

Appendix 2: Environmental and Social Management Plan (ESMP)
Durgesh Bhaisi Farm

Executive Summary:

This Environmental and Social Management Plan (ESMP) has been developed for proposed 20 m³ biogas sub-project in Durgesh Bhaisi Farm for mitigating likely environmental impacts predicted during environmental and social screening. This sub-project is classified as “Category C”, which means there is minimum environmental/social impact and hence there is no need of conduction of further environmental or social assessment. However, minor impacts predicted by the screening work are: health and safety issues of construction workers aesthetic degradation due to haphazard disposal of bio slurry, workers health during slurry handling and foul smell. The possible mitigation measures have been proposed in this ESMP and shall be implemented by the Construction Company and developer. The likely impacts not identified during screening as well as in this ESMP, if perceived during construction and/or operation phase shall also be avoided or mitigated by the Construction Company and/or developer.

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1. Introduction

For implementation of the biogas project, this environmental and social management plan is prepared for Durgesh Bhaisi Farm, Dhankauli-1, Kapilvastu Nepal. The organization is going to establish a 20 m³ large biogas plant within its premise. The project is supported by AEPC/NRREP/SREP.

2. Description of Sub-project and Location

The project lies in Dhankauli-1, Kapilvastu district. The coordinate of the sub-project site 27°35'9.24"N, 83° 0'55.20"E with altitude of 108 m

The biogas plant is proposed to be constructed within the farm. The Google map of the proposed location is provided below:

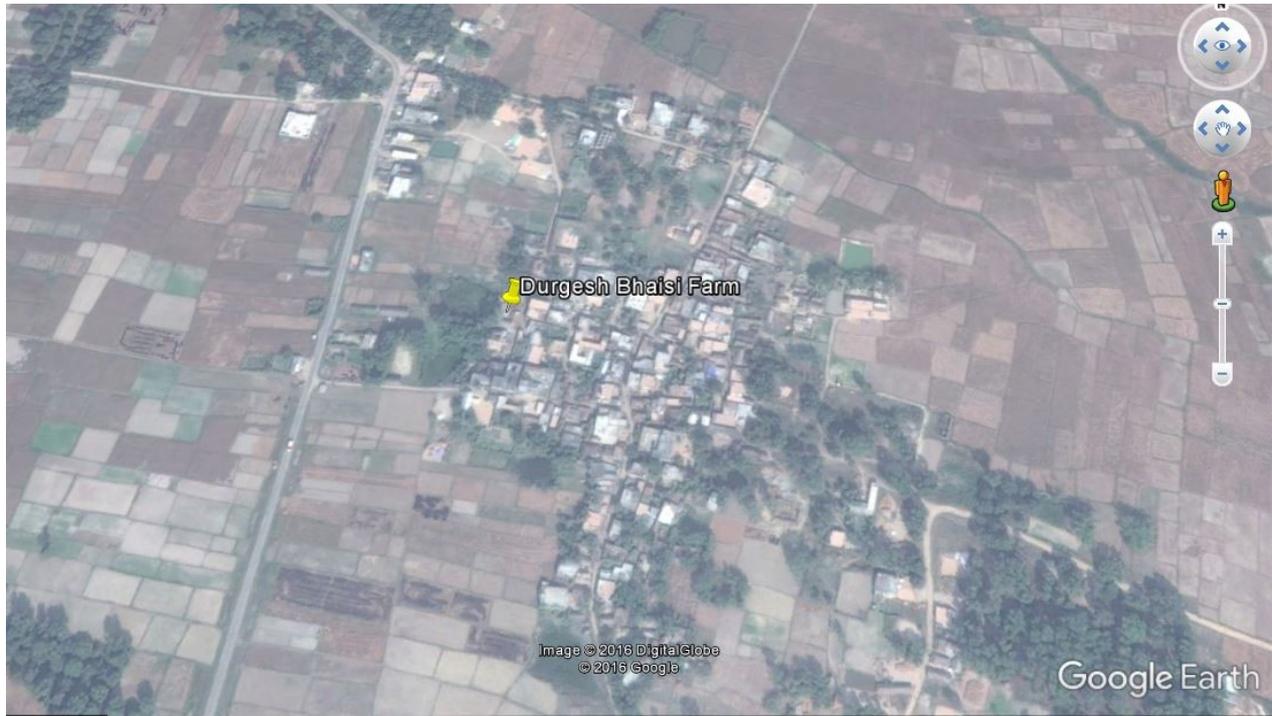


Figure: Location Map of proposed sub-project

The gas produced by the plant will be 4.33 m³ per day. 106kg of dung produced by buffalo and toilet waste from 8 people will be used as substrate as daily feeding. As this plant is supplemented by toilet waste, additional dilution water is not required. The plant will produce 237 kg of slurry per day which will be stored in compost pit to make dry and convert it into compost manure. The biogas will be used for thermal purpose and will replace 2 LPG and 6 Kg firewood per day currently being used in the farm.

The construction work starts with excavation of earthwork followed by stone lining, and reinforcement and cement aggregate works. A total of 12 construction workers will be involved during construction of the plant. Once after the construction completion, the dung and kitchen waste will be fed into the digester. The gas produced from the sub-project shall be used for thermal process only. AEPC will provide subsidy only after successful testing and

commissioning of plant against guaranteed performance requirement as mentioned in detailed design report.

3. Relevancy of preparing ESMP

This Environmental and Social Management Plan (ESMP) has been prepared for the proposed sub-project in order to mitigate the likely environmental impacts predicted during environmental and social screening. Any land acquisition or displacement of inhabitations will not be involved in the sub-project intervention. The significant negative impacts are not envisaged, however, negligible impacts identified during screening process might prevail during construction and operation phase. This sub-project is classified as "Category C", which means there is minimum environment impact and hence there is no need of conduction of further environmental or social assessment. The Environmental and Social Management Plan has been prepared in order to reduce thus identified adverse impacts prior to sub-project implementation.

4. Environmental and Social Baseline

Topographically, the sub-project site lies in Terai region of Nepal. The proposed location is 108m above sea level. From environmental aspect Banganga river and Ghorahe Nala lies near the field. Saraswati Community forest is the nearby community forest in the vicinity. Regarding Climatic condition, the meteorological data from Department of meteorology indicates that the region has warm summer days with mild winter temperature. The land-use pattern of the sub-project area indicates of agricultural land as major land-use with patchy settlements.

Developer owns (3561 m²) 7 ropani of land.. The land requirement for the construction of plant is 100m². Almost all land is being used for agricultural purpose and fodder production. The farm is located within settlement..Spring river is the nearest water source and is 50 m from the shed however, the sub-project does not affect the water source.

The sub-project location is dominated by Madheshi Adhivashi including Musalman, Kewat, Yadav and others. The settlement pattern is sparse. An all weather road exists to reach the sub-project location at distance of about 2 km from Taulihawa-Gorusinghe-Sandhikharka road which ultimately joins East West Highway at Gorusinge.

The current status of respiratory diseases of the community is not documented however, in rural areas of Nepal, the respiratory diseases are caused mainly because of burning of traditional energy sources especially firewood and cow dung cake. The major diseases that the community are commojnly suffered are diarrhea, dysentery, flues and in some cases cholera

too and are mostly transmitted because of unhygienic condition and through disease vectors like flies and mosquitoes.

5. Environmental and Social Impacts

During feasibility study of Durgesh Bhaisi Farm, considering environmental and social screening performed, it is not predicted to have significant negative environmental and social impacts.

The beneficial impact in environment is conversion of waste into compost and gas. Socially the positive impact is control of foul smell in the surrounding areas. This may encourage the developer to install large biogas plant utilizing all the farm waste and produce large quantity of fertilizer sufficient of farms in the community.

5.1 Beneficial impacts

Considering benefit to the community, the waste management from the project can reduce the pollution on the surrounding. The fertilizer from the sub-project can be sold to farmer community at low cost helping them to produce more agricultural products. The farm is also buying grass from farmers giving them opportunity to earn money. The sub-project can also provide job to local skilled workers during the construction phase, however the number of such employment would be very less. The subproject will provide renewable energy to the farm.

Buffalo manure is rich in organic substances so significant quantity of methane is released to the atmosphere during manure storage with anaerobic condition inside the dump. Methane is highly potent greenhouse gas than CO₂ with global warming potential 28- 36 over 100 years time period. The installation of biogas plant will directly reduce the emissions of methane gas from cattle manure. In addition, the biogas will also replace fossil fuels such as firewood and LPG that is being consumed in the farm thereby further contributing in greenhouse gas reduction.

5.2 Adverse impact

There will be no any major adverse impact to the surrounding community and environment.

5.2.1 Construction Phase

During construction phase, some minor impacts may be seen such as dust pollution, increased noise level and occupational health and safety of construction workers.

- **Construction related accidents:** There are several processes which will be involved in the site during its construction. Excavation work, use of machineries, welding etc. could lead accidents, but would be exceptional. It is projected that some 12 skilled and unskilled human resources will be involved in construction process for about a month. The impact is envisaged as site specific, low in magnitude, short term in duration, and construction workers as receptor.
- **Respiratory problems due to dusty environment:** During construction phase, there will be intermittent movements for transport vehicles for transporting construction materials and can lead to generate dusts. The dusty environment could be nuisance to workers (12 numbers of workers) and nearby settlement (about 10 households within 100m of periphery) and can directly affect the health of construction workers as well as local people of surrounding vicinity. Similarly, during excavation of digester and outlets, such impact could be visible. However the impact is envisaged to be a low in magnitude, short term duration and construction workers as receptor.
- **Increased noise due to construction activity:** The increased noise may be experienced due to vehicular movement and construction activities such as loading and unloading of construction materials and other construction activities. This will mainly affect construction workers (12 workers) and partly to resident living (about 10 households living in immediate vicinity) close to the construction site. The impact will remain for short duration i.e. construction period only and magnitude is projected to be low.

5.2.2 Operation Phase

- **Health and safety issue due to haphazard disposal and mismanagement of digested slurry:** 234 kg of liquid slurry will be generated each day from the plant. If the slurry is not well managed and disposed haphazardly, this could establish favourable environment for disease vectors like mosquitoes and flies. In addition, the aesthetics of the site would also be decreased due to such haphazard disposal. This can affect farm workers (12 numbers) as well as local resident (10 households) living in near vicinity. The impact will be area specific, with moderate magnitude and for long term duration.
- **Foul odor from substrate storage area:** If not properly managed, the slurry can generate foul odors which can be nuisance to about 4 farm workers as well as local residents of few households. But such foul odour would be prevalent only if the slurry is not properly digested. However, the compost pit constructed to manage slurry will reduce the smell. The magnitude is expected to be low, long term in duration and farm workers as the main receptor.

- **Ground water intrusion of slurry due to seepage and leakage from substrate storing area, digester and slurry storage yard:** The seepage of water from manure and slurry can pollute downstream water sources decreasing its quality with increasing nitrogen level and organic matter load. The case would be more prominent in case of toilet attached plants contaminating the source with fecal coliform. This can affect not only workers but also people living nearby who rely on same source of water. Since the water source is upstream the magnitude can be moderate with long term impact and farm workers and local resident as the main receptor.

- **Occupational health and safety issues including accidents associated with firing and explosion:**

The biogas is highly flammable and can happen accidental firing in anytime. Also, the gas stoves in use during the operation could lead to fire or accidents. The impact is envisaged as site specific, low in magnitude, occasional but the risk is long term in duration, farm workers as receptor.

6. Mitigation Measures

The environmental mitigation with their time of action, mitigation cost and responsibility are illustrated in the following table:

ENVIRONMENTAL AND SOCIAL MITIGATION MEASURES

S. N.	Environmental/Social Impacts	Mitigation Measures	Time of Action	Estimated Mitigation Cost (NRs.)	Responsibility
1.0 Construction Phase					
1.1	Construction related accidents	The construction premises shall be barricaded	During construction phase	-	Construction Company
		Provision of personal protective equipments (PPEs) like helmets, boots, gloves, etc for construction workers	During construction phase	-	Construction Company
		Provision of First Aid Kits at construction site	During construction phase	Minor	Construction Company/ Sub-project Developer
1.2	Respiratory problem due to dusty environment/vehicular emission in construction site	Spraying of water during excavation and vehicular use to reduce dust re-suspension	During construction phase	-	Construction Company/ Sub-project Developer
1.3	Increased noise due to construction activity	Work will be conducted from 8:00 AM-6:00 PM. If additional times are needed, local residents will be informed prior to do so.	During construction phase	-	Construction Company/ Sub-project Developer
2.0 Operation Phase					
2.1	Health and safety issue due to haphazard disposal and mismanagement of digested slurry	Storage of digested slurry in designated compost pit to prevent haphazard disposal	During operation phase	-	Sub-project Developer

		Use of personal protective equipments during slurry handling process	During operation phase	5,000	Sub-project Developer
2.2	Foul odour from substrate storage area	Avoid storing substrate as far as possible	During operation phase	-	Sub-project Developer
		Appropriate amount of daily feeding shall be done for complete digestion of slurry.	During operation Phase	-	Sub-project Developer
		Storage of dry manure/compost and wet slurry in closed yard/structure	During operation Phase	-	
2.4	Ground water intrusion of slurry due to seepage and leakage from substrate storing area , digester and slurry storage for producing dry manure	Proper sealing of base of storage area as well as digester and outlet with sealing material or concrete casting	During Construct ion Phase	Already included in construct ion cost	Constructio n Company/S sub-project Developer
2.5	Spreading of diseases due to increased disease vectors, flies, mosquitoes etc	Avoid formation of ditches and haphazard slurry disposal	During Operation phase	-	Sub-project Developer
2.6	Occupational health and safety issues including accidents associated with firing and explosion	Strictly avoid naked flames near digester	During operation phase	-	Sub-project Developer
		Awareness building of workers on safety practices	During operation phase	-	Sub-project Developer

7. Monitoring

It is also necessary to monitor to ascertain implementation of mitigation measures mentioned as well as to perform impact monitoring to figure out the impacts of the sub-project. The monitoring plan is provided in the table below: Regarding alternatives, the technology selected for this subproject is modified GGC 2047 model from wide range of anaerobic digestion technologies. The compost pit has been proposed as cost effective measures to process digested slurry. The construction work shall be permitted in day time only.

Environmental and Social Monitoring Plan

S. N.	Indicators	Methods	Frequency/Time	Place	Monitoring Authority	Monitoring Cost (NRs.)
1.1 Construction Phase						
1.1.1	The construction premises shall be barricaded	Direct Observation	During construction	Project Site	Sub-project Developer	-
1.1.2	Provision of personal protective equipments (PPEs) like helmets, boots, gloves, etc for construction workers	Direct Observation	During construction	Project Site	Sub-project Developer	-
1.1.3	Provision of First Aid Kits at construction site	Direct Observation	Once prior to start of construction	Project Site	Sub-project Developer	-
1.1.4	Spraying of water to reduce dust re-suspension	Records/Photographs	During construction	Project Site	Sub-project Developer	-
1.1.5	Compliance of construction activities performed only in designated time (8:00 to 6:00)	Interview with locals	During construction	Project Site	Sub-project Developer	-
1.2 Operation Phase						
1.2.1	Provision of composting pit	Direct observation/ Photographs/r	During construction	Project Site	Sub-project Developer	-

		Records				
1. 2. 2	Provision of personal protective equipments (PPEs) during operation	Direct observation/ Photographs	Once prior to operation	Project Site	Sub-project Developer	-
1. 2. 3	Avoid storing substrate as far as possible	Direct observation	Bi-weekly	Project Site	Sub-project Developer	-
1. 2. 4	Proper sealing of base of storage area as well as digester and outlet manure storage area with sealing material or concrete casting	Record of specification of constructed plant	During construction	Project Site	Sub-project Developer	-
1. 2. 5	Storage of compost and wet slurry in designated area	Direct observation	Bi-weekly	Project Site	Sub-project Developer/ Site manager	-
1. 2. 6	Avoid naked flames near digester	Direct observation	Daily	Project Site	Sub-project Developer/ Site manager	-
1. 2. 7	Build awareness of workers on safety practices	Direct observation/ verification of training conducted by technology provider and/or construction company	Once prior to operation	Project Site	Sub-project Developer	-

Most of the mitigation costs are covered within total construction cost and others required minor costs. The monitoring part is assigned to developer and will require one human resource which will be assigned to existing sub-project staff and other costs are minor.

8. Conclusion

The above mentioned mitigation measures shall strictly be implemented by the responsible individuals as mentioned in this ESMP. In addition, the monitoring as mentioned in this ESMP shall also be performed accordingly. The likely impacts not identified during screening as well as in this ESMP,

if perceived during construction and/or operation phase shall also be avoided or mitigated by the Construction Company and/or developer.