NATIONAL GREENHOUSE GAS INVENTORY SYSTEM OF MALAWI

LIVESTOCK EMISSIONS CALCULATORS: ENTERIC FERMENTATION & MANURE MANAGEMENT SYSTEMS

Standard Operating Procedures

NATIONAL GREENHOUSE GAS INVENTORY SYSTEM OF MALAWI

LIVESTOCK EMISSIONS CALCULATORS: ENTERIC FERMENTATION & MANURE MANAGEMENT SYSTEMS

Standard Operating Procedures

March 2019

TABLE OF CONTENTS

ACRONYMS AND ABBREVIATIONS

AD	Activity Data
EF	Emission Factor
GHG-IS	Greenhouse Gas Inventory System
QA/QC	Quality Assurance/Quality Control
SOP	Standard Operating Procedure
ADD	Agriculture Development Division
APES	Agricultural Production Estimates Report
IPCC	Intergovernmental Panel on Climate Change
UNFCCC	United Nations Framework Convention on Climate Change
EAD	Environmental Affairs Department
PERFORM	Protecting Ecosystems and Restoring Forests in Malawi
USAID	United States Agency for International Development

1.0   INTRODUCTION

The Government of Malawi with USAID's Protecting Ecosystems and Restoring Forests in Malawi (PERFORM) has developed the Greenhouse Gas Inventory System (GHG-IS) to support Malawi's Low Emissions Development Strategy. The GHG-IS uses a series of Microsoft Excel emissions calculators that combine methods and data from Intergovernmental Panel on Climate Change (IPCC) Guidelines (2006) with Malawi-specific data to produce estimates of emissions from each sector (see box). These emission calculators are accompanied by Standard Operating Procedures (SOPs) which provide comprehensive guidance on using the calculators.

This SOP covers the use of two separate Livestock Emissions Calculators:

- Livestock Calculator – Enteric Fermentation
- Livestock Calculator – Manure Management Systems

These Livestock Emissions Calculators produce estimates for reporting part of the annual emissions from the Agriculture, Forestry, and Other Land Use (AFOLU) Sector in Malawi. To derive the total estimated annual emissions from the AFOLU sector in Malawi, outputs from the Agricultural Soils Emissions Calculator, Fuelwood Emissions Calculator, and Land Use Change Emissions Calculator are also needed.

This document and serves to: (1) provide an overview of steps required to operate the Livestock Emissions Calculators; (2) direct analysts through the collection and entry of activity data; and (3) guide the interpretation and reporting of resulting emission estimates.

Under the GHG-IS, emissions from livestock in Malawi are accounted following the Intergovernmental Panel on Climate Change (IPCC) Tier 2 approach and accounts for emissions resulting from enteric fermentation as well as manure. The greenhouse gases (GHGs) emitted from these sources include CO_2, CH_4, and N_2O.

The main Government entity responsible for the GHG-IS Livestock Emissions Calculators is the Environmental Affairs Department (EAD). Personnel responsible for collecting, entering, and analyzing data for the GHG-IS will need to be assigned in accordance with the guidance set forth in *the GHG-IS Master Document* and will need to work with relevant government agencies to collect appropriate data for evaluating emissions from the agriculture sector.

Sectors accounted for in Malawi's GHG-IS

Energy: Emissions resulting from production and use of fuels for energy.

Industrial Processes and Product Use: Emissions from producing cement, lime, and ceramics.

Agriculture, Forestry, and other Land Use: Emissions from livestock and agricultural soil management (i.e., fertilizer application), forests remaining forests (degradation from unsustainable fuelwood harvest), and land use change.

Waste: Emissions from wastewater treatment and discharge, incineration and open burning of waste, and solid waste disposal.

2.0 OVERVIEW OF THE LIVESTOCK EMISSIONS CALCULATORS

To account for emissions from livestock in Malawi, two separate calculators (i.e., Excel workbooks) were developed that account for the two distinct sources of emissions from livestock (enteric fermentation and manure management). The Livestock Emissions Calculators are built as two separate modules (excel files), each of which encompass one livestock emissions category:

- Enteric Fermentation
- Manure Management

The Livestock Emissions Calculators is currently built to accommodate data entry and estimate emissions from 2010 to 2040 and follow a similar structure:

- Some tabs must be modified annually (activity data; AD, green), others on an irregular basis as needed (fundamental coefficients, blue), and some are the intermediary products of equations and require no management at all.
- The Livestock Emissions Calculators allow for disaggregation of emissions by year, animal species, and geographical location.
- To facilitate navigation across the numerous tabs and coefficients presented in the calculators, a navigation panel is offered in the first rows of each tab.
- Each coefficient tab presents the default values for their corresponding coefficient and allows for full data visualization by animal group and geographical location by selecting "show full table" on the top of each tab. Default values for a specific location can be overridden by uncovering the regionalization table selecting "show regionalization table" on the top of each of these tabs and entering the new values.

2.1 ENTERIC FERMENTATION CALCULATOR STRUCTURE

The Livestock Calculator - Enteric Fermentation includes the following tabs (i.e., Excel Worksheets):

Table 1 TABS IN ENTERIC FERMENTATION LIVESTOCK EMISSIONS CALCULATOR

TAB NAME	TAB PURPOSE
Workbook Overview	Provides an overview of the calculator and basic instructions on how to utilize the workbook
Change Log	List of all changes made to the calculator, and documents if they have been QA/QC'ed. The change log must be updated every time the calculator is updated or modified.

Activity Data Tracker (AD_Tracker tab)	Displays all the AD that needs to be entered in the calculator, per year of inventory. Clicking on the name of the AD shows the tab where the AD must be entered. Staff responsible for updating the calculator with new data must update the table in this tab to indicate whether the AD on a given year was complete, assumed to be 0, partially entered, missing, or entered but still requiring validation and QA/QC - these options appear in the dropdown menu in each cell of the table.
Emissions_All	Summary emissions by IPCC category to copy into the Emissions Aggregator Calculator to facilitate reporting.
Summary emissions	Reports total annual emissions in CH_4 from livestock enteric fermentation, based on the AD entered and the EF used. Results are reported by livestock category, livestock group, geographical location, and at the national level. The meaning of these tabs is described in the table heading in each of them.
CH4_Emissions	Reports total annual emissions in CH_4 from livestock enteric fermentation, based on the AD entered and the EF used. Results are reported by livestock category, livestock group, geographical location, and at the national level. The meaning of these tabs is described in the table heading in each of them. The 'CH4_Emissions' tab includes a 'Button' to copy automatically relevant values into the IPCC reporting tables of the Emissions Aggregator Calculator.
Activity_Data	AD needed to estimate annual emissions from livestock enteric fermentation. AD: Yearly livestock population in Malawi. It should be updated as new AD becomes available each year.
Emission Factors (CH4_Emission_Factors, EF_non-cattle_tier1, EF_ cattle_tier2 tabs)	Default values for each livestock type and geographical location, calculated annually from the fundamental and intermediary coefficients. The meaning of these tabs is described in the table heading in each of them.
Fundamental Coefficients (CFi, Ca, BW, MW, C, WG, Milk, Fat, Hours, Cpregancy, DE_pct, gestating_pct, populations, UE, ASH, VS, TAM tabs)	Key coefficients used to calculate emission factors. The meaning of these tabs is described in the table heading in each of them.
Intermediary or Derived Coefficients (CFi, Ca, BW, MW, C, WG, Milk, Fat, Hours, Cpregancy, DE_pct, gestating_pct, populations, UE, ASH, VS, TAM tabs)	Coefficients created as intermediary steps in equations, to facilitate the calculations and functionality of the emissions calculator. The meaning of these tabs is described in the table heading in each of them.

Populations QA/QC (populations_QAQC tab)	Quality Control checks for specific data-entry tasks (i.e. livestock population) that are likely to have errors.
Lists	General coefficients used throughout this calculator.

2.2 MANURE MANAGEMENT CALCULATOR STRUCTURE

The Livestock Calculator – Manure Management includes the following tabs (i.e., Excel Worksheets):

Table 2 TABS IN MANURE MANAGEMENT LIVESTOCK EMISSIONS CALCULATOR

TAB TYPE	TAB PURPOSE
Workbook Overview	Provides an overview of the calculator and basic instructions on how to utilize the workbook
Change Log	List of all changes made to the calculator, and indicates if they have been QA/QC'ed. The change log must be updated every time the calculator is updated or modified.
Activity Data Tracker (AD_Tracker tab)	Displays all the AD that needs to be entered on the calculator, per year of inventory. Clicking on the name of the AD shows the tab where the AD must be entered. Staff responsible for updating the calculator with new data must update the table in this tab to indicate whether the AD on a given year was complete, assumed to be 0, partially entered, missing, or entered but still requiring validation and QA/QC - these options appear in the dropdown menu in each cell of the table.
Activity Data	AD needed to estimate annual emissions from livestock enteric fermentation. AD: Yearly livestock population in Malawi. It should be updated as new AD becomes available each year.
Emissions_All	Summary emissions by IPCC category to copy into the Emissions Aggregator Calculator to facilitate reporting.
Emissions (Summary Emissions, Emissions_All, CH4_Emiss, N2O_emiss_direct, N2O_emiss_indirect tabs)	Reports total annual emissions in CH_4 and N_2O from manure management, based on the AD entered and the EF used. Note that N_2O emissions are calculated as direct or indirect emissions. Results are reported by livestock category, livestock group, geographical location, and manure management practice, at the national level. The meaning of these tabs is described in the table heading in each of them. The 'Emissions_All' tab includes a 'Button' to copy automatically relevant values into the IPCC reporting tables of the Emissions Aggregator Calculator.

Emission Factors (EF_CH4, EF3 tabs)	Default values for each livestock type and geographical location, calculated annually from the fundamental and intermediary coefficients. The meaning of these tabs is described in the table heading in each of them.
Fundamental Coefficients (TAM, Nrate, MS, FracGas tabs)	Key coefficients used to calculate emission factors. The meaning of these tabs is described in the table heading in each of them.
Intermediary or Derived Coefficients (Nex; N_volatilize tabs)	Coefficients created as intermediary steps in equations, to facilitate the calculations and functionality of the emissions calculator. The meaning of these tabs is described in the table heading in each of them.
Input coefficients for other inventory calculators (FracLossMS; N_MMS_Abv; F_PRP tabs)	Coefficients developed in the reporting format and units that other inventory calculators (i.e. agricultural soil management calculator) require as inputs.
Lists	General coefficients used throughout this calculator.

The tabs and tables are color-coded to indicate their function following this key:

Table 3 COLOR KEY FOR TAB AND TABLE FUNCTIONS

TABLE COLOR	FUNCTION
Orange	Results of total yearly emissions estimates, either by sector or aggregated.
Red	Summary emissions by IPCC category to copy into the Emissions Aggregator Calculator to facilitate reporting.
Yellow	Quality Control checks for specific data-entry tasks that are likely to have errors, and Activity Data Tracker.
Green	Activity data that should be updated yearly.
Blue	Default coefficient factors that contribute to emission factors. Should be periodically reviewed by sectoral experts and updated as new information is developed.
Purple	Coefficients that are developed in other inventory calculators (e.g., livestock calculators) and are required by this one as inputs.
Grey	Products of equations that represent intermediary steps between activity data and final emissions estimates. For review only, should not need update unless the formula has been corrupted. To recover the formula, the calculator manager should visit the reference listed on the table heading (usually an equation from the IPCC Guidelines).

The tables within each tab of the Livestock Emissions Calculators include a heading that describes:

- The IPCC-defined coefficient name (i.e., activity data, IPCC coefficient, etc.)
- A plain-language definition of the coefficient name
- Units of measurement
- Reference to where the coefficient is referred to in the IPCC 2006 Guidelines

- Frequency of review
- Notes where additional context is needed. Where deviations from IPCC 2006 Guidelines or assumptions have been made (see section 3.5) these will be noted here.

3.0 GHG ACCOUNTING USING THE LIVESTOCK EMISSIONS CALCULATORS

Malawi's GHG-IS is designed to allow for clear and consistent accounting for emissions by limiting data entry in the emissions calculators to activity data (AD)[1]. The process for collecting, entering, and reviewing those data are described below.

3.1. ACTIVITY DATA PRODUCTION

To account for emissions from livestock in Malawi the primary activity data category is head of livestock per year, disaggregated by agricultural development division (ADD). Additional variables that can serve as activity data, such as the population structure of cattle herds, can be collected annually but this is not strictly necessary. Specific activity data needs are given in Table 4 below.

Table 4 ACTIVITY DATA NEEDS FOR THE LIVESTOCK EMISSIONS CALCULATORS

ACTIVITY DATA	UNITS
Camel per ADD (Shire Valley, Blantyre, Karonga, Kasungu, Lilongwe, Machinga, Mzuzu, Salima)	head
Dairy cattle per ADD (Shire Valley, Blantyre, Karonga, Kasungu, Lilongwe, Machinga, Mzuzu, Salima)	head
Other Cattle per ADD (Shire Valley, Blantyre, Karonga, Kasungu, Lilongwe, Machinga, Mzuzu, Salima)	head
Donkeys per ADD (Shire Valley, Blantyre, Karonga, Kasungu, Lilongwe, Machinga, Mzuzu, Salima)	head
Goats per ADD (Shire Valley, Blantyre, Karonga, Kasungu, Lilongwe, Machinga, Mzuzu, Salima)	head
Horses per ADD (Shire Valley, Blantyre, Karonga, Kasungu, Lilongwe, Machinga, Mzuzu, Salima)	head
Poultry per ADD (Shire Valley, Blantyre, Karonga, Kasungu, Lilongwe, Machinga, Mzuzu, Salima)	head
Sheep per ADD (Shire Valley, Blantyre, Karonga, Kasungu, Lilongwe, Machinga, Mzuzu, Salima)	head
Swine per ADD (Shire Valley, Blantyre, Karonga, Kasungu, Lilongwe, Machinga, Mzuzu, Salima)	head

The Malawi Agriculture Production Estimate Survey (APES) is likely a good source of this activity data. However, it is important to be consistent with which 'cycle' to take values from. If, for example, the

---

[1] The magnitude of human activity resulting in emissions or removals taking place during a given period of time
https://unfccc.int/process/transparency-and-reporting/greenhouse-gas-data/greenhouse-gas-data-unfccc/definitions

third cycle of APES is used for one year, it should be used for subsequent years as well. The specific sectoral focal points to contact for these data are listed in the *GHG-IS Master Document.*

These data are produced <u>every year</u>.

In accordance with the timelines and guidance set forth in the established master GHG-IS Calendar given in Annex III of this SOP and on the *GHG-IS Master Document*, data should be entered into the Livestock Emissions Calculators during <u>the second trimester of the year</u>, <u>every year</u>, when the Round 3 of the APES (Agricultural Production Estimates) Report is released.

3.2. ACTIVITY DATA ENTRY

Once EAD personnel have collected the AD for the reporting period, they must be entered into the green AD tables in the tabs in the Livestock Emissions Calculators. The AD entered (animal population) should be disaggregated by ADD and reflect the appropriate reporting cycle (3rd cycle should be preferred).

The grey and blue tables in the tabs will populate automatically, according to the equations and assumptions indicated in each table heading. Once AD is entered, the total emissions are automatically calculated multiplying AD by its corresponding EFs. The red **Summary Emissions** tabs in each of the Livestock Emissions Calculators compiles the results generated on emissions from livestock in original gases as well as in tons of CO_2e for each year. A graph that visually describes the results is also produced and automatically updated.

When the calculator has been updated and/or the AD has been entered, rename the file to be saved file with today's date. **Do not overwrite existing versions**. For example, "Livestock Calculator – Manure Management Systems Emissions – July_17_2018".

Note: When opening the calculators, there may be a notice: 'SECURITY WARNING some active content has been disabled'. If you see this, you must click 'Enable Content'.

3.3. QA/QC & APPROVAL OF EMISSION ESTIMATES

It is imperative that quality assurance/quality control measures are undertaken to ensure data are correctly entered. The following steps must be followed by the individual responsible for QA/QC every time AD are entered into the Livestock Emissions Calculators.

1. Whenever the data entry analyst makes a change or a series of changes, review the new version of the workbook by reading the **Change Log**.

2. If there are any new changes that have not been reviewed yet, proceed to review all changes considering the following checklist:
   - For all activity data tables (green), confirm the values entered for the current year have been correctly entered and are plausible. If a large change is shown since the previous reporting period, make sure that the reason for this difference has been identified and documented in the **Log Change** notes.
   - Confirm that the QA/QC tables (yellow) in these tabs show 'OK' for each year with data entered. If it does not show 'OK', trace down the error in the corresponding coefficient (blue) table and correct it.
   - For all activity data coefficients, the original source documentation includes the same reporting entities as previous year.

- Confirm that the total emissions are appropriately compiling the groups and subgroups of AD.

3. On the emissions reporting tab (orange), confirm that all emissions estimates for the current year are within a reasonable range (± 20%) from previous year. If a change over this threshold is observed, the reason must have been identified and documented in the Change Log by the person responsible of entering the data. Note in the Change Log tab any comments related to changes that have been QA/QC'd. If any errors were resolved, note the change and set the status to 'OK'd'.

4. If any errors could not be resolved immediately, change the status to 'needs resolution' while a solution is determined. Seek out the expertise of teammates to resolve unexplained errors. Once resolved, update the change log again for this entry and change status to 'OK'd'.

5. Update the status of the AD entered on the AD_Tracker tab.

3.4. REPORTING OF EMISSIONS FROM LIVESTOCK

Emissions estimated using the Livestock Emissions Calculators will contribute to estimating total emissions from the agriculture sector. Therefore, appropriate outputs need to be accounted for under the agriculture sector total in the **Emissions Aggregator Calculator,** which compiles all sectoral emissions for UNFCCC (United Nations Framework Convention on Climate Change) reporting purposes. Additionally, the Total Emissions calculated by these Livestock Emissions Calculators are included in the Malawi's GHG Inventory Results Annual Report, both as total tons of CO_2e and per GHG gas (i.e. CO_2, CH_4, and N_2O), if applicable. The estimated emissions from the agriculture sector will also need to be included in Malawi's GHG Inventory Annual Report, both as total tons of CO_2e and per GHG (i.e., CO_2, CH_4, and N_2O), if applicable.

To facilitate the entry of the sectoral emission results into the IPCC reporting tables, the Livestock Emissions Calculators include a 'Button' that automatically selects and copies the results that are needed as inputs in the sectoral reporting table of the Emissions Aggregator Calculator. As instructed in the Emissions Aggregator Calculator and its SOPs, the calculator manager would only need to paste these values in the indicated cells of the **Emissions Aggregator Calculator**; the Emissions Aggregator Calculator will automatically create graphs and tables for reporting purposes once values from the Livestock Emissions Calculators are pasted in the Emissions Aggregator Calculator.

Copy results table to clipboard

This button is located in the top corner of the CH4_Emissions tab of the Enteric Fermentation Calculator and of the Emissions_All tab of the Manure Management Calculator.

3.5. ASSUMPTIONS MADE IN ACTIVITY DATA, COEFFICIENTS, & EMISSION FACTORS

While the IPCC 2006 Guidelines were followed when choosing equations and default factors, it was necessary to make some additional assumptions for Malawi due to data gaps or expert opinion. To ensure transparency and consistency, these assumptions are listed in the 'Notes' cell of the relevant coefficients and are further elaborated in **Error! Reference source not found.** (Manure Management Calculator) below.

Table 5 ASSUMPTIONS MADE IN THE ENTERIC FERMENTATION LIVESTOCK EMISSIONS CALCULATOR

COEFFICIENT	ASSUMPTION
CF_i	For non-lactating subgroups (bull, bull calf, heifer, heifer calf, oxen, steer) default IPCC values are used directly. For animal sub-groups that encompass both lactating and non-lactating animals (other cattle-cow, dairy cattle-cow), the final values is derived by weighting IPCC defaults between lactating/non-lactating animals within the subgroup based on estimated % gestating per year, and days of lactation per gestation.
Ca	Current estimates of animal feeding situation are based on interpretation of IPCC 2006 Vol 4. tables 10A1-10A3.
BW	For mature animals, body weight (BW) equates mature weight (MW). However, for youth (i.e. growing animals), BW should be less than MW.
MW	Youth and adult animals of the same species and class are assigned the same MW.
F_{SEW}	Coordinate with Manure Management workbook.
Milk	If milk production is monitored annually, it can be updated here. Alternatively, default estimates can be used – Estimate of 1.26 kg day^{-1} adapted from FAO Livestock Information, Sector Analysis and Policy Branch (AGAL) Malawi livestock sector brief (available at: http://www.fao.org/ag/AGAinfo/resources/en/publications/sector_briefs/lsb_MWI.pdf).
Fat	Percent milkfat for typical dairy animals. 4% used as placeholder; no source for estimate yet identified.
gestating %	Not a coefficient explicitly described in IPCC guidelines, but IPCC 2006 GHG Guidelines, Vol. 4, Equation 10.13 recommends adjusting NEp to account for less than full gestation in female population (and reference is actually table 10A.1-2).
Populations	Main categories are dairy and non-dairy cattle. For Malawi, only subcategories for non-dairy cattle are mirrored in national livestock, and therefore can be realistically characterized for emissions estimation. For non-dairy cattle, the subcategories of bull, bull calf, cow, heifer, heifer calf, oxen and steer are taken directly from Malawi's regular livestock census.
NE_p	Eq. 10.13. is modified here to take into account % of animals pregnant. The equation doesn't multiply by the %, but the guidelines recommends elsewhere in the chapter to take this step.
UE	0.04 assumes a diet of less than 85% on grain.
TAM	Typical animal mass. Assumed here to be the same as "BW".

Table 6 ASSUMPTIONS MADE IN THE MANURE MANAGEMENT LIVESTOCK EMISSIONS CALCULATOR

COEFFICIENT	ASSUMPTION
Nrate	Values for 'poultry' are assigned from IPCC 2006 Guidelines category 'chicken-other'.
$Frac_{LossMS}$	Livestock and MS combinations not represented in table 10.23 are conservatively set to 100% N loss.

4.0 UPDATING DEFAULTS AND EMISSION FACTORS

It is not expected that the GHG-IS operators will be responsible for refining or updating default values or emission factors. However, developments in the availability of information and new research may justify updating coefficients to allow emissions estimates to better reflect national circumstances. The process through which equations or default factors are be updated may involve a combination of expert review, literate review, original research, and comparison to neighboring countries. Guidelines for updating these factors are not provided here. However, in the event that any factors require updating, the following steps should be followed:

1. Decide if the update should apply to all or only some years. Applying to all years (including past) may necessitate the recalculation of emissions from past years. For example, the availability of new research that offers a more accurate way to account for emissions may necessitate recalculating emissions from past years, whereas changes related to new economic developments in Malawi should only be applied to years that these developments are believed to significant (including future years if appropriate).

2. Directly change the values in the corresponding emission factor table for the appropriate years.

3. For additions or removal of strata (i.e., animal group or category):
   a. Changes to a single table must be made to all tables that reflect that stratification.
   b. An appropriate value for each coefficient relevant to that strata must be developed or adopted.
   c. Add a row by inserting a new row across the entire workbook intersecting with the table.
   d. Ensure all formulas are copied into new row for that table.
   e. Check intermediary tables (grey) and final results (orange) to ensure that change causes an anticipated result.

4. Document any changes in the **Change Log** tab.

5. Update the status of the AD entered on the **AD_Tracker** tabs.

6. Deliver any documentation, studies, references etc. that support why the particular change was made to EAD, including a summary of the rationale for the change.

5.0 EXTERNAL RESOURCES

2006 IPCC Guidelines for National Greenhouse Gas Inventories. Volume 4. Agriculture, Forestry, and Other Land Use (AFOLU), available at https://www.ipcc.ch/meetings/session25/doc4a4b/vol4.pdf.

National Greenhouse Gas Inventory System Of Malawi. Master Document. October 2018.

ANNEX I. SECTORAL FOCAL POINTS

The sectoral focal points as presented below reflect institutional arrangements implemented for the 2017 Annual Greenhouse Gas Inventory. Future cycles may necessitate adjustments to the table to accurately reflect personnel changes.

GHG-IS Calculator name	Primary EAD Focal Point	Secondary EAD Focal Point	Sectoral focal point Institution	Primary Sectoral Focal Point	Secondary Sectoral Focal Point
Livestock Calculator - Manure Management Systems	Boniface Clement Tikiwa	Christopher Manda	Department of Animal Health and Livestock Development in the Ministry of Agricultural and Food Security	Suzgo Chappa	Patricia Mayuni
Livestock Calculator - Enteric Fermentation	Boniface Clement Tikiwa	Christopher Manda	Department of Animal Health and Livestock Development in the Ministry of Agricultural and Food Security	Suzgo Chappa	Patricia Mayuni

ANNEX II. SAMPLE DATA REQUEST LETTER

[EAD letterhead]

[name of primary sectoral FP]
[position]
[name of secondary sectoral FP]
[position]
Dep. of Animal Health and Livestock Development in the Ministry of Agricultural and Food Security
[address]

[date]

Dear [name of primary sectoral FP] and [name of secondary sectoral FP],

Through this letter, Environmental Affairs Department formally requests that you share sectoral data necessary to estimate annual greenhouse gas emissions from the livestock sector. As you know, Malawi has now formalized its annual greenhouse gas accounting and reporting, managed by the Environmental Affairs Department, and we reach out to all sectors every year seeking their collaboration to complete the annual multisectoral greenhouse gas emission estimates.

We request that you kindly share with us the annual livestock population of each Agricultural Development Division (ADD), included in the round 3 of the Agriculture Production Estimates Survey reported for [year], recently released.

Please share this data in an excel format, indicating in the headings the corresponding ADD and in the rows the corresponding type of animal.

Do not hesitate to reach out to us if this request raises any questions or concerns. We appreciate your collaboration and thank you in advance for your prompt reply to this request.

Regards,

[signature]

[name]
[position]
Environmental Affairs Department

ANNEX III. ACTIVITY DATA NEEDS & SOURCES USED IN 2010-2017

Activity Data (AD) needed	GHG-IS Calculator Name	AD subcategories	Required AD input units	AD relevant in Malawi (2010 - 2017)	Source (2010-2017)
Number of livestock per ADD	Livestock Calculator - Enteric Fermentation	camels, donkeys, cattle, goats, horses, poultry, sheep, swine	number of each animal type per ADD	all	Annual APES (Agriculture Production Estimates Survey) Report, round 3, Excel file shared directly by the Ministry of Agriculture, Irrigation and Water Development
Number of livestock per ADD	Livestock Calculator - Manure Management Systems	camels, donkeys, cattle, goats, horses, poultry, sheep, swine	number of each animal type per ADD	all	Annual APES (Agriculture Production Estimates Survey) Report, round 3, Excel file shared directly by the Ministry of Agriculture, Irrigation and Water Development