CDM – Executive Board

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

CONTENTS

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:

Title: Avoidance of methane emissions from Municipal Solid Waste and Food Waste through Composting

Version: 01

Date: 17/08/2007

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

The project activity entails production of organic manure-'Enrich' from municipal solid waste (MSW) and food waste (comprising of fish waste and coconut husk) through composting. The same is being developed by Krishi Rasayan Private Limited- the export and bio-tech arm of the renowned Krishi Rasayn Group. The waste materials are collected from various parts of Puri, a town in the state of Orissa in India, and treated aerobically to produce the organic manure. In absence of the project activity, the waste materials would have been dumped into landfills thereby allowing them to undergo anaerobic decomposition resulting in emissions of methane gas. Therefore the project activity helps in avoidance of methane emissions resulting from dumping of the waste materials as landfills. Moreover the aerobic treatment of the waste materials under the project activity does not result in any additional methane (or other green house gas) emissions. The only emissions that can be attributed to the project activity result from consumption of fossil fuel for transportation of the compost material from the plant site to the market[1] place. Therefore the project activity will bring about an overall reduction in anthropogenic emissions of green house gases (GHG) and hence will contribute significantly to reduce the impact of global warming. The emission reduction resulting from the project activity is estimated to be around 234314 tonnes of CO_2 over the entire crediting period of ten years which would not have happened in absence of the project activity with continued dumping of the waste materials into landfills.

Besides this direct global benefit, the project activity also aims at preserving and improving arable soil quality by promoting the use of the eco-friendly organic manure- 'Enrich'. This in turn enhances agricultural crop yields in the long term. Therefore the primary objectives of the project activity can be summarized as:

- Effective utilization of waste materials for producing organic manure- 'Enrich'
- Preservation and improvement of soil quality through the application of 'Enrich'

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- Enhancing the agricultural crop yield
- Reducing Global Warming

Contribution of the project activity towards sustainable development

The project activity contributes to the sustainable development of the host country-India. The sustainability aspect of the project activity has been dealt under the following four pillars of sustainable development.

Table A-1: Project Activity's contribution towards sustainable development	
Social Well-being	The project activity results in improving the general aesthetics of the city- Puri and hence aids in promoting industry and tourism in the state. Huge quantities of municipal solid waste and food waste, allowed to decay in landfills, are breeding grounds for germs which can cause outbreak of fatal diseases such as typhoid and cholera. The project activity by avoiding the decay of solid waste thus results in prevention of such diseases and helps in improving the health conditions of the city and its people.
Economic Well-being	The project activity results in production of eco-friendly organic manure which is marketed under the brand name 'Enrich'. The real economic benefits of 'Enrich' use include improved soil quality, water retention, biological activity, micronutrient content and improved pest resistance of crops. It helps in preserving and enhancing soil fertility which will help farmers to obtain better agricultural yields in the long term and over longer periods of time. The project activity also prevents loss of land caused by the common system of garbage disposal (land-filling). The town municipality will be able to allot the land thus saved for a number of industrial or commercial activities which would further improve the economic status of Puri city and its citizens. Moreover the project activity has also generated employment opportunities thereby addressing one of the key issues (*i.e.* unemployment issue) of prime concern for the host country.
Environmental Well-being	The project activity has a number of environmental benefits. It not only involves disposal of municipal solid waste and food waste in an eco-friendly manner but also results in reduction in emissions of Green House Gases (GHGs) such as methane and other harmful gases that may emanate from the decaying waste in the open landfills. It also promotes use of environment-friendly organic manure which, in

[1] The project activity produces organic manure of around 20% of the total waste materials being treated. The same is marketed in Orissa and West Bengal.

Table A-1: Project Activity's contribution towards sustainable development	
	turn, will reduce the use of chemical fertilizers that may be harmful for the soil.
Technological Well-being	In India, generation of municipal solid waste and food waste has been increasing due to population growth, life style changes and economic development. On the other hand, waste management responses have not kept pace with the increasing quantities of waste resulting in (a) a high proportion of uncollected waste, and (b) poor standards of transportation, storage, treatment and disposal. The project activity has adopted a robust transportation system along with a unique technology of composting the municipal solid waste and food waste collected. This innovative technology solution has so far not been used widely due to limitations related to solid waste handling and organic manure marketing. Thus, the success of the project activity is going to encourage project promoters to replicate the technology solution and address the critical environmental concerns of 'Solid Waste Management'.

A.3. Project participants:

Name of the party involved ((host) indicates a host party)	Private and/or public entity(ies) Project participants (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
Ministry of Environment and Forests (MoEF), Government of India	Krishi Rasayan Private Limited	No

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

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

A.4.1.1. Host Party(ies):

India

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

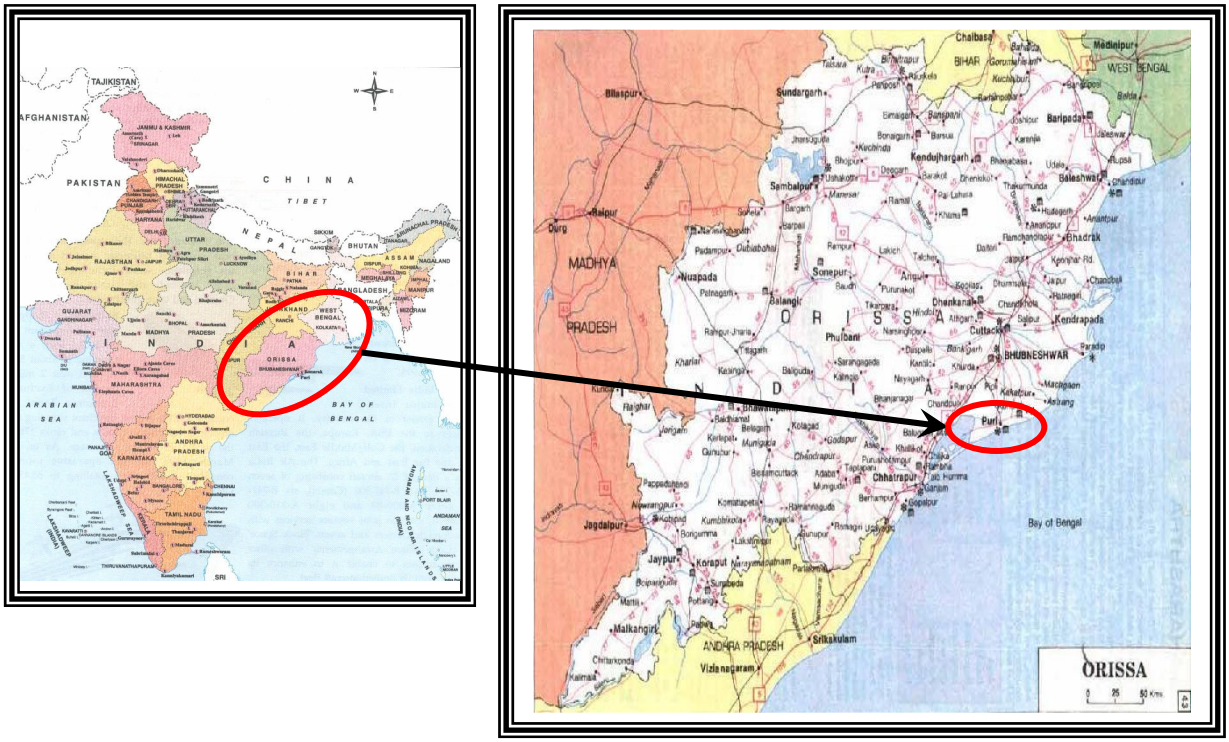
Orissa

A.4.1.3. City/Town/Community etc:

Puri

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

The town Puri is situated in the state of Orissa along the shore of the Bay of Bengal in Eastern India. The town is linked to most of the important cities in the country by rail. The nearest airport is in Bhubaneshwar, capital city of the state of Orissa which is just 60 kilometers away. Puri is a well known tourist place and is also a popular center of Hindu pilgrimage.



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

The project activity falls under:

Type: III- Other Project Activities

Category: F- Avoidance of methane production from decay of biomass through composting

Version 05; Scope 13; EB 33

Reference: Indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories

Technology Description

The project proponent uses indigenously developed aerobic composting technology for treatment of the municipal solid waste and the food waste collected from various parts of the town Puri. The aerobic composting is carried out in two different sections of the plant, namely

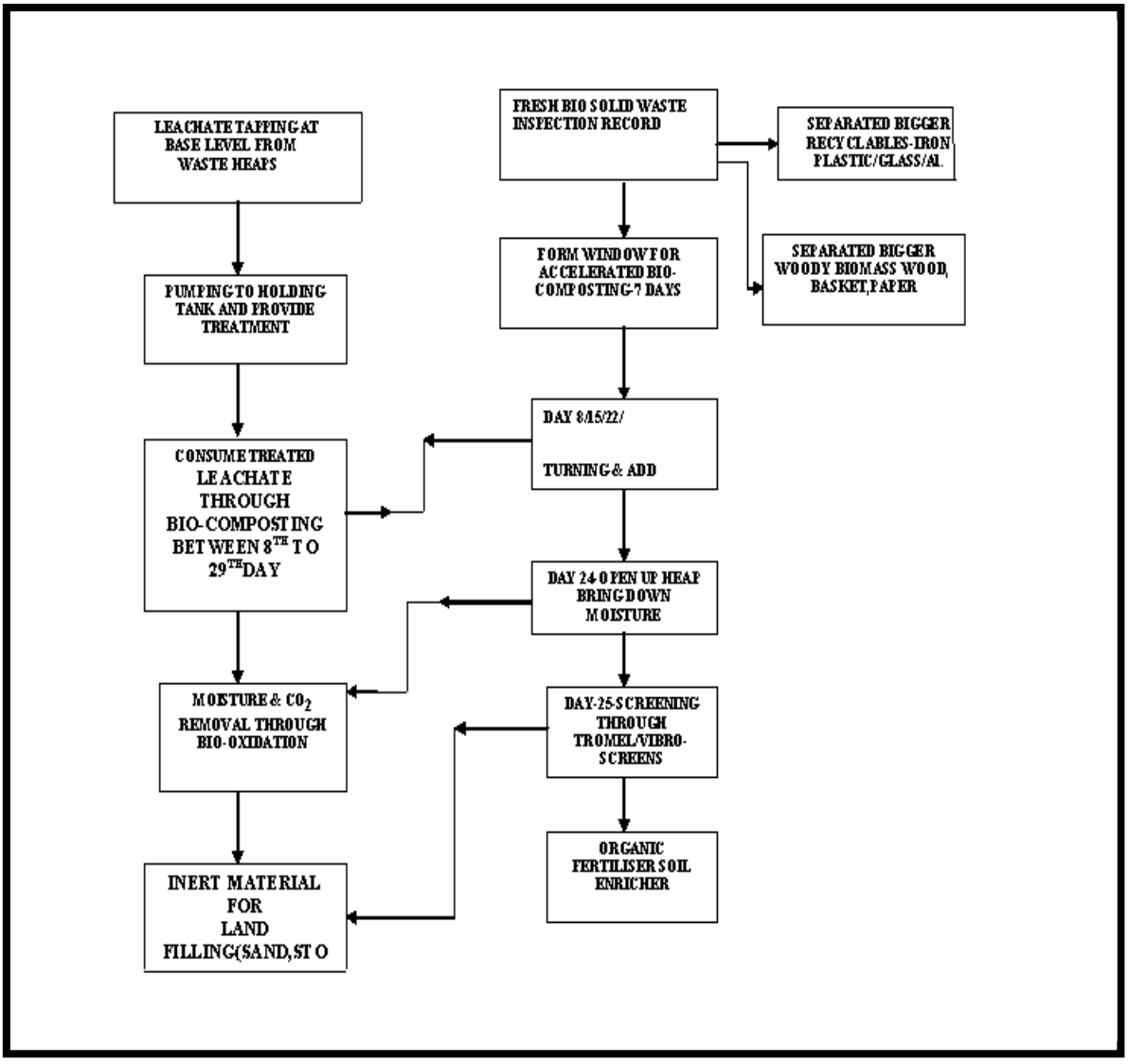
1. Dumping Grounds
2. Processing Section.

Dumping Grounds: The collected waste materials are first arranged in small heaps of 10 tonnes in Windrows having semi-circular structures within the dumping grounds. It is then treated with culture powder (Biological Innoculam) and water and is left to dry under the sunlight for a period of 24 days. Bacterial infusion in the waste materials results in higher temperature which burns all the pathogens and prevents the emissions of methane gas. Being exposed to an extremely heated environmental condition, the waste materials gradually lose its moisture and turns darker in colour. After 8 days, 15 days and 24 days, the heap is turned with the help of earth moving equipment and the complete exercise is repeated so that the entire heap receives sufficient amount of sunlight, water and culture powder and it becomes homogeneous in nature. The garbage heap is then fed into the Processing Section of the plant with the help of earth moving equipment.

Processing Section: From the dumping grounds, the waste materials are first fed into the Preparatory Section (a part of the Processing Section) by means of a pay loader where it undergoes various levels of screening with trammels of 16 mm, 8 mm, 4 mm and 2 mm respectively. The end product of this process is known as ‘semi-finished material’. It is stored in intermediate godowns and thereafter fed into the Finishing Section (another part of the Processing Section) by means of a skid-steer. In this section, the

semi-finished material is further screened in a Vibro-shaker and Sand Separator in order to remove the finer particles of 4 mm and 2 mm and the small particles of glass, pebbles, metals *etc* are discarded. It is then blown into a rotator chamber called Asperator Fan where it is separated from sand. Finally some water and Bacterial Innoculam (Culture Powder) are added and the finished product is packed into bags of 5 kgs, 10 kgs, and 50 kgs and sold to farmers. The discarded particles are sent to local processing plants for recycling.

The following flow sheet represents the entire treatment procedure to manufacture compost from the waste materials comprising of municipal solid waste and food waste:



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

Years	Estimation of annual emission reductions in tonnes of CO_2 e
2007- 2008	6291
2008-2009	11393
2009-2010	15485
2010-2011	20255
2011-2012	24049
2012-2013	27080
2013-2014	29524
2014-2015	31509
2015-2016	33134
2016-2017	35594
Total estimated reductions (tonnes of CO_2 e)	**234314**
Total number of crediting years	**10**
Annual average over the crediting period of estimated reductions (tonnes of CO_2 e)	**23431.4**

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

There is no public funding available for the project activity.

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

Debundling is defined as the fragmentation of a large project activity into smaller parts. A small-scale project activity that is part of a large project activity is not eligible to use the simplified modalities and procedures for small-scale CDM project activities. As per the requirements of "DETERMINING THE OCCURRENCE OF DEBUNDLING" as given in Appendix C of the Simplified Modalities and Procedures for Small-Scale CDM project activities,

"A proposed small-scale project activity shall be deemed to be a debundled component of a large project activity if there is a registered small-scale CDM project activity or an application to register another small-scale CDM project activity:

- *With the same project participants;*
- *In the same project category and technology/measure; and*
- *Registered within the previous 2 years; and*
- *Whose project boundary is within 1 km of the project boundary of the proposed small-scale activity at the closest point."*

Krishi Rasayan Private Limited has not implemented any other project activity, which falls under Category- III.F of "*Appendix B of the simplified modalities and procedures for small-scale CDM project activities"* and deals with the same technology/measure. No such project activity, proposed by Krishi Rasayan Private Limited with the same project category and technology/ measure and whose boundary is within 1 km of the project boundary of the small-scale project activity under consideration at its closest point, is registered or in the advanced stage of registration with UNFCCC in the last two years.

With the above explanation, it can be concluded that the small-scale project activity of Krishi Rasayan Private Limited is not a debundled component of a large project activity. Therefore the project activity under consideration is eligible to make use of "*Appendix B of the simplified modalities and procedures for small-scale CDM project activities"* for the determination of emission reductions resulting from the 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:

Title: Type III- Other Project Activities

Category F- Avoidance of methane production from decay of biomass through composting.

Reference: Appendix B of the simplified modalities and procedures for small-scale CDM project activities – Indicative Simplified Baseline and Monitoring Methodologies for selected small-scale CDM project activity categories, Version 05: EB 33.

Approach: Existing actual or historical emissions, as applicable.

Reference: Paragraph 48 of decision -17 /CP –7 of Modalities and procedures for CDM as defined in article 12 of Kyoto Protocol (FCCC/CP/2001/13/Add.2).

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

The approved small-scale methodology (*i.e.* Category-III.F) requires the project activity to meet all the applicability criteria as specified in the methodology. As per the provision in paragraph 1 of Category-III.F of "Appendix B of the simplified modalities and procedures for small-scale CDM project activities/ Version 05: EB 33", the category (*i.e.* 'Avoidance of methane production from decay of biomass through composting') comprises of

- 'measures to avoid the production of methane from biomass or other organic matter that would have otherwise been left to decay anaerobically in a solid waste disposal site without methane recovery. Due to the project activity, decay is prevented through aerobic treatment by composting and proper soil application of the compost. The project activity does not recover or combust methane (unlike III G), and does not undertake controlled combustion of the waste (unlike III E).'

The project activity entails aerobic treatment of the waste materials[2] (*i.e.* municipal solid waste and food waste) to produce organic manure through composting. The organic manure (*i.e.* 'Enrich') thus produced is marketed in the states of Orissa and West Bengal for soil application. In absence of the project activity the waste materials would have been dumped into the landfill sites without any provision for controlled combustion of the waste materials or any facilitation for recovery and/or combustion (controlled or uncontrolled) of the methane gas emanating from the same. Therefore, the project activity meets the above mentioned applicability criteria as defined in the Category-III.F methodology.

Apart from the key applicability criteria, the methodology also requires the project proponent to satisfy the following applicability condition:

- "measures are limited to those that result in emission reductions of less than or equal to 60kt CO_2 equivalent annually".

The average annual emission reduction resulting from the project activity is found to be 23431.4 tonees of CO_2 with the maximum annual emission reduction of 35594 tonnes of CO_2 from the project activity. Therefore the annual emission reduction resulting from the project activity for all the years in the proposed crediting period falls below the upper cap of annual emissions reductions of 60 kilo tonnes (kt) of CO_2 as prescribed by the methodology.

The above explanations clearly establish that the project activity meets all the applicability conditions of the approved small-scale methodology. This justifies the choice of the methodology, Category-III.F for the project activity under consideration.

Further in accordance with Paragraph 28 of the simplified modalities and procedures for small-scale CDM project activities, a simplified baseline and monitoring methodology listed in this appendix (Appendix B) may be used for a small-scale CDM project activity if project participants are able to demonstrate to a designated operational entity that the project activity would otherwise not be implemented due to the existence of one or more barrier(s) listed in Attachment A of this Appendix (B).

The project activity has been evaluated on the basis of the barriers listed in attachment A of Appendix B as required by paragraph 28 of the simplified modalities and procedures for small-scale CDM project activities. The barrier analysis (please refer to Section B.5 of the Project Design Document for details on barrier analysis) has established that the project activity would otherwise not be implemented because of the existence of investment barrier (Option a), technological barrier (Option b) and other barriers (Option d) associated with the implementation of the project activity.

From the above discussion it can be concluded that the small-scale project activity of Krishi Rasayan Private Limited can follow the approved small-scale methodology Category-III.F. Therefore, the baseline emissions, project emissions and leakage emissions (and hence the emission reductions) for the project activity are computed based on the guidance provided in paragraphs 4, 5, 6 & 7 of Category- III.F of "*Appendix B of the simplified modalities and procedures for small-scale CDM project activities"*. The monitoring methodology is based on the guidance provided in paragraph 8, 9, 10, 11 and 12 of Category-III.F of "*Appendix B of the simplified modalities and procedures for small-scale CDM project activities"*.

[2] Both municipal solid waste and food waste contain organic carbon which is the source of methane emissions during anaerobic decay in landfills. The organic part of the waste types has been represented by Degradable Organic Content (DOC) as specified later in section B.6.2.

B.3. Description of the project boundary:

According to paragraph 3 of small-scale methodology Category-III.F,

"the project boundary is the physical, geographical site:

(a) where the solid waste would have been disposed and the methane emission occurs in absence of the proposed project activity,

(b) where the treatment of biomass through composting takes place,

(c) where the soil application of the produced compost takes place,

(d) and the itineraries between them (a, b and c) where the transportation of the compost occurs."

The solid waste treatment plant has been developed on the same site wherein the municipal solid waste and the food waste were dumped in absence of the project activity. Thus the project boundary includes the plant site where the waste materials are treated aerobically to produce compost. The manufactured compost is marketed as 'Enrich' for soil applications in the states of Orissa and West Bengal. Therefore, according to points (c) and (d) above, the project boundary also includes the above mentioned states.

B.4. Description of baseline and its development:

Selection of baseline scenario for the project activity

Krishi Rasayan Private Limited identified the following realistic and credible alternatives to the project activity which could be implemented in order to handle the municipal solid waste and the food waste available to them from various parts of Puri town. These plausible alternatives were further analyzed with reference to the implications of implementing the alternatives.

Alternative-1: Implementation of the project activity, not undertaken as a CDM project activity

This alternative involves diversion of the waste materials (*i.e.* municipal solid waste and food waste) from dumping into landfills and its subsequent aerobic treatment to produce compost. This would result in avoidance of methane emissions associated with anaerobic decay of the waste materials being dumped.

This alternative is in compliance with all legal and regulatory requirements. However this alternative cannot be a part of the baseline as it faces all the barriers as discussed in the project additionality section (please refer to Section B.5 of the Project Design Document for further details).

Alternative-2: Incineration of waste materials for energy generation

This alternative involves incineration of the waste materials (*i.e.* municipal solid waste and food waste) for the purpose of generation of energy. However this is not a viable alternative for the project proponent because the waste materials are not suited for power/energy generation owing to its low calorific value and high moisture content. Moreover the composition and calorific value of the waste materials vary

considerably and thus cannot supply energy on a consistent basis. To ensure consistent power generation other combustibles such as wood, husk, bagasse *etc* have to be used along with the waste materials. These combustibles have to be bought and transported from their corresponding sources thus entailing high purchase and transportation costs. Moreover, there is no infrastructure present in and around the project location to utilize the waste for energy generation. Hence this alternative is not a part of the baseline.

Alternative-3*:* Conversion of the waste materials to pellets through pelletisation

This alternative involves conversion of the waste materials (*i.e.* municipal solid waste and food waste) to pellets which are used as fuel sources. Such an alternative is not viable because the capital cost of such an alternative is very high and there is hardly any market demand for the pellets in the country. The selling prices of the pellets are too high in comparison to those of other fuel sources available in the market. Moreover this alternative involves mechanical compression of the waste into pellets only and do not prevent methane gas emissions. It also does not have much environmental benefit as it does not prevent the emissions of methane through anaerobic decay of the waste.

Alternative-4: Disposal of the waste materials in landfill with provision for power generation from the landfill gas being captured

This alternative involves disposal of the waste materials (*i.e.* municipal solid waste and food waste) in landfills followed by landfill gas (LFG) capture from the disposal sites and utilization of the same for power generation. There is no legal or regulatory mandate on the project proponent to capture the LFG from the disposal sites and its utilization for power generation. Capture of LFG from the site requires major infrastructural investments which renders the alternative unviable for the project proponent. Hence this alternative is not a part of the baseline.

Alternative-5: Disposal of the waste materials in landfill with provision for flaring of landfill gas being captured

This alternative involves disposal of the waste materials (*i.e.* municipal solid waste and food waste) in landfills followed by landfill gas (LFG) capture from the disposal sites and its subsequent flaring. There is no legal or regulatory mandate on the project proponent to capture the LFG from the disposal sites and flare it. This alternative requires major infrastructural investments which renders it unviable for the project proponent. Hence this alternative is not a part of the baseline.

Alternative-6: Disposal of the waste materials in landfill for anaerobic decay

This alternative involves disposal of the waste materials (*i.e.* municipal solid waste and food waste) in landfills wherein it is allowed to undergo anaerobic decomposition resulting in methane emissions. This alternative is in compliance with all legal and regulatory requirements and is the most common alternative being practised by majority of the waste disposal systems in the country, especially in and around the

project location. This also does not require any major infrastructural investments and is a viable alternative available to the project proponent.

Therefore, from the above discussion it may be concluded that 'Alternative-6: Disposal of the waste materials in landfill for anaerobic decay' is the baseline scenario.

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:

As per the decision 17/CP.7 paragraph 43, a CDM project activity is additional if anthropogenic emissions of greenhouse gases by sources are reduced below those that would have occurred in the absence of the registered CDM project activity. The Appendix B of the simplified M&P for small-scale CDM project activities' of the UNFCCC requires the project proponent to determine the additionality of the project activity as per the guidance provided in Attachment A to Appendix B. The additionality of the project activity has been detailed below:

It is important to note that, in general, composting projects in developing countries such as India face a number of constraints. The market for composted materials such as the organic manure is very nascent and the people involved in the planning and management of compost projects need expertise in a wide range of subjects which in the present scenario is not available in India[3]. At the same time composting has the distinction of being the waste management system with the largest number of failed facilities worldwide. In most countries (especially in developed countries), most large mixed-waste compost plants, often designed by foreign consultants and paid for by aid from their home countries, have failed or operate at less than 30% of capacity. According to Solid Waste Management Sourcebook's Newsletter and Technical Publications (Municipal Solid Waste Management) titled '*Sound Practices Composting*' published by United Nations Environment Programme, Division of Technology, Industry and Economics[4],

"The problems most often cited for the failures of composting include: high operation and management costs, high transportation costs, poor quality product as a result of poor pre-sorting (especially of plastic and glass fragments), poor understanding of the composting process, and competition from chemical fertilizers (which are often subsidized). In many urban places, collection systems are too unreliable for urban authorities to consider running composting facilities efficiently."

[3] According to "Sustainable Composting – Case studies and guidelines for developing countries" prepared by Water, Engineering and Development Centre, Loughborough University in collaboration with SANDEC/EAWAG, Switzerland.

The project proponent, Krishi Rasayan Private Limited, has also faced similar barriers as mentioned above in order to implement the project activity. The same has been outlined below:

Investment Barriers

Although the project activity involves effective utilization of the waste materials (*i.e.* municipal solid waste and food waste) for production of organic manure through composting, the feasibility of the project activity is governed solely by the extent to which 'Enrich' (*i.e*. the compost product) is sold in the fertilizer market. The known markets for composted materials, in general, at the time of project planning were primarily restricted to household gardeners, nurseries and organic farmers only. The project proponent however aims at selling the composted organic manure-'Enrich' on a large scale to agricultural farmers who have for a very long time been using chemical fertilizers for increasing crop yields. Since the fertilizer market is completely driven by preferences of the end users (*i.e*. the agricultural farmers), therefore presently it is dominated by chemical fertilizers. In spite of the high cost of chemical fertilizers and the large quantities that are needed to maintain crop yields, it is very difficult to persuade farmers to use compost. Chemical fertilizers enhance the crop yield very quickly and hence its impact can be realized over a short spell of time. 'Enrich', on the other hand, produces a longer lasting and sustainable improvement in soil fertility, but it takes some three to four years for this to effect. The farmers, because of the absence of awareness about 'Enrich's long term benefits backup by their financial limitations preventing them to wait for such benefits, are very reluctant to use it and prefer short term benefits of high productivity with the use of chemical fertilizers. This has lead to excessive use of chemical fertilizers for years together resulting in significant deterioration of the soil quality. Such a background is the major hindrance for the project proponent while marketing 'Enrich', in spite of the facts that the crop yields have been gradually falling for several years due to over-usage of chemical fertilizers and that 'Enrich' can substantially improve productivity in the longer run[5].

As a result of the farmers' general lack of interest in 'Enrich', the various trade channels (such as dealers, transportation agencies *etc*) are also not willing to push the product as they do not realize similar profits as compared to the other fertilizers available in the market. Consequently the project proponent is forced to sell 'Enrich' at prices lower than those of chemical fertilizers thereby practically incurring financial

[4] Available at http://www.unep.or.jp/Ietc/estdir/pub/msw/sp/sp4/sp4_1.asp

[5] This has been demonstrated by studies titled 'Efficacy of Biofertilizer Krikelp Powder and Enrich on the production improvement on the paddy based crop sequence in the entisols of West Bengal' , 'Efficacy of bio-fertilizer Enrich on the production improvement of onion in the entisols of West Bengal' and 'Efficacy of bio-fertilizer Enrich on the production improvement of rapeseed-mustard in the inceptisols of West Bengal', conducted by Dr. R K Ghosh, Professor, Department of Agronomy, Faculty of Agriculture, Bidhan Chandra Krishi Viswavidyalaya, West Bengal.

losses. In spite of the lower price of 'Enrich' as compared to other chemical fertilizers, the farmers still prefer the use of the conventional chemical fertilizers as a result of their age-old practice. However further reduction in 'Enrich' pricing is practically beyond the scope of the project proponent because of the high production and marketing costs involved in its production and marketing.

The project proponent is facing such a strong market resistance since they have started marketing the compost 'Enrich'. However they have been consistently putting their efforts to convince the farmers about the advantages of increasing long term soil productivity through the use of 'Enrich' vis-à-vis the use of chemical fertilizers. This requires a very aggressive marketing campaign marked by high levels of publicity, media campaigning and sales promotions. Naturally the marketing strategy that the project proponent has to follow is a unique one because it entails selling a completely new concept rather than selling a product. Moreover, it has to be done on a large geographic network and thus requires various resources such as manpower, advertisement materials and numerous initiatives that entail huge investments under marketing expenses. The same is estimated to be of the order of INR 75.7 lakhs for the first year of the proposed crediting period with the detailed breakup is as provided below:

Table B-1: Marketing Expenses in the first year of the proposed crediting period

Sl. No.	Expense Head	Details	Amount (Rs)
1	Salary for marketing staff	4 x 30000 x 12	1440000
2	Traveling expenses	Yearly	100000
3	Telephone expenses	12 x 20000	240000
4	Farmers' meetings	12 x 100000	1200000
5	Microphone publicity	12 x 50000	600000
6	Demonstrations	12 x 20000	240000
7	Planters' meetings	12 x 100000	1200000
8	Dealers' meetings	12 x 75000	900000
9	Distributors' conference	Yearly	500000
10	Publicity through radio advertisements	Yearly	100000

11	Publicity through wall paintings	Yearly	100000
12	Publicity through Banners/Danglers	Yearly	50000
13	Vehicle campaigning	Yearly	50000
14	Gifts for farmers/dealers	Yearly	200000
15	Developments	Yearly	500000
16	Training and Orientation	Yearly	150000
Total Marketing Expenditures			**7570000**

These marketing expenses[6] will be incurred throughout the proposed crediting period to create awareness about the product on a large scale in the agricultural areas of Orissa and West Bengal. Under such circumstances the project proponent has been forced to escalate the investment costs without proper realization from the selling cost of 'Enrich'. This has created a tremendous financial burden on the project proponent thereby challenging their market sustenance. In addition to the heavy marketing expenses the project proponent also has to incur additional expenses[7] which further increases the total project cost. The CDM revenue stream will encourage the project proponent to continue with their efforts.

Technological Barriers

A major step involved in the composting process of the waste materials (*i.e.* municipal solid waste and food waste) to produce organic manure is drying of the waste materials in sunlight. The location of the waste treatment site is in the state of Orissa where the weather is wet for most of the time of the year (during the monsoons which continue usually from June to September). This makes drying of the waste materials very difficult as there is less availability of sunlight during the wet season. Moreover, the dried waste materials also absorb moisture due to the heavy rainfall and the problem of drying deteriorates further. Consequently, the production of compost is hindered considerably and the project proponent has to wait for dry spells to maintain desired production levels during monsoon which are a rarity. To overcome this setback, the project proponent plans to install a fibre glass shed or a canopy which will not only protect the dried waste materials from moisture and rain water but also ensure that the heaps receive sufficient sunlight. This will greatly enhance the production and regulate the supply of 'Enrich' to the

[6] Regular marketing expenses of around INR 30 lakhs will require to be incurred every year starting from the second year of the proposed crediting period.

[7] This includes an expenditure of approximately INR 550 lakhs for the construction of a canopy for drying the treated waste which the project proponent plans to implement and the expenditure of approximately INR 50 lakhs for construction of a concrete wall for the project site that the project proponent has already incurred.

market throughout the year. Moreover if this canopy is installed with a steam heating system, the plant can run three shifts daily and further increase production. The entire technology is available at a very high cost (approximately INR 5.5 crores) and it is impossible for the project proponent to presently fund this substantial amount for the project activity given the investment barriers it has been facing since the beginning.

The project proponent has also identified that the equipments operated for the waste treatment process may be upgraded to technology of higher sophistication to increase production levels. As per the studies carried out by the project proponent, the recovery of 'Enrich' from waste materials can be improved from the present level of 20% to 25% if the present machineries are replaced by the newer more advanced ones. This requires higher investments estimated to be around INR 25-30 lakhs. The nature of the waste materials which are the raw materials for the plant vary considerably and to maintain high productivity along with the quality of the compost, state-of-the-art equipments and machinery are required for waste segregation, sizing, sieving, grading, turning, quality up-gradation, shredding, blending, packing and weighing. To obtain these machineries high investments are required to be made. At present, given the investments that already have to be made in marketing initiatives it is virtually impossible for the project proponent to undertake modernization of the machineries. The project proponent thus hopes to fund the investments from the CDM revenue that may be accrued on registration of the project activity as a CDM project under the Kyoto Protocol and hence sustain proper management of harmful waste materials through composting.

Other Barriers

1. Absence of proper infrastructure for collection of waste materials: One of the major barriers that the project proponent is facing is the absence of proper infrastructure for collection of waste materials which is the raw material for the processing plant. At present the waste materials collection is highly disorganized and is done by the local municipality. Most of the municipalities in India are cash strapped and run on deficit budgets. As a result there is no proper system of collection in place and regulated supply of raw material for the plant cannot be ensured all the time. The production of the plant is thus heavily dependent on such a disorganized system of waste materials collection and dumping. The project proponent hopes to obtain the necessary coverage from CDM revenue for losses in production due to the irregularity in supply of waste materials.

2. Competition with the highly subsidized chemical fertilizer market: The composted product 'Enrich' has to compete with the chemical fertilizers which are highly subsidized. The Fertilizer Association of India (FAI), the leading lobby group for chemical fertilizers is focused on protecting the chemical fertilizer manufacturers' massive subsidies (which account to approximately INR 1425000 lakhs

annually[8]) for their chemical fertilizers. No such organization or body exists for the composted manures and the whole sector is de-centralized. This further increases the difficulty in selling the composted products in the market.

Impact of CDM Registration

With all these barriers in place, the market for the compost-'Enrich' has, so far, not been proved to be promising. This can be further evidenced from Mr. Malcolm Harper's case study on composting titled "A Composting Business in India" which is a part of the WEDC report on "Sustainable Composting – Case studies and guidelines for developing countries", where the author concludes that

- Urban waste composting involves risks, and success depends on the owners' willingness to make and learn from mistakes, to improvise and to search for new solutions.
- Urban composting is unlikely to be attractive to profit maximizing investors; it is far from glamorous, it has to be undertaken in an unpleasant environment, and the returns may be no more than adequate.
- The process may be highly capital intensive or it may employ quite large numbers of unskilled labour, with negligible investment in fixed assets. Urban composting can create jobs at a very low capital cost.
- The process is slow, and sales may be seasonal. The investment in fixed assets can be low, but the working capital requirement may be large, and anyone who undertakes such an enterprise must be prepared for this.

In view of the above, the project proponent was reluctant to go ahead with the project activity because of the associated barriers and risks. However, the Management of Krishi Rasayan Private Limited could understand that the project activity is a GHG avoidance project which has the potential to qualify under the Kyoto Protocol- Clean Development Mechanism and hence can avail financial assistance through sale of Certified Emission Reduction units resulting from the project activity. On assessment of the benefits that may be accrued on registration of the project as a CDM project, the Management of Krishi Rasayan Private Limited has decided to implement the project activity and hopes to provide coverage to losses in production or extra investments in view of the above mentioned barriers with CDM revenue.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

Computation of Baseline Emissions (BE_y)

[8] Source: http://www.indiatogether.org/2004/apr/env-rethink.htm

As explained in Section B.4 of the PDD, 'Alternative-6: Disposal of the waste materials in landfill for anaerobic decay' is found to be the baseline scenario for the project activity under consideration. Therefore the baseline emissions for the project activity is calculated as per the guidance provided in paragraph 4 of Category-III.F of the "Indicative Simplified Baseline and Monitoring Methodologies for Selected Small-Scale CDM Project Activity Categories" which states,

"The baseline emissions are the amount of methane from the decay of biomass content of the waste treated in the project activity. The Yearly Methane Generation Potential is calculated using the first order decay model based on discrete time estimate method of the IPCC Guidelines as described in category AMS III.G. Baseline emissions shall exclude methane emissions that would have to be removed or combusted to comply with national or local safety requirement or legal regulations"

In accordance with this guideline, the baseline emission for the project activity is determined from the yearly methane emission potential from the decay of the organic carbon in the waste materials (*i.e.* municipal solid waste and food waste) composted in the project activity. The first order decay model based on discrete time estimate method of IPCC guidelines, as described in Category-III.G, has been adopted for computation of baseline emissions. Baseline emissions shall exclude methane emissions that would have to be captured, fuelled or flared to comply with national or local safety requirement or legal regulations.

Baseline emissions in the year y is given as,

$$BE_y = BE_{CH4,SWDS,y} - MD_{y,reg} \otimes GWP\_CH_4 + MEP_{y,ww} \otimes GWP\_CH_4$$

Where:

BE_y = Baseline Emissions in the year y (in tCO_2/annum)

$BE_{CH4,SWDS,y}$ = Yearly methane generation potential of the waste materials composted by the project activity during the year "x" from the beginning of the project activity (*i.e.* x =1) up to the year "y" (*i.e.* x = y)[9] (in tCO_2/annum)

$MD_{y,reg}$ = Amount of methane that would have to be captured and combusted in the year "y" to comply with the prevailing regulations (in tCH_4/annum)

$MEP_{y,ww}$ = Methane emission potential in the year "y" of the wastewater (in tCH_4/annum)

GWP_CH_4 = Global Warming Potential of methane (=21)

'y' is any year within the proposed crediting period of the project activity.

[9] In other words, $BE_{CH4,SWDS,y}$ is the methane emissions avoided during the year *y* from preventing the waste materials disposal at the solid waste disposal site (SWDS) during the period 'x' from the start of the project activity (*i.e.* x =1) to the end of the year y (*i.e.* x =y).

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There are no national or local safety requirements or local regulations to remove or combust methane emissions from the baseline disposal site. Hence the quantum of methane that would be destroyed or removed each year for safety compliance is zero *i.e.* $MD_{y,reg} = 0$..

Furthermore the project activity does not involve co-composting of waste water and hence $MEP_{y,ww} = 0$.

Therefore,

$$BE_y = BE_{CH4,SWDS,y}$$

$BE_{CH4,SWDS,y}$ is calculated as per the guidance provided in the *'Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site'* as per paragraph 5 of Category-III.G. The same is given below:

$$BE_y = BE_{CH4,SWDS,y}$$

$$= \phi \otimes (1-f) \otimes GWP\_CH4 \otimes (1-OX) \otimes \frac{16}{12} \otimes F \otimes DOC_f \otimes MCF \otimes \sum_{x=1}^{y} \sum_{j} W_{j,x} \otimes DOC_j \otimes e^{-k_j (y-x)} \otimes (1-e^{-k_j})$$

Where:

Φ = Model correction factor to account for model uncertainties (= 0.9)

f = Fraction of methane captured at the solid waste disposal site (SWDS) and flared, combusted or used in another manner

GWP_CH_4 = Global Warming Potential of methane, valid for the relevant commitment period (= 21)

OX = Oxidation factor (reflecting the amount of methane from SWDS that is oxidized in the soil or other material covering the waste)

16/12 = Stoichiometric ratio of carbon to methane

F = Fraction of methane in the SWDS gas (volume fraction) (= 0.5)

DOC_f = Fraction of degradable organic carbon (DOC) that can decompose

MCF = Methane correction factor

$W_{j,x}$ = Amount of organic waste type *j* prevented from disposal in the SWDS in the year 'x' (tonnes)

DOC_j = Fraction of degradable organic carbon (by weight) in the waste type *j*

k_j = Decay rate for the waste type *j*

j = Waste type category (index)

x = Year during the crediting period; 'x' runs from the first year of the crediting period (*i.e.* x = 1) to the year y for which avoided emissions are calculated (*i.e.* x = y)

y = Year for which methane emissions are calculated *i.e.*any year within the proposed crediting period of the project activity

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Where different waste material types are prevented from disposal, the amount of different waste material types ($W_{j,x}$) is determined through sampling and the mean from the samples is calculated as follows:

$$W_{j,x} = W_x \cdot \frac{\sum_{n=1}^{z} p_{n,j,x}}{z}$$

Where:

$W_{j,x}$ = Amount of organic waste type *j* prevented from disposal in the SWDS in the year x (tonnes)

W_x = Total amount of organic waste prevented from disposal in year x (tonnes)

$p_{n,j,x}$ = Weight fraction of the waste type *j* in the sample *n* collected during the year x

z = Number of samples collected during the year x

Computation of Project Emissions (PE_y)

The methodology requires the project proponent to compute the project emissions as per the guidance provided in paragraph 5 of Category-III.F of the "Indicative Simplified Baseline and Monitoring Methodologies for Selected Small-Scale CDM Project Activity Categories". The same is calculated as below:

$$PE_y = PE_{y,transp} + PE_{y,power}$$

Where:

PE_y = Project Emissions in the year "y" (in tCO_2/annum)

$PE_{y,transp}$ = Emissions through incremental transportation in the year "y" (in tCO_2/annum)

$PE_{y,power}$ = Emissions through electricity or diesel consumption in the year "y" (in tCO_2/annum)

'y' is any year within the proposed crediting period of the project activity.

$PE_{y,transp}$ is the incremental CO_2 emissions due to incremental distances between the collection points of the waste materials (*i.e.* municipal solid waste and food waste) to the composting site and to the baseline disposal site as well as emissions due to transportation of compost from the composting site to the soil application sites. The same is calculated as explained below:

$$PE_{y,transp} = \left(Q_y / CT_y\right) \otimes DAF_w \otimes EF_{CO2} + \left(Q_{y,comp} / CT_{y,comp}\right) \otimes DAF_{comp} \otimes EF_{CO2}$$

Where:

Q_y = Quantity of waste materials composted in the year "y" (tonnes)

CT_y = Average truck capacity for waste materials transportation (tonnes/ truck)

DAF_w = Average incremental distance for waste materials transportation (km)

EF_{CO2} = CO_2 emission factor of fuel used for transportation (kg CO_2/km)

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$Q_{y, comp}$ = Quantity of compost produced in the year "y" (tonnes)
$CT_{y, comp}$ = Average truck capacity for compost transportation (tonnes/truck)
DAF_{comp} = Average distance for compost transportation (km)
'y' is any year within the proposed crediting period of the project activity.

For the project activity under consideration, the baseline disposal site is same as that of the composting site *i.e.* the waste materials, in absence of the project activity, would have been dumped in the same place where the composting plant is now situated. Hence there is no incremental distance between the collection points of the waste materials to the composting site and to the baseline disposal site *i.e.* $DAF_w = 0$. However, transportation of the organic manure-'Enrich' produced by composting the waste materials is transported and sold in the market of Orissa and West Bengal. This will lead to project emissions as explained above.

$PE_{y,power}$ is the CO_2 emissions related to the power used by the project activity facilities. The methodology requires the project proponent to compute the emission factors for grid electricity or diesel fuel used as per the guidance provided in Category-I.D of the "Indicative Simplified Baseline and Monitoring Methodologies for Selected Small-Scale CDM Project Activity Categories". However the electricity consumption of the project activity facilities is negligible and hence the CO_2 emissions from the same is neglected *i.e.* $PE_{y,power} = 0$.

Computation of Leakage Emissions (L_y)

The methodology requires the project proponent to consider leakage emissions if the equipment for composting is transferred from another activity or if the existing equipment is transferred to another activity. However for the project activity under consideration, the equipment for composting technology is not transferred from another activity and neither is there any transfer of existing equipment to another activity. Therefore there is no leakage emissions i.e. Ly = 0.

Computation of Emission Reductions (ER_y)

The emission reductions resulting from the project activity are calculated as the difference between the baseline emissions, the project emissions and emissions due to leakage as given below:

$$ER_y = BE_y - PE_y - L_y$$

Where:

ER_y = Emission Reductions in the year y (in tCO_2/annum)
BE_y = Baseline Emissions in the year y (in tCO_2/annum)

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PE_y = Project Emissions in the year "y" (in tCO_2/annum)

L_y = Leakage Emissions in the year "y" (in tCO_2/annum)

Since for the project activity under consideration, $L_y = 0$,

$$ER_y = BE_y - PE_y$$

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

Fixed parameters for the computation of Baseline Emissions

Data / Parameter:	ϕ
Data unit:	-
Description:	Model correction factor to account for model uncertainties
Source of data used:	Methodological tool – "Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site", available at Annex-14 of EB-26 Meeting Report.
Value applied:	0.9
Justification of the choice of data or description of measurement methods and procedures actually applied :	The value provided in the Methodological tool has been used.
Any comment:	Oonk et el. (1994) have validated several landfill gas models based on 17 realized landfill gas projects. The mean relative error of multi phase models was assessed to be 18%. Given the uncertainties associated with the model and in order to estimate emission reductions in a conservative manner, a discount of 10% is applied to model results.

Data / Parameter:	OX
Data unit:	-
Description:	Oxidation factor (reflecting the amount of methane from SWDS that is oxidized in the soil or other material covering the waste)
Source of data used:	Methodological tool – "Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site", available at Annex-14 of EB-26 Meeting Report.
Value applied:	0
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per the guidance provided in the Methodological tool, the above value is to be used for solid waste disposal sites that are not covered with oxidizing material such as soil or compost which is the same for this project activity.
Any comment:	-

Data / Parameter:	F
Data unit:	-
Description:	Fraction of methane in the SWDS gas (volume fraction)
Source of data used:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value applied:	0.5
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per the guidelines provided in the Methodological tool – "Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site", available at Annex-14 of EB-26 Meeting Report.
Any comment:	This factor reflects the fact that some degradable organic carbon does not degrade, or degrades very slowly, under anaerobic conditions in the SWDS. A default value of 0.5 is recommended by IPCC.

Data / Parameter:	DOC_f
Data unit:	-
Description:	Fraction of degradable organic carbon (DOC) that can decompose
Source of data used:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value applied:	0.5
Justification of the choice of data or description of	As per the guidelines provided in the Methodological tool – "Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site", available at Annex-14 of EB-26 Meeting Report.

measurement methods and procedures actually applied :	
Any comment:	-

Data / Parameter:	MCF
Data unit:	-
Description:	Methane Correction Factor
Source of data used:	Methodological tool – "Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site", available at Annex-14 of EB-26 Meeting Report.
Value applied:	0.8
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per the guidance provided in the Methodological tool, the above value is to be used for unmanaged solid waste disposal sites- deep and/or with high water table which is the same for this project activity.
Any comment:	The MCF accounts for the fact that unmanaged SWDS produce less methane from a given amount of waste than managed SWDS, because a larger fraction of waste decomposes aerobically in the top layers of unmanaged SWDS.

Data / Parameter:	DOC_j
Data unit:	-
Description:	Fraction of degradable organic carbon (by weight) in the waste type j
Source of data used:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories (adapted from Volume 5, Tables 2.4 and 2.5)
Value applied:	For j=1 *i.e.* for MSW, $DOC_1 = 0.2$ For j=2, *i.e.* for Food Waste (fish waste and coconut husk), $DOC_2 = 0.15$
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per the guidance provided in the Methodological tool – "Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site", available at Annex-14 of EB-26 Meeting Report, the above values are to be used for wet waste which is the same for this project activity.
Any comment:	

Data / Parameter:	k_j
Data unit:	-
Description:	Decay rate for the waste type j
Source of data used:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories (adapted from Volume 5, Tables 3.3)
Value applied:	For j=1 *i.e.* for MSW, $k_1 = 0.17$ For j=2, *i.e.* Food Waste (fish waste and coconut husk), $k_2 = 0.40$
Justification of the choice of data or description of measurement methods	As per the guidance provided in the Methodological tool – "Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site", available at Annex-14 of EB-26 Meeting Report, MSW may be classified as Moderately degrading type waste and hence from the above tool, the decay rate

and procedures actually applied :	for MSW is taken to be 0.17. Similarly food waste (*i.e.* fish waste and coconut husk) may be classified as Rapidly degrading waste type and hence from the above tool, the decay rate for food waste is taken to be 0.40.
Any comment:	The solid waste disposal site is in Puri which has tropical climatic conditions with mean annual temperature of 22.9 ^{0}C (*i.e.* MAT>20^{0}C) and a mean annual precipitation of 1500 mm (*i.e.* MAP>1000mm). Reference: http://www.int-res.com/articles/cr/2/c002p215.pdf http://www.imd.gov.in/section/climate/annual-rainfall.htm

Fixed parameters for the computation of Project Emissions

All the parameters required for the computation of project emissions will be monitored ex-post during the proposed crediting period of the project activity. Please refer to Section B.7.1 of the PDD for details.

B.6.3 Ex-ante calculation of emission reductions:

Ex-ante computation of Baseline Emissions

The ex-ante computation of baseline emissions for the project activity (please refer to 'Annex-3: Baseline Information' for detail computation) is tabulated below:

Years	Baseline Emissions (tonnes of CO_2 e)
2007-2008	6421
2008-2009	11523
2009-2010	15615
2010-2011	20412
2011-2012	24205
2012-2013	27236
2013-2014	29680
2014-2015	31666
2015-2016	33290
2016-2017	35776
Total	**235824**

Ex-ante computation of Project Emissions

The ex-ante computation of project emissions for the project activity (please refer to 'Annex-3: Baseline Information' for detail computation) is tabulated below:

Years	Project Emissions (tonnes of CO_2 e)

Years	Project Emissions (tonnes of CO_2 e)
2007-2008	130
2008-2009	130
2009-2010	130
2010-2011	156
2011-2012	156
2012-2013	156
2013-2014	156
2014-2015	156
2015-2016	156
2016-2017	182
Total	**1508**

Ex-ante computation of Emission Reductions

The ex-ante computation of emission reductions for the project activity is tabulated below:

Years	Emission Reductions (tonnes of CO_2 e)
2007-2008	6291
2008-2009	11393
2009-2010	15485
2010-2011	20255
2011-2012	24049
2012-2013	27080
2013-2014	29524
2014-2015	31509
2015-2016	33134
2016-2017	35594
Total	**234314**

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

Years	Estimation of project activity Emissions (tonnes of CO_2 e)	Estimation of baseline Emissions (tonnes of CO_2 e)	Estimation of leakage (tonnes of CO_2 e)	Estimation of overall emission reductions (tonnes of CO_2 e)
2007-2008	130	6421	0	6291
2008-2009	130	11523	0	11393

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Years	Estimation of project activity Emissions (tonnes of CO_2 e)	Estimation of baseline Emissions (tonnes of CO_2 e)	Estimation of leakage (tonnes of CO_2 e)	Estimation of overall emission reductions (tonnes of CO_2 e)
2009-2010	130	15615	0	15485
2010-2011	156	20412	0	20255
2011-2012	156	24205	0	24049
2012-2013	156	27236	0	27080
2013-2014	156	29680	0	29524
2014-2015	156	31666	0	31509
2015-2016	156	33290	0	33134
2016-2017	182	35776	0	35594
Total (tonnes of CO_2 e)	**1508**	**235824**	**0**	**234314**

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

Title: Type III- Other Project Activities

Category F- Avoidance of methane production from biomass decay through composting.

Reference: Appendix B of the simplified modalities and procedures for small-scale CDM project activities – Indicative Simplified Baseline and Monitoring Methodologies for selected small-scale CDM project activity categories, Version 05: EB 33.

B.7.1 Data and parameters monitored:

Parameters to be monitored for the computation of Baseline Emissions

Data / Parameter:	f
Data unit:	-
Description:	Fraction of methane captured at the SWDS and flared, combusted or used in another manner
Source of data to be used:	Plant Log Book- Written information from the operator of the solid waste disposal site and/or site visits at the solid waste disposal site.
Value of data	0
Description of	The parameter will be monitored annually.

measurement methods and procedures to be applied:	
QA/QC procedures to be applied:	-
Any comment:	At present, there is no provision for capturing, flaring or combusting the methane emissions at the SWDS. This justifies the choice of the data value.

Data / Parameter:	GWP_CH_4
Data unit:	$tCO_2e/t\ CH_4$
Description:	Global Warming Potential (GWP) of methane, valid for the relevant commitment period.
Source of data to be used:	Decisions under UNFCCC and the Kyoto Protocol (a value of 21 is to be applied for the first commitment period of the Kyoto Protocol)
Value of data	21
Description of measurement methods and procedures to be applied:	This parameter will be monitored annually.
QA/QC procedures to be applied:	Data value as provided in relevant decisions of UNFCCC and the Kyoto Protocol will be used. Therefore no QA/QC procedure is required.
Any comment:	-
Data / Parameter:	W_x
Data unit:	tonnes
Description:	Total amount of organic waste prevented from disposal in year x
Source of data to be used:	Plant Log Book
Value of data	Please refer to 'Annex-3: Baseline Information'.
Description of measurement methods and procedures to be applied:	The parameter will be monitored continuously with a weighing system installed in the plant.
QA/QC procedures to be applied:	Yes. The weighing system will be calibrated as and when required. Moreover, being the primary raw material for manufacturing the compost, the parameter will be audited.
Any comment:	A lower uncertainty level of the parameter will be ensured through calibration of the weighing system and auditing the parameter. Discrepancies, if identified, will be addressed immediately and proper preventive measures will be undertaken.

Data / Parameter:	$p_{n,1,x}$
Data unit:	-
Description:	Weight fraction of the MSW (waste type j = 1) in the sample n collected during the year x.
Source of data to be used:	Plant Records- Sample measurements carried out by the project proponent.

Value of data	-
Description of measurement methods and procedures to be applied:	The size and frequency of sampling should be statistically significant with a maximum uncertainty range of 20% at a 95% confidence level. As a minimum, sampling should be undertaken four times per year. The MSW will be weighed in each of the samples to determine the weight fraction.
QA/QC procedures to be applied:	-
Any comment:	For ex-ante computation of baseline emissions, the quantity of MSW in the waste materials has been assumed based on the Procurement Planning of different waste types during the proposed crediting period of the project activity. Please refer to 'Annex-3: Baseline Information' for quantity of MSW assumed to be treated under the project activity. However the same will be determined ex-post based on the sample analysis conducted in the proposed crediting period.

Data / Parameter:	$p_{n,2,x}$
Data unit:	-
Description:	Weight fraction of the Food Waste comprising of fish waste and coconut husk (waste type j = 2) in the sample n collected during the year x.
Source of data to be used:	Plant Records- Sample measurements carried out by the project proponent.
Value of data	-
Description of measurement methods and procedures to be applied:	The size and frequency of sampling should be statistically significant with a maximum uncertainty range of 20% at a 95% confidence level. As a minimum, sampling should be undertaken four times per year. The Food Waste will be weighed in each of the samples to determine the weight fraction.
QA/QC procedures to be applied:	-
Any comment:	For ex-ante computation of baseline emissions, the quantity of Food Waste in the waste materials has been assumed based on the Procurement Planning of different waste types during the proposed crediting period of the project activity. Please refer to 'Annex-3: Baseline Information' for quantity of Food Waste assumed to be treated under the project activity. However the same will be determined ex-post based on the sample analysis conducted in the proposed crediting period.

Data / Parameter:	z

Data unit:	-
Description:	Number of samples collected during the year x
Source of data to be used:	Plant Records
Value of data	-
Description of measurement methods and procedures to be applied:	The parameter will be monitored continuously for all the samples collected and analysed.
QA/QC procedures to be applied:	-
Any comment:	For ex-ante computation of baseline emissions, the quantity of different waste types that will be treated under the project activity have been determined based on the Procurement Planning of different waste types during the proposed crediting period of the project activity. However the same will be determined ex-post based on the number of samples collected and analysed to determine the weight fractions of the different waste types in that sample.

Parameters to be monitored for the computation of Project Emissions

Data / Parameter:	$Q_{y, comp}$
Data unit:	tonnes
Description:	Quantity of final compost product produced and transported in the year y
Source of data to be used:	Plant Records
Value of data	Please refer to 'Annex-3: Baseline Information'.
Description of measurement methods and procedures to be applied:	The parameter will be measured with a weighing system installed in the plant. The same will be recorded separately for all the trucks carrying the compost from the composting site to the soil application site (*i.e.* markets in Orissa and Wets Bengal).
QA/QC procedures to be applied:	Yes. The weighing system will be calibrated as and when required. Moreover, the parameter will be audited.
Any comment:	A lower uncertainty level of the parameter will be ensured through calibration of the weighing system and auditing the parameter. Discrepancies, if identified, will be addressed immediately and proper preventive measures will be undertaken.

Data / Parameter:	$CT_{y,comp}$
Data unit:	tonnes/truck
Description:	Average truck capacity for final compost product transportation
Source of data to be used:	Transporters' Challans

Value of data	10
Description of measurement methods and procedures to be applied:	The parameter will be obtained from the transporters and recorded in the Plant Records.
QA/QC procedures to be applied:	No
Any comment:	The uncertainty level of the parameter is considered to be low since the same will be obtained from a third party. Furthermore the same can always be verified by actual measurement of the truck capacity. Therefore no QA/QC procedure is required to be planned for the parameter.

Data / Parameter:	DAF_{comp}
Data unit:	km
Description:	Average incremental distance for final compost product transportation
Source of data to be used:	Transporters' Challans
Value of data	For Orissa market: DAF_{comp_Orissa} = 150km For West Bengal market: $DAF_{comp\_West\ Bengal}$ = 300km
Description of measurement methods and procedures to be applied:	The parameter will be obtained from the transporters and recorded in the Plant Records.
QA/QC procedures to be applied:	No
Any comment:	The uncertainty level of the parameter is considered to be low since the same will be obtained from a third party. Therefore no QA/QC procedure is required to be planned for the parameter.

Data / Parameter:	EF_{CO2}
Data unit:	kg CO_2/km
Description:	CO_2 emission factor of the fuel (diesel) used for transportation
Source of data to be used:	i) Transporters' Challans and ii) 2006 IPCC Revised Guidelines for National Greenhouse Gas inventories
Value of data	0.79
Description of measurement methods	The parameter will be calculated based on - The average mileage of the trucks used for transportation of the compost,

and procedures to be applied:	- The net calorific value of the transportation fuel (diesel), - The carbon emission factor of the transportation fuel (diesel),
QA/QC procedures to be applied:	No
Any comment:	The uncertainty level of the parameter is considered to be low since the same will be determined based on the data provided by a third party and IPCC default values on net calorific value and carbon emissions factor of the transportation fuel. Therefore no QA/QC procedure is required to be planned for the parameter.

B.7.2 Description of the monitoring plan:

Please refer to 'Annex-4: Monitoring Information' for details.

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

Parameter	Details
Date of completing the final draft of this baseline selection and monitoring plan	17/08/2007
Name of person/ entity determining the baseline and establishing the monitoring plan	Krishi Rasayan Private Limited
Note: The contact information for the project proponent is provided in Annex-1 of this Project Design Document.	

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

08/08/2003

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

20y 0m

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:

Not Applicable.

C.2.1.2. Length of the first crediting period:

Not Applicable.

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

01/12/2007 or the date of registration of the project activity with UNFCCC, whichever is later.

C.2.2.2. Length:

10y 0m

SECTION D. Environmental impacts

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

As per the directives of the Ministry of Environment and Forests (MoEF), Government of India (the central governmental authority regulating the assessment of environmental impacts of industrial activities), the project proponent is not required to conduct an 'Environmental Impact Assessment' for the project activity under consideration due to its small-scale. However the impact of the project activity on the following baseline parameters has been evaluated:

Impact on local air quality: The project activity is a positive footstep towards improvement of the local air quality. Diversion of the waste materials from landfills to composting prevents the emission of harmful air pollutants such as methane. It also prevents the emission of bad odour, breeding of flies and outbreak of diseases in the nearby areas. Hence there is no negative impact on the ambient air quality due to the composting activity.

Impact on water quality: The composting activity does not lead to generation of significant quantum of waste water which may impact the water quality. Furthermore, the project proponent follows standard practice of disposal of sewage generated within the plant. Therefore no negative impact on the water quality is envisaged due to the implementation of the project activity.

Impact on soil quality: The composting activity does not have any negative impact on the land quality. In fact, it improves the soil conditions by preventing the dumping and decay of waste materials in the area.

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Moreover application of the compost-'Enrich' to soil also improves the soil nutrients and facilitates an increase in soil productivity on a sustainable basis.

Impact on noise level: The composting activity does not lead to any significant noise generation. All the activities are carried out within the plant premise thereby ensuring minimal impact on the local habitats.

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:

The above discussion clearly establishes that the project activity does not have any negative impact on the baseline environment that prevailed before the implementation of the project activity. However the project proponent, as a statutory requirement, will comply with all the standards as prescribed by the State Pollution Control Board.

SECTION E. Stakeholders' comments

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

Stakeholder consultation is an integral component for all project activities undertaken by Krishi Rasayan Private Limited. The same is carried out in a transparent manner as described below:

Identification of stakeholders: All the people/ parties who are involved with the project activity at any stage of its implementation are considered as stakeholders for the project activity. This includes both government and non-governmental organizations. For the project activity under consideration, the following stakeholders have been identified:

- Local People
- Employees of Krishi Rasayan Private Limited
- Non Governmental Organization (NGO)
- Puri Municipality
- Orissa State Pollution Control Board (OSPCB)

Information Sharing: Salient information regarding the project activity are shared with the identified stakeholders either verbally or through written communications. Representatives from Krishi Rasayan Private Limited meet the stakeholders, appraise them about all the aspects of the project activity and request for their feedback.

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Compilation of the feedbacks received: The comments received from all the stakeholders are compiled. The Management of Krishi Rasayan Private Limited is consulted in case any significant comments are received and appropriate measures are to be undertaken to address the same.

Please refer to the following section for details on stakeholder consultation with all the stakeholders identified as above.

E.2. Summary of the comments received:

Sl No.	Name of Stakeholders	Mode of Communication	Feedback	Status
1	Local People	Representatives from Krishi Rasayan Private Limited have met the local people in and around the plant premise. Brief details on the project activity, its socio-economic and environmental impacts are verbally communicated to the local people and they are requested to provide their feedbacks on the same.	The local people acknowledged the project activity's contribution towards socio-economic development of the locality through creation of employment opportunities. Furthermore it improves the local air quality by eliminating the emissions of methane from the waste materials which otherwise would have been dumped. This also eliminates the foul smell coming out of the dumps thereby improving the tourism business in Puri. The local people have commended their effort and assured their support to the Management of Krishi Rasayan Private Limited.	Krishi Rasayan Private Limited has already received a written consent form the representatives of the local people.
2	Employees of Krishi Rasayan Private Limited	The employees of the organisation have been informed about the project activity and its associated socio-economic and environmental benefits through a formal notice.	The employees have understood the positive attributes of the project activity and appreciated the decision of the Management to come up with such an environment friendly mechanism for productive utilisation of waste materials.	The employees have communicated their feedback through written communication to the Management of Krishi Rasayan Private Limited.

Sl No.	Name of Stakeholders	Mode of Communication	Feedback	Status
3	Non Governmental Organizations (NGO)	The details of the project activity implementation, its associated environmental benefits as well as its contribution towards socio-economic up-liftment of the Puri town as a whole have been conveyed to the NGO through a formal letter and their opinions on the same have been requested for.	The NGO has appreciated the initiative of Krishi Rasayan Private Limited for venturing into effective utilisation of the waste materials thereby significantly improving the local environmental quality and the aesthetics of the Puri town as well as benefiting the local economic structure through creation of employment opportunities for the local people.	A written consent has already been received from the NGO.
4	Puri Municipality	The representatives of Krishi Rasayan Private Limited have met with the Puri Municipality with the project proposal. They have detailed all the aspects of the project activity implementation.	The project activity completely eliminates the burden of solid waste disposal from Puri Municipality by ensuring effective utilisation of the solid waste to produce compost. The same also reduces the requirement of land where the waste materials would otherwise have been dumped in absence of the project activity.	Puri Municipality has commended the initiative of Krishi Rasayan Private Limited and has been providing their full support since the beginning.

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

The project activity has received only positive feedbacks from all the stakeholders as explained above. However stakeholder consultation is an on-going process which will be continued throughout the proposed crediting period of the project activity. All the comments received so far have been considered while preparation of the CDM Project Design Document.

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Furthermore, as per the requirement of UNFCCC, the CDM Project Design Document will be web-hosted on the DOE's (Designated Operational Entity) website for a period of one month for global stakeholder consultation. The comments received by the Validator during the period of global stakeholder consultation will be properly addressed as a part of CDM process.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Krishi Rasayan Private Limited
Street/P.O.Box:	234/3A AJC Bose Road
Building:	FMC FORTUNA
City:	Kolkata
State/Region:	West Bengal/South Asia
Postfix/ZIP:	700 020
Country:	India
Telephone:	033 2283 9454
FAX:	033 2287 1436
E-Mail:	atul@krishirasayan.com
URL:	www.krishirasayan.com
Represented by:	Mr. A Churiwal
Title:	Managing Director
Salutation:	Mr.
Last Name:	Churiwal
Middle Name:	-
First Name:	Atul
Department:	
Mobile:	09434724240
Direct FAX:	+91 33 2287 1436
Direct tel:	+91 33 2287 5730
Personal E-Mail:	-

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

Till date, funding from any Annex I country is not available for the project activity.

Annex 3

BASELINE INFORMATION

The project activity involves avoidance of GHG emissions through diversion of waste materials consisting of municipal solid waste (MSW) and food waste (fish waste and coconut husk) to produce compost. The quantity of MSW and food waste generated in the town of Puri is a dynamic quantity and is expected to vary considerably over time. It is expected that the quantities of the waste materials will increase over time and hence the amounts of waste materials treated by the composting facility of Krishi Rasayan Private Limited are also expected to increase. The planned increase in the quantities of waste materials to be treated by the facility has been provided as below.

Table An-3.1: Quantity of waste materials to be treated by the project activity

Year	Quantity of MSW	Quantity of Food Waste		Total Quantity of Waste Materials to be treated
		Quantity of Fish Waste	Quantity of Coconut Husk	
	(tonnes per day)	(tonnes per day)	(tonnes per day)	(tonnes per day)
2007-2008	80	15	5	100
2008-2009	80	15	5	100
2009-2010	90	20	10	120
2010-2011	90	20	10	120
2011-2012	90	20	10	120
2012-2013	90	20	10	120
2013-2014	90	20	10	120
2014-2015	90	20	10	120
2015-2016	90	20	10	120
2016-2017	110	20	10	140

The emission reduction computations have been carried out keeping in mind the above expected increments in the quantity of waste materials to be treated under the project activity. The following tables provide a step-wise computation of baseline emissions and project emissions for the project activity under consideration.

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Computation of Baseline Emissions (BE_y)

Computation of Baseline Emissions																										
Proposed Crediting Period	ϕ	f	(1-f)	GWP_{CH4}	OX	(1-OX)	F	DOC_f	MCF	y	x	Municipal Solid Waste							Food Waste							Baseline Emissions (tonnes of CO_2)
												$W_{j,x}$	DOC_j	k_j	e^{-kj}	$(1-e^{-kj})$	$k_j(y-x)$	$(e^{-kj(y-x)})$	$W_{j,x}$	DOC_j	k_j	e^{-kj}	$(1-e^{-kj})$	$k_j(y-x)$	$(e^{-kj(y-x)})$	
2007-2008	0.9	0	1	21	0	1	0.5	0.5	0.8	1	1	29200	0.20	0.17	0.844	0.156	0	1.000	7300	0.15	0.4	0.670	0.330	0	1.000	6421
																									$BE_{y=1}$	**6421**
2008-2009	0.9	0	1	21	0	1	0.5	0.5	0.8	2	1	29200	0.20	0.17	0.844	0.156	0.17	0.844	7300	0.15	0.4	0.670	0.330	0.4	0.670	5102
	0.9	0	1	21	0	1	0.5	0.5	0.8	2	2	29200	0.20	0.17	0.844	0.156	0	1.000	7300	0.15	0.4	0.670	0.330	0	1.000	6421
																									$BE_{y=2}$	**11523**
2009-2010	0.9	0	1	21	0	1	0.5	0.5	0.8	3	1	29200	0.20	0.17	0.844	0.156	0.34	0.712	7300	0.15	0.4	0.670	0.330	0.8	0.449	4093
	0.9	0	1	21	0	1	0.5	0.5	0.8	3	2	29200	0.20	0.17	0.844	0.156	0.17	0.844	7300	0.15	0.4	0.670	0.330	0.4	0.670	5102
	0.9	0	1	21	0	1	0.5	0.5	0.8	3	3	29200	0.20	0.17	0.844	0.156	0	1.000	7300	0.15	0.4	0.670	0.330	0	1.000	6421
																									$BE_{y=3}$	**15615**
2010-2011	0.9	0	1	21	0	1	0.5	0.5	0.8	4	1	29200	0.20	0.17	0.844	0.156	0.51	0.600	7300	0.15	0.4	0.670	0.330	1.2	0.301	3311
	0.9	0	1	21	0	1	0.5	0.5	0.8	4	2	29200	0.20	0.17	0.844	0.156	0.34	0.712	7300	0.15	0.4	0.670	0.330	0.8	0.449	4093
	0.9	0	1	21	0	1	0.5	0.5	0.8	4	3	29200	0.20	0.17	0.844	0.156	0.17	0.844	7300	0.15	0.4	0.670	0.330	0.4	0.670	5102
	0.9	0	1	21	0	1	0.5	0.5	0.8	4	4	32850	0.20	0.17	0.844	0.156	0	1.000	10950	0.15	0.4	0.670	0.330	0	1.000	7906
																									$BE_{y=4}$	**20412**
2011-2012	0.9	0	1	21	0	1	0.5	0.5	0.8	5	1	29200	0.20	0.17	0.844	0.156	0.68	0.507	7300	0.15	0.4	0.670	0.330	1.6	0.202	2699
	0.9	0	1	21	0	1	0.5	0.5	0.8	5	2	29200	0.20	0.17	0.844	0.156	0.51	0.600	7300	0.15	0.4	0.670	0.330	1.2	0.301	3311
	0.9	0	1	21	0	1	0.5	0.5	0.8	5	3	29200	0.20	0.17	0.844	0.156	0.34	0.712	7300	0.15	0.4	0.670	0.330	0.8	0.449	4093
	0.9	0	1	21	0	1	0.5	0.5	0.8	5	4	32850	0.20	0.17	0.844	0.156	0.17	0.844	10950	0.15	0.4	0.670	0.330	0.4	0.670	6197
	0.9	0	1	21	0	1	0.5	0.5	0.8	5	5	32850	0.20	0.17	0.844	0.156	0	1.000	10950	0.15	0.4	0.670	0.330	0	1.000	7906
																									$BE_{y=5}$	**24205**
2012-2013	0.9	0	1	21	0	1	0.5	0.5	0.8	6	1	29200	0.20	0.17	0.844	0.156	0.85	0.427	7300	0.15	0.4	0.670	0.330	2	0.135	2213
	0.9	0	1	21	0	1	0.5	0.5	0.8	6	2	29200	0.20	0.17	0.844	0.156	0.68	0.507	7300	0.15	0.4	0.670	0.330	1.6	0.202	2699
	0.9	0	1	21	0	1	0.5	0.5	0.8	6	3	29200	0.20	0.17	0.844	0.156	0.51	0.600	7300	0.15	0.4	0.670	0.330	1.2	0.301	3311
	0.9	0	1	21	0	1	0.5	0.5	0.8	6	4	32850	0.20	0.17	0.844	0.156	0.34	0.712	10950	0.15	0.4	0.670	0.330	0.8	0.449	4911
	0.9	0	1	21	0	1	0.5	0.5	0.8	6	5	32850	0.20	0.17	0.844	0.156	0.17	0.844	10950	0.15	0.4	0.670	0.330	0.4	0.670	6197
	0.9	0	1	21	0	1	0.5	0.5	0.8	6	6	32850	0.20	0.17	0.844	0.156	0	1.000	10950	0.15	0.4	0.670	0.330	0	1.000	7906
																									$BE_{y=6}$	**27236**
2013-2014	0.9	0	1	21	0	1	0.5	0.5	0.8	7	1	29200	0.20	0.17	0.844	0.156	1.02	0.361	7300	0.15	0.4	0.670	0.330	2.4	0.091	1824
	0.9	0	1	21	0	1	0.5	0.5	0.8	7	2	29200	0.20	0.17	0.844	0.156	0.85	0.427	7300	0.15	0.4	0.670	0.330	2	0.135	2213
	0.9	0	1	21	0	1	0.5	0.5	0.8	7	3	29200	0.20	0.17	0.844	0.156	0.68	0.507	7300	0.15	0.4	0.670	0.330	1.6	0.202	2699
	0.9	0	1	21	0	1	0.5	0.5	0.8	7	4	32850	0.20	0.17	0.844	0.156	0.51	0.600	10950	0.15	0.4	0.670	0.330	1.2	0.301	3931
	0.9	0	1	21	0	1	0.5	0.5	0.8	7	5	32850	0.20	0.17	0.844	0.156	0.34	0.712	10950	0.15	0.4	0.670	0.330	0.8	0.449	4911
	0.9	0	1	21	0	1	0.5	0.5	0.8	7	6	32850	0.20	0.17	0.844	0.156	0.17	0.844	10950	0.15	0.4	0.670	0.330	0.4	0.670	6197
	0.9	0	1	21	0	1	0.5	0.5	0.8	7	7	32850	0.20	0.17	0.844	0.156	0	1.000	10950	0.15	0.4	0.670	0.330	0	1.000	7906
																									$BE_{y=7}$	**29680**

2014-2015	0.9	0	1	21	0	1	0.5	0.5	0.8	8	1	29200	0.20	0.17	0.844	0.156	1.19	0.304	7300	0.15	0.4	0.670	0.330	2.8	0.061	1511
	0.9	0	1	21	0	1	0.5	0.5	0.8	8	2	29200	0.20	0.17	0.844	0.156	1.02	0.361	7300	0.15	0.4	0.670	0.330	2.4	0.091	1824
	0.9	0	1	21	0	1	0.5	0.5	0.8	8	3	29200	0.20	0.17	0.844	0.156	0.85	0.427	7300	0.15	0.4	0.670	0.330	2	0.135	2213
	0.9	0	1	21	0	1	0.5	0.5	0.8	8	4	32850	0.20	0.17	0.844	0.156	0.68	0.507	10950	0.15	0.4	0.670	0.330	1.6	0.202	3174
	0.9	0	1	21	0	1	0.5	0.5	0.8	8	5	32850	0.20	0.17	0.844	0.156	0.51	0.600	10950	0.15	0.4	0.670	0.330	1.2	0.301	3931
	0.9	0	1	21	0	1	0.5	0.5	0.8	8	6	32850	0.20	0.17	0.844	0.156	0.34	0.712	10950	0.15	0.4	0.670	0.330	0.8	0.449	4911
	0.9	0	1	21	0	1	0.5	0.5	0.8	8	7	32850	0.20	0.17	0.844	0.156	0.17	0.844	10950	0.15	0.4	0.670	0.330	0.4	0.670	6197
	0.9	0	1	21	0	1	0.5	0.5	0.8	8	8	32850	0.20	0.17	0.844	0.156	0	1.000	10950	0.15	0.4	0.670	0.330	0	1.000	7906
																									$BE_{y=8}$	**31666**
2015-2016	0.9	0	1	21	0	1	0.5	0.5	0.8	9	1	29200	0.20	0.17	0.844	0.156	1.36	0.257	7300	0.15	0.4	0.670	0.330	3.2	0.041	1255
	0.9	0	1	21	0	1	0.5	0.5	0.8	9	2	29200	0.20	0.17	0.844	0.156	1.19	0.304	7300	0.15	0.4	0.670	0.330	2.8	0.061	1511
	0.9	0	1	21	0	1	0.5	0.5	0.8	9	3	29200	0.20	0.17	0.844	0.156	1.02	0.361	7300	0.15	0.4	0.670	0.330	2.4	0.091	1824
	0.9	0	1	21	0	1	0.5	0.5	0.8	9	4	32850	0.20	0.17	0.844	0.156	0.85	0.427	10950	0.15	0.4	0.670	0.330	2	0.135	2582
	0.9	0	1	21	0	1	0.5	0.5	0.8	9	5	32850	0.20	0.17	0.844	0.156	0.68	0.507	10950	0.15	0.4	0.670	0.330	1.6	0.202	3174
	0.9	0	1	21	0	1	0.5	0.5	0.8	9	6	32850	0.20	0.17	0.844	0.156	0.51	0.600	10950	0.15	0.4	0.670	0.330	1.2	0.301	3931
	0.9	0	1	21	0	1	0.5	0.5	0.8	9	7	32850	0.20	0.17	0.844	0.156	0.34	0.712	10950	0.15	0.4	0.670	0.330	0.8	0.449	4911
	0.9	0	1	21	0	1	0.5	0.5	0.8	9	8	32850	0.20	0.17	0.844	0.156	0.17	0.844	10950	0.15	0.4	0.670	0.330	0.4	0.670	6197
	0.9	0	1	21	0	1	0.5	0.5	0.8	9	9	32850	0.20	0.17	0.844	0.156	0	1.000	10950	0.15	0.4	0.670	0.330	0	1.000	7906
																									$BE_{y=9}$	**33290**
2016-2017	0.9	0	1	21	0	1	0.5	0.5	0.8	10	1	29200	0.20	0.17	0.844	0.156	1.53	0.217	7300	0.15	0.4	0.670	0.330	3.6	0.027	1046
	0.9	0	1	21	0	1	0.5	0.5	0.8	10	2	29200	0.20	0.17	0.844	0.156	1.36	0.257	7300	0.15	0.4	0.670	0.330	3.2	0.041	1255
	0.9	0	1	21	0	1	0.5	0.5	0.8	10	3	29200	0.20	0.17	0.844	0.156	1.19	0.304	7300	0.15	0.4	0.670	0.330	2.8	0.061	1511
	0.9	0	1	21	0	1	0.5	0.5	0.8	10	4	32850	0.20	0.17	0.844	0.156	1.02	0.361	10950	0.15	0.4	0.670	0.330	2.4	0.091	2114
	0.9	0	1	21	0	1	0.5	0.5	0.8	10	5	32850	0.20	0.17	0.844	0.156	0.85	0.427	10950	0.15	0.4	0.670	0.330	2	0.135	2582
	0.9	0	1	21	0	1	0.5	0.5	0.8	10	6	32850	0.20	0.17	0.844	0.156	0.68	0.507	10950	0.15	0.4	0.670	0.330	1.6	0.202	3174
	0.9	0	1	21	0	1	0.5	0.5	0.8	10	7	32850	0.20	0.17	0.844	0.156	0.51	0.600	10950	0.15	0.4	0.670	0.330	1.2	0.301	3931
	0.9	0	1	21	0	1	0.5	0.5	0.8	10	8	32850	0.20	0.17	0.844	0.156	0.34	0.712	10950	0.15	0.4	0.670	0.330	0.8	0.449	4911
	0.9	0	1	21	0	1	0.5	0.5	0.8	10	9	32850	0.20	0.17	0.844	0.156	0.17	0.844	10950	0.15	0.4	0.670	0.330	0.4	0.670	6197
	0.9	0	1	21	0	1	0.5	0.5	0.8	10	10	40150	0.20	0.17	0.844	0.156	0	1.000	10950	0.15	0.4	0.670	0.330	0	1.000	9056
																									$BE_{y=10}$	**35776**

Computation of Project Emissions (PE_y)

Table An-3.3: Computation of Project Emissions											
Parameters	**Designation**	**Unit**	**Proposed Crediting Period**								
			2007-2008	**2008-2009**	**2009-2010**	**2010-2011**	**2011-2012**	**2012-2013**	**2013-2014**	**2014-2015**	**2015-2016**	**2016-2017**
Amoumt of wate materials composted	W_x	MT	36500	36500	36500	43800	43800	43800	43800	43800	43800	51100
Production of 'Enrich'	$Q_{y,comp}$	MT	7300	7300	7300	8760	8760	8760	8760	8760	8760	10220
Emission Factor of Transporting Fuel- Diesel												
Mileage of transporting vehicle (Assumed)		km/ litre of Diesel	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Specific Gravity of transporting fuel (Diesel)		kg/litre	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Mileage of transporting vehicle		km/ kg of Diesel	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Net calorific value of Diesel Fuel (IPCC)		TJ/KiloTonnes	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
Carbon Emission factor of Diesel fuel (IPCC)		tCO_2/TJ	74.1	74.1	74.1	74.1	74.1	74.1	74.1	74.1	74.1	74.1
Emission factor for transport fuel(Diesel)		kg CO_2/ kg of Diesel	3.19	3.19	3.19	3.19	3.19	3.19	3.19	3.19	3.19	3.19
CO_2 Emission Factor for transport fuel (Diesel)	EF_{CO2}	kg CO_2/ km	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79
Project Emissions from transportation of 'Enrich' in Orissa Market												
Enrich' sold in Orissa Market	$Q_{y,comp\_Orissa}$	MT	3650	3650	3650	4380	4380	4380	4380	4380	4380	5110
Average truck capacity for 'Enrich' transportation **(Assumed)**	$CT_{y,comp\_Orissa}$	tonnes/truck	10	10	10	10	10	10	10	10	10	10
Distance from the plant to the Orissa market	DAF_{comp_Orissa}	km	150	150	150	150	150	150	150	150	150	150
CO_2 Emission Factor for transport fuel (Diesel)	EF_{CO2}	kg CO_2/ km	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79
Project Emissions from transportation of 'Enrich' in Orissa Market	$PE_{y,transp,comp\_Orissa}$	**tCO_2**	**43**	**43**	**43**	**52**	**52**	**52**	**52**	**52**	**52**	**61**
Project Emissions from transportation of 'Enrich' in West Bengal Market												
Enrich' sold in West Bengal Market	$Q_{y,comp\_West\ Bengal}$	MT	3650	3650	3650	4380	4380	4380	4380	4380	4380	5110
Average truck capacity for 'Enrich' transportation **(Assumed)**	$CT_{y,comp\_West\ Bengal}$	tonnes/truck	10	10	10	10	10	10	10	10	10	10
Distance from the plant to the West Bengal market	$DAF_{comp\_West\ Bengal}$	km	300	300	300	300	300	300	300	300	300	300
CO_2 Emission Factor for transport fuel (Diesel)	EF_{CO2}	kg CO_2/ km	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79
Project Emissions from transportation of 'Enrich' in West Bengal Market	$PE_{y,transp,comp\_West\ Bengal}$	**tCO_2**	**87**	**87**	**87**	**104**	**104**	**104**	**104**	**104**	**104**	**121**
Project Emissions from transportation of 'Enrich'	$PE_{y,transp,comp\_West\ Bengal}$	**tCO_2**	**130**	**130**	**130**	**156**	**156**	**156**	**156**	**156**	**156**	**182**

Annex 4

MONITORING INFORMATION

The project activity is a GHG avoidance project where the waste materials (*i.e.* municipal solid waste and food waste), collected from different parts of Puri town are treated aerobically to produce compost and the same is marketed in the brand name of 'Enrich' in Orissa and Wets Bengal. The financial performance of the project activity depends significantly on the CDM revenue to be availed through sale of Certified Emission Reduction (CER) units accrued from the project activity. This will require proper monitoring of all the relevant GHG performance parameters. Therefore the project proponent has developed a robust monitoring protocol which will be followed throughout the proposed crediting period in order to ensure proper operation of the project activity resulting in generation of carbon credits. The same is explained below:

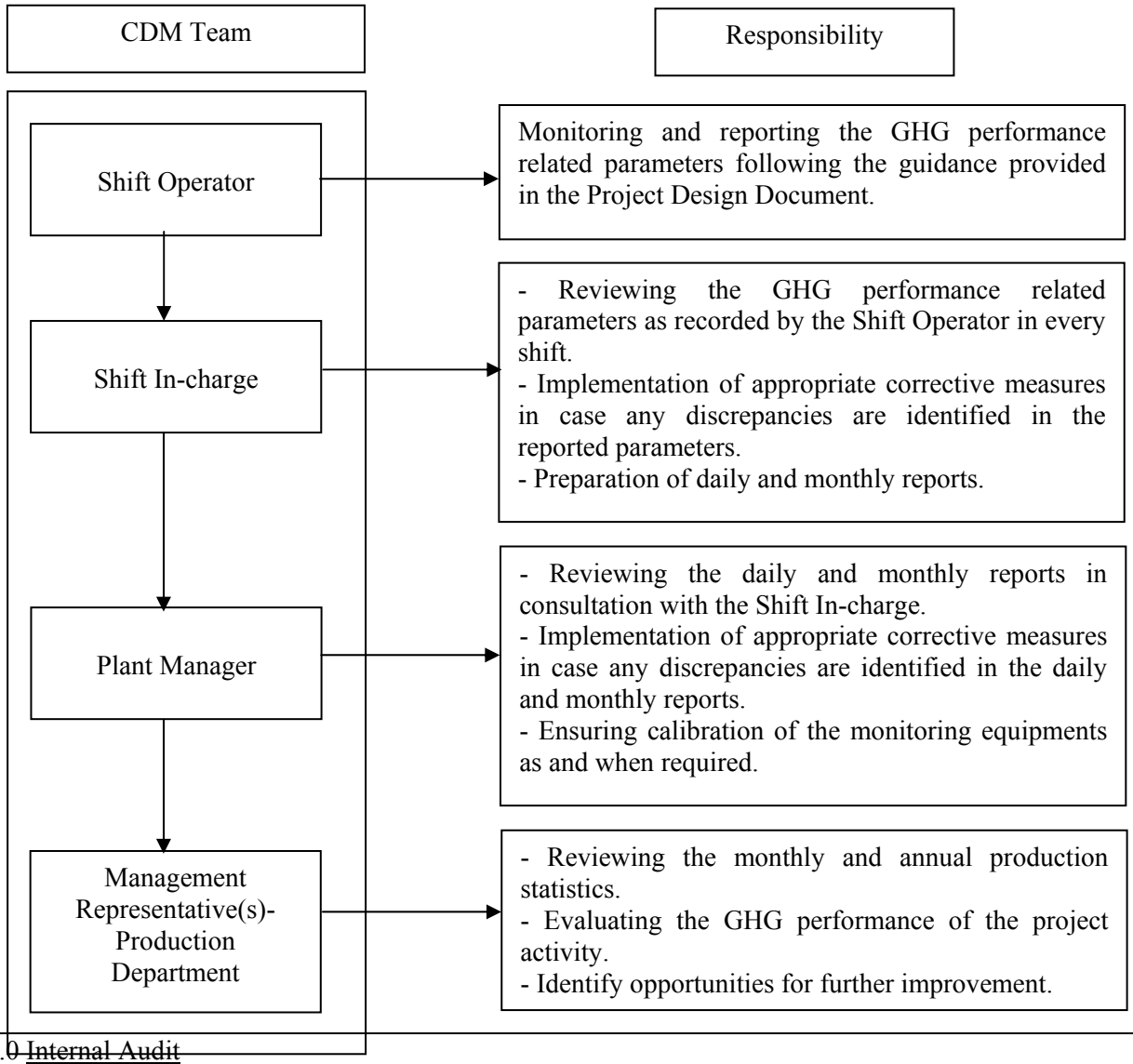
Table An-4.1: Monitoring Plan

1.0 Objective

- To ensure smooth uninterrupted operation of the project activity and hence generation of carbon credits
- To ensure proper monitoring, reporting and verification of all the parameters required to evaluate the GHG performance of the project activity
- To identify flaws in the monitoring system and open up opportunities for further improvement

2.0 Roles and Responsibilities

The project proponent has developed a 'CDM Team' who will be involved in monitoring, reporting and verification of all the GHG performance related parameters. The following schematic diagram will explain the individual roles and responsibilities of all the members of the 'CDM Team':



3.0 Internal Audit

Internal Audit will be conducted once in a year in order to assess the GHG performance of the project

activity. Auditors will consist of people from different departments of Krishi Rasayan Private Limited. The audit findings and the necessary corrective actions will be documented and reported to the Management Representative(s) of the Production Department for their immediate actions. The Plant Management will also be informed on the same. Compliance with the audit findings and evaluation of implementation of the corrective actions will be a part of the subsequent audit.
4.0 Experience and Training
The Plant Manager will be qualified graduate with prior work experience. The Shift In-charge will also possess prior work experience. All the Shift Operators will be provided with extensive on-the-job trainings under the guidance of the Shift In-charge which will include training on plant operations, data monitoring and report generation.

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