CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-SSC-PDD)
Version 03 - in effect as of: 22 December 2006

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Revision history of this document

Version Number	Date	Description and reason of revision
01	21 January 2003	Initial adoption
02	8 July 2005	•The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document. •As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <http://cdm.unfccc.int/Reference/Documents>.
03	22 December 2006	•The Board agreed to revise the CDM project design document for small-scale activities (CDM-SSC-PDD), taking into account CDM-PDD and CDM-NM.

SECTION A. General description of small-scale project activity

A.1 Title of the small-scale project activity:

>> Destruction of Hazardous Waste using Plasma Technology at Ankleshwar, Gujarat - India
Version 01
Date 2nd November, 2012

A.2. Description of the small-scale project activity:

1. In India, there 36,165 hazardous waste (HW) generating industries generating 62,32,507 MT of waste every year. [1] Of this 6.67% waste requires to be incinerated. Maharashtra and Gujarat generate 62.87% of the country's total incinerable HW. (Maharashtra 36.75%, Gujarat 26.12%).

2. Government of India has notified The Hazardous Wastes (Management, Handling and Transboundary Movement) Rules, 2008 under the Environment Protection Act, 1986 as amended from time to time. Hazardous Waste has been defined in Rule 3 of the aforementioned notification as any waste, which by reason of any of its physical, chemical, reactive, toxic, flammable, explosive or corrosive characteristics causes danger or is likely to cause danger to health or environment, whether alone or when in contact with other wastes or substances.

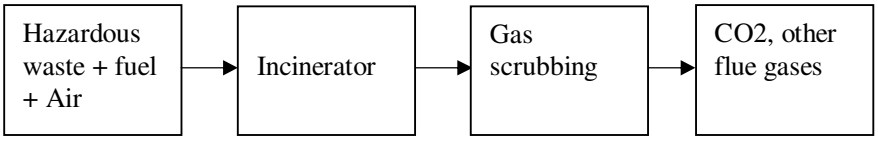
3. The Current status of management of incinerable HW in India is as follows

Sr. No	Particulars	Statistics
1	Common Incinerator	13 Nos in 6 States
2	Individual Incinerators	127 Nos. in 12 States
3	Total Incineration capacity	3,27,705 MTA
4	Generation of Incinerable Waste in Country	4,15,794 MTA
5	Deficit in Incineration Capacity	88,089 MTA
6	Proposed Capacity Enhancement	2,56,710 MTA

4. Gujarat is generating 108,622 MTA of incinerable waste[2].[3] This is managed by 37 Individual Incinerators and 5 Common incinerators.

5. Ankleshwar is one of the major industrial areas in the Bharuch district, Gujarat with more than 1200 industries generating significant HW. There is one common incineration facility in the district is installed in this town viz. Bharuch Enviro Infrastructure Ltd.

6. The scheme of incineration - current practice for hazardous waste treatment:



[1] National Inventory of Hazardous Waste Generating Industries & Hazardous Waste Management in India, February 2009 – published by Central Pollution Control Board, Hazardous Waste Management Division, Delhi.

[2] Table 3.4 of ibid report.

[3] Chart 3.3 of ibid report.

7. Plasma Energy Applied Technologies Ankleshwar Pvt. Ltd. is a special purpose vehicle company established by PEAT International P Ltd., Vadodara to implement its' parent companies (PEAT International Inc., Northbrook, USA) patented technology to

   7.1. Destroy hazardous waste with thermal plasma and
   7.2. Generate useful energy – Thermal and/or Electrical
   7.3. And other by products (vitrified slag – used as an aggregate in construction and/or road and sodium sulphide solution 20% - a chemical required by the local industries of Ankleshwar).

8. Thus this technology is having following features;
   8.1. It is replacing GHG Intensive Incinerators (baseline scenario) for the destruction of HW.
   8.2. It will export an anticipated 1.382 MW power to the grid.

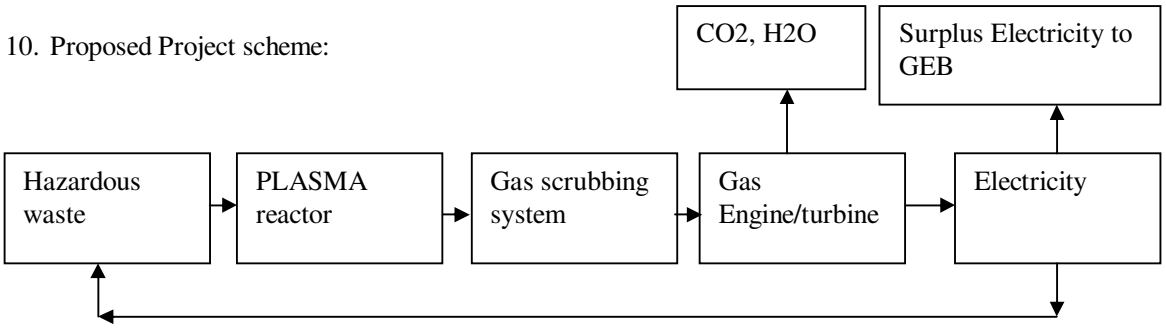
9. Contribution to Sustainable Development
   9.1. GHG Emission Reduction:
   Since the project activity is not an incineration process, it does not require any direct fossil fuels to destroy the hazardous waste. Further, the consumption of electricity for generating the plasma is offset by the production of Syngas in the reactor in sufficient quantities to produce enough electricity, thereby becoming a net exporter of electricity.
   Further there the ash content becomes NIL in the Proposed Project.
   The project also produces vitrified materials that envelope the hazardous metals and inorganic material to produce aggregates that can be used in road building or produce artificial jewellery etc (depending on the composition of the waste).

   9.2. Technological Development
   The plasma technology is the latest technology globally for the destruction of hazardous waste. Hence new technology is being used in the project activity. In the plasma technology for destruction of hazardous waste, there are technological differences between the various technologies. PEAT's technology has the distinction of generating Syngas from the hazardous waste containing carbon and then generating energy (thermal and / or electrical).

   9.3. Environment Development
   The project activity does not produce dioxins and other hazardous wastes that are likely to be emitted in to the atmosphere from the incineration process.
   As the technology requires no ash disposal, the emissions from transportation segment – in terms of GHG and SPM are reduced for ash transportation.

   9.4. Social Development
   Since the process involves state of the art technology, it would increase the demand for qualified engineers; and reduce the emissions and discharges of waste into the environment.

10. Proposed Project scheme:



A.3. Project participants:

>>

Name of party involved ((host) indicates a host party)	Private and/or Public entity (ies) project Participants	Kindly indicate if the Party involved wishes to be considered as project participant
India	Plasma Energy Applied Technologies Ankleshwar Pvt Ltd, Ankleshwar, India	No

A.4. Technical description of the small-scale project activity:

1) The technology covers the use of plasma gasification technology for the destruction of Waste containing carbon as an alternative to the use of incinerators. The technology produces several end products:
   i. Syngas, which is then used as fuel to generate energy – either heat or electricity;
   ii. A vitrified matrix
      1. that can be used for various construction-industry purposes, including roadbed material or concrete aggregate; and/or
      2. For the recovery of metals and metal alloys from waste feedstocks.
   iii. The Syngas cleaning process also yields valuable chemicals – such as diluted sodium sulphide; a valuable chemical in certain chemical industries.

2) Plasma is a distinct phase of matter, separate from the traditional solids, liquids, and gases. It is often described as the fourth state of matter. It is the ionised (highly charged) state of matter where the electrons in the outer most shell of the atom have been removed from the atom to make it a charged particle and thus able to conduct electricity efficiently. It is a collection of charged particles that respond strongly and collectively to electromagnetic fields, taking the form of gas-like clouds or ion beams. Since the particles in plasma are electrically charged (generally by being stripped of electrons), it is frequently described as an "ionized gas."

3) The technology uses plasma-arc electrodes and/or torches to produce thermal plasmas.
   i. Graphite electrodes or torches are the device that converts electrical energy into thermal energy. They generate controlled plasma "fields" when a steady flow of gas is forced between electrodes with a high electrical current flowing between electrodes. This now ionized gas generates an intense heat in the form of an arc column or "plume" (Temperatures in excess of 5,000^{o}C).

ii. Plasma-arc electrodes or torches create an ultra-high energy environment where the energy density is greater than the bonding energy between the elemental atoms that form molecules. When the molecules that form the waste are fed into the plasma field, the molecules are dissociated into their basic elemental atomic constituents. This dissociation permanently and totally destroys the molecular compounds and their properties.

4) HW, when heated to a very high temperature in the controlled atmosphere of the reducing plasma reactor undergoes predictable physical and chemical changes. The plasma arc electrodes and/or torches maintain the temperature of the plasma reactor at a uniformly high level (i.e. 1,000 to 1,500 deg C). This high temperature in the reactor prevents the formation of complex organic molecules and breaks down organics into a gas. The formation of dioxins or furans is impossible inside the plasma reactor due to the unique process features, including high uniform temperatures and a lack of excess oxygen within the system and rapid quenching of the gases.

i. The organic portion of the waste, depending on the composition of the waste stream, is broken into carbon, oxygen and hydrogen, essentially. Typically a controlled (stoichiometric) amount of oxygen (either in the form of steam or pure oxygen or both) can be added to reform the dissociated elements of the waste into a synthesis gas ("Syngas"), consisting mainly of Carbon Monoxide (CO) and Hydrogen (H_2).

ii. Depending on the constituents of the waste, the syngas will be scrubbed with water or alkali to recover chemicals and after that cleaned syngas will be used to produce energy – either in the form of electricity of steam.

iii. The inorganic constituents of the waste (other than carbon and oxygen) are melted (vitrified) into an environmentally safe, leach resistant, glass matrix and separately removed in an environmentally safe and sequestered safely. The carbon in the inorganic portion of the waste is also typically released to form Syngas. The other portions are in the form of inert glass constituents, such as Silicates, Borosilicates, Calcium Oxide, Alumina or metals and metal alloys. These end-products from the process have beneficial commercial uses and thus the landfill requirements are easily neglected.

A.4.1. Location of the small-scale project activity:

>> Plot No 9206. GIDC Ankleshwar , District Bharuch

A.4.1.1. Host Party(ies):

>> India

A.4.1.2. Region/State/Province etc.:

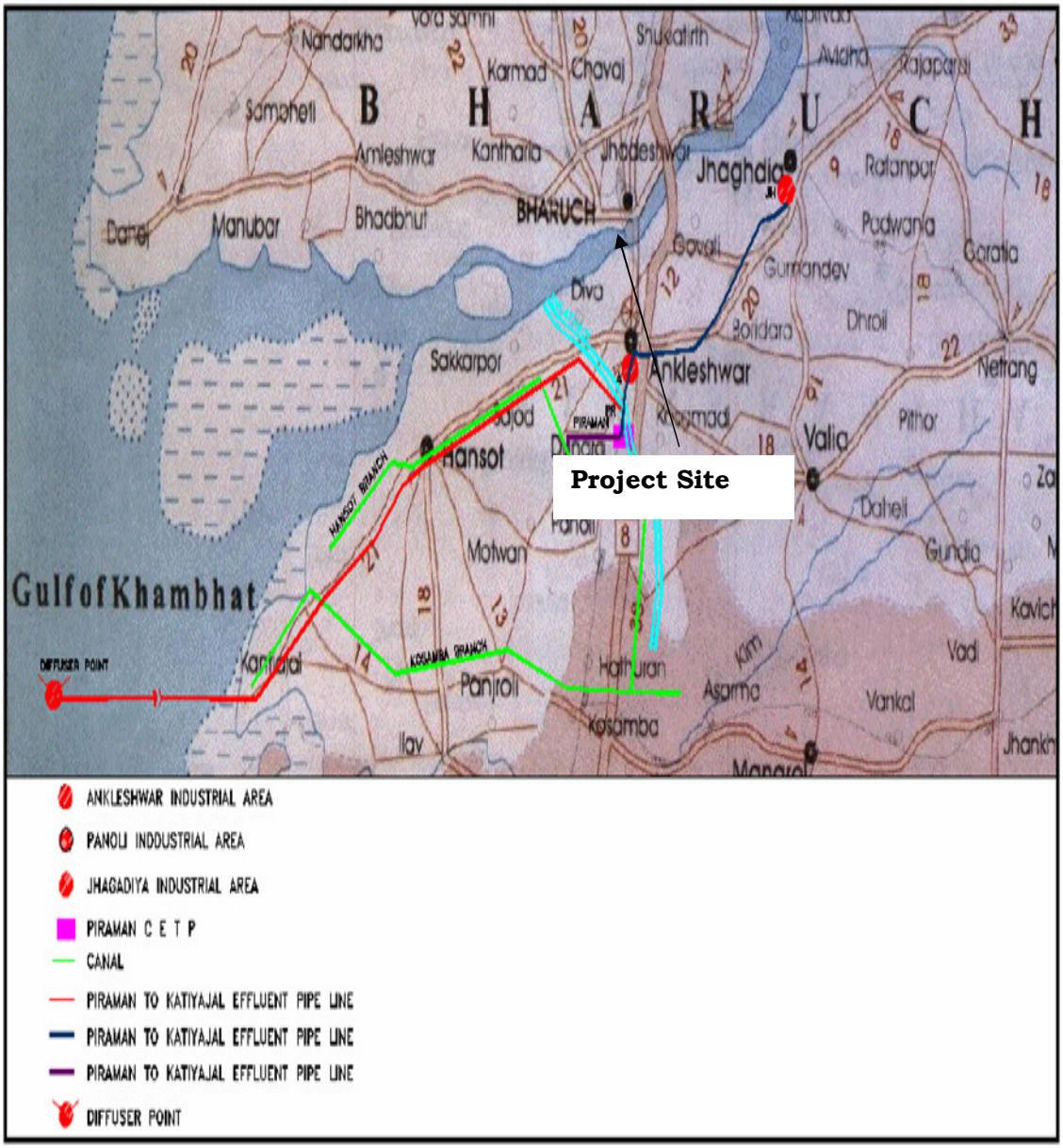
>>Gujarat

A.4.1.3. City/Town/Community etc:

>>Ankleshwar

A.4.1.4. Details of physical location, including information allowing the unique identification of this small-scale project activity :

Plot no. 9206, GIDC, Ankleshwar, Distt. Bharuch, Gujarat, India
Latitude 21° 37'09"N
Longitude 73°1'6"E



INDIA
State and Union Territories
N
AFGHANISTAN
TAJIKISTAN
PAKISTAN
CHINA
(TIBET)
NEPAL
BHUTAN
BANGLADESH
MYANMAR
SRI LANKA
JAMMU & KASHMIR
Srinagar
Jammu
HIMACHAL PRADESH
Shimla
Chandigarh
PUNJAB
Dehradun
UTTARAKHAND
HARYANA
NEW DELHI
Jaipur
RAJASTHAN
UTTAR PRADESH
Lucknow
SIKKIM
Gangtok
ARUNACHAL PRADESH
Itanagar
Dispur
ASOM (ASSAM)
NAGALAND
Kohima
Shillong
MEGHALAYA
Imphal
MANIPUR
BIHAR
Patna
Agartala
TRIPURA
Aizawl
MIZORAM
JHARKHAND
Ranchi
WEST BENGAL
Kolkata
Gandhinagar
GUJARAT
Bhopal
MADHYA PRADESH
CHHATTISGARH
Raipur
Diu
Daman
Silvassa
DADRA & NAGAR HAVELI
Mumbai
MAHARASHTRA
(ODISHA) ORISSA
Bhubaneshwar
Hyderabad
ANDHRA PRADESH
Yanam (Puducherry)
Panaji
GOA
KARNATAKA
Bengaluru (Bangalore)
Chennai
Puducherry
Mahe (Puducherry)
Kavaratti
LAKSHADWEEP (INDIA)
KERALA
TAMIL NADU
Karaikal (Puducherry)
Thiruvananthapuram
ANDAMAN & NICOBAR ISLANDS (INDIA)
Port Blair
LEGEND
International Boundary
State Boundary
National Capital
State & U.T. Capital
Map not to Scale
Copyright © 2011 www.mapsofindia.com
This map is updated as on April 15, 2011
Area shown in the map above

A.4.2. Type and category(ies) and technology/measure of the small-scale project activity:

>> This draft SSC PDD is part of the documentation along with the submission of a new small scale methodology titled *Destruction of Waste containing carbon using Plasma Technology and recovery of energy (thermal and/or electrical) using Syngas generated.*

The suggested sectoral scope III Type III

In order to manage the Hazardous waste, it has to be destroyed to change their chemical profile. This is normally done by incineration globally using fossil fuels. This is done in individual plants or in common treatment plants. The ash is disposed off in landfills.

This technology uses plasma technology to destroy the hazardous nature of chemicals into elemental form to neutralize their hazardous nature. The chemicals like HCl or H2S – formed during destruction are neutralized with Water and alkaline solution.

A.4.3 Estimated amount of emission reductions over the chosen crediting period:

Sr No	Crediting Period	Estimation of Annual GHG emission reduction in tCO_2e
1.	2014	5191
2.	2015	5191
3.	2016	5191
4.	2017	5191
5.	2018	5191
6.	2019	5191
7.	2020	5191
8.	2021	5191
9.	2022	5191
10.	2023	5191
11.	Total Estimated GHG emission reduction	51910
12.	No of years in crediting period	10
13.	Average Estimated GHG emission reduction per annum	5191

A.4.4. Public funding of the small-scale project activity:

>> The project is financed by the Project Proponents, government subsidies and commercial banks only and no public funding is involved.

A.4.5. Confirmation that the small-scale project activity is not a debundled component of a large scale project activity:

The proposed project activity is a small-scale project activity and it is not a bundled component of a larger project activity.

SECTION B. Application of a baseline and monitoring methodology

B.1. Title and reference of the approved baseline and monitoring methodology applied to the small-scale project activity:

>> Proposed Methodology
Destruction of Waste containing carbon using Plasma Technology and recovery of Energy (Thermal and/or Electrical) using Syngas

B.2 Justification of the choice of the project category:

>>
Plasma Technology is a new technology that is not incineration, and is significantly different. In incineration, it is an oxidation process along with combustion of the flammable materials in the waste. The combustion is initiated by ignition of fossil fuels added to the waste. Plasma technology destroys the waste into its elemental gases and metals. The elemental carbon is then used to generate Syngas. The Syngas is then used as a fuel to generate energy (thermal/ electricity) in the form required. Hence it is neither a capture of waste energy. It is therefore a type III project.

None of the approved methodologies cover this scenario, hence a new methodology is being proposed.

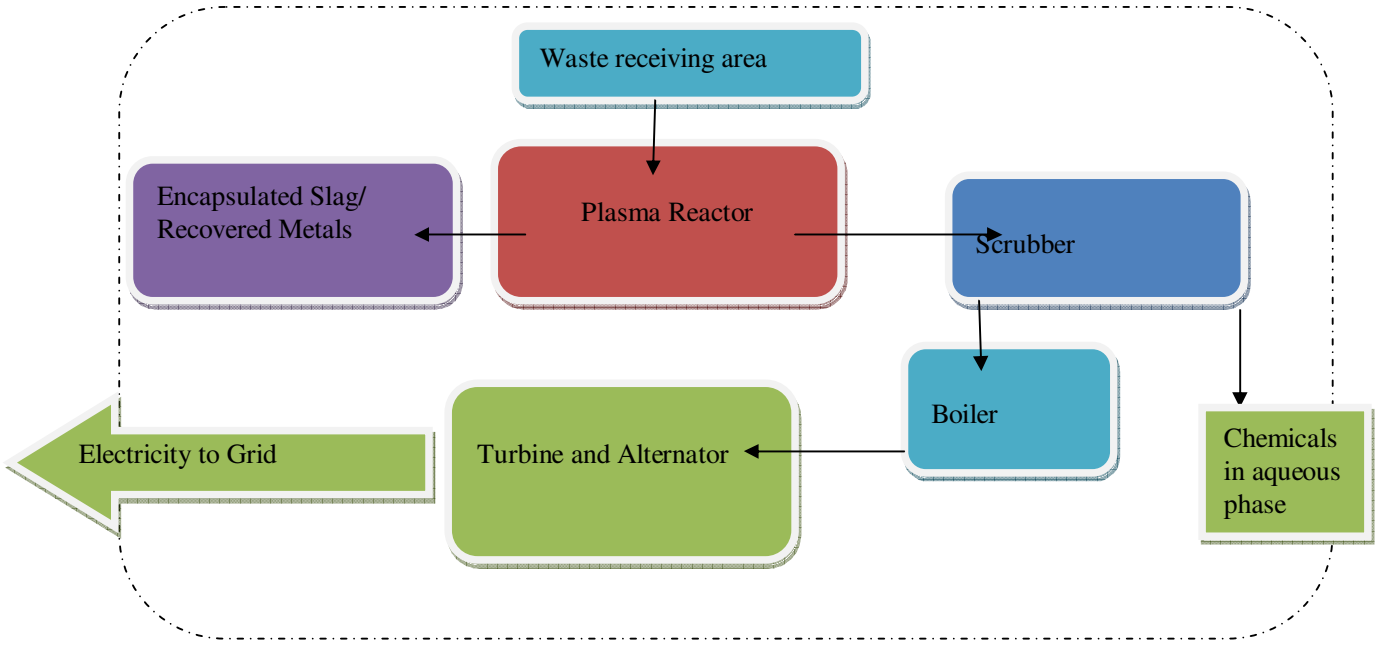
The project activity meets the applicability conditions of the proposed methodologies, as demonstrated below

	Applicable Conditions under Proposed Methodology	**Justification**
1.	Facility may be new or replacing existing incinerator technology,	It is a new facility to meet the additional demand in Ankleshwar that is not being serviced by the existing incinerators.
2.	New facilities to comply with General Guidelines to SSC CDM Methodology	
a.	PA is a small scale activity emission reduction estimated will not go beyond 60 ktCO_2e per annum during the entire crediting period.	PA is type III project activity. There is neither Type I / Type II activity embedded in the PA nor planned in conjunction with the PA. It is expected to yield a maximum GHG emission reduction of 5191 tCO_2e per annum during the 10 year crediting period.
b.	Identification of most plausible baseline scenario as per Para 19 of the Guidance	Identification of the most plausible baseline scenario is done in section B.4 ,

B.3. Description of the project boundary:

>> The project boundary is the geographical physical location of the plant for the destruction of hazardous waste, encompassing the following activities.

Figure 1: Project Boundary



B.4. Description of baseline and its development:

>> The baseline scenario identification as per Para 19 of the General Guidelines to SSC CDM Methodologies Version 17 is submitted below

Step 1: Identification of alternatives available to the project proponent that deliver comparable level of service including the proposed project activity undertaken without being registered as a CDM Project Activity.

The alternatives that exist for the destruction of hazardous waste containing biodegradable carbon in a common hazardous waste Treatment and storage facility (TSDF) are:

1. Incineration of hazardous waste containing using fossil fuels
2. Landfill of hazardous waste.
3. Destruction of hazardous waste using plasma technology without utilization of Syngas
4. Destruction of hazardous waste using plasma technology with utilization of Syngas – the proposed project activity without being registered as a CDM project.
5. Destruction of hazardous waste using plasma technology with utilization of Syngas – the proposed project activity with being registered as a CDM project.

Step 2: List the alternatives identified as per Step 1 in compliance with the local regulations.

All the project activities other than project 2 are in compliance with the local regulations.

Step 3: Estimate and rank the alternatives identified in Step 2 taking into account barrier tests specified in attachment A to Appendix B of the simplified modalities and procedures of SSC CDM

Incineration is the lowest capital cost for destruction of hazardous waste and the prevalent technology in the country http://cpcb.nic.in/divisionsofheadoffice/hwmd/Information_TSDF.pdf.

The barrier test is being given in the following subsection.

Step 4: If only one alternative remains that is

- Not the proposed project activity undertaken without being considered as a CDM project activity; and
- It corresponds to one of the baseline scenarios provided in the methodology; then the project activity is eligible under the methodology

If more than one alternative remain that correspond to the baseline scenarios provided in the methodology, choose the alternative with the least emissions as the baseline

The baseline scenario is the destruction of hazardous waste using the incineration process using fossil fuels and grid electricity. The incineration process is as per plan sanctioned by the Gujarat Pollution Control Board – the state statutory body monitoring the management of hazardous waste.

As per current technological applications, the hazardous waste is being destroyed in an incinerator using fossil fuels – Natural Gas to initiate the ignition of the Hazardous waste. In addition, electricity from the grid is used in utilities to the incinerator.

The baseline generates ash residue which is landfilled.

The baseline uses activated carbon in the scrubbing process to absorb volatile substances that escape with the flue gases. The spent carbon is fed back into incinerator along with the waste and converted to CO_2 in the incinerator that escapes to the atmosphere along with the flue gases.

The hazardous waste received in HDPE Drums is fed into the incinerator along with the drum, without opening to avoid the spillage and impact to the environment. Waste received in steel drums is also fed into the incinerator, and after complete incineration of waste, the empty drums are removed on cooling the incinerator.

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered small-scale CDM project activity:

Step 1: Identification of alternatives to the project activity consistent with current laws and regulation. The anthropogenic emissions in the incineration process are reduced by the project activity in the following manner

1. No Fuel is used in the project scenario except as a supplementary fuel, when needed, in the syngas utilization system.
2. Minimal electricity is consumed from the grid in the Plasma process (generally only during start-up and maintenance Operations). The project anticipates generates surplus electricity due to utilization of the syngas and this surplus would be supplied to Grid.
3. The activated carbon is used in incineration as well as project emission. Thus, its CO2 emission offsets in the total emission – the CO2 emission from both will be similar.
4. The project emissions from the consumption of electrodes (carbon) and additives (sodium carbonate) are negligible compared to total emission reduction by consumption of fuel and surplus energy supplied to a grid.

Sub-step 1a: Define alternatives to the project activity:

The alternatives are

1. Scenario 1: Incineration process for combustion of hazardous waste
   a. This is the standard technology being used in India for combustion of hazardous waste. The Central Government's guidelines for handling hazardous waste are http://cpcb.nic.in/contents.php. In either case, the technology is incineration.
   b. This is in accordance with the regulatory requirements for compliance with the local environmental regulations as enunciated in the Hazardous Waste Management Rules 2008 as amended.

2. Scenario 2: Use of Plasma reactor for destruction of hazardous waste without utilization syngas.
   a. The PTDR technology is the latest technology and different variants of the technology are available globally. One variant is Plasma Thermal Destruction and Recovery Technology developed by PEAT International, Northbrook, IL, USA. This technology is proposed for the project activity.
   b. Other variants include Westinghouse technology http://www.assocham.org/events/recent/event_426/RR_Kanade.pdf to generate Syngas and then use waste heat recovery to generate power. CDM ID 4483 - Waste heat recovery projects at Pune and Nagpur in Maharashtra, Validator TUV

Nord. The project has been withdrawn at validation. Reference UNEP Risoe CDM/JI Pipeline Analysis and Database, August 1st, 2011.

3. Scenario 3: Implementing the project without CDM benefits.
   a. CDM Benefits are required to overcome increased capital cost of syngas utilization system.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

>> A new methodology "Destruction of Waste containing carbon using Plasma Technology and recovery of Energy (Thermal and/or Electrical) using Syngas the emission reductions are as follows

1. Baseline Emissions

$$BE_{y} = BE_{FF,y} + BE_{EC,y} + BE_{EG,y} + BE_{TWI,y} + BE_{TWO,y} + BE_{ADD,y} \quad (1)$$

Where

$BE_{FF,y}$ is calculated using the annual emission from the fuel used in the baseline scenario. The fuel used will be the lowest carbon content fuel with the lowest Levelised cost available in the region where the project activity is located or the one used in the baseline scenario, if incineration exists. The efficiency of the incinerator will be the rated efficiency of the incinerator, as adjusted for age of the incinerator.

$BE_{EC,y}$ is calculated as per current version of 'Tool to calculate electricity consumption in baseline, project and/or leakage consumption from electricity consumption'.

$BE_{EG,y}$ is the energy (thermal or electrical or combination) that is being replaced by the generation of Syngas by the Project Activity. It will be calculated as per AMS I.C

$BE_{TWI,y}$ is calculated as the emissions from the transportation of the waste containing carbon from the place of generation to the place of destruction.

$BE_{TWO,y}$ is calculated as the emissions from the transportation of the residues from the incineration process to the landfill. This is being considered since there will be significant reduction in the quantity of solid waste generation – vitrified solids and metal alloys from project activity instead of oxides from incineration.

$$BE_{FF,y} = \Sigma\,(Q_{NG,y} * EF_{NG,y}) + \Sigma\,(Q_{Diesel,y} * EF_{Diesel,y}) + \Sigma\,(Q_{NG} * EF_{NG}) \quad (2)$$

$Q_{NG,y}$ is the quantity of Natural Gas consumed in year *y* in the incinerator and/or ancilliary activities – such as, evaporation to concentrate liquid wastes tonnes/annum.

$EF_{NG,y}$ is the emission factor of the Natural Gas consumed in year *y*. tCO_2e/tonne fuel.

$Q_{Diesel,y}$ is the quantity of Diesel consumed in year *y* in the incinerator and/or ancilliary activities – such as, evaporation to concentrate liquid wastes tonnes/annum.

$EF_{Diesel,y}$ is the emission factor of the Diesel consumed in year *y*. tCO_2e/tonne fuel.

$Q_{NG,y}$ is the quantity of Natural Gas consumed in year *y* for concentrating aqueous waste by incinerators.

$EF_{NG,y}$ is the emission factor of the Natural gas consumed in year *y*. tCO_2e/tonne fuel.

Where the historical data is not used for reasons enunciated above, the quantity and the fuel used will be based on the manufacturer's specifications for baseline scenario solution or the actual consumption in the past year. The fuel used will be as per standard practice in the region or the least cost and lowest carbon content fuel available in the region identified in the PDD.

$$BE_{EC,y} = \sum kWh_{i,y} * EF_{grid,y} \div [1 - T_{Tech\ Loss}] \quad (3)$$

$kWh_{i,y}$ is the net electricity consumed in year *y* by the incinerator.

$EF_{Grid,y}$ is the emission factor for grid electricity *i* consumed in year *y*. tCO_2e/tonne fuel.

$$BE_{EG,y} = (kWh_{gen,y} - kWh_{cons,y}) * EF_{grid,y} \quad (4)$$

$kWh_{gen,,y}$ is the net electricity generated in year *y* by project acitivities.

$kWh_{Cons,,y}$ is the net electricity consumed in year *y*. by project activities.

$EF_{grid,y}$ is the emission factor for grid electricity consumed in year y, tCO_2e/tonne fuel

$$BE_{TWI,y} = D_{TWI,y} \times N_{TWI,y} \times EF_{per\ trip} \quad (5)$$

Where

$BE_{TWI,y}$ is the emissions from the transportation of the waste containing carbon from the place of generation to the place of destruction

$D_{TWI,y}$ is the distance in kms from the place of generation to the place of destruction in year y X 2.

$N_{TWI,y}$ is the number of trips per annum made by the transport vehicle for transportation of waste containing carbon at the place of destruction and back in year y measured in km.

$EF_{per\ trip.u}$ is the per km emission factor from the use of fossil fuel as the transport fuel in tonnes CO_2e.

<u>*Note*</u>: This should generally be the same as the project scenario, unless the Project Activity is substituting an existing waste containing carbon destruction process at a different location.

$$BE_{TWO,y} = D_{TWO,y} \times N_{TWO,y} \times EF_{per\ trip} \quad (6)$$

Where

$BE_{TWO,,y}$ is the emissions from the transportation of the residues from the incineration process to the landfill

$D_{TWO,y}$ is the distance in kms from the incinerator to the landfill for the waste residues from the incineration process in year *y* X 2

$N_{TWO,y}$ is the number of trips per annum made by transport vehicle for depositing the waste residue from the incineration process at the landfill site and back in year *y* measured in km.

$EF_{per\ trip,y}$ is the per km emission factor from the use of fossil fuel as the transport fuel.

$$BE_{ADD,y} = \sum_i Q_{i,y} \times EF_{i,y} \quad (7)$$

Where

$BE_{ADD,y}$ is the emissions from the use of additives in the processes in the baseline scenario

$Q_{i,y}$ is the quantity of additive *i* used in the incineration process in the baseline in year *y*

$EF_{i,y}$ is the emission factor for the additive used in year y. It will be calculated from the carbon content of the additive. Emission Factor of the additive will be calculated from the chemical equation for the emission of CO_2 from the breakup of the additive on heating/ reformulation post the plasma treatment.

Emission factor per ton of waste incinerated:

$$BE_{per\ ton} = BE_y / Q_{waste\ in\ ton,\ y} \quad (8)$$

Where;

BE per ton is the CO2 emission per ton of waste incinerated

BE y is the Total CO2 Emission per year

Q waste in ton, y is the Total waste incinerated per year

2. Project Emissions

Project Activity emissions are from two broad categories

1. Project Activity PA_y
2. Transport Emissions of By Products $TR_{BP,y}$

$$PE_y = PA_y + BE_{ADD,y} + TR_{BP,y} \quad (9)$$

Project Activity Emissions are two types – Positive emissions of GHG gases from

1. Consumption of carbon electrodes,
2. Consumption of Waste Activated Carbon

The consumption of electricity in the project activity is already accounted for in the baseline grid emissions, as the project activity is a net exporter of electricity to the grid.

$$PA_y = (Q_{electrode,y} + Q_{act\ carbon,y}) * 44 \div 12 \quad (10)$$

Where

$Q_{electrode,y}$ is the quantity of carbon electrodes consumed in year *y* (tonnes/annum) in the project activity

$Q_{act\ carbon,y}$ is the quantity of activated carbon consumed in year y (tonnes/annum) in the project activity.

Any carbon containing residue left in the project activity is recycled to the plasma reactor.

In addition, there are transport emissions related to the movement of vitrified material and metal. Since the quantity of the vitrified material and metal is less than the quantity of ash generated in the incinerator, the transport emissions are lower. The transport of the residues in the baseline have been accounted for in the baseline emissions, therefore the

$$PE_y = D_{PE,y} \times N_{PE,y} \times EF_{per\ trip} \quad (11)$$

PE_y is the emissions from the transportation of the vitrified material and metal from the Project activity to the potential clients

$D_{PE,y}$ is the distance in kms from the project activity to the potential clients for the vitrified material and metal from the project X 2 in year *y*

$N_{PE,y}$ is the number of trips per annum made by transport vehicle for transporting the vitrified material and metal from the project to the potential clients and back in year, y.

$EF_{per\ trip,y}$ is the per km emission factor from the use of fossil fuel as the transport fuel.

Emission factor per Ton of waste treated by Project:

$$PE_{per\ ton} = PE_y / Q_{waste\ in\ ton,\ y} \quad (12)$$

Emission reduction is as given below;

$$ER_{Total\ (Tons\ of\ CO2\ per\ year)} = (BE_{Factor} - PE_{Factor})_{(Ton\ of\ CO2/Ton\ of\ waste)} * (Total\ waste\ treated\ by\ Project)_{(Ton\ of\ waste/year)} \quad (13)$$

3. Leakage

There are no leakages.

B.6.2. Data and parameters that are available at validation:

(Copy this table for each data and parameter)

Data / Parameter:	Quantity of waste fed to the PLASMA reactor
Data unit:	Ton per year
Description:	Waste feeding to the reactor for treatment
Source of data used:	Auto Weight Balance and log sheet
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied :	Measurement of waste fed to the reactor will be done automatically by PLC/SCADA system and each feed data will be stored in operator's computer system. Records of previous measurement and actual feed rate will also be available for future reference.
Any comment:	

Data / Parameter:	Chemical analysis of each type of waste
Data unit:	pH, % (Wt. basis) of C, H, O, N, S, H2O, Inorganics, Metals
Description:	Ultimate analysis of particular waste type will be carried out for better control and high purity treatment of each type of waste.
Source of data used:	In-house well equipped laboratory
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied :	Measurement procedure/methods will be based on government standards/approved methods and carried out by well trained chemists. Laboratory will be sufficiently well equipped for such measurements.
Any comment:	

Data / Parameter:	Temperature in the PLASMA reactor
Data unit:	Degree Centigrade
Description:	Temperature inside the PLASMA reactor will be maintained above 1000 C for ensuring safe and controlled emissions and better treatment of the waste.
Source of data used:	Thermocouples will be installed at different places inside the PLASMA reactor to measure the temperature during operation.
Value applied:	

Justification of the choice of data or description of measurement methods and procedures actually applied :	Temperature measurement will be carried out by Thermocouples installed inside the PLASMA reactor. Log sheet will be maintained automatically by PLC/SCADA system installed in the plant.
Any comment:	

Data / Parameter:	Steam generated and fed to the turbine
Data unit:	Degree Centigrade, M3/Hr, Kg/Cm2
Description:	Temperature, flow of steam and pressure of the steam will be measured during the operation to ensure the safe and continuous operation of the turbine for electricity generation.
Source of data used:	Thermocouple, Flow measurement instrument, pressure measurement instrument will be installed in the steam line.
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied :	Continuous measurement of the all of the above parameters for steam will be carried out by means of instruments installed and logging of parameters will be done by PLC/SCADA system installed in the plant.
Any comment:	

Data / Parameter:	Electricity generated by Turbine
Data unit:	KW-Hr
Description:	Steam will be supplied to turbine and electricity will be produced from turbine system.
Source of data used:	Energy meter will be installed for measurement of electricity produced.
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied :	Government approved energy meter will be installed for measurement of electricity produced by turbine.
Any comment:	

Data / Parameter:	Electricity imported from the grid
Data unit:	KW-Hr
Description:	Part/Full/Nil electricity will be imported from the grid. Quantity of the electricity imported from the grid will be based on the process and operation schedules.
Source of data used:	Energy meter will be installed for measurement of electricity imported from the grid
Value applied:	

Justification of the choice of data or description of measurement methods and procedures actually applied :	Government approved energy meter will be installed for measurement of electricity imported from the grid
Any comment:	

Data / Parameter:	Electricity exported to the grid
Data unit:	KW-Hr
Description:	Part/Full/Nil electricity will be exported from the grid. Quantity of the electricity exported to the grid will be based on the process and operation schedules.
Source of data used:	Energy meter will be installed for measurement of electricity exported to the grid
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied :	Government approved energy meter will be installed for measurement of electricity exported to the grid
Any comment:	

Data / Parameter:	Consumption of additives and their analysis
Data unit:	Kg/Hour, % purity
Description:	Consumption of additives will be measured based on the weight balance reading and record will be maintained by PLC/SCADA system Analysis of additives will be either carried out in in-house laboratory Or will be provided by authorised dealer and record for the same will be maintained for future reference
Source of data used:	Operator's computer will maintain consumption data. Record book and bills copy will be used as record for analysis reports
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied :	Consumption and analysis will be recorded all the time in well specified and dedicated manner
Any comment:	

Data / Parameter:	Fuel consumption and fuel efficiency of transportation equipment
Data unit:	Liters/year, Liters/Kilometer
Description:	Consumption of fuels by transportation vehicles will be measured on yearly basis and efficiency is specified by vehicle type Or will be calculated based on the fuel consumption and kilometre travelled.
Source of data used:	Fuel Station bills will be kept in record for measurement
Value applied:	

Justification of the choice of data or description of measurement methods and procedures actually applied :	Fuel bills and travel distance will be maintained for every particular year and will be used for calculating efficiency of the vehicle
Any comment:	

Data / Parameter:	Consumption of graphite electrodes and carbon content of graphite
Data unit:	Kg/year, % purity
Description:	Consumption of graphite electrodes will be measured and recorded. Purity of graphite electrodes will be analysed in in-house laboratory or designated laboratory
Source of data used:	Daily record book will maintain graphite consumption and purity
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied :	Consumption of graphite electrode will be recorded in daily register for graphite electrode and purity will also be recorded for the entire bulk of graphite used during the process throughout the year
Any comment:	

B.6.3 Ex-ante calculation of emission reductions:

Baseline Emissions:

Baseline emission are calculated as:

$$BE_y = BE_{FF,y} + BE_{EC,y} + BE_{EG,y} + BE_{TWI,y} + BE_{TWO,y} + BE_{ADD,y} \quad (1)$$

BE_y = 1909.16 + 2077.61 + 3601.44 + 0.0691

= 7588.28 tCO2/year

1. Baseline emission from Fuel used ($BE_{FF,y}$):

$$BE_{FF,y} = (Q_{NG,y} + EF_{NG,y}) + (Q_{Diesel,y} + EF_{Diesel,y}) + (Q_{NG,y} + EF_{NG,y}) \quad (2)$$

= 1381.261 + 60.43 + 467.46

= 1909.16 tCO2/year

2. Baseline Emission from electricity used;

$$BE_{EC,y} = \sum kWh_{i,y} * EF_{grid,y} \div [1 - T_{Tech\ Loss}] \quad (3)$$

= (337.12 * 0.82) ÷ [1 – 4%] * (7200/1000)

= 2077.61 tCO2/year

3. Baseline emission from energy replacement by the project activity;

$$BE_{EG,y} = (kWh_{gen,y} - kWh_{cons,y}) * EF_{grid,y} \quad (4)$$

= (1382-772) * 0.82 * (7200/1000)

= 3601.44 tCO2/year

4. Baseline emission from transporting waste;

$$BE_{TWI,y} = D_{TWI,y} \times N_{TWI,y} \times EF_{per\ trip} \quad (5)$$

= 1 * 150 * 2 * 0.23034 / 1000

= 0.069102 tCO2/year

5. Baseline emission from transporting residue/ash;

$$BE_{TWO,y} = D_{TWO,y} \times N_{TWO,y} \times EF_{per\ trip} \quad (6)$$

= 0

Note: landfill site is located in the same premises and so, this is assumed to be NIL.

6. Baseline emission from the use of additives;

$$BE_{ADD,y} = \sum_i Q_{i,y} \times EF_{i,y} \quad (7)$$

= 0

Note: Additives are not used in baseline process.

7. Baseline emission per ton of waste treated;

$$BE_{per\ ton} = BE_y / Q_{waste\ in\ ton,\ y} \quad (8)$$

= 7588.28 / 12800

= 0.5928 tCO2/year

Project Emissions:

1. Total project emission per year;

$$PE_y = PA_y + BE_{ADD,y} + TR_{BP,y} \quad (9)$$

= 163.15 + 0.69102 + 653.184

= 817.03 tCO2/year

2. Project emission from project activities;

$$PA_y = (Q_{electrode,\ y} + Q_{act\ carbon,\ y}) * 44 \div 12 \quad (10)$$

= (0.18 + 6) * (44 / 12) * (7200 / 1000)

= 163.15 tCO2/year

3. Project emission from transportation of recovered metal/by-product;

$$PE_y = D_{PE,y} \times N_{PE,y} \times EF_{per\ trip} \quad (11)$$

= 10 * 150 * 2 * 0.23034 / 1000

= 0.69102 tCO2/year

4. Project emission per ton of waste treated;

$$\mathbf{PE_{per\ ton} = PE_y / Q_{waste\ in\ ton,\ y}} \quad (12)$$

= 817.03 / 10800

= 0.0756 tCO2/year

Emission Reduction:

$$ER_{Total\ (Tons\ of\ CO2\ per\ year)} = (BE_{Factor} - PE_{Factor})_{(Ton\ of\ CO2/Ton\ of\ waste)} * (Total\ waste\ treated\ by\ Project)_{(Ton\ of\ waste/year)} \quad (13)$$

= (0.5928 – 0.0756) * (10800)
= 5585.58 tCO2/year

B.6.4 Summary of the ex-ante estimation of emission reductions:

GHG emission summary for the crediting period is estimated as below;

Sr No	Crediting Period	Estimation of Annual GHG emission reduction in tCO_2e
1.	2014	5191
2.	2015	5191
3.	2016	5191
4.	2017	5191
5.	2018	5191
6.	2019	5191
7.	2020	5191
8.	2021	5191
9.	2022	5191
10.	2023	5191
11.	Total Estimated GHG emission reduction	51910
12.	No of years in crediting period	10
13.	Average Estimated GHG emission reduction per annum	5191

B.7 Application of a monitoring methodology and description of the monitoring plan:

B.7.1 Data and parameters monitored:

(Copy this table for each data and parameter)	
Data / Parameter:	Quantity of waste fed to the PLASMA reactor
Data unit:	Ton per year
Description:	Waste feeding to the reactor for treatment
Source of data to be used:	Auto Weight Balance and log sheet
Value of data	~ 14850 Ton per year
Description of measurement methods and procedures to be applied:	Measurement of waste fed to the reactor will be done automatically by PLC/SCADA system and each feed data will be stored in operator's computer system. Records of previous measurement and actual feed rate will also be available for future reference.
QA/QC procedures to be applied:	Regular and efficient recording of waste inlet to the project
Any comment:	
Data / Parameter:	Chemical analysis of each type of waste
Data unit:	pH, % (Wt. basis) of C, H, O, N, S, H2O, Inorganics, Metals

Description:	Ultimate analysis of particular waste type will be carried out for better control and high purity treatment of each type of waste.
Source of data to be used:	In-house well equipped laboratory
Value of data	NA
Description of measurement methods and procedures to be applied:	Measurement procedure/methods will be based on government standards/approved methods and carried out by well trained chemists. Laboratory will be sufficiently well equipped for such measurements.
QA/QC procedures to be applied:	Scheduled calibration of the instruments will be performed
Any comment:	

Data / Parameter:	Temperature in the PLASMA reactor
Data unit:	Degree Centigrade
Description:	Temperature inside the PLASMA reactor will be maintained above 1100 C for ensuring safe and controlled emissions and better treatment of the waste.
Source of data to be used:	Thermocouples will be installed at different places inside the PLASMA reactor to measure the temperature during operation.
Value of data	1200 C
Description of measurement methods and procedures to be applied:	Temperature measurement will be carried out by Thermocouples installed inside the PLASMA reactor. Log sheet will be maintained automatically by PLC/SCADA system installed in the plant.
QA/QC procedures to be applied:	Standard thermocouples will be used
Any comment:	

Data / Parameter:	Steam generated and fed to the turbine
Data unit:	Degree Centigrade, M3/Hr, Kg/Cm2
Description:	Temperature, flow of steam and pressure of the steam will be measured during the operation to ensure the safe and continuous operation of the turbine for electricity generation.
Source of data to be used:	Thermocouple, Flow measurement instrument, pressure measurement instrument will be installed in the steam line.
Value of data	NA
Description of measurement methods and procedures to be applied:	Continuous measurement of the all of the above parameters for steam will be carried out by means of instruments installed and logging of parameters will be done by PLC/SCADA system installed in the plant.
QA/QC procedures to be applied:	Standard instruments will be used
Any comment:	

Data / Parameter:	Electricity generated by Turbine
Data unit:	KW-Hr
Description:	Steam will be supplied to turbine and electricity will be produced from turbine system.

Source of data to be used:	Energy meter will be installed for measurement of electricity produced.
Value of data	NA
Description of measurement methods and procedures to be applied:	Government approved energy meter will be installed for measurement of electricity produced by turbine.
QA/QC procedures to be applied:	Standard Energy meters will be used
Any comment:	

Data / Parameter:	Electricity imported from the grid
Data unit:	KW-Hr
Description:	Part/Full/Nil electricity will be imported from the grid. Quantity of the electricity imported from the grid will be based on the process and operation schedules.
Source of data to be used:	Energy meter will be installed for measurement of electricity imported from the grid
Value of data	NA
Description of measurement methods and procedures to be applied:	Government approved energy meter will be installed for measurement of electricity imported from the grid
QA/QC procedures to be applied:	Standard energy meter will be installed by government authorities
Any comment:	

Data / Parameter:	Electricity exported to the grid
Data unit:	KW-Hr
Description:	Part/Full/Nil electricity will be exported from the grid. Quantity of the electricity exported to the grid will be based on the process and operation schedules.
Source of data to be used:	Energy meter will be installed for measurement of electricity exported to the grid
Value of data	NA
Description of measurement methods and procedures to be applied:	Government approved energy meter will be installed for measurement of electricity exported to the grid
QA/QC procedures to be applied:	Standard energy meter will be installed by government authorities
Any comment:	

Data / Parameter:	Consumption of additives and their analysis
Data unit:	Kg/Hour, % purity
Description:	Consumption of additives will be measured based on the weight balance reading and record will be maintained by PLC/SCADA system Analysis of additives will be either carried out in in-house laboratory Or will be provided by authorised dealer and record for the same will be maintained for future reference
Source of data to be used:	Operator's computer will maintain consumption data. Record book and bills copy will be used as record for analysis reports

Value of data	NA
Description of measurement methods and procedures to be applied:	Consumption and analysis will be recorded all the time in well specified and dedicated manner
QA/QC procedures to be applied:	Records will be maintained
Any comment:	

Data / Parameter:	Fuel consumption and fuel efficiency of transportation equipment
Data unit:	Liters/year, Liters/Kilometer
Description:	Consumption of fuels by transportation vehicles will be measured on yearly basis and efficiency is specified by vehicle type Or will be calculated based on the fuel consumption and kilometre travelled.
Source of data to be used:	Fuel Station bills will be kept in record for measurement
Value of data	NA
Description of measurement methods and procedures to be applied:	Fuel bills and travel distance will be maintained for every particular year and will be used for calculating efficiency of the vehicle
QA/QC procedures to be applied:	Records and bills from the suppliers will be maintained
Any comment:	

Data / Parameter:	Consumption of graphite electrodes and carbon content of graphite
Data unit:	Kg/year, % purity
Description:	Consumption of graphite electrodes will be measured and recorded. Purity of graphite electrodes will be analysed in in-house laboratory or designated laboratory
Source of data to be used:	Daily record book will maintain graphite consumption and purity
Value of data	NA
Description of measurement methods and procedures to be applied:	Consumption of graphite electrode will be recorded in daily register for graphite electrode and purity will also be recorded for the entire bulk of graphite used during the process throughout the year
QA/QC procedures to be applied:	Records will be maintained
Any comment:	

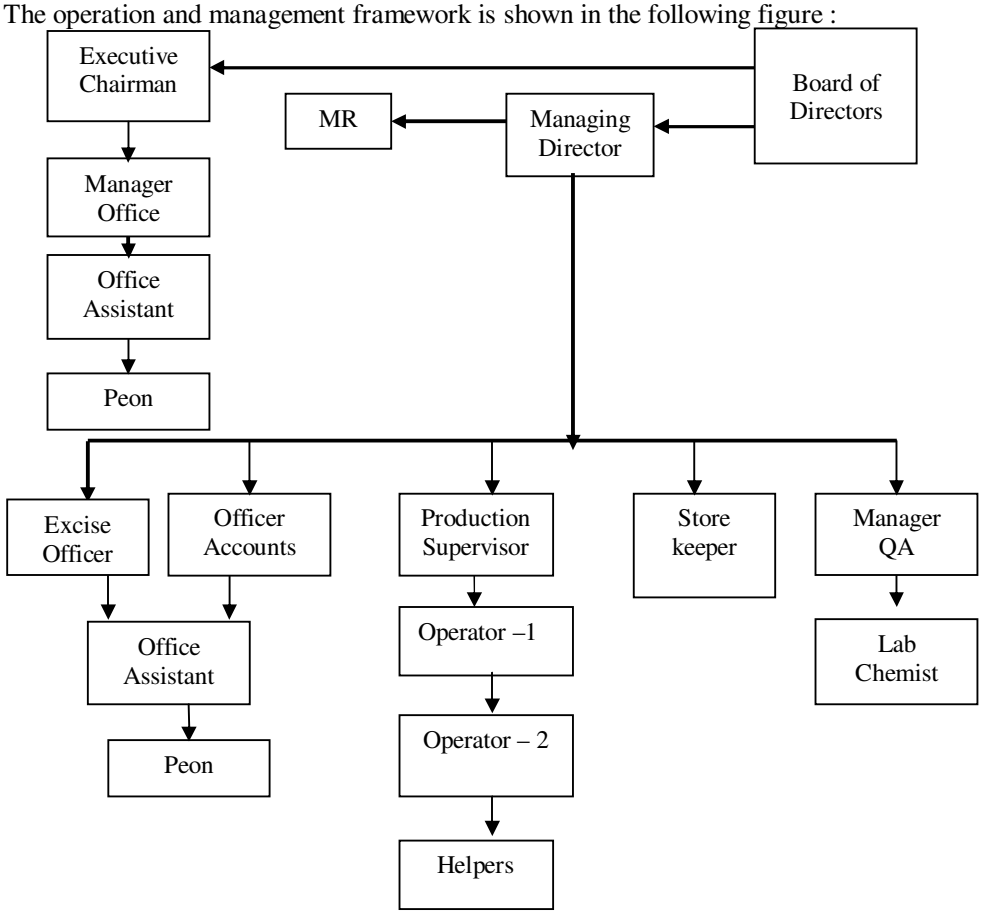
B.7.2 Description of the monitoring plan:

1. The monitoring procedures define a project-specific standard against which the project's performance (i.e. GHG reductions) and conformance with all relevant criteria will be monitored. It includes developing suitable data collection methods and data interpretation techniques for monitoring and verification of the GHG emissions with specific focus on technical performance parameters.
2. The monitoring plan provides a range of data measurement, estimation and collection options/techniques in each case, indicating preferred options consistent with good practices to

allow the project managers and the operational staff, the auditors, and the verifiers to apply the most practical and cost-effective measurement approaches to the project. The aim is to provide the project with a clear, credible, and accurate set of monitoring, evaluation and verification procedures. The purpose of these procedures would be to direct and support continuous monitoring of the project performance/ the key project indicators to determine the project outcomes, the greenhouse gas (GHG) emission reductions.

3. The monitoring covers the baseline and the project emissions. The monitoring includes the record of all variables and parameters (e.g. process data, effluent data, transportation data, emission factors) required by the methodology, as provided in section B.7.1 of this PDD.
4. All the data will be archived electronically or in hard copy in line with the methodology, and data will be kept until two years after the completion of the full crediting period (10 years).
5. In order to ensure the successful operation of the project and the creditability and verifiability of the CERs achieved, the project will have a well-defined management and operational system. The system will include the operation and management of the monitoring and record keeping system. Data monitoring will be conducted by the production supervisors supervised by the managing director. It is in the responsibility of the managing director to ensure that the required and experienced capacity is available. If needed, other staff will be assigned by him to assist in monitoring tasks. Initial training will be provided to the staff to operate the monitoring system properly before the project activity starts operation. It is also the responsibility of the managing director to organize and implement a quality management system that ensures the integrity of the data.

The operation and management framework is shown in the following figure :



6. All recorded data will be transferred to and stored as electronic spreadsheets and other electronic files. The calibration certificates will be stored as paper copies, although scanned copies may also be stored electronically. The project proponent will develop spreadsheet procedures for processing the data stored electronically in order to calculate emission reductions as applied to this project and described in sections B.6 and B.7.1.
7. The original data, calculation procedures and resulting emission reductions will be verified by an independent Designated Operational Entity (DOE) on an annual basis. The DOE will issue a Verification Report based on its findings and submit it to the CDM Executive Board for the issuance of CERs.

B.8 Date of completion of the application of the baseline and monitoring methodology and the name of the responsible person(s)/entity(ies)

Dr. C.B. Upasani
Director;
Jyoti Om Chemical research Centre Pvt. Ltd
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SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

10 years

C.1.1. Starting date of the project activity:

>> July 2014

C.1.2. Expected operational lifetime of the project activity:

>> 10 years

C.2 Choice of the crediting period and related information:

C.2.1. Renewable crediting period

C.2.1.1. Starting date of the first crediting period:

>>N/A

C.2.1.2. Length of the first crediting period:

>>N/A

C.2.2. Fixed crediting period:

10 years

C.2.2.1. Starting date:

>> July 2014

C.2.2.2. Length:

>> 10 years

SECTION D. Environmental impacts

>>

D.1. If required by the host Party, documentation on the analysis of the environmental impacts of the project activity:

>>

D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

>>

SECTION E. Stakeholders' comments

>>

E.1. Brief description how comments by local stakeholders have been invited and compiled:

>>

E.2. Summary of the comments received:

>>

E.3. Report on how due account was taken of any comments received:

>>

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

Annex 3

BASELINE INFORMATION

Annex 4

MONITORING INFORMATION

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