Monitoring Report

CARBON OFFSET UNIT (CoU) PROJECT

Title: **Avoidance of methane emissions through composting at Nisol, Jahaj, India**

UCR Project ID: 404

Version 2.0

Date of MR: 15/06/2024

1st CoU Issuance Period: 01/01/2013-31/12/2023 (11 years 00 months)

1st Monitored Period: 01/01/2013-31/12/2023 (11 years 00 months)

	Monitoring Report (MR) CARBON OFFSET UNIT (CoU) PROJECT

Monitoring Report	
Title of the project activity	**Avoidance of methane emissions through composting at Nisol, Jahaj, India**
UCR Project Registration Number	404
Version	2.0
Completion date of the MR	15/06/2024
Monitoring period number and duration of this monitoring period	Monitoring Period Number: 1 Duration of this monitoring Period: (first and last days included **(01/01/2013-31/12/2023**)
Project participants	**Owner**: Nisol Manufacturing Company Private Limited **Aggregator**: Imageio Knowledge Solutions Pvt. Ltd
Host Party	India
Applied methodologies and standardized baselines	UNFCCC CDM ***AMS-III.F***. Small-scale methodology *Avoidance of methane emissions through composting*, Version 12.0 TOOL04 Methodological tool Emissions from solid waste disposal sites, Version 08.1
Sectoral scopes	SECTORAL SCOPE - 13: Waste handling and disposal
SDG Impacts:	SDG 8 Decent work and economic growth SDG 13 Climate Action SDG 2 Zero Hunger
Estimated annual amount of GHG emission reductions for this monitoring period	2013: 2741 CoUs
	2014: 5763 CoUs
	2015: 7617 CoUs
	2016: 9604 CoUs
	2017: 11175 CoUs
	2018: 12128 CoUs
	2019: 13961 CoUs
	2020: 15622 CoUs
	2021:18481 CoUs
	2022: 21089 CoUs
	2023: 22419 CoUs
Total CoUs for this MP-01:	**140600 CoUs (140600 tCO_{2eq})**

SECTION A. Description of project activity

A.1. Purpose and general description of Carbon offset Unit (CoU) project activity >>

a) Purpose of the project activity and the measures taken for GHG emission reductions >>

The project activity **Avoidance of methane emissions through composting at Nisol, Jahaj, India** is located at Survey N. 114/115 P, Dharmaj - Khambhat Road, Village: Jahaj, Taluka: Khambhat, District: Anand, State Gujarat, Country: India.

The details of the registered project are as follows:

Purpose of the project activity:

The project activity is the composting of the agro-industrial biomass waste (tobacco dust) from activities at M/s. Nisol Manufacturing Company Private Limited (NMCPL). The project proponent (NMCPL or PP), operates a nicotine sulphate agro-industrial manufacturing plant whose waste product is tobacco dust.

The main use of nicotine sulphate is as an Active Pharmaceutical Ingredient (API) in smoking cessation products such as nicotine chewing gums, nicotine patches, lozenges, and nasal sprays.

The project activity avoids the emissions of methane (a GHG) to the atmosphere from agro-industrial biomass waste (tobacco dust) that would have otherwise been left to decay anaerobically in a solid waste disposal site (SWDS), by composting. The produced compost is handled aerobically and submitted to soil application without resulting in methane (CH_4) emissions. CH_4 is formed in anaerobic sections of the compost, but it is oxidised to a large extent in the aerobic sections of the compost. The estimated CH_4 released into the atmosphere ranges from less than 1 percent to a few per cent of the initial carbon content in the material (UNFCCC- CDM Guidance: Beck-Friis, 2001; Detzel et al., 2003; Arnold, 2005).

b) Brief description of the installed technology and equipment>>

The composting facility, operated by the project proponent, results in avoidance of methane emissions which would have resulted from dumping of the waste materials in unscientific and/or ordinary landfills. Even though CO_2 has a longer-lasting effect, methane sets the pace for warming in the near term. At least 25% of today's global warming is driven by methane from human actions. The waste materials are collected from within the project boundary and treated aerobically to produce the organic fertilizer. The organic fertilizer produced is sold to farmers for sustainable soil applications.

The baseline scenario is the situation where, in the absence of the project activity, the waste materials would have been dumped at an existing unscientific and ordinary landfill, which is the most common practice of disposal of solid wastes in the country. This would have resulted in anaerobic decomposition of the waste materials and generation of methane due to anaerobic decay. Many farmers visit the project activity directly with their tractors/trailers and collect treated compost directly throughout the year according to their crop rotation patterns and space availability at their fields.

Composting facility within the project boundary

Farmers collecting compost within the project boundary for soil applications

Farmers collecting compost within the project boundary for soil applications

During the waste treatment process a small quantity of water is used to facilitate the action of the culture powder. This quantity of water is too insignificant to generate any leachate from the waste. Moreover, most of the water is evaporated out as the treated waste is made to dry for a significant length of time. The solid waste type being composted is with largely homogenous properties.

To ensure the chances of leachate generation to minimum, the PP has provided the entire dumping ground with concrete flooring. This ensures zero seepage to the groundwater levels. Small amount of waste water which may be generated is appropriately directed through channels into the municipality's drainage system to ensure there is no groundwater or soil contamination.

Compliance of CTO:

M/s. Nisol Manufacturing Company Pvt. Ltd.

Survey No. 114/115 P, Village Jahaj, Dharmaj - Khambhat Road,
Taluka Khambhat, Dist: Anand - 388 580, Gujarat, INDIA

COMPLIANCE REPORT AS PER CTO AMENDMENT CONDITION

CTO NO. : - GPCB/CCA-AND-114/ID:32168

NO.	DESCRIPTION OF CONDITIONS	STATUS	ACTIONS REQUIRED	FREQUENCY
1.	**CTO NO. : AWH- 32586** **VALIDATION DATE 08/04/2019**	Complied	--	--
	The manufacture following proposed additional Products in existing:	Complied	--	--
	NO. | PRODUCTS | QUANTITY IN MT / Month 1. | Nicotine Sulphate (40%) | 50 2. | Spent Tobacco Dust | 2064	Company is manufacturing Nicotine Sulphate (40%) -18 MT/Month at present scenario. Now increasing the demand, we will going to manufacture Nicotine Sulphate (40%) -100 MT/Month.	Planning & Monitoring to ensure that production is not exceeding the consented capacity.	Monthly
Specific Condition as amended:				
1	Applicant shall obtain amendment for D.G.Set, water consumption and wastewater generation including the percolators in EC.	Company has already applied EC application for proposed expansion, EC application contain the revised water consumption, wastewater generation, source of flue gas emission and hazardous waste. Application dated: 02/03/2015		
2	Applicant shall install flow meter on waste water reuse line and maintain record of the same.	Complied Company has installed the flow meter on waste water reuse line.	--	Monthly

GPCB compliance data on waste generated per month

The PP employs advanced equipment and technologies to ensure optimal conditions, closely monitoring factors like temperature, humidity, and oxygen levels to obtain premium compost that meets the highest standards.

The compost produced is a sustainable alternative to chemical fertilizers. The PP places a strong emphasis on promoting a circular economy and sustainable waste management practices. By recycling agro-industrial waste and transforming them into valuable compost, the PP contribute to waste reduction and minimize the environmental impact associated with conventional waste disposal methods.

c) Relevant dates for the project activity (e.g. construction, commissioning, continued operation periods, etc.)>>

The project activity was commissioned on **30/05/2009.** The total emission reductions achieved by the project activity is estimated to be **140600** tCO_{2e}. During the current UCR monitoring period, the plant underwent continued operation, except scheduled maintenance or breakdown.

Start Date of current crediting period: 01/01/2013
Continued operations: 30/05/2009 onwards
PP operating facility since: 30/05/2009

The bulk of the generated treated compost is typically picked up during the April and May months every year. During this period, approximately 700 – 800 tractors per day collect compost from the project site. The compost is not subject to anaerobic storage or disposed of in a landfill post treatment.

Year	Waste Generated (MT)
2013	16856.725 ton
2014	19087.930 ton
2015	17355.277 ton
2016	22459.700 ton
2017	22392.000 ton
2018	21803.000 ton
2019	29319.000 ton
2020	29727.400 ton
2021	40333.851 ton
2022	41410.734 ton
2023	38510.253 ton
Total	**299255.87**

d) Total GHG emission reductions achieved or net anthropogenic GHG removals by sinks achieved in this monitoring period>>

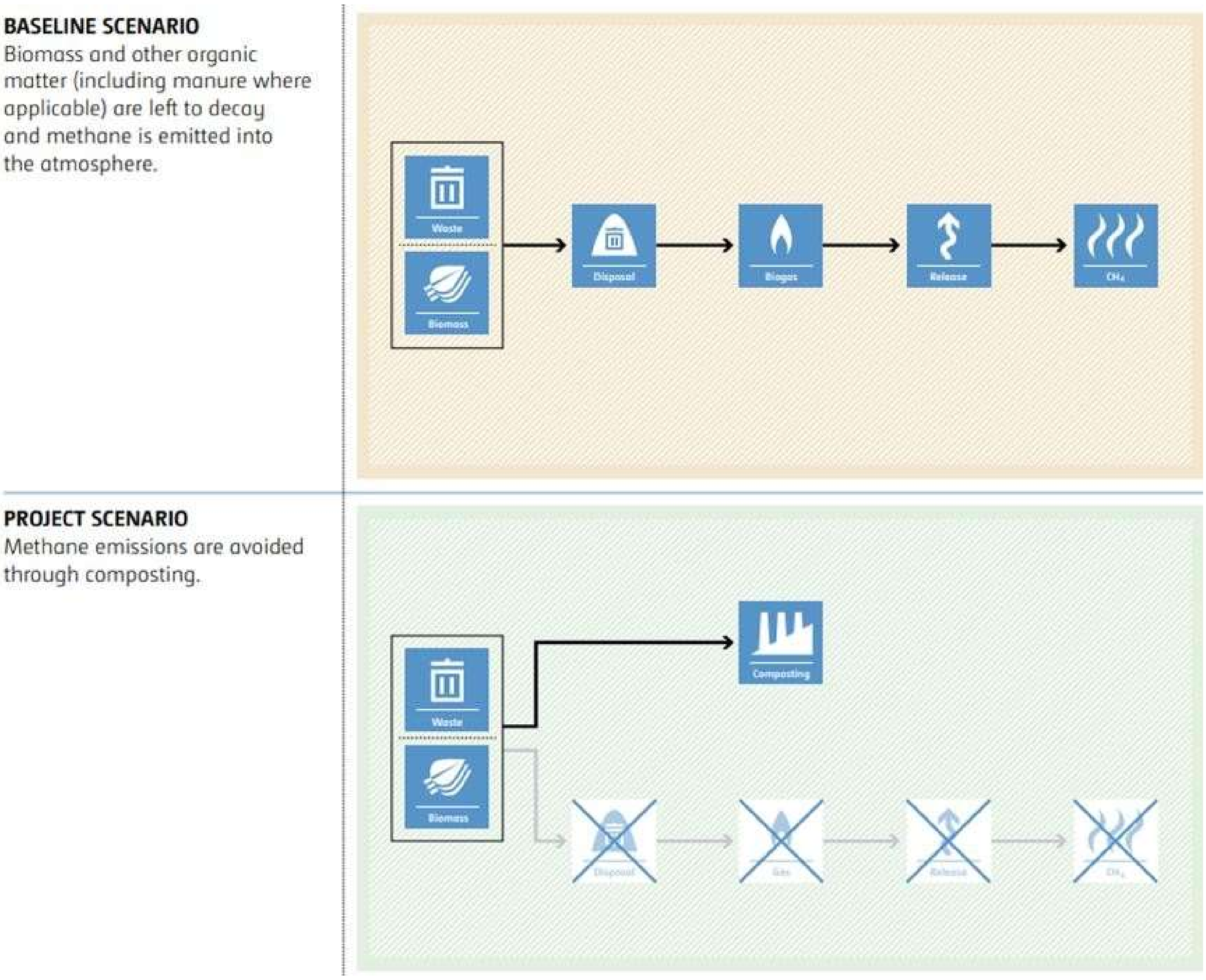
The total GHG emission reductions achieved in this monitoring period is as follows:

Summary of the Project Activity and ERs Generated for the Monitoring Period	
Start date of this Monitoring Period	01/01/2013
Carbon credits (CoUs) claimed up to	31/12/2023
Total ERs generated (tCO_{2eq})	140600 tCO_{2eq}
Project Emissions (tCO2eq)	21786 tCO_{2eq}

The baseline scenario identified at the MR stage of the project activity is:

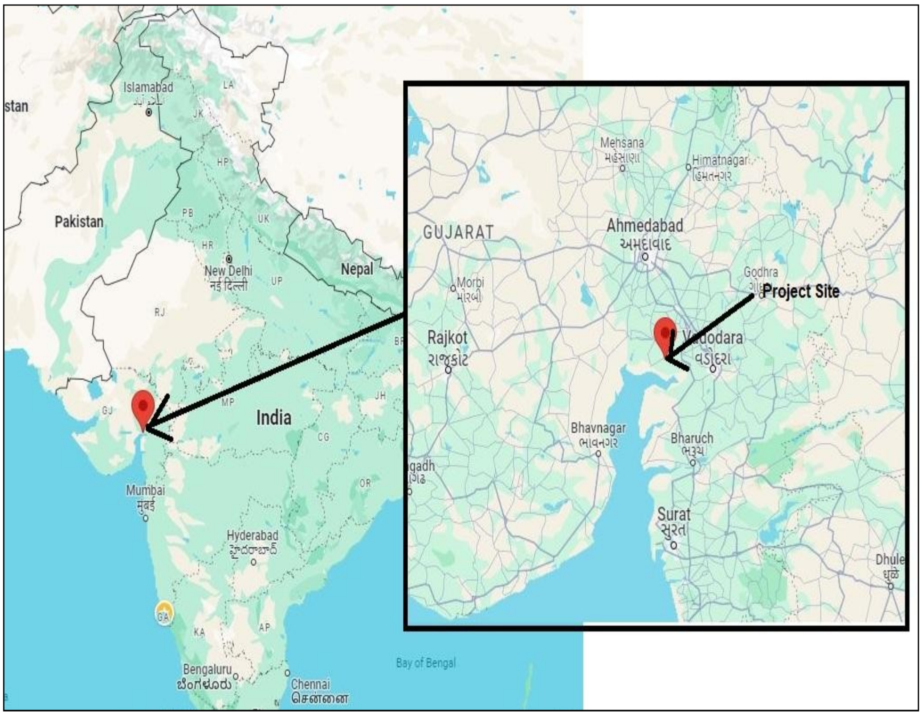
- the amount of methane emitted from the decay of the degradable organic carbon in the biomass solid waste. The yearly Methane Generation Potential for the solid waste is calculated using the first order decay model as described in the latest version of the methodological tool “Emissions from solid waste disposal sites”.

Baseline emissions shall exclude emissions of methane that would have to be captured, fuelled or flared to comply with national or local safety requirement or legal regulations.



A.2. Location of project activity>>

Survey N. 114/115 P, Dharmaj - Khambhat Road,
Village: Jahaj,
Taluka: Khambhat,
District: Anand,
State Gujarat,
Country: India
Latitude 22° 22' 45.94" N
Longitude: 72° 45' 02.91" E



A.3. Parties and project participants >>

Party (Host)	Participants
India	**Owner**: Nisol Manufacturing Company Private Limited **Aggregator**: Imageio Knowledge Solutions Pvt. Ltd **UCR ID#:** 953822321 **Contact**: miral9@gmail.com

A.4. References to methodologies and standardized baselines >>

SECTORAL SCOPE – 13: Waste handling and disposal

TYPE - Small Scale

CATEGORY - UNFCCC CDM Adapted Methodology **AMS-III.F**. Small-scale methodology ***Avoidance of methane emissions through composting***, Version 12.0

This methodology comprises measures to avoid the emissions of methane to the atmosphere from biomass or other organic matter that would have otherwise been left to decay anaerobically in a solid waste disposal site (SWDS), or in an animal waste management system (AWMS), or in a wastewater treatment system (WWTS). In the project activity, controlled aerobic treatment by composting of biomass is introduced.

The project activity does not recover or combust landfill gas from the disposal site (unlike AMS-III.G "Landfill methane recovery"), and does not undertake controlled combustion of the waste that is not treated biologically in a first step (unlike AMS-III.E "Avoidance of methane production from decay of biomass through controlled combustion, gasification or mechanical/thermal treatment").

Measures are limited to those that result in emission reductions of less than or equal to 60 kt CO2 equivalent annually.

For the purpose of this methodology, the following definitions apply:
(a) Residual waste - a solid waste type with largely homogenous properties. This includes, inter alia, material that remains after the waste is treated, e.g. compost, and biomass residues (by-product, residue or waste stream from agriculture, forestry and related industries);
(b) Solid waste - Material that is unwanted and insoluble (including gases or liquids in cans or containers). Hazardous waste is not included in the definition of solid waste. Solid waste may include residual wastes; and,
(c) Solid waste disposal site (SWDS) - designated areas intended as the final storage place for solid waste. Stockpiles are considered a SWDS if: (a) their volume to surface area ratio is 1.5 or larger; and if (b) PP confirms that the material is exposed to anaerobic conditions (i.e. it has a low porosity and is moist).

A.5. Crediting period of project activity >>

Type: Renewable
1st Crediting period state date: 01/01/2013
1st Crediting period end date: 31/12/2023
Length of the 1st crediting period corresponding to this monitoring period: 10 years 00 months

A.6. Contact information of responsible persons/entities >>

PCN, MR and other documentation by:
UCR Aggregator: Imageio Knowledge Solutions Pvt. Ltd
UCR ID#: 953822321
Contact: miral9@gmail.com

SECTION B. Implementation of project activity

B.1. Description of implemented registered project activity >>

a) Provide information on the implementation status of the project activity during this monitoring period in accordance with UCR PCN>>

Tobacco industries produces large amount of organic wastes during the manufacturing and processing of the cigarettes. The most useful of them are ground part of the leafs. This type of the waste is characterized in high content of total nitrogen and C: N ratio (13.5:15.9).

This quality makes it ideal to be used directly within the agricultural sector. Nitrogen content in the tobacco dust shows high manorial value expressed in terms of high crop yields and degree of its utilization. This organic waste has an advantageous effect on the soil in terms of increasing the soil humus with every increasing quantity of the organic amendments (*Jacek C. et.al. 2002*).

Composting is an environmentally friendly and effective technology for treatment or management of organic wastes, whose end-product is suitable for use in farm soil applications. It is a biological treatment in which aerobic mesophilic and thermophilic microorganisms transform the biodegradable organic matter into CO_2, NH_3, H_2O and a stable organic matter-compost

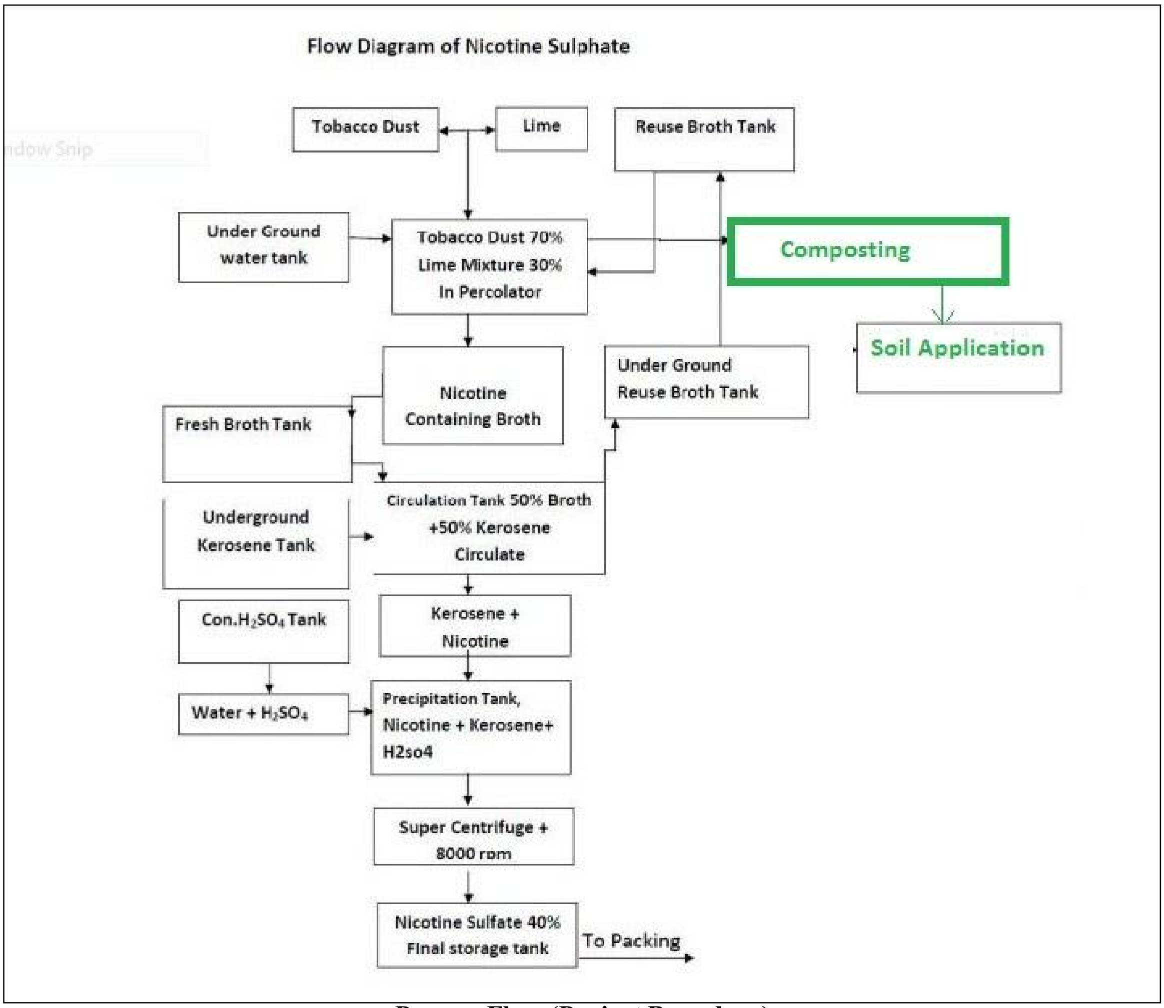
The composting process is designed for agricultural enhancement. The extraction of nicotine from tobacco dust consist of four major steps, namely,

- Mixing or Blending
- Percolation with water
- Extraction with solvent
- Packing and forwarding

Firstly different types of Tobacco dust are mixed in proportion with calcium oxide, and are filled in a stainless steel vessel. Then water is added in proportion till the percolate is collected at the bottom in collection tanks. After the final percolation, left over water in the tobacco dust and lime mix, is sucked by a vacuum pump. The remaining dust is than by a closed underground conveyer to the storage tower. Next the percolate (broth) is taken for extraction with kerosene in overhead vessels.

After allowing the kerosene to mix with the broth, the mixture is allowed to settle for about half hour, and then from the bottom, the broth is collected and stored in collection tanks and the kerosene containing the nicotine is taken to another vessel where a very small proportion of sulphuric acid is added to make nicotine.

The broth collected after the above extraction is again used in place of water as the input for the percolation with a new batch of tobacco dust and lime mix. Finally the nicotine sulphate is centrifuged and packed in MS drums and exported.



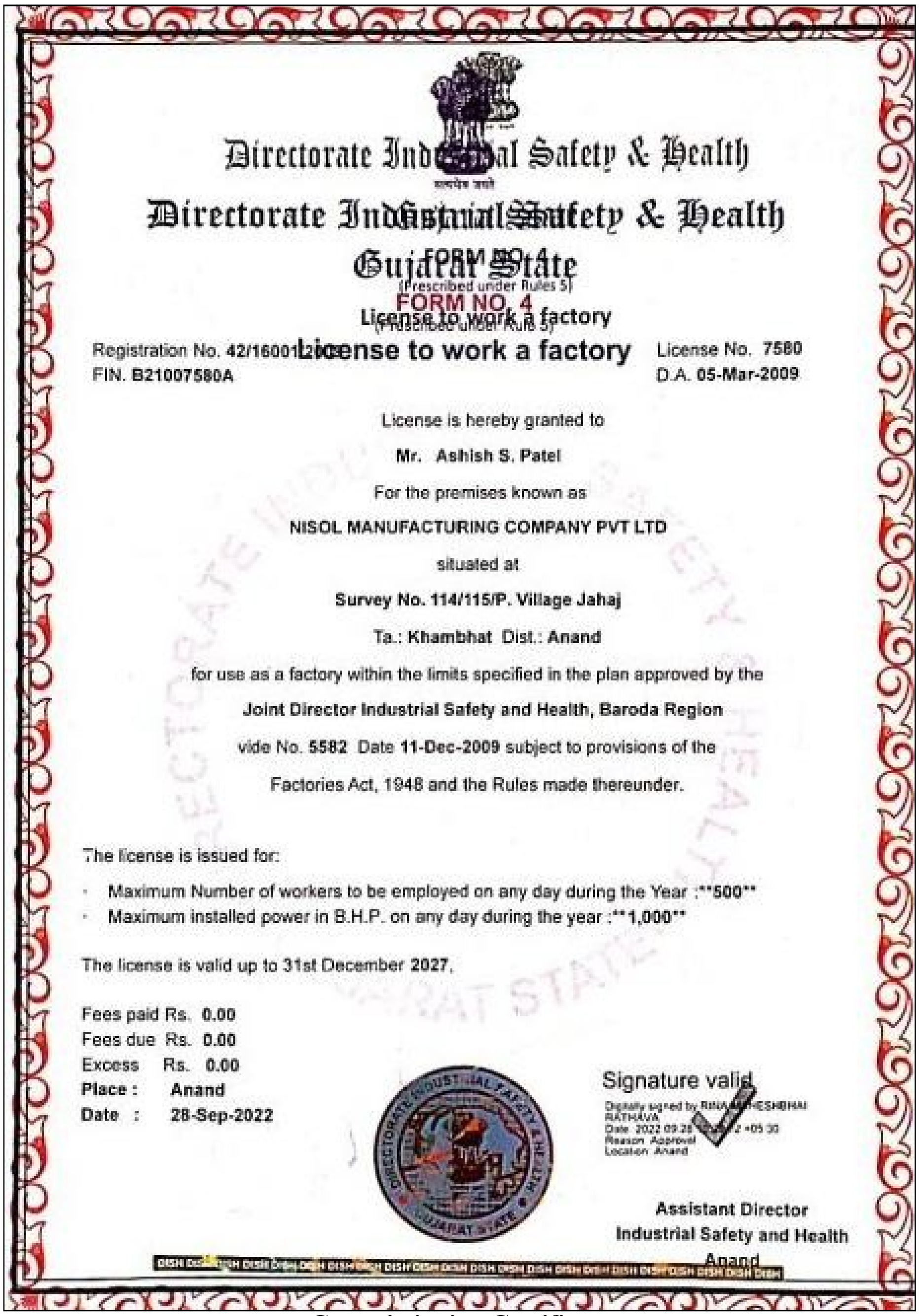
Process Flow (Project Boundary)

The project activity converts the agro-industrial biomass waste (tobacco dust) generated at the site into compost, by storing the same in composting warehouses within the project boundary and letting it aerobically degrade for a period of 8 – 10 months in a year. The tobacco dust, which contains organic matter, serves as the primary organic material for composting. When organic materials with moisture are stored under favourable conditions, beneficial microorganisms such as bacteria and fungi begin to break down the organic matter into compost.

Periodically turning or mixing the composting pile with the help of JCBs helps distribute moisture, oxygen, and microorganisms more evenly, accelerating the decomposition process. This composting process takes several months for the organic materials to fully decompose into a stable, nutrient-rich compost.

The tobacco dust after percolation with water is stored and sold as a natural mix for vermin-compost or directly as a deweedicide to farmers. The two main countries producing nicotine sulphate are India & China. However, the Indian manufacturers have an additional advantage because of the large network established with the local tobacco growing farmers and also the high nicotine content in the Indian tobacco dust.

b) For the description of the installed technology(ies), technical process and equipment, include diagrams, where appropriate>>



Directorate Industrial Safety & Health
Gujarat State
FORM NO. 4
(Prescribed under Rules 5)
License to work a factory

Registration No. 42/16001/2009
FIN. B21007580A

License No. 7580
D.A. 05-Mar-2009

License is hereby granted to
Mr. Ashish S. Patel
For the premises known as
NISOL MANUFACTURING COMPANY PVT LTD
situated at
Survey No. 114/115/P. Village Jahaj
Ta.: Khambhat Dist.: Anand
for use as a factory within the limits specified in the plan approved by the
Joint Director Industrial Safety and Health, Baroda Region
vide No. 5582 Date 11-Dec-2009 subject to provisions of the
Factories Act, 1948 and the Rules made thereunder.

The license is issued for:

- Maximum Number of workers to be employed on any day during the Year :**500**
- Maximum installed power in B.H.P. on any day during the year :**1,000**

The license is valid up to 31st December 2027.

Fees paid Rs. 0.00
Fees due Rs. 0.00
Excess Rs. 0.00
Place : Anand
Date : 28-Sep-2022

Signature valid
Digitally signed by RINA MAHESHBHAI RATHAVA
Reason: Approval
Location: Anand

Assistant Director
Industrial Safety and Health
Anand

Commissioning Certificate

The project activity is included in the schedule of EIA notification – and falls under Synthesis Organic Chemical under Category 5 (f) – A and an Environmental Clearance to the proposed expansion project has been obtained.

GUJARAT POLLUTION CONTROL BOARD
Paryavaran Bhavan
Sector-10-A, Gandhinagar 382 010.
Fax : (079) 23232156
Website : www.gpcb.gov.in
By R.P.A.D.

In exercise of the power conferred under section-25of the Water (Prevention and Control of Pollution) Act-1974, under section-21 of the Air (Prevention and Control of Pollution) Act-1981 and Authorization under rule 3(c) & 5(4) of the Hazardous Waste (Management, Handling and Trans boundary Movement) Rules 2008 framed under the E (P) Act-1986.

And whereas Board has received consolidated application ID 5587 dated 06/03/2009, for the consolidated consent and authorization (CC & A) of this Board under the provisions / rules of the aforesaid Acts Consent & Authorization is hereby granted as under.

CONSENT AND AUTHORISATION :
(Under the provisions / rules of the aforesaid environmental acts)

1 Consent Order No. : 32586, date of issue 29-6-2009.
2 The consent under Water Act - 1974, Air Act - 1981 & Authorization under Environment (Protection) Act, 1986 shall be valid up to 05/03/2014 to operate industrial plant for manufacture of the following products.

Sr. No.	Product	Max. Quantity MT/MONTH
1	NicotineSulphate(40%)	50
2	Spent Tobacco dust	2054

Subject to the following conditions.

2.1 Applicant shall comply with all the conditions stipulated by SEIA/MOEF in the order of Environment Clearance issued.
2.2 Applicant shall submit the yearly statement of production and Export quantity at the end of each financial year duly endorsed by ministry of Commerce and Industry, office of the Development Commissioner, Kandla SEZ.
3.1 There shall be total 0.200Klpd of industrial effluent from the manufacturing process and other ancillary industrial operations, which shall be totally reuse in process after treatment & unit shall strickly adhere to zero discharge.
3.2 The quantity of sewage effluent from the factory shall not exceed 0.100 KLPD.
3.3 TRADE EFFLUENT:
3.3.1 Sewage shall be disposed of through septic tank/soak pit system.
4. CONDITIONS UNDER THE AIR ACT:
4.1 There shall be no use of fuel hence there shall be no flue gas emission.
4.2 There shall be no process emission from the manufacturing process as well as any other ancillary process.
4.3 The concentration of the following parameters in the ambient air within the premises of the industry shall not exceed the limits specified hereunder.

PARAMETER	PERMISSIBLE LIMIT
Suspended Particulate Matter	500 microgram per cubic meter
Oxides Of Sulphur	120 microgram per cubic meter
Oxides Of Nitrogen	120 microgram per cubic meter

4.4 The industry shall take adequate measures for control of noise levels from its own sources within the premises so as to maintain ambient air quality standards in respect of noise to less than 75 dB(A) during day time and 70 dB (A) during night time. Daytime is reckoned in between 6a.m. and10 p.m. and nighttime is reckoned between 10 p.m. and 6 a.m.

5. GENERAL CONDITIONS:-
5.1 Any change in personnel, equipment or working conditions as mentioned in the consents form/order should immediately be intimated to this Board.
5.2 Applicant shall also comply with the general conditions given in annexure I.
5.3 Industry shall have to display the relevant information with regard to hazardous waste as indicated in the Court's order [illegible] of 1995 dated 14th October 2003.

GPCB NOC for the project activity 30/05/2009

Soil is non-renewable reserve that has high frequency of contamination and very low rate of replenishment in this environment. Immense food requirements have evolved the compelled usage of chemical fertilizers to have optimum crop leaf area in minimum time scale that have devastating impacts on biological, physical and chemical properties of the soil.

Tobacco dust is an agro-industrial waste which can be applied to the agricultural soil to recycle essential nutrients such as nitrogen (N), phosphorous (P) and potassium (K) back into the soil that the crops has taken up from the soil.

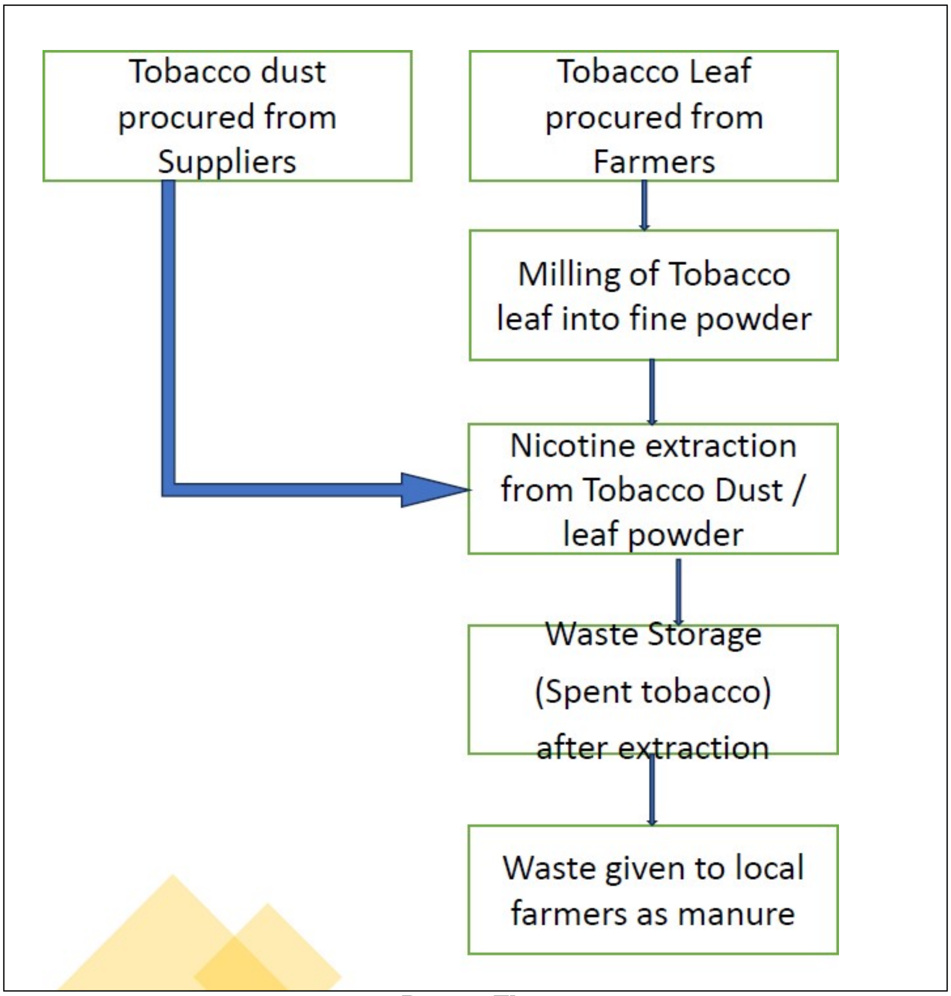
Tobacco dust is rich in nitrogen (N) (2.35%), potassium (K) (1.95%) and phosphorous (P) (937 ug/g) which can provide essential nutrients to the soil and plant. It has abundant quantity of organic content that exceeds the micro and macroorganism movement in soil which further increases the porosity of the soil; increase the infiltration of the oxygen.

Tobacco dust increases the pH of the soil, maintain the electrical conductivity (EC) that does not leads to the salinity of the soil. Further it also increases the nitrogen (N) content in various vegetable, house-plants and wheat straws and increases the biomass content and average survival rate of the tomatoes.

It's a good insecticide; which prevent the insects and other viruses such as Tobacco mosaic virus that are detrimental for the crops such as pepper, cucumber that shows light and dark green, crinkled, puckered leaves. Furthermore it's an eco-friendly management strategy for soil, environment and human health that does not generates pollution however it reduces the organic waste (*source: Sarah Shakeel. Consideration of Tobacco Dust as Organic Amendment for Soil: A Soil & Waste Management Strategy. Earth Sciences. Vol. 3, No. 5, 2014, pp. 117-121. doi: 10.11648/j.earth.20140305.11*).

Composting facility within the project boundary

Farmers using the collected compost aerobically in their agricultural fields



Process Flow

B.2 Do no harm or Impact test of the project activity>>

There are social, environmental, economic and technological benefits which contribute to sustainable development.

- **Social benefits:**
- On a social level, the project creates more job opportunities.
- There is a positive impact in the socio-economic conditions of the area in terms of direct and indirect employment due to the project activity.
- The project activity fosters sustainable agriculture. The utilization of compost on the farm helps improve soil fertility while eliminating the need for synthetic fertilizers.

- **Environmental benefits:**
- Reduces greenhouse gas emissions by composting. Cutting methane emissions is the fastest opportunity to immediately slow the rate of global warming, even as India decarbonizes their energy systems.
- Reducing pesticide and synthetic fertilizer usage: The application of tobacco compost reduces the consumption and spraying of the extensively damaged synthetic and commercial fertilizer on crops (*Tangkoonboribun and Sassanarakkit, 2009*).
- Improving soil health and crop yield: Tobacco compost reduces rice damaged by golden apple snail by about 14%. The rate of application more than 625 Kg/ha can improve rice yield due to the high nitrogen content of the compost at 1.34% and high organic matter with 46.65%.
- Promotes sustainable agriculture. The organic compost replaces the use of chemical fertilizer that would have been used in the absence of the project activity.
- Prevents crop damage: The chemical nature of the tobacco dust and its nicotine presence make the soil unfit for the insects breeding. In South America the control of Golden Apple snail problem in paddy fields and nearby crops was solved due to the application of the tobacco dust. The tobacco dust has high content of organic percentage that increases the pH of the soil, improves the total porosity and increases the infiltration of the soil (*Candemir et al., 2012).*

- **Economic benefits:**
- The project has a positive impact on the development of the local economy.
- This project shows financial additionality as there was a cheaper means of waste treatment. It would have been much cheaper and easier for the waste to be put into landfills, but instead, the PP has decided to finance the construction of a composting facility to properly treat the waste.

There is no reported negative impact on the groundwater table or adverse impacts on the surrounding villages of the project activity.

There is no reserved forest & no national park or sanctuary within 10 km radius of the plant.

United Nations Sustainable Development Goals:

Positive contribution of the project activity to the following Sustainable Development Goals:

- SDG13: Climate Action
- SDG 2: Zero Hunger
- SDG 8: Decent Work and Economic Growth

Development Goals	Targeted SDG	Target Indicator (SDG Indicator)
SDG 13: Climate Action	13.2: Integrate climate change measures into national policies, strategies and planning Lowered GHGs by 140600 tCO2	13.2.1: Number of countries that have communicated establishment or operationalization of an integrated policy/ strategy/ plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production (including a national adaptation plan, nationally determined contribution, national communication, biennial update report or other)
SDG 2: Zero Hunger	2.4 Sustainable food production and resilient agricultural practices	2.4.1 The project activity ensures sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality. The number of farms using the compost from the project activity replace chemical fertilizer that would have been used in the absence of the project activity.
SDG 8: Decent Work and Economic Growth	8.5: By 2030, achieve full and productive employment and decent work for all women and men, including for young people and persons with disabilities, and equal pay for work of equal value Target: Training, O&M staff	8.5.1: Average hourly earnings of female and male employees, by occupation, age and persons with disabilities The project activity provides direct employment to over 126 people.

B.3. Baseline Emissions>>

In accordance with this methodology 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. tobacco waste which is defined as a type of food waste) composted in the project activity. The first order decay model based on discrete time estimate method of IPCC guidelines, has been adopted for computation of baseline emissions.

Baseline emissions exclude methane emissions that would have to be captured, fuelled or flared to comply with national or local safety requirement or legal regulations.

In the case of construction of new composting facilities or expansion of capacity of existing composting facilities, the emission reduction achieved by the project activity will be measured as the difference between the baseline emission and the sum of the project emission and leakage.

As per the *TOOL04 Methodological tool Emissions from solid waste disposal sites, Version 08.1*, emissions are determined as per the following two relevant or applicable options:

- Application A: The UCR project activity mitigates methane emissions from a specific existing SWDS. Methane emissions are mitigated by capturing and flaring or combusting the methane (e.g. "ACM0001: Flaring or use of landfill gas"). The methane is generated from waste disposed in the past, including prior to the start of the UCR project activity. In these cases, the tool is only applied for an ex ante estimation of emissions in the project design document (CDM-PDD). The emissions will then be monitored during the crediting period using the applicable approaches in the relevant methodologies (e.g. measuring the amount of methane captured from the SWDS);
- Application B: The UCR project activity avoids or involves the disposal of waste at a SWDS. An example of this application of the tool is ACM0022, in which municipal solid waste (MSW) is treated with an alternative option, such as composting or anaerobic digestion, and is then prevented from being disposed of in a SWDS. The methane is generated from waste disposed or avoided from disposal during the crediting period. In these cases, the tool can be applied for both ex ante and ex post estimation of emissions. These project activities may apply the simplified approach detailed in 0 when calculating baseline emissions.

Physiochemical Composition of Tobacco Dust.

Sr. No.	Parameters	Values
1.	Moisture Content	7.7%
2.	pH	5.69
3.	Ash	35.4%(dry)
4.	Total Nitrogen (Kjeldahl)	2.38%(dry)
5.	Carbon/Nitrogen ratio	15.1
6.	Phosphorous	0.5%(dry)
7.	Calcium	3.7%(dry)
8.	Magnesium	0.55%(dry)
9.	Potassium	0.4%(dry)
10.	Nicotine	1.50%(dry)

Source: Sponza. D. T., "Toxicity Studies in a Tobacco Industry Biological Treatment Plant". Journal of Water, Air, and Soil Pollution, 134: 137–164 (2002).

Waste composition is one of the main factors influencing emissions from solid waste treatment, as different waste types contain different amount of degradable organic carbon (DOC) and fossil carbon. In the project activity, only one type of waste is disposed (residual waste for the project activity), hence waste sampling is not required.

2006 IPCC Guidelines for National Greenhouse Gas Inventories

TABLE 2.5
DEFAULT DOC AND FOSSIL CARBON CONTENT IN INDUSTRIAL WASTE (PERCENTAGE IN WET WASTE PRODUCED)[1]

Industry type	DOC	Fossil carbon	Total carbon	Water content [2]
Food, beverages and tobacco (other than sludge)	15	-	15	60
Textile	24	16	40	20
Wood and wood products	43	-	43	15
Pulp and paper (other than sludge)	40	1	41	10
Petroleum products, Solvents, Plastics	-	80	80	0
Rubber	(39) [3]	17	56	16
Construction and demolition	4	20	24	0
Other [4]	1	3	4	10

Source: Expert Judgement; Pipatti *et al.* 1996; Yamada *et al.* 2003.

[1] The default values apply only for process waste from the industries, office and other similar waste are assumed to be included in MSW.

[2] Note that water contents of industrial wastes vary enormously, even within a single industry.

[3] Natural rubbers would likely not degrade under anaerobic condition at SWDS (Tsuchii, *et al.*, 1985; Rose and Steinbüchel, 2005).

[4] These values can be used also as defaults for total waste from manufacturing industries, when data on waste production by industry type are not available. Waste from mining and quarrying should be excluded from the calculations as the amounts can be large and the DOC and fossil carbon contents are likely to be negligible.

TABLE 2.3
MSW COMPOSITION DATA BY PERCENT - REGIONAL DEFAULTS

Region	Food waste	Paper/cardboard	Wood	Textiles	Rubber/leather	Plastic	Metal	Glass	Other
Asia									
Eastern Asia	26.2	18.8	3.5	3.5	1.0	14.3	2.7	3.1	7.4
South-Central Asia	40.3	11.3	7.9	2.5	0.8	6.4	3.8	3.5	21.9
South-Eastern Asia	43.5	12.9	9.9	2.7	0.9	7.2	3.3	4.0	16.3
Western Asia & Middle East	41.1	18.0	9.8	2.9	0.6	6.3	1.3	2.2	5.4
Africa									
Eastern Africa	53.9	7.7	7.0	1.7	1.1	5.5	1.8	2.3	11.6
Middle Africa	43.4	16.8	6.5	2.5		4.5	3.5	2.0	1.5
Northern Africa	51.1	16.5	2	2.5		4.5	3.5	2	1.5
Southern Africa	23	25	15						
Western Africa	40.4	9.8	4.4	1.0		3.0	1.0		
Europe									
Eastern Europe	30.1	21.8	7.5	4.7	1.4	6.2	3.6	10.0	14.6
Northern Europe	23.8	30.6	10.0	2.0		13.0	7.0	8.0	
Southern Europe	36.9	17.0	10.6						
Western Europe	24.2	27.5	11.0						
Oceania									
Australia and New Zealand	36.0	30.0	24.0						
Rest of Oceania	67.5	6.0	2.5						
America									
North America	33.9	23.2	6.2	3.9	1.4	8.5	4.6	6.5	9.8
Central America	43.8	13.7	13.5	2.6	1.8	6.7	2.6	3.7	12.3
South America	44.9	17.1	4.7	2.6	0.7	10.8	2.9	3.3	13.0
Caribbean	46.9	17.0	2.4	5.1	1.9	9.9	5.0	5.7	3.5

Volume 5: Waste

TABLE 2.4
DEFAULT DRY MATTER CONTENT, DOC CONTENT, TOTAL CARBON CONTENT AND FOSSIL CARBON FRACTION OF DIFFERENT MSW COMPONENTS

MSW component	Dry matter content in % of wet weight [1]	DOC content in % of wet waste		DOC content in % of dry waste		Total carbon content in % of dry weight		Fossil carbon fraction in % of total carbon	
	Default	Default	Range	Default	Range [2]	Default	Range	Default	Range
Paper/cardboard	90	40	36 - 45	44	40 - 50	46	42 - 50	1	0 - 5
Textiles [3]	80	24	20 - 40	30	25 - 50	50	25 - 50	20	0 - 50
Food waste	40	15	8 - 20	38	20 - 50	38	20 - 50	-	-
Wood	85 [4]	43	39 - 46	50	46 - 54	50	46 - 54	-	-
Garden and Park waste	40	20	18 - 22	49	45 - 55	49	45 - 55	0	0
Nappies	40	24	18 - 32	60	44 - 80	70	54 - 90	10	10
Rubber and Leather	84	(39) [5]	(39) [5]	(47) [5]	(47) [5]	67	67	20	20
Plastics	100	-	-	-	-	75	67 - 85	100	95 - 100
Metal [6]	100	-	-	-	-	NA	NA	NA	NA
Glass [6]	100	-	-	-	-	NA	NA	NA	NA
Other, inert waste	90	-	-	-	-	3	0 - 5	100	50 - 100

[1] The moisture content given here applies to the specific waste types before they enter the collection and treatment. In samples taken from collected waste or from e.g., SWDS the moisture content of each waste type will vary by moisture of co-existing waste and weather during handling.

[2] The range refers to the minimum and maximum data reported by Dehoust *et al.*, 2002; Gangdonggu, 1997; Guendehou, 2004; JESC, 2001; Jager and Blok, 1993; Würdinger *et al.*, 1997; and Zeschmar-Lahl, 2002.

[3] 40 percent of textile are assumed to be synthetic (default). Expert judgement by the authors.

[4] This value is for wood products at the end of life. Typical dry matter content of wood at the time of harvest (that is for garden and park waste) is 40 percent. Expert judgement by the authors.

[5] Natural rubbers would likely not degrade under anaerobic condition at SWDS (Tsuchii et al., 1985; Rose and Steinbüchel, 2005).

[6] Metal and glass contain some carbon of fossil origin. Combustion of significant amounts of glass or metal is not common.

Since the decay rate of the waste is an important parameter in baseline emissions calculations of the composting project activity, the following climatic conditions of the surrounding area as per the methodology requirements have been described as below: Micro-meteorology The climate of Gujarat is varied, as it is moist in the southern districts and dry in the - northern region. The Arabian Sea and the Gulf of Cambay in the west and the forest-covered hills in the east soften the rigours of climatic extremes, consequently reducing the temperature and render the climate more pleasant and healthy. Khambhat lies along the middle part of the state and experiences a climate with aridity index of 15 to 20 per cent indicating adequate moisture availability in the soils for most part of the year.

Batch code: EUINBA-00104320

Report date: 21.10.2021

NISOL MANUFACTURING COMPANY PVT. LTD. - Anand
REG. OFFICE: RANCHHODKRUPA,
R.R. PATEL MARG,
AT- DHARMAJ, TALUKA - PETLAD,
388430Anand.
INDIA

Mr NILANSHU GAJJAR

ANALYTICAL REPORT

Sample code:	258-2021-09006770	**Report code:**	AR-21-IR-092184-01
Sample name:	Spent Tobacco (Week - 26)		
		Received on:	22.09.2021
		Analysed between:	23.09.2021 - 20.10.2021
Sample reference	005-11732-30033		
Quantity received:	500g Approx		
Sample packing:	Sealed Polythene Pack	**Condition on receipt:**	Good
Sampling:	NOT SAMPLED BY EUROFINS		

CHEMICAL			*Method*	*Result Unit*	*LOQ*
IR138	**IR**	pH	By Digital pH Meter	9.24	
IR467	**IR**	Nitrogen	IS 7219:1973	0.86 g/100g	
IR227	**IR**	Total Chloride	AOAC 950.52	1.04 g/100g	10
METAL CONTAMINANTS			*Method*	*Result Unit*	*LOQ*
IR217	**IR**	Lead (Pb)	AOAC 2015.01	4.260 mg/kg	0.05
IR218	**IR**	Cadmium (Cd)	AOAC 2015.01	0.450 mg/kg	0.02
IR221	**IR**	Arsenic (As)	AOAC 2015.01	2.200 mg/kg	0.05
IR219	**IR**	Mercury (Hg)	AOAC 2015.01	0.010 mg/kg	0.01
IR222	**IR**	Chromium (Cr)	AOAC 2011.19	1.150 mg/100g	0.1
IR223	**IR**	Nickel (Ni)	AOAC 2011.14	6.95 g/100g	0.1
IR235	**IR**	Copper (Cu)	AOAC 2011.14	1.19 g/100g	0.1
MINERALS			*Method*	*Result Unit*	*LOQ*
IR093	**IR**	Sodium (Na)	AOAC 2011.14	562 g/100g	0.2
IR095	**IR**	Calcium (Ca)	AOAC 2011.14	14948.8 g/100g	0.1
IR094	**IR**	Potassium (K)	AOAC 2011.14	680.3 g/100g	0.1
IR232	**IR**	Manganese	AOAC 2011.14	15.66 g/100g	0.2
IR231	**IR**	Zinc (Zn)	AOAC 2011.14	3.11 g/100g	0.1

POLYCYCLIC AROMATIC HYDROCARBONS		*Result Unit*	*LOQ*
IR424	**IR** **Poly aromatic hydrocarbons (Sum of 4 PAH)** **Method: EASI-CHE-SOP-21**		

The results may not be reproduced except in full, without a written approval of the laboratory. The results relate only to the sample analysed.

Page 2/2

eurofins

Batch code: EUINBA-00104320

POLYCYCLIC AROMATIC HYDROCARBONS			*Result*	*Unit*	*LOQ*
IR424	**IR**	**Poly aromatic hydrocarbons (Sum of 4 PAH)**	**Method: EASI-CHE-SOP-21**		
Benzo(a)pyrene			3.47	µg/kg	0.5
Benz(a)anthracene			2.82	µg/kg	0.5
Chrysene			12.42	µg/kg	0.5
Benzo(b)fluoranthene			3.41	µg/kg	0.5
Sum of 4 PAH			22.12	µg/kg	

PESTICIDES			*Method*	*Result Unit*	*LOQ*
IR0LG	**IR**	DDT (DDT+ DDE + TDE)	EASI-CHE-SOP-21	<0.01 mg/kg	0.01
IR04Y	**IR**	Chlordane	EASI-CHE-SOP-21	<0.01 mg/kg	0.01
IR05Z	**IR**	Aldrin	EASI-CHE-SOP-21	<0.01 mg/kg	0.01
IR06B	**IR**	Heptachlor	EASI-CHE-SOP-21	<0.01 mg/kg	0.01
IR06I	**IR**	Dieldrin	EASI-CHE-SOP-21	<0.01 mg/kg	0.01
IR06A	**IR**	Endrin	EASI-CHE-SOP-21	<0.01 mg/kg	0.01
IR01I	**IR**	Mirex	EASI-CHE-SOP-21	<0.01 mg/kg	0.01
IR01G	**IR**	Hexachlorobenzene (HCB)	EASI-CHE-SOP-21	<0.01 mg/kg	0.01
IR1HA	**IR**	Toxaphene (camphechlor)	EASI-CHE-SOP-21	<0.01 mg/kg	1

MICROBIOLOGICAL			*Method*	*Result Unit*	*LOQ*
IR021	**IR**	Salmonella	ISO 6579-1	Absent /25 g	
IR034	**IR**	*Escherichia coli*	ISO 16649-2	<10 cfu/g	10

The tests identified by the two letters code IR are performed by Eurofins Analytical Services India (Bangalore), INDIA.

Ms Jyoti Sindhu
Assistant Director- Lab

Mr Sourabh Halder
Assistant Manager - Microbiology

LOQ = Limit of Quantification

*************** END OF REPORT ****************

Waste Characteristics Report

B.4. Debundling>>

The project is not a debundled component of a larger project activity.

SECTION C. Application of methodologies and standardized baselines

C.1. References to methodologies and standardized baselines >>

SECTORAL SCOPE –
13: Waste handling and disposal

TYPE - Small Scale

CATEGORY - UNFCCC CDM Adapted Methodology **AMS-III.F**. Small-scale methodology ***Avoidance of methane emissions through composting***, Version 12.0

This methodology comprises measures to avoid the emissions of methane to the atmosphere from biomass or other organic matter that would have otherwise been left to decay anaerobically in a solid waste disposal site (SWDS), or in an animal waste management system (AWMS), or in a wastewater treatment system (WWTS). In the project activity, controlled aerobic treatment by composting of biomass is introduced.

The project activity does not recover or combust landfill gas from the disposal site (unlike AMS-III.G "Landfill methane recovery"), and does not undertake controlled combustion of the waste that is not treated biologically in a first step (unlike AMS-III.E "Avoidance of methane production from decay of biomass through controlled combustion, gasification or mechanical/thermal treatment").

Measures are limited to those that result in emission reductions of less than or equal to 60 kt CO2 equivalent annually

C.2. Applicability of methodologies and standardized baselines >>

Methodology key elements

Typical projects	Controlled biological treatment of biomass or other organic matter is introduced through aerobic treatment by composting and proper soil application of the compost
Type of GHG emissions mitigation action	GHG emission avoidance: Avoidance of GHG emissions by alternative treatment process

Applicability
1. The methodology is applicable to the project activity since it involves the composting of the organic fraction of biomass waste from agricultural or agro-industrial activities including manure.
2. This methodology is applicable to the project activity since it includes construction and expansion of treatment facilities as well as activities that increase capacity utilization at an existing facility.
3. The produced compost is handled aerobically and submitted to soil application, the proper conditions and procedures (not resulting in methane emissions) are ensured.
4. The project activity does not involve co-composting of wastewater or other solid biomass waste.
5. The location and characteristics of the disposal site of the biomass and co-composting wastewater in the baseline condition is known
6. Blending materials are not added in the project activity to increase the efficiency of the composting process (e.g. to achieve a desirable C/N ratio or free air space value)
7. For solid wastes diverted from a solid waste disposal site, the following requirement shall be checked ex ante at the beginning of each crediting period:

(a) Establish that identified landfill(s)/stockpile(s) can be expected to accommodate the waste to be used for the project activity for the duration of the crediting period; or

(b) Establish that it is common practice in the region to dispose of the waste in solid waste disposal site (landfill)/stockpile(s).

8. The project participants can clearly define the geographical boundary of the region, taking into account the source of the waste i.e. if waste is transported up to 50 km, the region may cover a radius of 50 km around the project activity. In addition, it should also consider the distance to which the final product after composting will be transported. In either case, the region covers a reasonable radius around the project activity that can be justified with reference to the project circumstances but in no case it shall be more than 200 km. In case produced compost is handled aerobically and submitted to soil application, the proper conditions and procedures (not resulting in methane emissions) must be ensured.

9. Compost is not stored under anaerobic conditions and/or delivered to a landfill.

The UCR project activity avoids or involves the disposal of waste at a SWDS. The project activity uses composting as a treatment method and prevents the waste from being disposed of in a SWDS. The methane is generated from waste disposed or avoided from disposal during the crediting period. In these cases, the tool (*TOOL04 Methodological tool Emissions from solid waste disposal sites Version 08.1*) is applied for both ex ante and ex post estimation of emissions.

The operation of the composting facility is documented in a quality control program, monitoring the conditions and procedures that ensures the aerobic condition of the waste during the composting process (e.g. temperature and moisture during different composting stages).

Soil application of the compost in agriculture is monitored. This includes documenting the sales or delivery of the compost final product. It also includes an in situ verification of the proper soil application of the compost to ensure aerobic conditions for further decay. Such verification is done at representative sample of farm sites. The conditions for proper soil application ensuring aerobic conditions is established by local farming experts taking into account the soil conditions, crop types grown and weather conditions.

The definitions contained in the Glossary of UNFCCC CDM terms shall apply

Managed SWDS - a SWDS that has controlled placement of waste (i.e. waste directed to specific deposition areas, a degree of control of scavenging and a degree of control of fires) and will include at least one of the following: (i) cover material; (ii) mechanical compacting; or (iii) levelling of the waste. In this tool, a SWDS that does not meet this definition is considered an unmanaged SWDS;

Residual waste - a solid waste type with largely homogenous properties. This includes, inter alia, material that remains after the waste is treated, e.g. biomass residues (by-product, residue or waste stream from agriculture, forestry and related industries);

Solid waste disposal site (SWDS) - designated areas intended as the final storage place for solid waste. Stockpiles are considered a SWDS if: (a) their volume to surface area ratio is 1.5 or larger; and if (b) a visual inspection by the DOE confirms that the material is exposed to anaerobic conditions (i.e. it has a low porosity and is moist);

Parameter	SI Unit	Description
$BE_{CH4,SWDS,y}$	$t\ CO_{2e}/yr$	Baseline, project or leakage methane missions

$PE_{CH4,SWDS,y}$ $LE_{CH4,SWDS,y}$		occurring in year y generated from waste disposal at a SWDS during a time period ending in year y (where y is a period of 12 consecutive months)

C.3. Applicability of double counting emission reductions >>

There is no double counting of emission reductions. The project has never applied for voluntary carbon credits in any other program in the past.

C.4. Project boundary, sources and greenhouse gases (GHGs)>>

The project boundary is the physical, geographical site where

(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; and

(c) Where the products from composting (compost) is handled, disposed, submitted to soil

	Source	GHG	Included?	Justification/Explanation
Baseline	- Emissions from transportation to the landfill - Emissions from landfill	CO_2	**Included**	Emission from Transportation
		CH_4	**Included**	CH4 emissions from the decomposition of organic waste
		N_2O	Excluded	Negligible
Project Activity	Emissions from composting process and transportation to field	CO_2	**Included**	CO2 emissions from the transportation of compost to farms
		CH_4	Excluded	Composting process
		N_2O	**Included**	Composting process

C.5. Establishment and description of baseline scenario (UCR Protocol) >>

The amount of methane that would in the absence of the project activity be generated from disposal of waste at the solid waste disposal site ($BE_{CH4,SWDS,y}$) is the baseline and is calculated with a multi-phase model. The calculation is based on a first order decay (FOD) model. The model differentiates between the different types of waste j with respectively different decay rates kj and different fractions of degradable organic carbon (DOCj). The model calculates the methane generation based on the actual waste streams Wj,x disposed in each year x, starting with the first year after the start of the project activity until the until the end of the year y, for which baseline emissions are calculated (years x with x = 1 to x = y).

$$BE_y = BE_{CH4SWDS,y} + BE_{ww,y} + BE_{CH4,manure,y} - MD_{y,reg} \times GWP_{CH4}$$

Where:

BE_y = Baseline Emissions in the year y (in tCO2/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) (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 tCH4/annum). 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. $MD_{y,reg} = 0$.

$MEP_{y,ww}$ = Methane emission potential in the year “y” of the wastewater (in tCH4/annum) $GWP_{\_CH4}$ = Global Warming Potential of methane (=21 for the first UCR crediting period)

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

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

For the current monitoring period the values of x, y will vary depending on year.

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

The amount of methane produced in the year y ($BE_{CH4,SWDS,y}$) is calculated as follows:

$$BE_{CH4,SWDS,y} = \varphi \cdot (1-f) \cdot GWP_{CH4} \cdot (1-OX) \cdot \frac{16}{12} \cdot F \cdot DOC_f \cdot MCF \cdot \sum_{x=1}^{y} \sum_{j} W_{j,x} \cdot DOC_j \cdot e^{-k_j (y-x)} \cdot (1-e^{-k_j})$$

Where:

$BE_{CH4,SWDS,y}$ = Methane emissions avoided during the year y from preventing waste disposal at the solid waste disposal site (SWDS) during the period from the start of the project activity to the end of the year y (tCO2e)

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

f = Fraction of methane captured at the SWDS and flared, combusted or used in another manner (0)

GWP_{CH4} = Global Warming Potential (GWP) of methane, valid for the relevant UCR commitment period (i.e. 21 conservative default)

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

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

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

MCF_y = Methane correction factor. The MCF should be selected as a default value ($MCF_y = MCF_{default}$) as indicated for unmanaged SWDS (source: TOOL04 Methodological tool Emissions from solid waste disposal sites Version 08.1).

MCF_y = 0.8 for unmanaged solid waste disposal sites – deep. This comprises all SWDS not meeting the criteria of managed SWDS and which have depths of greater than or equal to 5 meters;

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

In this case only one type of waste is disposed (residual waste for the project activity), then Wj,x = Wx and Wj,i = Wi and waste sampling is not required as per TOOL04.

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 first UCR crediting period (x = 1) to the year y for which avoided emissions are calculated (x = y)

y = Year for which methane emissions are calculated

According to the IPCC, the tobacco, food, and beverage industries are major sources of food waste (*source: 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Chapter 2: Waste Generation, Composition and Management Data*). The decomposition of organic materials, like food scraps, can produce methane and carbon dioxide.

Equation

$$ER_y = BE_y - (PE_y + LE_y)$$

Where:

ER_y	=	Emission reduction in the year y (tCO_{2e})
PE_y	=	Project emissions in the year y (tCO_{2e}) = 0 tCO2e
LE_y	=	Leakage emissions in year y (tCO_{2e})= 0 (the composting process is aerobic)

Project Emissions

Assumptions for calculating ex-post project emissions as follows:

- *Project emissions due to fossil fuel and electricity usage have been neglected because of low value. However it is to be noted that they will be monitored ex-post as per monitoring plan.*
- *Mileage of diesel tractor/trucks is assumed to be 3.5 km/litre of diesel*
- *Specific gravity of diesel is assumed to be 0.87*
- *Average tractor capacity will be monitored*
- *Average distance from composting site to farms will be monitored (for under 200km)*
- *IPCC 2006 default values assumed for NCV and Emission Factor of diesel*
- *Project emissions of nitrous oxide from composting ($PE_{N20,y}$) are determined as follows*:

$$PE_{N2O,y} = Q_y \times EF_{N2O,y} \times GWP_{N2O} \quad \text{Equation (7)}$$

Where:

$PE_{N2O,y}$ = Project emissions of nitrous oxide from composting in year y ($t\ CO_2e/yr$)

Q_y = Quantity of waste composted in year y (t/yr)

$EF_{N2O,y}$ = Emission factor of nitrous oxide per tonne of waste composted valid for year y ($t\ N_2O/t$)

GWP_{N2O} = Global Warming Potential of N_2O ($t\ CO_2e/t\ N_2O$)

A default value is used: $EF_{N20,} = EF_{N20,default} = 0.0002$ (Option 2 in the step "Determination of methane and nitrous oxide emissions from the composting process" as per the methodology, page 11).

Global warming potential (GWP) values relative to CO_2

Industrial designation or common name	Chemical formula	GWP values for 100-year time horizon		
		Second Assessment Report (SAR)	Fourth Assessment Report (AR4)	Fifth Assessment Report (AR5)
Carbon dioxide	CO_2	1	1	1
Methane	CH_4	21	25	28
Nitrous oxide	N_2O	310	298	265

AR5 values GWP_{N2O}: (p. 73-79)

Project CO_2 emissions due to **incremental transportation distances** under AMS-III.F (i.e. $PE_{y,transp}$) is neglected, taking into account the fact that:

(a) Such an emission source is not a significant source; and

(b) CO_2 emissions would likely be comparable for transporting the chemical fertilizer that would have been used in the absence of the project activity.

Composting project emissions occur in the composting process (which is fast and occurs within the year), while the same waste, if disposed in the landfill (baseline scenario), would decay in a much slower way, releasing methane according to its composition (as modelled in the FOD model)- source. The compost is sold directly to farmers for agriculture or related activities within a radius of under 200km from the project boundary. The PP has documentation for all the sales or delivery of the compost final product to such farmers.

Crediting Period	Baseline Emissions (BE_y)	Project Emissions- Default N2O (PE_{yN2O})	Project Emissions- compost transport to farm (PE_y)	Emission Reductions (ER_y)
	(tCO_2)		(tCO_2)	(tCO_2)
2013	3968	893	334	2741
2014	7153	1012	378	5763
2015	8880	920	344	7617
2016	11239	1190	445	9604
2017	12805	1187	443	11175
2018	13716	1156	432	12128
2019	16095	1554	581	13961
2020	17787	1576	589	15622
2021	21417	2138	799	18481
2022	24104	2195	820	21089
2023	25222	2041	763	22419
Total	**162386**	**15861**	**5925**	**140600**

Calculated Emission Reductions over the monitored period (**ER**) = **140600 CoUs (140600 tCO_{2eq})**

C.6. Prior History>>

The project activity has not applied to any other GHG program for generation or issuance of carbon offsets or credits.

C.7. Monitoring period number and duration>>

Monitoring Period Number: 01
Monitoring Duration: 01/01/2013 to 31/12/2023 (11 years, 00 months)

C.8. Changes to start date of crediting period >>

There are no changes to the monitoring/crediting period as mentioned in the PCN

C.9. Permanent changes from PCN monitoring plan, applied methodology or applied standardized baseline >>

Project emissions on account of N_2O have been included for conservative purposes. The registered PCN incorrectly states that the average rainfall in the region is about 495.3 mm (Page 12). **The average rainfall in the state is 1107 mm** (source: Source: http://www.rainwaterharvesting.org/Urban/Rainfall.htm). Apart from this, there are no permanent changes from registered PCN monitoring plan and applied methodology.

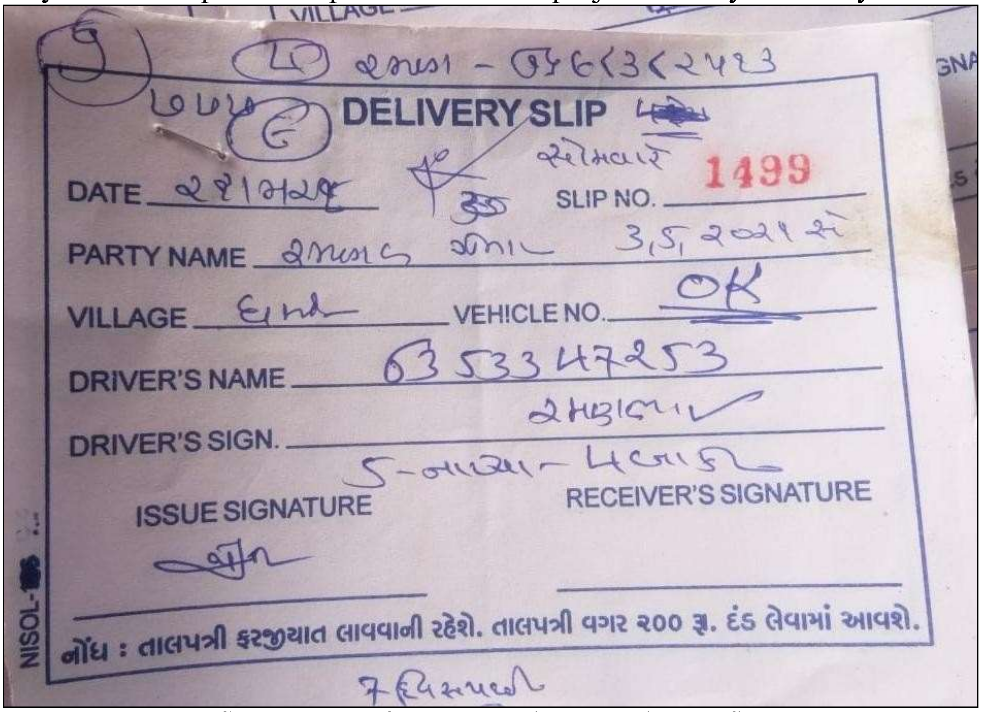
C.10. Monitoring plan>>

The monitoring plan consists of the following:

Temperature Testing: Continuous monitoring and maintenance of compost temperature, the compost temperature is maintained within a specific range, typically 65-70 °C. **Pathogen Reduction:** The compost reaches and maintains a temperature of 55 °C or higher for 15 days or longer. The windrow should be turned a minimum of 5 times during the period when the temperature is maintained at 55 °C or higher. **Ripening Step:** The compost should undergo a ripening phase for about 60-80 days. The temperature of the compost gradually drops to 30-45 °C during the ripening process. **Objective External Quality Control:** Collection of compost samples from the ripening pile. Samples should be tested in a certified laboratory to ensure compliance with quality standards. **Marketing Step:** Introduction of the compost to farmers for agricultural use. Marketing activities commence after meeting quality standards and ensuring the compost is free of pathogens.

The operation of composting facility is documented in a quality control program, monitoring the conditions and procedures that ensure the aerobic condition of the waste during the composting process (e.g. temperature and moisture during different composting stages).

Soil application of the compost in agriculture is also monitored. This includes documenting the sales or delivery of the compost final product from the project activity boundary.



DELIVERY SLIP

DATE

SLIP NO. 1499

PARTY NAME

VILLAGE

VEHICLE NO. OK

DRIVER'S NAME 6353347253

DRIVER'S SIGN.

ISSUE SIGNATURE

RECEIVER'S SIGNATURE

નોંધ : તાલપત્રી ફરજીયાત લાવવાની રહેશે. તાલપત્રી વગર ૨૦૦ રૂ. દંડ લેવામાં આવશે.

Sample copy of compost delivery receipts on file

The conditions for proper soil application ensuring aerobic conditions is established by a local expert and reports taking into account the soil conditions, crop types grown and weather conditions. The applicability of the compost for soil application is established by **the local expert, Dr N.J. Jadav, Professor and Head, Department of Agricultural Chemistry and Soil Science, B.A. College of Agriculture, Anand Agricultural University**, Anand, Gujarat, India as under:

DEPARTMENT OF AGRICULTURAL CHEMISTRY
AND SOIL SCIENCE
B. A. COLLEGE OF AGRICULTURE
ANAND AGRICULTURAL UNIVERSITY
ANAND- 388 110 (GUJARAT)

Dr. N. J. Jadav
Professor and Head

Phone No.: 02692-225740
E-mail.: hodbacabaca@aau.in

No.BACA./Ag.Chem/ 16/307 /2022

Date: 08/04/2022
13

Not used for judicial work

Lab No. -163

To,

Nishol Manufacturing Pvt. Ltd.
Ranchhod Krupa
Mu. Dharmaj, Ta. ~~Borsad~~ Petlad, Dist. Anand
Mo. 9727706063

Sir,

Analysis report of the given sample is here below with the following findings.

Sample Name	Total N (%)	Total P (%)	Total K (%)	Organic Matter (%)	pH	EC (dS/m)
					1:10	
Organic Manure B	0.58	0.80	0.23	35.88	8.53	4.20

Professor & Head
Dept. Ag. Chem. & Soil Sci.
B. A. College of Agriculture
AAU, Anand 388 110

DEPARTMENT OF AGRICULTURAL CHEMISTRY
AND SOIL SCIENCE
B. A. COLLEGE OF AGRICULTURE
ANAND AGRICULTURAL UNIVERSITY
ANAND- 388 110 (GUJARAT)

Dr. N. J. Jadav
Professor and Head

Phone No.: 02692-225740
E-mail.: hodssacbaca@aau.in

No.BACA./Ag.Chem/ 17 30 /2022

Date: 08/04/2022 13

Not used for judicial work

Lab No. =164

To,

Nishol Manufacturing Pvt. Ltd.

Ranchhod Krupa

Mu. Dharmaj, Ta. ~~Borsad~~ Petlad, Dist. Anand

Mo. 9727706063

Sir,

Analysis report of the given sample is here below with the following findings.

Sample Name	Total N (%)	Total P (%)	Total K (%)	Organic Matter (%)	pH	EC (dS/m)
					1:10	
Organic Manure C	0.39	0.42	0.22	41.5	8.56	1.05

Professor & Head

Dept. Ag. Chem. & Soil Sci.
B. A. College of Agriculture
AAU, Anand 388 110

DEPARTMENT OF AGRICULTURAL CHEMISTRY
AND SOIL SCIENCE
B. A. COLLEGE OF AGRICULTURE
ANAND AGRICULTURAL UNIVERSITY
ANAND- 388 110 (GUJARAT)

Dr. N. J. Jadav
Professor and Head

Phone No.: 02692-225740
E-mail.: hodsachem@aau.in

No.BACA./Ag.Chem/ 15/306 /2022 Date: 08/04/2022 13

Not used for judicial work

Lab No. =162

To,

Nishol Manufacturing Pvt. Ltd.
Ranchhod Krupa
Mu. Dharmaj, Ta. ~~Borsad~~ Petlad, Dist. Anand
Mo. 9727706063

Sir,

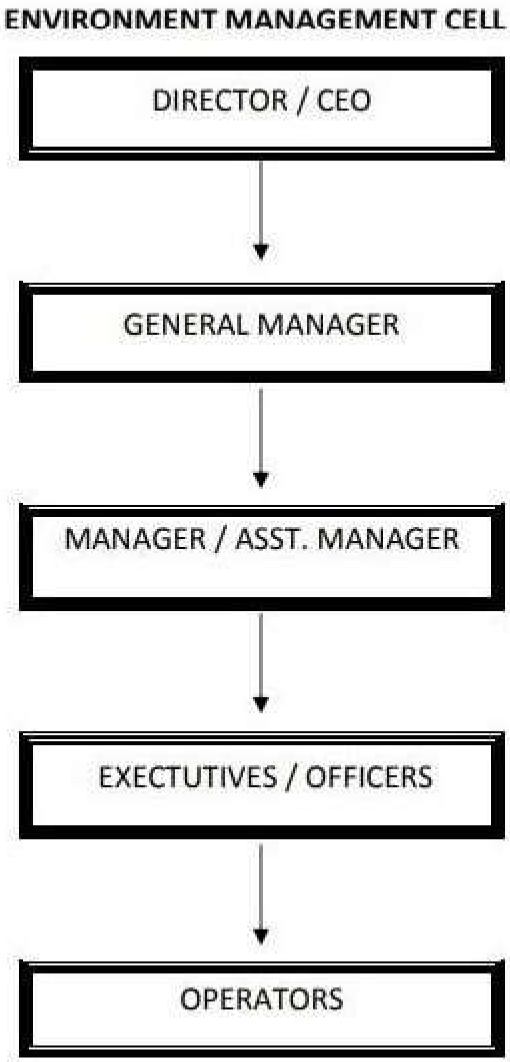
Analysis report of the given sample is here below with the following findings.

Sample Name	Total N (%)	Total P (%)	Total K (%)	Organic Matter (%)	pH	EC (dS/m)
					1:10	
Organic Manure A	0.34	0.537	0.19	25.9	8.49	1.47

Professor & Head
Dept. Ag. Chem. & Soil Sci.
B. A. College of Agriculture
AAU, Anand 388 110.

Overview of the option to determine parameters	
φ_y	Project or leakage emissions: default values Baseline emissions: default values or project specific value estimated yearly
OX	Default value
F	Default value
$DOC_{f,y}$ or $DOC_{f,m}$	In the case of residual waste: estimated once
MCF_y	Default values (based on SWDS type) for SWDS without a water table above the bottom of the SWDS
kj	Default values (based on waste type)
$W_{j,x}$ or $W_{j,i}$	Calculated based on monitored data
DOC_j	Default values or waste specific value estimated once
f_y	Monitored

The PP has setup the following environmental cell to monitor and record relevant data for the UCR project activity.



Data / Parameter Monitored or Used (Default):

Data / Parameter:	Φ
Data unit:	0.85
Description:	Default value for the model correction factor to account for model uncertainties
Source of data:	For project or leakage emissions: $\varphi_{default} = 1$.
Measurement procedures (if any):	For baseline emissions: **Application B: Humid/wet conditions**
Monitoring frequency:	-
QA/QC procedures:	-
Any comment:	- The default above is applicable to Option 1 in the procedure “Determining the model correction factor (φy)”

Data / Parameter:	OX
Data unit:	0.1
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:	Based on an extensive review of published literature on this subject, including the IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Measurement procedures (if any):	-
Monitoring frequency:	-
QA/QC procedures:	-
Any comment:	When methane passes through the top-layer, part of it is oxidized by methanotrophic bacteria to produce CO2. The oxidation factor represents the proportion of methane that is oxidized to CO2 This should be distinguished from the methane correction factor (MCF) which is to account for the situation that ambient air might intrude into the SWDS and prevent methane from being formed in the upper layer of SWDS

Data / Parameter:	F
Data unit:	0.5
Description:	Fraction of methane in the SWDS gas (volume fraction)
Source of data:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Measurement procedures (if any):	-
Monitoring frequency:	-
QA/QC procedures:	-
Any comment:	Upon biodegradation, organic material is converted to a mixture of methane and carbon dioxide

Data / Parameter:	$DOC_{f,default}$
Data unit:	0.15 Weight fraction
Description:	Default value for the fraction of degradable organic carbon (DOC) in MSW that decomposes in the SWDS
Source of data:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Measurement procedures (if any):	-
Monitoring frequency:	-
QA/QC procedures:	-
Any comment:	This factor reflects the fact that some degradable organic carbon does not degrade, or degrades very slowly, in the SWDS

Data / Parameter:	$MCF_{default}$
Data unit:	0.8
Description:	Methane correction factor
Source of data:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Measurement procedures (if any):	In case that the SWDS does not have a water table above the bottom of the SWDS: -0.8 for unmanaged solid waste disposal sites – deep. This comprises all SWDS not meeting the criteria of managed SWDS and which have depths of greater than or equal to 5

	meters;
Monitoring frequency:	-
QA/QC procedures:	-
Any comment:	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:	DOCj
Data unit:	0.15
Description:	Fraction of degradable organic carbon in the waste type j (weight fraction)
Source of data:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories (adapted from Volume 5, Tables 2.4 and 2.5)
Measurement procedures (if any):	Food, food waste, beverages and tobacco (other than sludge): 15
Monitoring frequency:	-
QA/QC procedures:	-
Any comment:	The procedure for the ignition loss test is described in BS EN 15169:2007 Characterization of waste. Determination of loss on ignition in waste, sludge and sediments. The percentages listed in table above are based on wet waste basis which are concentrations in the waste as it is delivered to the SWDS. The IPCC Guidelines also specify DOC values on a dry waste basis, which are the concentrations after complete removal of all moist from the waste, which is not believed practical for this situation

Data / Parameter:	kj
Data unit:	1/yr-
Description:	Decay rate for the waste type j
Source of data:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories (adapted from Volume 5, Table 3.3)
Measurement procedures (if any):	Food, food waste, beverages and tobacco (other than sludge): 0.40
Monitoring frequency:	-
QA/QC procedures:	Food, food waste, sewage sludge, beverages and tobacco- (Tropical (MAT>20°C) = 0.40 Note: MAT – mean annual temperature, MAP – Mean annual precipitation, PET – potential evapotranspiration. MAP/PET is the ratio between the mean annual precipitation and the potential evapotranspiration. If a waste type disposed in a SWDS cannot clearly be attributed to one of the waste types in the table above, project participants should choose, among the waste types that have similar characteristics, the waste type where the values of DOCj and kj result in a conservative estimate (lowest emissions).
Any comment:	Documented as 1107 mm using long-term averages based on statistical data, where available. Reference: http://www.rainwaterharvesting.org/Urban/Rainfall.htm)

Data / Parameter:	$W_{j, x}$
Data unit:	tonnes
Description:	Amount of organic waste type j prevented from disposal in the SWDS in the year "x"
Source of data:	Plant Log Book
Measurement	For the project activity under consideration there is just one

procedures (if any):	waste type namely Tobacco. This is generated within the project boundary. It is directly measured. No sampling of waste will be required to estimate the amount of waste type j prevented from disposal in the SWDS. Hence the parameter W j, x is individually measured and not estimated by sampling. The parameter is monitored continuously with a weighing system (weigh bridge) installed in the plant.
Monitoring frequency:	-Continuous
QA/QC procedures:	The weighing system is calibrated as and when required. Moreover, being the primary raw material for manufacturing the compost, the parameter will be audited. Data will be archived for a period of crediting period + 2 years in both electronic and paper formats
Any comment:	A lower uncertainty level of the parameter will be ensured through calibration of the weighing system and auditing the parameter. In case of unavailability/uncertainty of data during a period, this parameter can be estimated and cross checked with the production data of compost (which is measured).

Data / Parameter:	$Q_{y, comp}$
Data unit:	tonnes
Description:	Quantity of final compost product produced and transported in the year y
Source of data:	Plant Log Book
Measurement procedures (if any):	The parameter is measured and recorded separately for all the tractors/trucks carrying the compost from the composting site to the soil application site (i.e. farms in the surrounding area). Data is archived for a period of crediting period + 2 years in both electronic and paper formats.
Monitoring frequency:	-Continuous
QA/QC procedures:	The weighing system is calibrated as and when required. Moreover, being the primary raw material for manufacturing the compost, the parameter can be audited. Data will be archived for a period of crediting period + 2 years in both electronic and paper formats
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. In case of unavailability/uncertainty of data during a period, this parameter may be estimated and cross checked with the quantity of waste composted (which is measured).

Data / Parameter:	Aerobic conditions of the waste during treatment
Data unit:	Verification (Aerobic/Anaerobic)
Description:	The operations of the composting facility is documented in a quality control program monitoring the conditions and procedures that ensure aerobic conditions of the waste during the treatment process by composting
Source of data:	1. Plant Log data 2. Test certificates from accredited laboratory
Measurement procedures (if any):	Samples of the waste treated by the composting process is tested in situ for checking aerobic conditions.
Monitoring frequency:	- Half yearly
QA/QC procedures:	The PP prioritizes treatment of the waste with regular turning to ensure that aerobic treatment commences as soon as waste enters the treatment facility site. The mechanical turning of

	the waste may be verified by the usage bills of kilometres run by the JCB.
Any comment:	Regular turning of waste and maintenance of specified height of windrows are key parameters of the technology to maintain aerobic conditions during composting. In case data of testing is not available for a certain period of the crediting years, the records of turning records (which can be verified by fuel use and kilometres run by the JCB excavators) can be used.

Data / Parameter:	Aerobic conditions at end users and soil applications
Data unit:	Verification (Aerobic/Anaerobic)
Description:	Documentation of sales or delivery of the final compost product
Source of data:	1. Plant log data 2. Test certificates from university/accredited laboratory 3. Sales/delivery invoices
Measurement procedures (if any):	Verification of aerobic conditions of the compost and its soil application will be carried out in two parts: • Verification at plant site: Every batch of batch size approximately 100 tonnes of finished product will be tested by random sampling for aerobic conditions. The redox potential of the sample will be tested by an accredited laboratory. • Farm site verification: A random site for soil application of the compost will be selected and the aerobic conditions will be checked from a sample of the topsoil 20 days after application of the compost. Testing will be done by accredited laboratory. Redox potential value of the sample will be tested and based on this value it will be inferred whether aerobic conditions are maintained.
Monitoring frequency:	- Once a year
QA/QC procedures:	1. Cross verification with compost sold data 2. Special instructions to end users to maintain aerobic conditions
Any comment:	Records on maintenance of aerobic conditions is archived for crediting period + 2 years and any discrepancy will be immediately reported to plant manager. The project proponent will ensure data for this parameter is available for verification in each year of the crediting period.