK through the Waste and Emissions Trading (WET) Bill.

Situation in Germany

Landfill

The Household waste regulation (TA Siedlungsabfall) that has taken effect from June 1, 2005, sets out that only waste with an organic substance content $\leq 5\%$ by weight may be deposited in a landfill in the case of incinerated waste or, with an organic share of the dry residue $\leq 18\%$ by weight (determined as TOC) in the case of mechanically-biologically treated waste.

Packaging waste management and compliance scheme

In 2001, 74% of packaging waste was already recycled in Germany.

The German Packaging Ordinance: In recent years the German Packaging Ordinance has been the focus of policy attention in Europe. The Ordinance (commonly known as the Topfer Decree) covers all types of packaging waste and obliges manufacturers and distributors to take back packaging for reuse or recycling outside the public waste disposal system. The German Ordinance states that all packaging should be returned to the retailer unless a separate collection system is set up.

Compliance scheme: the Duales System

The work of Duales System Deutschland AG³ is based on the Packaging Ordinance that stipulates that used packaging must be recycled and that material-specific recycling targets must be fulfilled. Thus, DSD AG as a private enterprise organises the collection and sorting of used sales packaging as well as its transportation to the recycling plants.

Trade and industry in their role as the producers of packaging waste conclude contracts with DSD AG which exempt them from their take-back and recycling obligation. They also pay licence fees for the right to use the Green Dot. This symbol is printed on packaging and means that the manufacturers concerned have paid a financing contribution to the Dual System for collecting, sorting and recycling this packaging.

DSD AG in turn enters into contracts with the waste management partners who are responsible for collecting and sorting the waste and forwarding it for recycling.

³ www.gruener-punkt.de

Complementary information about waste treatment in Germany:

- Composting
In 2001 there were about 900 composting sites in Germany.

- Anaerobic digestion
The number of anaerobic digestion plants lies between 500 and 800. Around 37 large industrial digestion plants treat pure bio-waste, in total around 500.000 tonne.

- Biological-mechanical Pre-treatment
In order to save land filling capacity and to meet the requirements of the TA Siedlungsabfall more and more plants are built in Germany to reduce the organic content in the residual waste with pre-treatment composting or digestion technologies. In 2001 around 47 pre-treatment plants processed 2.4m tonnes waste essentially with incineration of Refuse Derived Fuel.

Waste management routes in the US

Waste management policy is dealt with at State level.

In 2003, 30% of the municipal waste was recovered and recycled or composted, 14 percent was burned at combustion facilities, and the remaining 56 percent was disposed of in landfills.

EPA has ranked the most environmentally sound strategies for MSW. Source reduction (including reuse) is the most preferred method, followed by recycling and composting, and, lastly, disposal in combustion facilities and landfills. The Environmental Protection Agency has set a national goal of recycling 35% of America's municipal solid waste.

Several national programs have been launched to increase waste prevention and to divert waste from landfills and incinerators. For example:

- Climate change and waste: promotes waste prevention, reuse and recycling in order to reduce emissions of greenhouse gases.

- Pay-As-You-Throw: system where households pay for garbage collection by the amount of trash collected rather than a flat fee. Households save money by throwing away less garbage and recycling. In 2000, more than 5,000 U.S. cities were using Pay-As-You-Throw Programs, in which residents paid for MSW collection based on the amount of waste they throw away—encouraging recycling and waste reduction.

Landfill:

Under the Resource Conservation and Recovery Act (RCRA), landfills that accept MSW are primarily regulated by state, tribal, and local governments. EPA, however, has established national standards these landfills must meet in order to stay open.

In addition to those programs, the most environmentally sound strategies such as composting and recycling have been promoted. Among them, composting of yard trimming and recycling could be of interest to the jute packaging:

- Composting of yard trimming

Yard trimmings: In large part, backyard composting and yard trimmings collection and recovery programs have become quite popular (In 2000, 57% of yard trimmings was recycled, (12% in 1990).The composting industry has grown rapidly over the past decade, and it provides an alternative to traditional disposal options for yard trimmings. Many local and regional yard trimmings collection programs have been set up.

- Recycling

Recycling programs concern items, such as paper, glass, plastic, and metals. Clothes and other textile products (considered as “non-durable” products) were recovered for recycling or export at a rate of 16% in 2003.

Despite national targets and national programs, waste management strategy and regulation are defined by each US state governments. For example there is no comprehensive, federal extended producer responsibility law in the United States (such as Packaging waste Directive in Europe), although states and cities have created recycling programs calling for specified percentage diversions of waste from the waste stream.

As the Pacific Southwest region is known to be quite advanced, the situation in California can give a good forecast of the evolution in waste management in the US. In California, 66 millions tonnes of municipal waste are generated per year and about a third is packaging. The Recycling and Solid Waste Program of EPA's Pacific Southwest Regional Office promotes waste reduction, recycling, and the safe and effective management of municipal solid waste. California's policy is to improve Packaging efficiency and reduce Packaging waste. Projects include eliminating packaging, reducing packaging, designing refillable or reusable packages, and producing recyclable packages.

Municipal Solid Waste Landfills

Municipal solid waste landfills (MSWLFs) receive household waste. MSWLFs can also receive non-hazardous sludge, industrial solid waste, and construction and demolition debris. All MSWLFs must comply with the federal regulations in 40 CFR Part 258 (Subtitle D of RCRA), or equivalent state regulations. Federal MSWLF standards include:

- Location restrictions—ensure that landfills are built in suitable geological areas away from faults, wetlands, flood plains, or other restricted areas.
- Composite liners requirements—include a flexible membrane (geomembrane) overlaying two feet of compacted clay soil lining the bottom and sides of the landfill, protect groundwater and the underlying soil from leachate releases.
- Leachate collection and removal systems—sit on top of the composite liner and removes leachate from the landfill for treatment and disposal.
- Operating practices—include compacting and covering waste frequently with several inches of soil help reduce odor; control litter, insects, and rodents; and protect public health.
- Groundwater monitoring requirements—requires testing groundwater wells to determine whether waste materials have escaped from the landfill.
- Closure and post closure care requirements—include covering landfills and providing long-term care of closed landfills.
- Corrective action provisions—control and clean up landfill releases and achieves groundwater protection standards.
- Financial assurance—provides funding for environmental protection during and after landfill closure (i.e., closure and post closure care).

Some materials may be banned from disposal in municipal solid waste landfills including common household items such as paints, cleaners/chemicals, motor oil, batteries, and pesticides. Leftover portions of these products are called household hazardous waste. These products, if mishandled, can be dangerous to health and the environment. Many municipal landfills have a household hazardous waste drop-off station for these materials.

Bioreactor Landfills

Bioreactors are municipal solid waste landfills that are designed to quickly transform and degrade organic waste. The increase in waste degradation and stabilization is accomplished through the addition of liquid and, in some cases, air to enhance microbial processes. Bioreactors are a new approach to landfill design and operation that differ from the traditional "dry tomb" municipal landfill approach.

Solid Waste Combustion/Incineration

Burning MSW can generate energy while reducing the amount of waste by up to 90 percent in volume and 75 percent in weight.

To reduce waste volume, local governments or private operators can implement a controlled burning process called combustion or incineration. In addition to reducing volume, combustors, when properly equipped, can convert water into steam to fuel heating systems or generate electricity. Incineration facilities can also remove materials for recycling.

Over one-fifth of the U.S. municipal solid waste incinerators use refuse derive fuel (RDF). In contrast to mass burning, where the municipal solid waste is introduced "as is" into the combustion chamber, RDF facilities are equipped to recover recyclables (e.g., metals, cans, glass) first, then shred the combustible fraction into fluff for incineration.

A variety of pollution control technologies significantly reduce the gases emitted into the air, including:

scrubbers—devices that use a liquid spray to neutralize acid gases

filters—remove tiny ash particles

Burning waste at extremely high temperatures also destroys chemical compounds and disease-causing bacteria. Regular testing ensures that residual ash is non-hazardous before being landfilled. About ten percent of the total ash formed in the combustion process is used for beneficial use such as daily cover in landfills and road construction.

Electricity from Municipal Solid Waste

Currently, over thirty percent of MSW generated in the United States is recycled annually. While not producing this waste in the first place is the preferred management strategy for this material, recycling is preferred over any method of disposal. The majority of MSW that is not recycled is typically sent to landfills after it is collected. As an alternative, MSW can be directly combusted in waste-to-energy facilities to generate electricity. Because no new fuel sources are used other than the waste that would otherwise be sent to landfills, MSW is often considered a renewable power source. Although MSW consists mainly of renewable resources such as food, paper, and wood products, it also includes non-renewable materials derived from fossil fuels, such as tires and plastics.

At the power plant, MSW is unloaded from collection trucks and shredded or processed to ease handling. Recyclable materials are separated out, and the remaining waste is fed into a

combustion chamber for burning. The heat released from burning the MSW is used to produce steam, which turns a steam turbine to generate electricity.

The United States has about 892 operational MSW-fired power generation plants, generating approximately 2,500 megawatts, or about 0.3 percent of total national power generation. However, because construction costs of new plants have increased, economic factors have limited new construction.

The Combustion and Incineration Regulations: 40 CFR Part 60 (Subchapter C - Air Programs) govern the environmental performance of these incinerators.

http://www.epa.gov/epaoswer/non-hw/muncpl/landfill/sw_combst.htm

Disposal criteria

The Jute waste can be classified under the biodegradable municipal solid waste. An analysis of Jute indicates the following constituents and properties in the table below by the virtue of which it can be seen that jute products not only degrade naturally but also form a good source of waste to energy if so used without possibility of contaminants being present.

TABLE: Proximate analysis and Ultimate analysis of Jute Products

SR. NO.	PARAMETER	PROTOCOL	RESULT	UNIT
PROXIMATE ANALYSIS				
1	Jute Yarn			
	Moisture	By AOAC : 2000	9.42	%WW
	Ash	By AOAC : 2000	0.86	%WW
	Cellulose	By UV Spectrophotometer	62	%
	Lignin	By UV Spectrophotometer	17.01	%
	Acetyl Value	By AOAC : 2000	Nil	
	Volatile matter	By AOAC : 2000	2.28	%
2	Jute Shopping bag			
	Moisture	By AOAC : 2000	7.85	%WW
	Ash	By AOAC : 2000	2.12	%WW
	Cellulose	By UV Spectrophotometer	64	%
	Lignin	By UV Spectrophotometer	18.62	%
	Acetyl Value	By AOAC : 2000	Nil	
	Volatile matter	By AOAC : 2000	3.29	%

(Source: Analysis carried out by SGS Limited, India)

SR. NO.	PARAMETER	PROTOCOL	RESULT	UNIT
ULTIMATE ANALYSIS				
3	Jute Yarn			
	C	IS 1350 PART 4 SECI & SEC II	42.3	%
	H	IS 1350 PART 4 SECI & SEC II	5.46	%
	N	IS 1350 PART 4 SECI & SEC II	0.21	%
	S	IS 1350 PART 3	0.01	%
	O	IS 1350 PART 4 SECI & SEC II	40.77	%
	HHV	IS 1350 PART 2	4260	cal/kg
4	Jute Shopping bag			
	C	IS 1350 PART 4 SECI & SEC II	42.9	%
	H	IS 1350 PART 4 SECI & SEC II	5.44	%
	N	IS 1350 PART 4 SECI & SEC II	0.11	%
	S	IS 1350 PART 3	0.11	%
	O	IS 1350 PART 4 SECI & SEC II	41.04	%
	HHV	IS 1350 PART 2	4690	cal/kg

(Source : _ Analysis carried out by SGS Limited, India)

In this section, the GHG impacts of waste management for Jute products in the municipal solid waste stream is projected on the basis of life cycle assessment and the following options are explored :

- a. Reuse and recycle
- b. Incineration
- c. Landfill
- d. Composting
- e. Waste to Energy Process
- f. Opportunity for JI projects

a. Reuse and Recycle:

Recycling can reduce GHG emissions at the manufacturing stage and avoid landfill methane emissions. Recycling of jute products increases the storage of carbon. Hence maximum use of jute products is encouraged to minimize the Greenhouse gas impacts in the Jute life cycle.

Jute products like Hessian cloth and sackings, after their intended use can be recycled to manufacture non woven jute geotextile or Jute felt. The feasibility of this alternative depends on the logistics and availability of the used jute products like sacking, Hessian like packaging material etc. in quantities and in proximity to the non-woven manufacturing centre.

Moreover, most jute products can be recycled for multiple uses.

b. Incineration:

Burnt in an energy-producing incineration plant, jute products produce a residual calorific value that is comparable to that of coal (18.6 MJ/kg). Jute is a natural fibre containing almost 40% of carbon. Jute can be considered a carbon neutral as it is from plant sources. During the growing of jute the plant sequesters carbon.

c. Landfill:

As a common alternative to incineration, jute can be safely added to landfill refuse sites, where natural decomposition takes place. Jute is fully biodegradable and does not release harmful substances or gases such as dioxins.

As a biodegradable material, jute will enhance the possibility of contributing towards landfill methane emission. There are legislative restrictions in EU countries for disposing the biodegradable material in landfill. Therefore, jute can only be disposed off in a managed landfill with necessary facility for methane capture and utilization. The expected methane generation per tonne of jute is 0.125.

The performance of the managed landfill will be depending on:

- (1) The percentage of land filled waste sent to landfills with gas recovery and
- (2) methane oxidation rate and gas collection system efficiency.

d. Composting:

Compost can be defined as material derived from aerobic decomposition of recycled plant waste, biosolids, or other organic material. The composted material shall be fully composted and to have maintained a temperature above 55 degrees Celsius or 131 degrees Fahrenheit for at least 15 days as per EPA/40 CFR Part 503. The composted material has moisture content such that no visible free water or dust is produced when handling the material.

Compost products shall meet the following physical criteria:

- 100 percent shall pass through a 1-inch sieve when tested in accordance with AASHTO T87 and T88.
- The pH range shall be between 5.0 and 8.5.
- Foreign material (plastic, minerals soils, concrete, metal, etc.) shall not be more than 2 percent of the compost dry weight.
- Compost shall comprise not more than 50% amended of the soil.
- Acceptance of composted products shall be based on the following submittals by the contractor:
 - A request for Approval of a Material Source.
 - A copy of the Composting Permit for the Material Source selected.
 - Certification by the supplier that the compost product originates 100 percent from recycled organic material that has been aerobically composted

Composting of jute products: Jute products fulfill the above said requirements as follows:

- The pH of the jute is 6.5
- Generally the jute bags do not contain any foreign material such as plastic, metals etc. Only in case of some laminated shopping bag, the LDPE content is about 5-10%.⁴
- Ecolabeled jute product further enhances the environmental benefits of the natural fibre, by making it suitable for aerobically composting.

⁴ The data reported is based on our collected data (from shopping bag units)

e. Waste to Energy Processes:

When waste is combusted, energy recovery displaces fossil fuel-generated electricity from utilities (thus reducing GHG emissions from the utility sector), and landfill methane emissions are avoided. Waste-to-energy facilities produce clean, renewable energy through the combustion of municipal solid waste in specially designed power plants equipped with the most modern pollution control equipment to clean emissions.

Ash residue from waste-to-energy facilities represents about 10% by volume of the original trash. The ash is tested in accordance with strict state and federal leaching tests and is consistently shown to be safe for land disposal and reuse. Ash makes good cover in landfills because it exhibits concrete-like properties causing it to harden once it is placed and compacted in a landfill, reducing the potential for rainwater to leach contaminants from trash landfills into the ground. Waste-to-energy ash is beneficially reused as landfill cover, roadbed or building material.

f. opportunity for JI projects:

The Joint Implementation (JI) scheme helps industrialized countries reduce greenhouse gas (GHG) emissions cost-efficiently. It also encourages transfer of technology and know-how between cooperating countries.

A JI project is a cost-efficient way for industrialized countries that have signed the Kyoto Protocol to meet reduction commitments. It is also an incentive for industrialized countries to share knowledge on green technology. Cooperating parties earn emission reduction units (ERU) for their efforts.

JI investors can use the emissions reduction acquired from the project to increase their emissions allowance. For the host country that transfers the emission reduction the emissions allowance is correspondingly reduced.

Cost-efficient emissions cutting: The JI scheme provides for a cost-effective implementation of the Kyoto Protocol, where emissions reductions can be reached at the lowest possible cost. A JI project could replace a coal-fired power plant with a more efficient combined heat and power plant based on carbon neutral fuel. In practice, JI projects are most likely to take place in countries with transitioning economies, e.g. Eastern Europe. These countries tend to have more options for cutting emissions at a lower cost.

Putting the climate first:

Participation is voluntary, and benefits are reaped by both parties, as well as the environment: Host country receives foreign investment and advanced green technologies. Investor country receives help to achieve compliance with part of their emissions reduction commitments at a lower cost than it would domestically. Real, measurable, long-term, and cost-effective benefits that can help reduce the climate change are achieved. Reductions in emissions that are additional to that of efforts applied to the usual operations of a company are achieved.

The waste to energy projects based on jute waste utilization has good opportunity for being registered as JI project provided the transportation emission leakages and the economics of the process are worked out to the advantage of the project participants.

Appendix 1 – UK compliance scheme

BETAPACK

103 Tenter Lane, Warmsworth, DONCASTER, South Yorkshire DN4 7JE
Tel: 01302 857 448 Fax: 01302 857448

BIFFPACK

Biffa Waste Services Limited, Coronation Road, Cressex
HIGH WYCOMBE, Bucks HP12 3TZ
Tel: 01494 556565 Fax: 01494 484836

BUDGET PACK

WTE House, Sharpness Distribution Centre, Burma Road, Sharpness, Berkeley,
Gloucestershire GL13 9UQ
Tel : 01453 814230 Fax: 01453 814229
www.budget-pack.com e-mail: info@budget-pack.com

CLEANAPACK

c/o Cleanaway Ltd, The Drive, Warley, BRENTWOOD
Essex CM13 3BE
Tel: 01277 234567 Fax: 01277 229900

COMPLYPACK

Andrew Francis, Complypak Ltd, 63 Elphinstone Road, Hastings
East Sussex TN34 2EG
Tel 01424 432320 Fax 01424 202983

DIFPAK

Pishiobury House, Pishiobury Drive, Sawbridgeworth
Hertfordshire CM21 0AF
Tel: 01279 721921 Fax: 01279 600561

ECOPAK

9 East Haddon Road, Dundee DD4 7LD
Tel: 01382 401007 Fax: 01382 461029

IMPACT

Biffa Waste Services Limited, Coronation Road, Cressex
HIGH WYCOMBE, Bucks, HP12 3TZ
Tel: 01494 427271 Fax: 01494 449841

INTEGRA

PO Box 17, Darlington, DL1 2WX
Tel: 07905 540538

KITE ENVIRONMENTAL SOLUTIONS

Unit H2, Grovelands Industrial Estate, Exhall, Coventry,
Warks, CV7 9ND
Tel: 024 7636 4414 Fax: 024 7636 4404

NIPAK LIMITED
54A Strathearn Court, Hollywood, Co. Down BT18 8QT
Tel: 028 9042 7595 www.nipak.co.uk

ONYXPAK
PWDS, Tameside Drive, Castle Bromwich, Birmingham B35 7AG
Tel: 0121 749 6583 Fax: 0121 749 5324

PAPER COLLECT
Hamilton House, Gogmore Lane, CHERTSEY, Surrey, KT16 9AP
Tel: 01932 569 797 Fax: 01932 569 749

PAPERPAK LIMITED
Boston House, Grove Technology Park, WANTAGE OX12 9FF
Tel: 01235 760011 Fax: 01235 770200

PENNINE-PACK LTD
Green Business Network, 5 Town Hall Street
SOWERBY BRIDGE HX6 2QD
Tel: 01422 316661 Fax: 01422 316 662

RECYCLE-PAK LTD
Unit 121 Clydesdale Place, Moss Side Employment Area
Leyland, Preston PR26 7QS
Tel: 01772 331100 Fax: 01772 454777

S.W.S. LIMITED
Thomlinson Road, Longhill Industrial Estate, HARTLEPOOL TS25 1NS
Tel: 01429 276961 Fax: 01429 864320

SYNERGY COMPLIANCE LTD
St Olaves, 23 Church Street, Nesham Place, Houghton-le-Spring
Tyne & Wear, DH5 8AA
Telephone: 0191 5126607 Fax: 0191 5121152

TaG PACK
Trees are Green Limited, Alderham Bank, Barford, WARWICK CV35 8DA
Tel: 01926 625802 Fax: 01926 625805

TODDPAK
F D Todd & Sons Limited, Excelsior Mill, THIRSK
North Yorkshire, YO7 1QF
Tel: 01845 523131 Fax: 01845 523997

VALPAK LIMITED
Stratford Business Park, Banbury Road, Stratford-upon-Avon CV37 7GW
Tel: 084506 825725 Fax: 084506 825329
Email: info@valpak.co.uk

WASTEPAK
Pishiobury House, Pishiobury Drive, Sawbridgeworth
Hertfordshire CM21 0AF

Tel: 01279 721921 Fax: 01279 600561

WESPACK

WES Building, Plastics Road, Wilton International, Redcar TS10 4RG

Tel: 01642 442080 Fax: 01642 442090

Note: VALPACK is the biggest scheme

Appendix 2 – UK recyclers (textile)

Shanks East London

Frog Island Waste Management Facility, Creek Way, Rainham, Essex, RM13 8EN Phone: 01708 634 540, Fax: 01708 634 545, frogisland@shanks.co.uk

Squash GB Ltd

79 High Street, Barrington, Cambridgeshire, CB2 5QX Phone: 01223 874575, sales@squashgb.com

Advance Textile Recycling Ltd

Meadow Mills, Carlton Road, Dewsbury, West Yorkshire, WF12 2BA Phone: 01924 455151, Fax: 01924 456755

Alex Robertson & Son

Hayfield Industrial Estate, Hayfield Place, Kirkaldy, Fife, KY2 5DH Phone: 01592 263387, Fax: 01592 204911

Alfred Pearson & Son Ltd

Hillgate Street Works, Hillgate Street, Ashton Under Lyme, Manchester, OL6 9HT Phone: 0161 330 1956

Allen Jones Ltd

Drinkwater Gardens Works, off Richmond Row, Liverpool, Merseyside, L3 3BW Phone: 0151 207 2567, Fax: 0151 207 0900

Andrew Donelan Wipers Ltd

Tower Road, Darwen, Lancashire, BB3 2DU Phone: 01254 873873

Biomass Recycling

The Recycling Centre, Yarm Road, Stockton on Tees, Durham, TS18 3RU Phone: 01642 654166, Fax: 01642 391197

Black Country Rag Co Ltd

4A/B Greets Green Road, Greets Green Industrial Estate, West Bromwich, West Midlands, B70 9EW Phone: 0121 520 7586, Fax: 0151 522 3340

Bunzl Textile Products Ltd

PO Box 1, Victoria Mills, Wharf Street, Dewsbury, WF12 9AL Phone: 01924 465756, Fax: 01924 454180

C&C Textiles

Unit 1 Carey Avenue, Barnsley, South Yorkshire, S70 1QQ Phone: 01226 283682

Caledonian Waste Compactors

Caledonian House, 415 Oakwood Lane, Leeds, West Yorkshire, LS8 3LF Phone: 0113 205 1750, Fax: 0113 248 1175, lukecaledonian@yahoo.co.uk

Clyde Recycling Ltd

141-167 Waddell Street, Glasgow, G5 0NB Phone: 0141 429 5373, Fax: 0141 429 7376

Coppermill Ltd

78/90 Cheshire Street, Bethnal Green, London, E2 6EH Phone: 020 7729 2999, Fax: 020 7739 9400

Cullingworth Summers & Co Ltd

Syke Mills, Syke Lane, Earlsheaton, Dewsbury, West Yorkshire, WF121 8HX Phone: 01924 488766, Fax: 01924 488835

D Robinson & Co

Woodside, Stoke Albany Road, Desborough, Northants, NN14 2SP Phone: 01536 761963, Fax: 01536 763160

Denton Hampshire Ltd

Ings Mill, Dale Street, Ossett, West Yorkshire, WF5 9HQ Phone: 01924 280622, Fax: 01924 265015

Devizes Textiles

Unit 3 Garden Trading Estate, London Road, Devizes, Wiltshire, SN10 2HW Phone: 01380 724451, Fax: 01380 720711

Ecotex Ltd

Unit 3, Savile Street, Batley, West Yorkshire, WF17 6JS Phone: 01924 439309, Fax: 01924 439343, elaine-ecotex@tiscali.co.uk

Elvan International Ltd

Factory 7, Ennerdale Road, Kitty Brewster Industrial Estate, Blyth, Northumberland, NE24 4RG Phone: 01670 360977, Fax: 01670 361238

Firth Packing Ltd

Mill Road, off Bradford Road, Dewsbury, West Yorkshire, WF13 2EU Phone: 01924 465323, Fax: 01924 457511

Greenhill Textile Co Ltd

Greenhill Mills, Grange Road, Batley, WF17 6LH Phone: 01924 475550, Fax: 01924 475970

Harris & Co

Farr's Lane, Prince Street, Bristol, Avon, BS1 4PZ Phone: 0117 9277434, Fax: 0117 9252354

HB Textiles

Moderna Business Park, Mytholmrod, Hebden Bridge, West Yorkshire, HX7 5QQ Phone: 01422 884644, Fax: 01422 882305

Howard Wipers (Denny) Ltd

Units 12 & 13 Wichester Ind Est, Denny, Stirlingshire, FK6 6QE Phone: 01234 826633, Fax: 01234 826555

I&G Cohen Ltd

Castle Works, Bazaar Street, Pendleton, Salford, Manchester, M6 6GS Phone: 0161 736 8899, Fax: 0161 745 8697

Intertex International Ltd

Unit E, Implex House, Bridge Road Ind Estate, Southall, London, UB2 4AB Phone: 020 8813 8382, Fax: 020 8813 8233

J Cohen & Sons

107 Fairfield Street, Ardwick, Manchester, M2 2WG Phone: 0161 273 3788, Fax: 0161 273 3788

J Coles & Grandad UK Ltd

Po Box 83034, 34a Avondale Blvd, Brampton, Ontario, Canada, L6T 1H0 Phone: 001 905 790 7189, Fax: 001 905 790 6172

J McAndrew & Son Ltd

Battinson Road Mill, Queens Rod Mill, Queens Road, Halifax, West Yorkshire, HX1 5PR Phone: 01422 355617, Fax: 01422 347198

J Sparrowhawk & Son

159 Commonsides, East Mitcham, Surrey, CR4 2QB Phone: 0181 648 4144, Fax: 0181 687 2827

JE Williams

Unit 2, Freeman Street, Birkenhead, Merseyside, L41 1BR Phone: 0151 647 6532, Fax: 0151 647 6532

Jenda Collection Services

Fitzwilliam House, Station Road, Irthingborough, Northants, NN9 5QF Phone: 01933 651065, Fax: 01933 651065

Kettering Textiles

66/78 Dennington Road, Dennington Road Industrial Estate, Wellingborough, Northants, NN8 2QH Phone: 01933 442833, Fax: 01933 442831

Kingsley

Tregonnigge Industrial Estate, Falmouth, Cornwall, TR11 4SN Phone: 01326 373531

Lawrence M Barry & Co

Britannia Mill, North Crescent, Cody Business Centre, Cody Road, London, E16 4TG Phone: 020 7476 2888, Fax: 020 7473 1381

Leetex Wipers & Disposables Ltd

Unit 3 Hollis Road, Grantham, Lincolnshire, NG31 6AA Phone: 01476 577777, Fax: 01476 577774

LW Sait & Sons

35 Waterden Road, Hackney, London, E15 2EE Phone: 0208 985 0062, Fax: 0208 985 0062

M&J Bowers

Lucott, Limington, Yeovil, Somerset, BA22 8EQ Phone: 01935 840308, Fax: 01935 841544

McQueens Waste Textiles

34 King Street, Grimthorpe, Barnsley, S72 7DX Phone: 01226 714436, Fax: 01226 781029

Merlin (Recycled Textile) Products

Blackhorse Road, Exhall, Coventry, CV7 9FW Phone: 02476 361186, Fax: 02476 361311

Midland Wiper

Fletcher Street, Long Eaton, Nottingham, NG10 1JU Phone: 0115 973 5187

Mudford (Wakefield) Ltd

Crockroft Mill, Alverthorpe Road, Wakefield, West Yorkshire, WF2 9NT Phone: 01924 364771, Fax: 0924 291725

Nathan's Wastesavers Ltd

Unit 13 Winchester Avenue, Denny, Falkirk, Stirlingshire, FK6 6QE Phone: 01324 826633, Fax: 01324 826555

Ragtex UK Ltd

Units 1-5, Forest Park Industrial Estate, 47 Parker Drive, Leicester, LE4 0JP Phone: 0116 234 0648, Fax: 0116 234 0649

Randisi Textile Recycling Ltd

Mulgrave Street, Bradford, BD3 9SE Phone: 01274 309111, Fax: 01274 309222

RG Textiles Ltd

Unit 10, Merthyr Industrial Estate, Dowlais, Merthyr Tydfil, Mid Glamorgan, CF48 2TD Phone: 01685 370972, Fax: 01685 359251

Sam Greenberg Ltd

7th Floor Northway House, 1379 High Road, Whetstone, London, N20 9LP Phone: 01084923510, Fax: 020 84469663

Saul D Harrison & Sons Plc

4 Langley Close, Harold Hill Industrial Estate, Romford, RM3 8XB Phone: 01708 377330, Fax: 01708 377220

Savanna Rags International Ltd

Croft Mill, Forest Road, Mansfield, Nottinghamshire, NG18 4BU Phone: 01623 421555, Fax: 01623 428835

Scope

Northern Office, 25A High Street, Knaresborough, North Yorkshire, HG5 0ET Phone: 01423 862963, Fax: 01423 862963

Staffordshire Textiles (UK) Ltd

1st Floor, Crossley Stone HOUse, 20 Crossley Stone, Rugeley, Staffordshire, WS15 2DH
Phone: 01889 576821, Fax: 01889 578683

Terimpex Ltd

18 High Street, Ringstead, Northants, NN14 4DA Phone: 01933 460855, Fax: 01933 460892

TIC International Ltd

19 Rea Street South, Birmingham, B5 6LB Phone: 0121 605 9330, Fax: 0121 622 7164

Tradetex Ltd

2A Thames Road, Barking, Essex, IG11 0HZ Phone: 020 8591 8592, Fax: 020 8594 7502

TW Beaumont

Spafield Mill, Upper Road, Batley, West Yorkshire, WF17 7LS Phone: 01924 461401,
Fax: 01924 461378

WH Tracey Ltd

Paradise Mill, John Street, Bury, Lancashire, BL9 5AA Phone: 0161 764 1937, Fax: 0161 761 6366

Wilcox Industrial Supply

Star Works, Batmanshill Road, Bilston, West Midlands, WV14 8AG Phone: 01902 357300, Fax: 01902 357319

World UK Trading Ltd

Podington Industrial Estate, Aifield Road, Hinwick, Northants Phone: 01234 782823,
Fax: 01536 412289

Appendix 3 – UK stakeholders

Government

Environment Agency of England & Wales

Charles Cox: Ecolabel team at DEFRA charles.cox@defra.gsi.gov.uk

Jute users (packaging)

Barrie Turner, Juteexpo barrie.turner@jutexpo.co.uk

Canby Ltd. <http://www.jutebags.co.uk/>

Jimpex UK Packaging Ltd <http://www.jimpexuk.com/>

JuteBag.co.uk www.jutebag.co.uk

Waste Management – trade association, charities

Packaging directive compliance scheme (Appendix 1)

Waste and Resource Action Program (WRAP) www.wrap.org.uk

Letsrecycle <http://www.letsrecycle.com/>

Environmental Service Association <http://www.esauk.org/>

London Remade <http://www.londonremade.com/>

Waste Company

See list on www.letsrecycle.com/directory/

Large waste companies are Biffa, Onyx, Cleanway, SITA and Shanks

German stakeholders

Government

Umweltbundesamt, (Federal Environmental Agency)

http://www.blauer-engel.de/englisch/navigation/body_blauer_engel.htm

Jute users

Juteko GMBH

info@juteko.de

Mr. Peter Clasen

CC@wgc.de

Eurojute,

eurojute@verbondgroothandel.nl

Waste Management – trade association, charities

German Scrap, Recycling & Waste Disposal Association

German Association of Water,

Wastewater and Waste

<http://www.atv.de/english/willkomm.htm>

Waste Company

See list on http://dmoz.org/Business/Textiles_and_Nonwovens/Fibers/Recycling/
and www.euro.recycle.net

Large waste companies are AUGUST BEYER GmbH & Co.KG , ReSales GmbH etc.

USA stakeholders

Government

Environment Protection Agency, USA

Linda Culpepper, Deputy Director linda.culpepper@ncmail.net

Jute users (packaging)

Mr.M.Martin, Burlap and Jute

Association ,New York

Telephone: (212) 4081042

Ms. Maxine Shapiro, Textile Bag

and Packaging Association .

sccashapir@aol.com

The Potato Association of America

umpotato@maine.edu

Waste Management – trade association, charities

Lets recycle

<http://www.letsrecycle.com/>

National Solid Waste

Management Association

<http://www.nswma.org/>

Environnemental Industries Association

<http://www.envasns.org/>

Office of Federal Env. Executive

<http://www.ofee.gov/>

Waste Company

See list of contacts for Municipal solid waste recycling on

<http://www.epa.gov/reg3wcmd/solidwasteitems.htm>

Large waste companies are Waste Industries USA, Inc., Waste Connections Inc. etc.