Guidelines for Disposal of Thermoset Plastic Waste including SMC/FRP

CENTRAL POLLUTION CONTROL BOARD

(Ministry of Environment & Forests, Govt. of India)

'PariveshBhawan' C.B.D.Cum-Office Complex,

East Arjun Nagar, Shahdara, Delhi-110032

(March, 2015)

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1.0 Background:

It is well known that plastic waste are non-biodegradable & remain on earth for several years. Further, some of the plastic waste like thermoset plastic waste can't be remoulded/recycledand may cause environmental issues. In view of non-recyclable nature of the thermoset plastic, the petitioner Sh. Money Goyal&Akash Seth filed a petition No OA 124/2014 in Hon'ble NGT in respect of non-recyclability of SMC/FRP enclosuresbeing used by some Electricity Departments in Haryana, Punjab, UP etc. Hon'ble NGT while hearing the saidmatteron 27.01.2015 passed the following direction:-

"The CPCB in consultation with the MoEF shall constitute such a Committee within a period of 2 weeks from the date of receipt of the copy of the order and thereafter, we request the Committee thus constituted to study the entire aspect and give its recommendations to the CPCB expeditiously in any event within 4 weeks."

The copy of the Hon'ble NGTs Order is attached as **Annexure-I**. In compliance of the Order of the Hon'ble NGT, Central Pollution Control Board constituted a Committee comprising officials from MoEF&CC, BIS, CIPET, IIT Delhi and Associated Cement Company (ACC). The Order for constitution of the Committee is attached as **Annexure-II**.The first meeting of the Committee was held on February 3, 2015.

2.0Definition of Thermoset Polymer including SMC/FRP Plastic waste:

Thermoset plastic when cured by heat or other means, changes into a substantially infusible or insoluble product. The thermoset polymer is a kind of plastic, which due to its composite chemical structure can't be re-moulded/recycled. The thermoset plastic discarded after use are accumulated & landfilled. The SMC/FRP products are a kind of thermoset plastics commonly made from composites of glass fibres embedded in polyester resin, vinylester resin, epoxy resins etc.

2.1 Definition of Sheet Moulding Compound (SMC):-

Sheet moulding compound (SMC) or sheet moulding composite is a ready to mould glass-fiber reinforced polyester material primarily used in compression moulding. This is manufactured by dispersing long strands (usually >1") of chopped fiber (commonly glass fibers or carbon fibers on a bath of resin (commonly polyester resin, vinylester resin or epoxy resin). The longer fibers in SMC result in better strength properties than standard bulk moulding compound (BMC) products.

2.2 Definition of Fibre Reinforced Polymer (FRP):-

The FRP are both thermoset and thermoplastic, FRP products having thermoset base material are discussedhere. FRP composite materials consist of two or more distinct physical phases, one of which, the fibrous, is dispersed in a continuous matrix phase.

Composites offer the designer a combination of properties not available in traditional materials. It is possible to introduce the fibres in the polymer matrix at highly stressed regions in a certain position, direction and volume to obtain maximum efficiency from the reinforcement, and then, within the same member to reduce the reinforcement to a minimal amount at regions of low stress. Other advantages offered by the material are its lightness, resistance to corrosion, resilience, translucency and greater efficiency in construction compared to the more conventional materials.

3.0 Chemical Structure & Properties of Thermosetting Polymers:

3.1. Epoxy resins

The terminology 'epoxy resin' is generally applicable to both prepolymers as well as to cured resins. The former contains reactive epoxy groups whereas the cured resin may or may not contain reactive epoxy groups. While the term can be justified in the former case, the cured resins are also called epoxy resins. Epoxy resins typically contain a three membered ring with -O- atom. Different terminologies are also used to specify the group such as epoxide, oxirane and ethoxyline group, $RCHOCH_2$. Commercial epoxy resins usually contain aliphatic, cycloaliphatic, or aromatic backbones. Epoxy resins are highly reactive presumably due to the strained three membered ring structures and react with many nucleophilic and electrophilic reagents. Therefore, a wide variety oforganic compounds having active hydrogen atoms can be used as curatives. These include amines (both aliphatic/aromatic and primary/secondary), phenols, carboxylic acids, thiols, anhydrides etc. The general reaction of epoxy resin with these compounds are presented below;

Epoxy resins possess high resistance to chemicals and corrosion, besides having moderate toughness, flexibility and excellent mechanical and electrical behavior. Epoxy resins are also used as outstanding adhesives for different substrates. Epoxies are used in tooling, for laminates in flooring and to a small extent in moulding powders and in road surfacing. Epoxy resins are used for encapsulation of miniature components, particularly in space crafts. Epoxy resin laminates are useful in aircraft industry, while Carbon fiber/epoxy resin composites are used for structuralmodification in aeroplanes and epoxy/aramid fibers find uses inthe design of small boats.

3.2. Unsaturated polyester resins

Linear unsaturated polyesters, which are often, called prepolymers have varied industrial applications. Unsaturation is introduced into the resin molecule using an unsaturated dicarboxylic acid such as maleic acid. For example, polyester of the following type is generated by reaction between ethylene glycol and maleic acid;

Commercial unsaturated polyesters are based on phthalic acid, maleic acid, ethylene glycol, and butanediol. The crosslink density, which represents the average number of crosslinks between polyester chains and the average length of the crosslinks, determines the mechanical properties of the product. The crosslink density, in turn, depends on the relative amount of the unsaturated acids used to prepare the prepolymer. The average length of the crosslinks depends on the relative amounts of the prepolymer and monomer and on the copolymerization behaviour of the two double bonds. For example, fumarate-styrene system yields a harder and tougher material than fumaratemethyl methacrylate system. The unsaturated polyester- matrix is employed in fiber-reinforced plastics (FRP) structures. The resins are also useful for decorative coatings. The resin finds use in the manufacturing of large structures such as boats and car bodies since it is curable at roomtemperature. The powder form of the resin is used in solution or emulsion form as binders for glass-fiber performs and for the manufacture of pre-impregnated cloths.

3.3. Phenolic resins

Phenolic polymers are obtained by the polymerization of phenol with formaldehyde [1]. The polycondensation reaction can be accelerated either by acids or by bases. The reaction yields resole prepolymers (resole phenolics) which are mixtures of mononuclear methylolphenols and various dinuclear and polynuclear compounds. Other productsinclude substitution at o- and p- positions and the type of bridge between the rings (methylene versus ether). The typical ratio of formaldehyde to phenol is 1.2:1. Substituted phenols such as cresols (o-, m-, and p-), p-butylphenol, resorcinol, and bisphenolA are used for specific applications. Other aldehydes such as acetaldehyde, glyoxal, 2-furaldehyde are also used. The composition and molecular weights of the resole depend on the ratio of monomers, pH, temperature and other reaction conditions. For crosslinking temperature as high as 180°C is necessary. During the curing process, methylene and ether bridges are formed between benzene rings to yield a network structure.Phenolic mouldings are hard, insoluble and heat resistant materials, since they are highly crosslinked and interlocked [2]. The type of resin and filler influence the chemical resistance of the cured material. Cresol and xylenol-based resins are inert towards NaOH attack, whereas simple phenolformaldehyde will be affected. Phenolic mouldings are resistant to acids except 50 % sulphuric acid, formic acid, and oxidizing acids, if the filler used is also resistant. The reins are stable up to 200°C

Phenol-formaldehyde mouldings are widely used for domestic plugs and switches. Used in electrical industry where high electrical insulation properties are not needed. It is used for making cases, knobs, handles and telephones. In automobile industry, the resins are used for making fuse-box covers, distributor heads, and in other applications where electrical insulation together with adequate heat resistance are needed. Heat resistant grade of the resins are used for saucepan handles, saucepanlid knobs, lamp housings, cooker handles, welding tongs, and electrical iron parts. Since the resin is hard and can be electroplated, it is used in the manufacture of 'golf ball' heads for typewriters etc. Bottle caps and closures are made from the resin in large quantities.

3.4. Urea-formaldehyde resin

It is an aminoplastic, a term generally used to represent resinous polymers formed by the interaction of amines or amides with aldehydes. The cured products form crosslinked insoluble and infusible thermoset. Compared to phenolic resins, the resins are cheaper, light in color, and have better resistance to electrical tracking. However,it exhibits higher water absorption and poor heat resistance. The mono and dimethylol derivatives, formed during the reaction, further condense with urea to give the final resin structure.

There are many desirable properties for U-F moulding powders that enable to keep it in the highest application level. The wide range of colours is a reason for the widespread use of the material. U-F resins do not impart taste and odour to foodstuffs and beverages with which they come in contact. Another added advantage is their good electrical insulation properties with particularly good resistance to tracking. The resin can resist continuous heat upto a temperature of 70°C. Some physical properties of urea-formaldehyde resins are presented in the **Table 1.**

The major application of urea-formaldehyde resin is in the field of electric and electronic applications. Itis mainly used for making plugs, sockets and switches. In addition, it is used for domestic applications such as pot and panhandles and tablewares. In the sanitary sector, the resins are used as toilet seats and miscellaneous bathroom equipment. The wide colour range and freedom from taste and odour make the material a good choice for the manufacture of bottle caps and closures. However, nowadays, its consumption in this area has been reduced by the development of new thermoplastics. Buttons are made from U-F moulding powders due to its resistance to detergents and dry-cleaning solvents. Miscellaneous uses include meat trays, toys, knobs, lampshades etc. The bulk of U-F resins are used as adhesives for particleboard, plywood and furniture industries. Another application of the resin is inthe manufacture of chipboard. U-F resins are also used to make foams. U-F foams are placed on airport runways to act as an arrester bed to stop aircraft that overshoot during emergency landings or abortive take-offs. Another large scale application of the resin lies in the manufacture of firelighters.

Mineral-filled melamine based compositions have superior electrical insulation and heat resistance to the cellulose-filled grades. The resins are used for the manufacture of decorative foils in compression moulding. The principal application of the resin is for the manufacture of tableware. A wide color range distribution, surface hardness and stain resistance are the reasons. Cellulose-filled compositions are used at small levels for the manufacture of trays, clock cases and radio cabinets. The mineral-filled compounding are used in electrical applications and knobs and handles for kitchen utensils. M-F resins are widely employed for laminating applications owing to their high hardness, good scratch resistance, freedom from color and heat resistance. They are also used asadhesives. Melamine-formaldehyde condensates are useful in textile industry. They are useful agents for permanent glazing, rot proofing, wool shrinkage control and, with phosphorus compounds, flame proofing. The resin can be used to prepare paper with enhanced wet-strength.

3.6. Polyimides

In Polyamides, the branched nature of the functional group facilitates the production of polymers. The backbone consists mainlyof ring structures and hence high softening points. The polymers exhibit high thermal stability and are hence valuable for high temperature applications.Aromatic polyimides are formed by the polycondensation of dianhydrides with diamines. For example, polycondensation of pyromellitic anhydride with p,p′-diaminodiphenyl results in the synthesis of polyimides. The reaction is carried out in two steps. In the first step, the reaction is conducted with suitable solvents such as DMF at around 50°C, where polymerization takesplace with the formation of polyamic acid Thepolyamic acid is then casted as a film, by evaporating the solvent and baked at 300°C in the atmosphere of nitrogen. Where polycondensation takes place to form the product. In the second step, the product is converted into the required shape. Polyimides, which can be either thermoplastic or thermoset, are widely used in aerospace applications. Thermosetting polyimidesprovide easier processing and higher thermal resistance, while thermoplastic polyimides offer greater toughness. A comparison of the properties of epoxy and polyimide thermoset matrices is furnished in **Table 2.**

The polymer is having excellent resistance to oxidative degradation and is inactive towards most chemicals other than strong bases and high-energy radiations. The principal application of polyimides is as compressor seals in jet engines. It is used in data processing equipment such as pressure discs, sleeves, bearings, and as friction elements and as valve shafts in shut-off valves. Due to their heat resistance capacity and resistant to deformation, the polymers are used in soldering and welding equipment. However, the disadvantage of the polymer is that they may undergo hydrolysis and crack in water or steam at temperatures above 100°C. For such purposes, polyetheretherketones (PEEK) are employed.

Table 2. Properties of Composite Matrices

Property	Epoxy	Polyimide
Modulus, GPa	2.8-4.2	3.2
Tensile Strength, MPa	55-130	56
Compressive strength, MPa	140	187
Density, g cm^{-3}	1.15-1.2	1.43
Thermal expansion coefficient, 10-6 °C	45-65	50

4.0 Sources/uses of SMC/FRP Plastic Waste;

The wide utilization of Thermoset Polymers including Sheet Moulding Compound (SMC)/Fibre Reinforced Plastics (FRP) is due to the combination of their mechanical and physical properties at the lowest system cost, without compromising on quality. Thermoset plastics are used in a broad range of applications, such as:

- **Automotive:** cars, trucks and other commercial and agricultural vehicles (body parts, structure and engine parts)
- **Mass transport:** trains, trams, light railways and monorail
- **Electrical & electronics:** housing, fuses, switchgear, etc.
- **Building & construction:** civil engineering and household fixtures
- **Domestic appliances:**coffee machines, toasters, irons etc.
- **Sanitary :** bathroom suites and hygienic surfaces.

5.0 Different options for Disposal of Thermoset Polymer including SMC/FRP Waste;

The use of polymer materials has simplified the modern life. At the same time, the extensive use of polymer materials in every walk of life have caused serious waste problems. The handling of increased amount of polymer waste has become a serious issue globally and is also a cause of depletion of petroleum resources which are an essential requirement of the mankind.

5.1Collection, Segregation & Transportation

At present, no system exists with Municipal Bodies for collection, segregation & transportation of all kind of plastic waste including SMC/FRP/Polycarbonate plastic waste. The self-life of thermoset plastics being 3-4 years until it is broken/burnt due to accidents. As per Rule 6(d) of the Plastic Waste (Management and Handling) (Amendment) Rules, 2011, the collection system shall be as under;

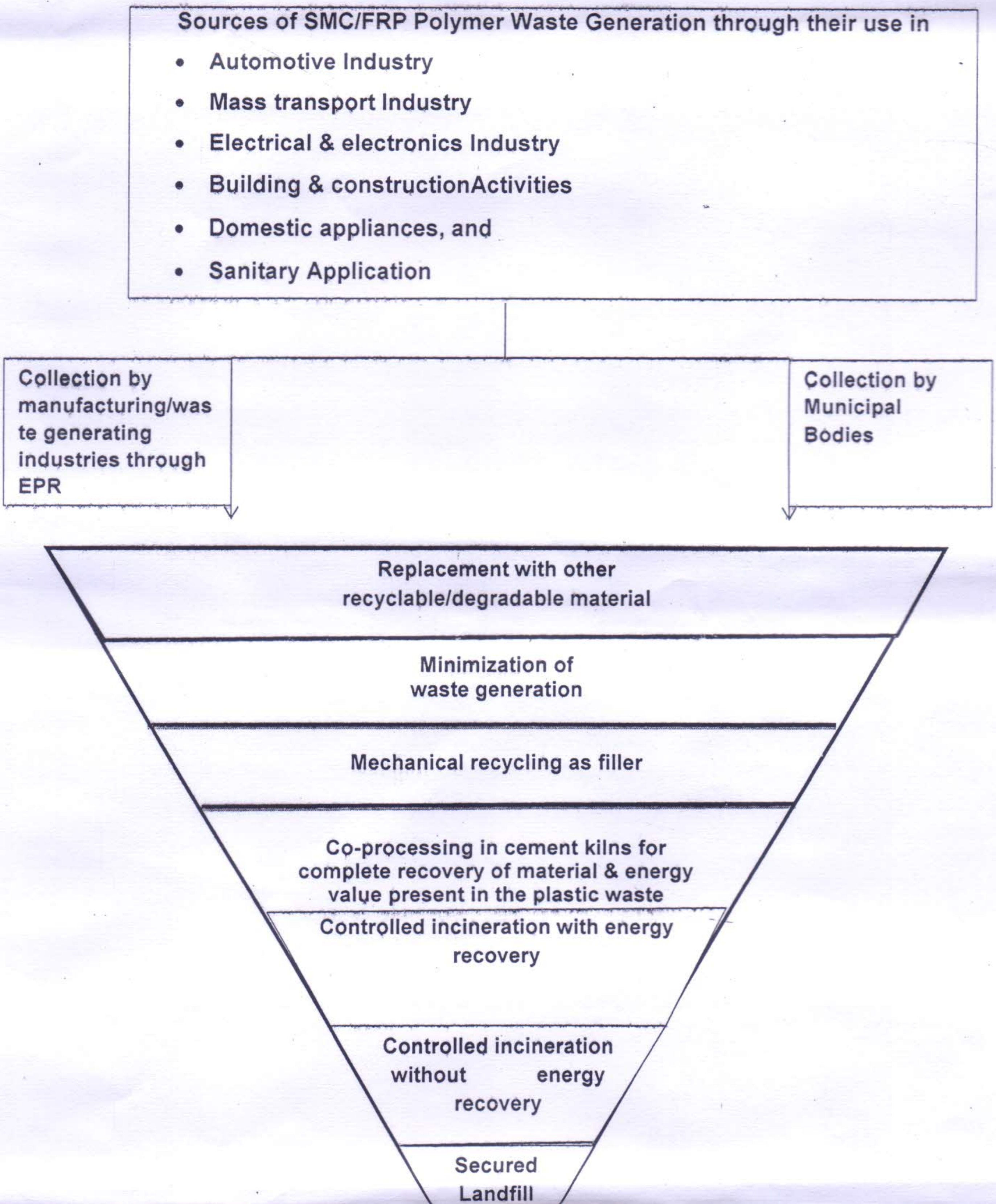
(i) The responsibility for setting up collection system for plastic waste shall be of the municipal authority concerned and the said municipal authority may, for this purpose, seek the assistance of manufacturers of plastic carry bags, multilayered plastic pouches or sachets or of brand owners using such products;

(ii) The municipal authority may work out the modalities of a mechanism based on Extended Producer's Responsibility involving such manufacturers, registered within it's jurisdiction and brand owners with registered offices within it's jurisdiction either individually or collectively, as feasible or set up such collection system through its own agencies.

5.2 Disposal Options:

The most deserved optionsare; (i) minimising the waste generation;(ii) reuse of materials in the same application;(iii) recycling in another application (including energy recovery)followed by(iv) incineration without energy recovery or landfilling for thermosetting polymer waste.Based on the various options practiced globally for disposal of plastic waste including SMC/FRP wastes and the waste management hierarchy, recommendation on collection &disposal of SMC/FRP wastes are illustrated in**Fig - 1:**

<u>Figure – 1: Collection and Disposal of SMC/FRP Waste</u>



5.2.1 Co-processing of Thermosetting polymer waste in cement plants:-

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Co-processing is a more environmentally friendly and sustainable method of waste disposal as compared to landfiling and incineration because of reduced emissions and no residue after the treatment. Co-processing refers to the use of waste materials in industrial processes as alternative fuels or raw material (AFR) to recover energy and material from them. Due to the high temperature and long residence time in cement kiln all types of wastes can be effectively disposed without any harmful emissions. As per the Basal Convention, variety of wastes including hazardous wastes, get disposed in an environmentally safe and sound manner through the technology of co-processing in cement kiln Disposal of SMC / FRP wastes through co-processing is practiced in many countries as a regular method for their environmentally sound disposal. In India also, the capability of disposing FRP in an environmentally sound manner has been demonstrated through a co-processing trial carried out by ACC Limited intheir Madukkarai Cement Works in Tamil Nadu. The results of this trial have demonstrated that there is no untoward impact of co-processing of FRP in the cement kiln on emissions or on the product quality. This trial was carried out at a Thermal Substitution Rate (TSR) of 0.924% which was reviewed by CPCB and permission to regularly co-process FRP waste in cement kiln at MadukkaraiCement Works granted.

5.2.1.1 Pre requisites for Co-processing of SMC/FRP polymer waste in cement plants:

There is urgent need to prepare protocol as per the requirement for accepting & co-processing of such kind of SMC / FRP waste by Cement Plants. Following should be considered as a prerequisite for permitting coprocessing of SMC / FRP wastes in cement plants.

a) The cement plant should receive the SMC / FRP waste from the generators/collectors through manifest system for proper traceability.
b) The cement plants should be equipped with proper feeding system for feeding SMC / FRP in the kiln inlet or Pre-calciner. This can be simple manual system or a system with automatic facility for feeding. Both facilities should be able to monitor and record the feeding rate for proper assessment of the feed rate.
c) The waste material, that is taken for coprocessing in the kiln, should be of such a size that is compatible with the feeding arrangement available in the kiln.
d) The preprocessing of the waste material to the required size can be implemented by the waste generating industry or waste collecting agency or a third party preprocessor or the cement plant itself in a system that is set up for environmentally sound shredding of the SMC / FRP waste.
e) The co-processing facility and the preprocessing facility shall be equipped with proper fire fighting system to mitigate the fire risks.
f) Proper display boards shall be set up in the co-processing and preprocessing facilities with relevant safety signs and waste specific workplace labels for handling of SMC/FRP waste material.

g) The cement plants undertaking co-processing operation of SMC / FRP should have online emission monitoring for Dust, SO_2 andNOx, and should be undertaking the offline stack monitoring of heavy metals and dioxin / Furans once a year while undertaking co-processing operation.

5.2.1.2Location of Clinker Cement Plants in India:

Presently, there are **125** cement plants, in 17 States/UTs of India.The remaining (17) State/UTs however,don't have any Cement Plants. Out of the **125** Cement Plants only '**39**' plants in **11** States namely; Andhra Pradesh, Chhattisgarh, Gujarat, Himachal Pradesh, Jharkhand, Karnataka, M.P., Maharashtra, Orissa, Rajasthan, &Tamilnadubased on the permission accorded by CPCB/SPCBs are accepting and co-processing the hazardous/non-hazardous waste including plastic waste as per the requirement of cement plants to be fulfilled by the supplier of the waste.Where ever the disposal of SMC/FRP is feasible by way of co-processing in cement kilns, the co-processing option must be adopted asa preferred choice.

5.2.2Mechanical Recycling:

Many initiatives have looked at the **mechanical recycling** of glass fibre composites. In this route, the waste composite is broken up and then ground into small particles. The resulting mixture of fibre, polymer and additives is then re-used in other products as minor fillers. A range of applications for this waste have been investigated, which include its use as a filler in sheet and bulk moulding compounds (SMC/BMC) and in asphalt and concrete reinforcement. Organising a viable collection/transportation/processing system for the waste and finding sufficient outlets for the recyclate are two barriers to this approach. A number of processes which recover the fibre and resin/chemical content of the original composites are also being developed, but these tend to be more complex and expensive.

5.2.3 Incineration:

Incineration is another method of disposal of SMC/FRP. However, in this process depending upon the inorganic content upto50% of the composite waste remains as ash, which has to be land filled. Moreover, incineration is not always possible (where limits are imposed on the energy content of the waste).In case of large waste material parts the glass fibre residue can cause process stoppages due to low temperature. The uncontrolled incineration can give rise to other environmental issues.

5.2.4 Landfill:

Secured landfill is another option that can be utilised for disposal of the thermoset wastes. The experience has however demonstrated that the land utilised for the landfill purpose gets locked and the liability associated with this land, filled-up with materials tends to continue forever, besides the land remains unusable. Most countries have stopped the practice of utilising landfill as the option for disposal of wastes.The cost of landfill and incinerationis expected to keep on increasing over the time due to increase in land and fuel coils. Further, availability of land is a major issue in the cities/towns, therefore, this method could be ranked as least preferred option.

6.0 Recommendations&Conclusion:

The most preferred option for disposal of SMC/FRP wastes, therefore co-processing in cement plants due to its high temperature (upto2000°C and long residence time)., Co-processing of plastic waste including SMC/FRP/Polycarbonate waste needs to be synergized with the preparedness of Municipal Bodies. Because, cement plants need such kind of waste as per thepre-requisite conditions to be fulfilled by the manufacturers orusers or Municipal Bodies. Besides the Cement Plants are required to create necessary infrastructure to process/receive plastic waste including SMC/FRP polymer waste.Since, co-processing of SMC/FRP/Polycarbonate in cement-kilns isenvironmentally the most appropriate disposal option, municipalities, waste generating producers and cement plants must collaborate with each other for working out modalities for implementing this option. In case the co-processing option is difficult to be practiced, other options such as mechanical recycling etc. shall be explored and implemented.

7.0 Alternate Material:

The most preferred option is minimization of use of SMC/FRP/Polycarbonate polymer products & promoting use of alternate material which could be easily recyclable/reusable/degradable.

8.0 References

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Annexure – I

BEFORE THE NATIONAL GREEN TRIBUNAL
PRINCIPAL BENCH, NEW DELHI

Original Application No. 124/2014
And
M.A. No. 382/2014 & M.A. No. 64/2015

Money Goyal&Ors.V/s Ministry of Environment & Forests &Ors.

CORAM: HON'BLE JUSTICE DR. P. JYOTHIMANI, JUDICIAL MEMBER
HON'BLE MR. B.S. SAJWAN, EXPERT MEMBER
HON'BLE MR. RANJAN CHATTERJEE, EXPERT MEMBER

Present: Applicant / Appellant : Mr.HaminderSyal and Mr.Akash Seth, Advs.
Respondent No. 1 : Mr.VikasMalhotra, Adv.
Respondent No. 3 : Ms.ManishaAgrawalNarain, Adv. andMr. S.L. Gundli, Sr. Law Officer, CPCB
Respondent No. 4 : Mr.NitinKaushal and Mr. Rahul Meena, Advs.
Respondent Nos. 6to8 : Mr.Jayat K. Sud, SSC, PSPCL and Ms. Bonita Singh, Advs.
Respondent No. 9 : Mr.Tarunvir Singh Khehar and GurmeetKhehar, Advs.

	Date & Remarks	Order of the Tribunal
	Item No. 3 January, 27 2015	Respondent no. 3, CPCB has filed M.A. No.64/2015. The 3rd respondent has filed the above M.A seeking permission from this Tribunal to constitute an Expert group to frame guidelines on the subject matter involved. In the previous order of this Tribunal dated 12.12.2014 we have directed the CPCB as well as MoEF to jointly frame guidelines for the purpose of proper and appropriate disposal of SMC/FRP plastics and produce the same today.

It is the case of the CPCB that since the Waste Management relating to plastic requires a thorough scientific study, the CPCB felt appropriate to constitute an expert group consisting of Members from CIPET, BIS, IIT-D and ICPE. It is their case that if such expert group studies the effects as well as the consequences of such a project it will be appropriate for the project to come in proper manner, for safe disposal of the non-recyclable and non- biodegradable plastic.The learned Counsel appearing for MoEFMr.Malhotra, also submit that constitution of such Committee will be an appropriate step for better handling of the situation. Accordingly, taking note of the entiresituation, we are of the view, that the request made on behalf of CPCB in the miscellaneous application has to be conceded. Accordingly, M.A. No. 64/2015 stand allowed and is accordingly disposed of. The CPCB in consultation with the MoEF shall constitute such a Committee within a period of 2 weeks from the date of receipt of the copy of the order and thereafter, we request the Committee thus constituted to study the entire aspect and give its recommendation to the CPCB expeditiously in any event within 4 weeks.

In the meantime, the order passed in the last two paragraphs in the earlier order shall continue to be in operation.

Stand over to 5th March, 2015.

...., JM
(Dr. P. Jyothimani)

...., EM
(B.S. Sajwan)

...., EM
(RanjanChatterjee)

CENTRAL POLLUTION CONTROL BOARD

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B- 17011/7/PCP (PWM)/2013 Dated:27.01.2015

ORDER

Sub: Constitution of Expert Group for framing Guidelines for Disposal of Thermoset Plastics.

Hon'ble NGT vide its Order dated **12.12.2014** directed CPCB &MoEF to jointly frame Guidelines for proper & appropriate disposal of SMC/FRP products and place before the Hon'ble NGT for its approval. As a follow-up of direction, Competent Authority, CPCB is pleased to form an Expert Group having representations from MoEF, CIPET, BIS and research institutions having expertise in Plastic Waste Management for framing Guidelines for disposal of thermoset plastics. The structure of Exert Group is given below :-

1. **Director & I/c PCP, CPCB**	**- Chairman**
2. Director or his/her Nominee, MoEF&CC (HSMD)	- Member
3. Representative from CIPET	- Member
4. Representative from BIS	- Member
5. Representative from IIT Delhi (Polymer Science)	- Member
6. Representative from ACC	- Special invitee
7. **Dr. S. K. Nigam (Scientist 'D', CPCB)**	**- Member Convener**

The tenure of Expert Group will **'4' weeks** from date of issue of Order. The Expert Group may also include Expert Members as per the requirement of the abovesaid subject. The Expert Group will meetin CPCB to frame Guidelines for Disposal of Thermoset Plastic Waste including SMC, FRP etc. waste.

The Expert Group will submit draft Guidelines to Chairman, CPCB for consideration before placing the Hon'ble NGT.

Sd/-

(A B Akolkar)
Member Secretary