

**ANNEX V: ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)
of Milijuli Badhsala Pvt. Ltd.**

Executive Summary:

This Environmental and Social Management Plan (ESMP) has been developed for proposed 50 m³ biogas sub-project within Milijuli Badhsala Pvt. Ltd. in order to mitigate the likely environmental impacts predicted during environmental and social screening. 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. Some of the impacts caused by the sub-project are: health and safety issues of construction workers, increased dust level during construction phase, pit waste (muck) disposal, possible water sources (ground water intrusion) contamination due to leakage of slurry liquid, 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. 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.

sfo{sf/L ;f/f+z M

lrtjg lhNnf v}/xgL-*, df cjl:yt ldnLh'nL awzfnf k|f= nL= df k|:tfljt
) 3= dL= sf] 7'nf] jfof]Uof; ;yfkf kl/of]hgfaf6 pTkGg x'g ;Sg]
jftfj/OfLo tyf ;fdflhs k|efj Go'lgs/Of ug{sf nflu jftfj/OfLo tyf ;fdflhs
Joj:yfkg of]hgf tof/ kfl/Psf] 5 . k|:tfljt kl/of]hgf] ; awzfnf lf]q
leqaf6 pTkflbt s'lxg] kmf]xf]/x? phf{ pTkfbgsf nflu k|of]u ul/g]
x'gfn] pn]Vo gsf/fTds k|efj gkg]{ b]lvPsf] 5 . oBlk kl/of]hgf
lgdf{Of tyf ;~rfngsf] ;dodf s]xL k|efj b]lvG ;Sg] klG cf^sng ul/Psf]
5 . 5gf}6 qmddf k|fKt glthf cg';f/ s'g} klG pNn]Vo k|efj gx'g]
b]lvPsf] o; pk-kl/of]hgf]O{ ju{ 'u' df jlu{s[t ul/Psf] 5 . ;Defjotf
cWoogn] pkk|of]hgf lgdf{Of tyf ;~rfng cl3 jftfj/Of tyf ;fdflhs
Joj:yfkg of]hgf tof/ ug'kg]{ ;'fj cg';f/ k|efj Go'lgs/Of of]hgf /
cg'udg of]hgf ;lxt sf] jftfj/Of tyf ;fdflhs Joj:yfkg of]hgf k|:t't ul/Psf]
5 .

o; kl/of]hgf af6 pNn]Vo jftfj/OfLo tyf ;fdflhs k|efjx? kfg]
{ gb]lvPtfklG ;fdfGo k|efjx? h:t} lgdf{Of r/Ofdf sdbf/x?sf] :jf:Yodf
x'g;Sg] k|efj, :n/Lsf] r'xfj6af6 kfgLsf] >f]tdf x'g;Sg] k|b'if0f,:n/L
tyf dn pTkfbg ;DalGwsf sfo{ubf{ x'g;Sg] :jf:Yo ;DaGwL ;d:of tyf
h]g]/]6/ h8fg tyf ;~rfngaf6 x'g] ;Sg] Wjlg k|b'if0f cflb /x]sf 5g\ .
o; jftfj/OfLo tyf ;fdflhs Joj:yfkg of]hgf] dfly pNn]lvt ;fdfGo k|efjx?
sf] Go'lgs/Ofsf pkfox? lglb{i6 u/]sf] 5 / oL k|efj Go'lgs/Ofsf
pkfox? clgjfo{ ?kdf nfu' ugf{sf ;fy} ;f] sf] cg'udg ;d]t ug{'kg]
{ 5 . o; of]hgfdf pNn]v gePsf s'g} k|efjx? kl/of]hgf lgdf{Of tyf

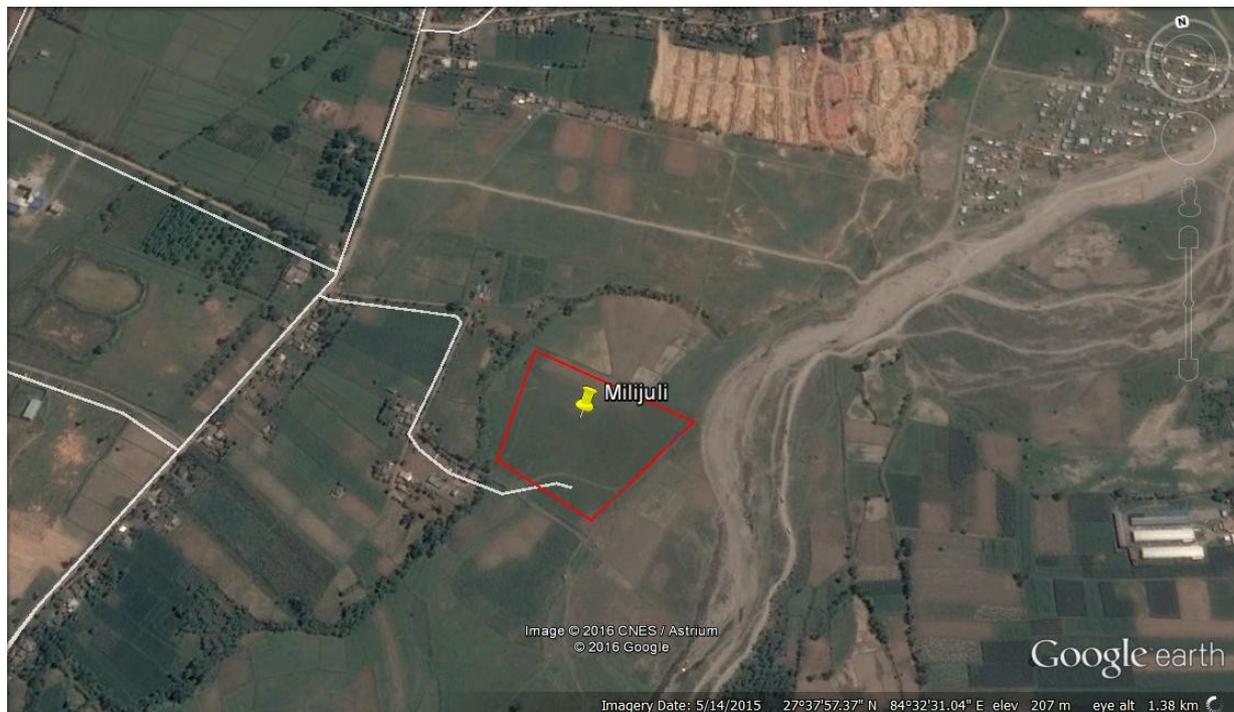
;~rfngsf ;dodf pTkGg ePdf To:tf k|efjx?nfO{ ;d]t Go"lgs/Of ug] { bflotj lgdf{Of sDkgL jf ;~rfnssf] x'g] 5 .

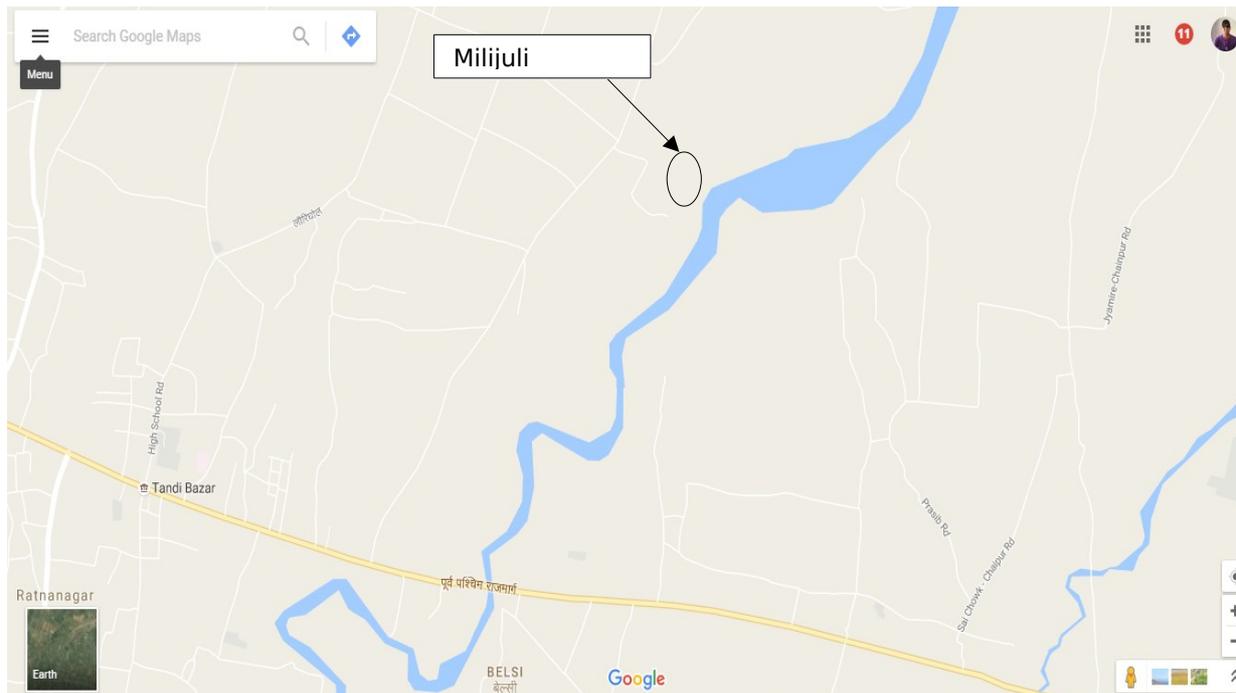
1. Introduction

Milijuli Badhsala Pvt. Ltd. is slaughter house which want to use its biodegradable wastes to produce biogas for electricity generation.. The total land area is 8126 sq. m. (24 Katha) and there are currently 20 water buffalo. From available 606 kg of digester slurry production per day, the detail design recommends construction of 50m³ biogas plant adopting native modified GGC 2047 model. Thus generated biogas is proposed to be used in the form of electricity. The sub-project is under evaluation for AEPC/SREP support.

2. Description of Sub-project and Location

The sub-project is located at Khairahani-8, Chitwan. The coordinate of the sub-project site is 27°37'57.37"N, 84°32'31.04"E with altitude of 207 m. The figure provided below illustrates the sub-project location as well as environmental setting near the sub-project site.

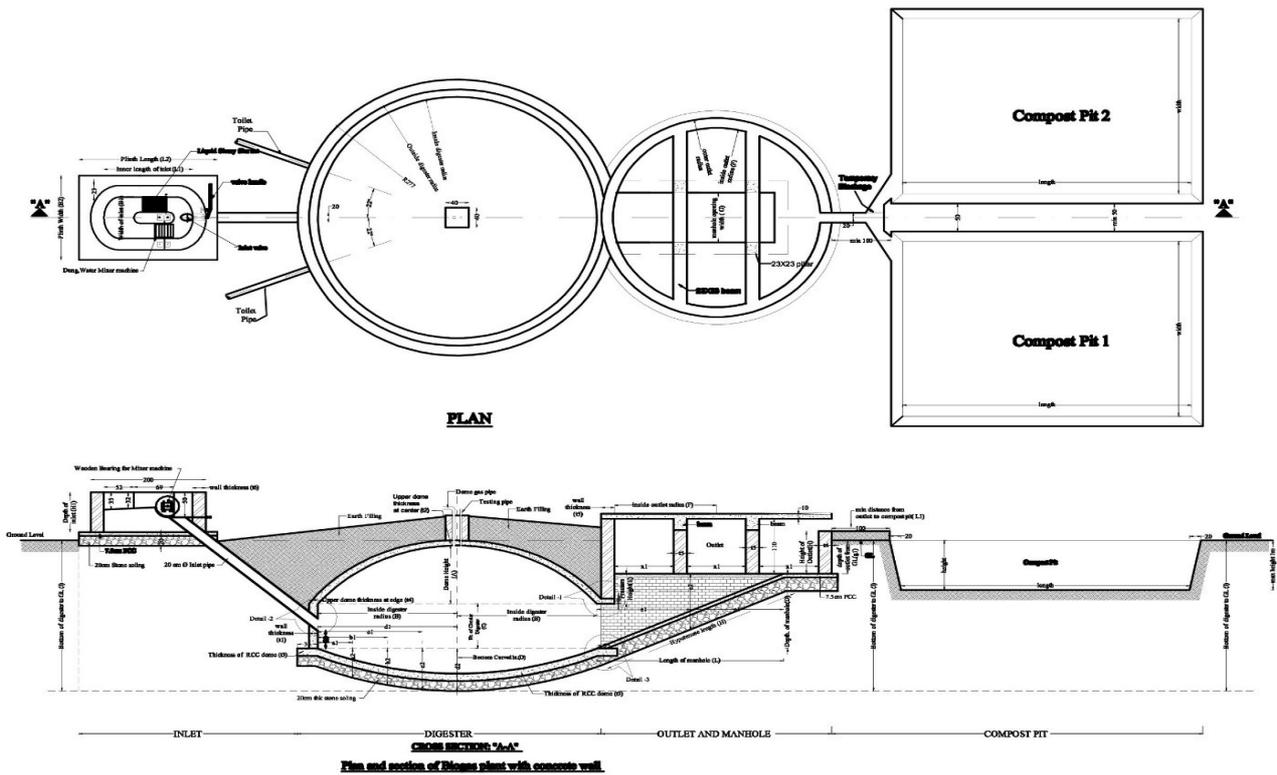




The proposed plant is 50m³ single unit modified GGC 2047 model fixed dome digester (33.3 m³ digester volume and 16.7m³ gas storage volume) with 10.9 m³ of biogas production per day. The generated biogas will be used only for electricity generation. A 5 kVA biogas generator will generate maximum of 18 kwhr of electrical output each day.

The major works that will be carried out during construction are excavation of earthwork for digester, cement aggregate works and civil construction work. A generator will be installed in order to generate electricity from biogas. Once after the construction completion, 273 kg of dung along with 333 litres of dilution water with total feeds amount of 606 kg will be fed into the digester daily. A total of 606 litres liquid slurry will be generated each day.

The schematic diagram and technology details of the modified GGC 2047 biogas plant provided below: 50 m³ biogas plant civil drawing.



3. Relevancy of preparing ESMP

This Environmental and Social Management Plan (ESMP) has been prepared for mitigating likely environmental impacts associated with construction of proposed 50m³ biogas plant, predicted during environmental and social screening. Any land acquisition or displacement of inhabitations will not be involved in this sub-project. The significant negative impacts are not predicted since the sub-project itself reduces wastes and converts into useful renewable energy. However, negligible impacts identified and might prevail during construction and operation phase. This sub-project is classified as “**Category C**”, with minimum environmental/social impacts and hence there is no need of conduction of further environmental or social assessment. This 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

The sub-project location is situated in the Terai region of Nepal. The topography is flat land with altitude of about 207 m above sea level. Regarding climatic condition, as it is situated in Terai region, sub-tropical climate with hotter summer and mild winter with occasional cold wave (during winter) prevails in the sub-project area. The land use pattern of proposed sub-project is fallow land within farm premise however the sub project vicinity is dominated by

agricultural land use with sparse settlement. In addition, most of the total land area owned by the developer is used for fodder plantation.

The farm is spread over 8126 sq. m. (24 Katha) of land with potential for land expansion. The farm has allocated around 237m² of land which is sufficient for construction of biogas plant including compost pit. The ground conditions are favorable to build a biogas plant. The nearest settlement (Rayamajhi Tole, Khanal Tole and Thadechowk) from the plant site is more than 500 meter away. Hence, there will not be any significant negative effect to neighboring settlement. Since the farm is accessible from the major market points like Narayanghat and Tandi, sourcing of the construction materials will not be a major issue.

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 commonly 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, considering environmental and social screening performed, it is not predicted to have significant negative environmental and social impacts. However, apart from beneficial impacts, it is predicted to have few environmental/social impacts and is provided below:

5.1 Beneficial Impacts

Considering the benefit to the nearby community, there seems no any direct advantage to nearby population however, management of the organic waste within the farm obviously reduce the foul odour which is the nuisance to nearby locality. During construction phase, there would be few numbers of employment opportunities. Nevertheless, the sub-project will be present itself as a show case waste to energy sub-project.

5.2 GHG emission reduction as beneficial impact

Cow 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 year's 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 LPG and diesel that is being consumed in the farm thereby further contributing in greenhouse gas reduction.

5.3 Adverse Impacts

There will be no any significant adverse impact to the surrounding community and environment by the implementation of the proposed sub-project. However, during construction and operation phase, minor impacts have been predicted and provided as below:

Construction Phase

- **Construction related accidents:** There are several processes which will be involved in the site during its construction. Excavation work, use of machineries and civil construction works etc. could lead accidents, but the occurrence of such incidences would be exceptional. It is projected that about 18 skilled and unskilled human resources will be involved in construction process. The impact is envisaged as site specific, low in magnitude, short term in duration, 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. Similarly, during excavation of digester and outlets, such impact could be visible. This could be nuisance to construction workers and nearby residents of about 5 to 6 households. 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 and partly to residents (5 to 6 households) living close to the construction site. The impact will remain for short duration i.e. construction period only and magnitude is projected to be low.
- **Issues related to excavated material:** The size of the biogas plant proposed is 50m³. During construction phase, a total of about 280m³ of muck soil is predicted to be generated from various excavation work like excavation of digester, outlet and compost pit. The haphazard disposal and storage of excavated material may cause sedimentation in nearby agricultural field as well as nearby Kayar Khola during rainy season. Apart from this, the stockpiling of excavated material may degrade the aesthetics of the subproject vicinity. However, the impact is assessed as site specific, low in magnitude, short term in duration.

Operation Phase

- **Health and safety issue due to haphazard disposal and mismanagement of digested slurry:** 606 kg of digester slurry will be generated each day from the plant. If the slurry is not well managed and disposed haphazardly in and around subproject site, this could establish favorable breeding environment for disease vectors like mosquitoes and flies etc. In addition, the aesthetics of the site would also be decreased due to such unmanaged disposal. This can affect farm workers (about 25 staffs) as well as local residents (5 to 6 households) living in near vicinity. The impact will be area specific, with moderate magnitude and for long term duration
- **Intrusion of digested slurry into nearby Kayar Khola:** The haphazard disposal of digested slurry could have risk of changing quality of nearby Kayar Khola river. This river is flowing about 100m south east to the subproject location. As the digested slurry would have high BOD and Total Solids, the river could experience changing BOD level and thereby reducing dissolved oxygen, turbidity and and eutrophication. However, because of the volume of such digested slurry waste, the impact will be site specific, low in magnitude but long term in duration.
- **Foul odour from substrate storage area and outlet of plant** If not properly managed, the slurry can generate foul odors which can be nuisance to farm workers

(25 staffs). It is not envisaged to impact to nearby locals (5 to 6 households) because these settlements are sufficiently far from subproject area. The fact about the foul odour from biogas plant is that such foul odour would be prevalent only if the slurry is not properly digested. However, the designated compost pits will be installed in order to collect all slurries passed from outlet. 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. The case could be more prominent in case of toilet attached plants. 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. The open firing or electrical shorts can cause huge fire and explosion. Also, many mechanical and electrical devices such as generators, tractors, pumps will be in use during the operation which 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.
- **Noise from operation of generators:** Biogas Generator will be used for electricity generation from biogas. It can generate loud noise and can be nuisance to people residing within farm. Noting that the nearby settlement is sufficiently far from the sub-project area, the impact is envisaged as site specific, low in magnitude, long term in duration, farm workers as receptor.

6. Mitigation Measures

The environmental mitigation measures with their time of action and responsibility are prescribed in the following matrix:

Regarding alternatives, the developer has selected modified GGC 2047 model biogas plant from wide range of technologies like floating drum type model, up-flow sludge blanket, CSTR etc. which will have greater conversion efficiency than existing native technology with moderate cost. There are different ways of management of digested slurry like composting, screw press for producing dry manure instantly, disposal of post digested without using it as manure etc. In this sub-project, a dewatering unit is proposed for producing dry manure from liquid slurry. The implementation of below mentioned mitigation measures shall be strictly done during specified time.

Environment 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
1.4	Issues related to excavated material	The excavated soil/muck shall be used for land development and filling within subproject vicinity	Prior to operation 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	Intrusion of digested slurry into nearby Kayar Khola	Prevent haphazard disposal of digested slurry and collection of slurry from outlet in designated	During operation phase	-	Sub-project Developer

S.N.	Environmental/Social Impacts	Mitigation Measures	Time of Action	Estimated Mitigation Cost (NRs.)	Responsibility
		compost pit.			
2.3	Foul odour from substrate storage area and outlet of plant	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	-	Sub-project Developer
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/ manure storage area with sealing material or concrete casting	During Construction Phase	Already included in construction cost	Construction Company/Sub-project Developer
2.5	Spreading of diseases due to increased disease vectors, flies, mosquitoes etc	Avoid formation of ditches and haphazard slurry disposal; storage of digested slurry in designated compost pits	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	-	Construction company
2.7	Increased noise level from operation of generator	Provision of generator shed	During operation phase	-	Construction Company

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. 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.

Environmental and Social Monitoring Plan

S.N.	Indicators	Methods	Frequency/Time	Place	Monitoring Authority	Monitoring Cost (NRs.)
<i>1.1 Construction Phase</i>						
1.1.1	The construction premises shall be barricaded	Direct Observation	During construction	Sub-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	Sub-project Site	Sub-project Developer	-
1.1.3	Provision of First Aid Kits at construction site	Direct Observation	Once prior to start of construction	Sub-project site	Sub-project Developer	-
1.1.4	Spraying of water to reduce dust re-suspension	Records/Photographs	During construction	Sub-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	Sub-project site	Sub-project Developer	-
1.1.6	Management of excavated materials; used for land development	Direct Observation	During construction	Sub-project site	Sub-project Developer	-
<i>1.2 Operation Phase</i>						
1.2.1	Provision of composting pit	Direct observation/ Photographs/records	During construction	Sub-project site	Sub-project Developer	-
1.2.2	Provision of personal protective equipments (PPEs) during operation	Direct observation/ Photographs	Once prior to operation	Sub-project site	Sub-project Developer	-
1.2.3	Avoid storing substrate as far as possible	Direct observation	Bi-weekly	Sub-project site	Sub-project Developer	-
1.2.4	Avoid discharge of digested slurry into nearby river	Direct Observation	monthly	Sub-project site	Sub-project Developer	-

S.N.	Indicators	Methods	Frequency/Time	Place	Monitoring Authority	Monitoring Cost (NRs.)
1.2.5	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	Sub-project site	Sub-project Developer	-
1.2.6	Storage of compost and wet slurry in designated area	Direct observation	Bi-weekly	Sub-project site	Sub-project Developer/Site manager	-
1.2.7	Avoid naked flames near digester	Direct observation	Daily	Sub-project site	Sub-project Developer/Site manager	-
1.2.8	Build awareness of workers on safety practices	Direct observation/ verification of training conducted by technology provider and/or construction company	Once prior to operation	Sub-project site	Sub-project Developer	-
1.2.9	Provision of generator shed	Direct observation	Once prior to operation	Sub-project site	Sub-project Developer	-

8. Conclusion and recommendation

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 in this ESMP, if perceived during construction and/or operation phase shall also be avoided or mitigated by the Construction Company and/or developer. Although farm has 20 water buffalo, 50 m³ biogas plants can produce 18 KWh electrical output per day which can fulfill 15.6 KWh electrical demand per day by 14 water buffalo.