

Defra GHG AC0114

National Level Statistics Workshop

Workshop Note 9 – Workshop Proceedings

1. Introduction

The United Kingdom (UK) Greenhouse Gas (GHG) Inventory for Agriculture estimates emissions of nitrous oxide and methane from soils, manure and enteric sources by integration of generic emissions factors (on a per head of livestock, hectare of land, or kilogram of fertiliser basis) with national agricultural census, fertiliser use and farm practice survey data. A more detailed methodology is required in which UK specific emission factors are integrated with detailed agricultural data that map regional and sector differences in farm practice that affect emissions, and which can track the adoption of mitigation methods by the industry.

Defra project AC0114 (part of the GHG Platform) is tasked with developing a revised Inventory methodology that better represents the structure of the industry, based on the linkage of national statistics and a sector and spatial disaggregation of the data. A one day workshop was organised in December 2010 at Defra Foss House, York, for government and industry data analysts and policy makers to discuss relevant existing statistics and horizon scan emerging data sources. The objective of this workshop was to identify existing national data sets, data collection methods and expertise in government and industry that are relevant to the aims of project AC0114.

The workshop was planned with the support of Paul McDonnell and Michelle Lonsdale from Defra. The workshop was attended by 40 delegates from industry and government (see **Workshop Note 3 Attendance**). The Devolved Administrations were represented by members of the WAG and DARD-NI. Unfortunately, weather conditions prevented attendance by Adam Krawczyk and Caspian Richards from the Scottish Government, who were therefore represented by AC0114 team members from SAC and CEH. Further meetings with RERAD, WAG and DARD-NI are planned to make up for this.

The structure for the workshop (see **Work Shop Note 5 Coordination Narrative**) and the presentations given are available from the AC0114 project SharePoint.

The workshop was organised in two phases. The first phase consisted of presentations by AC0114 team members and Defra data analysts on the existing Inventory methodology and key national statistics. This was intended to establish a common level of understanding of requirements and to identify some issues with existing data sources. The second phase consisted of table discussions and reporting back on the needs of an improved Inventory. These discussions were structured by farm type and involved groups of mixed expertise on data and agricultural systems.

2. Coordination

The workshop was introduced and chaired by Paul McDonnell and Steven Anthony. The presentation used to coordinate the workshop is available from the AC0114 project SharePoint (see **Workshop Note 4 Coordination Presentation**). A voice recording was made of all presentations.

The objectives of the improved Inventory project were introduced as:

- Integrating country specific emission factors and regional agricultural statistics to enable an improved Inventory of nitrous oxide and methane emissions for the UK with an assessment of uncertainty;
- Mapping regional and sector differences in farm practice, and tracking the adoption of mitigation methods by the industry;
- Enabling the Inventory to function as a forecasting and performance monitoring tool with respect to targets for emission reductions.

3. Background to the Inventory

3.1 Scene Setting

Tom Misselbrook presented on the requirements for an improved Inventory (see **Workshop Note 6 Scene Setting Presentation**). The present Agricultural Inventory is used for reporting UK emissions under the UNFCCC Kyoto Protocol and under the European Monitoring Mechanism. The Agricultural Inventory does not include carbon emissions from fuel use and land use change, as these are reported under separate inventories for Energy and Land Use, Land Use Change and Forestry. Agriculture is presently responsible for c. 8% of UK GHG emissions expressed as a carbon dioxide equivalent. The most important agricultural emissions are enteric methane and nitrous oxide from soils and manure management.

The UK Climate Change Act sets demanding reduction targets for UK GHG emissions. Under the UK Low Carbon Transition Plan¹ (LCTP) mitigation actions have been identified that promise an average reduction of GHG emissions by an equivalent of three million tonnes of carbon annually from English agriculture in the period 2018 to 2022. All of the Devolved Administrations have targets for reducing emissions. The agricultural sectors have produced Action Plans to achieve significant reductions in emissions through improvements in efficiency and changes in farm practice. However, the existing Inventory is largely based on generic emission coefficients that are not specific to UK agricultural practice and are not sensitive to the anticipated changes in UK agricultural practice. There is therefore a need to improve the structure and calculations used by the Inventory to monitor and forecast progress in reducing GHG emissions for agricultural sectors and regions of the UK.

3.2 Inventory Calculations

Adrian Williams presented on the method of emission calculation in the existing Inventory (see **Workshop Note 7 Inventory Calculation Presentation**). An important clarification was that as the Inventory does not include GHG emissions from off-farm activities (such as fertiliser manufacture and food processing) it cannot be used to calculate the carbon footprint of commodities, although new emission factors that are generated should be usable for this purpose.

¹ The Low Carbon Transition Plan was published under the previous administration; the present Government (July 2011) have not endorsed the report nor have they agreed to set targets for individual sectors

The generic approach used by the existing Inventory is that diverse farm activities are characterised by a driver for pollution (such as quantity of fertiliser nitrogen applied or number of animals) that is multiplied by generic emission factors, applied globally. The global application of emission factors without respect to effects of local soil, climate, land use and timing of activities may result in emissions estimates that are incorrect and regionally biased. It is not necessarily true that an improved Inventory will result in a lower estimate of emissions.

Improvements to the Inventory will be focussed on resolution (spatial, sectoral, temporal and activity) for better reporting and understanding of emission sources, quantification of the uncertainty in emission calculations for assessing what differences or changes can be claimed, and representation of the uptake of mitigation methods.

A key objective of an improved Inventory is the tracking of change, associated with improved farm practice and the changing structure of the industry. The more detail is added to the Inventory and the more sensitive the model to changes in farm practice, the greater the number of parameter estimates required. This may result in an increase in the overall uncertainty in the Inventory calculation. It may not be possible to confirm calculated reductions in GHG emissions statistically. As a consequence, a 'weight of evidence' provided by semi-quantitative indicators of positive changes in farm practice may become as important to policy and industry users of the Inventory.

4. National Level Statistics

Defra data analysts presented an overview of key national data sets presently used in the Inventory (or with potential for use in the new Inventory). The objective was to inform discussion in the afternoon, and to identify constraints relating to:

- Information content
- Spatial coverage;
- Spatial or temporal resolution – especially country specific differences;
- Sample size and robustness;
- Continuity (1990 to 2020);
- Relevance and adaptability.

4.1 Marc Thomas – British Survey of Fertiliser Practice

Presented the history and design of the British Survey of Fertiliser Practice. This survey has been consistent for England and Wales since the 1970s and a detailed Farm Level data set has been available since 2004. The survey covers Great Britain and is collected by farm interview. It is a stratified survey, with c. 1400 samples taken annually, but only 130 of these within Wales. The survey records individual applications on every field on a farm, providing data on fertiliser type, nutrient content, timing, method and rate of application. The survey can be used to identify national trends in nutrient use and for major crops is very precise. Similar data on manure applications are also recorded but are more variable. The derived statistics are generally robust only at Country or Government Office Region level, but there is a potential for higher resolution mapping by modelling of fertiliser and manure use in relation to Farm Types. This might also improve the estimation of fertiliser use for Wales. There is some flexibility for varying the sample design and data collated each year, but there are increasing resource constraints. A significant concern in past Inventory calculations has been the small number of sample returns for Wales, and

the reliance on extrapolating survey data from Scotland for use in Northern Ireland. However, a pilot survey for fertiliser data collection is planned for Northern Ireland through the Farm Business Survey. An annual survey of the quantities of compound, blended and straight fertilisers delivered in Northern Ireland by local fertiliser firms for agricultural use also exists. This might be used to constrain estimates of fertiliser use on specific crops.

4.2 Helen Hoult – Farm Practice Survey and June Agricultural Census

Presented on the Farm Practice Survey. This survey covers only England, but a one off UK wide survey is taking place in 2010 as part of the EU Farm Structure Survey. The survey is based on c. 3,000 responses annually and the results are robust at the regional level. The survey has run since 2004. The topics vary each year and are driven by prevailing policy interests. The survey is postal and therefore is not ideal for detailed technical questions. The content of the 2011 survey has been defined, and will include questions on climate change mitigation and adaptation; nutrient management; manure and slurry storage; and farm health plans. The survey takes place on 1st March and is normally published in August each year.

Presented on the June Agricultural Survey. This is a UK wide survey on agricultural activity, carried out separately by the DAs on June 1st each year, geo-referenced by individual holding and business identifiers that enables data to be mapped and summarised for geographic regions. The sample size and robustness of the data varies from year to year. It is a true Census (130,000 farms in England) only every 10 years. It is a Large Survey (60,000 farms in England) every three years as it contributes to the EU Farm Structure Survey (EU-FSS), and a Small Survey (30,000 farms in England) in intervening years. After 2010, statistical results will be published only at Local Authority or Region scale. The smallest non-commercial holdings are now excluded from the survey. The future of the survey is under review. It will almost certainly continue to exist as it is required by EU regulation, but the sample size will be small in non EU-FSS years. It may not be appropriate to produce a holding level data set in interim years.

4.3 Lindsay Holmes – Animal Feed Surveys and Crop Production

Presented on the Survey of Compound Animal Feed production and the Survey of Integrated Poultry Unit production. Both surveys are run monthly and are published 2 months in arrears at a GB level, with historic data available to 1990. The surveys collect data on the raw materials used to produce animal feed, and the split of the feed products between livestock type. In terms of compound feed ingredients, the survey covers cereals, various oilseeds (cake and meal), peas and beans, sugar beet pulp and molasses, fruit pulp and additive such as minerals. Feed products are split down into various categories by livestock type. Regional disaggregation of the data is difficult because the data are collected at national company level. The survey is believed to represent c. 90% of feed production in GB. Other feed data is available by integration of fodder crop areas from the June Agricultural Survey with estimates of yield provided by ADAS and others. The yield estimates are based on consulting the industry and are not a true survey. A Home Grown Cereals Authority (HGCA) national cereal balance sheet is also used to provide an estimate of overall grain fed on farm. A similar Animal Feed Statistics survey is conducted in Northern Ireland each year and provides monthly information on the quantities of compounds and processed animal feedstuffs used by Northern Ireland feedstuff manufacturers, and the quantities of raw materials used.

Presented on Crop Production Data. For the main arable crops (cereals and oilseed rape) yield and production areas are taken from the June Agricultural Survey. Yields for sugar are obtained from British Sugar and for potatoes from the Potato Council. There are difficulties with ascertaining crops grown and fed on farms, other than for cereals. For Northern Ireland, an annual crop production survey also provides information on yields for hay and grass silage.

4.4 Andrew Woodend – Farm Business Survey

Presented on the Farm Business Survey. The Farm Business Survey was begun in 1936 and collects the management accounts of the whole farm business. The survey is conducted separately within the four countries of the UK and is based on c. 2000 farms in England. Personal visits are undertaken by research officers who visit the surveyed farms twice annually. The survey provides an independent measure of levels and trends in farm business incomes, diversification, costs, gross and net margins; labour; rent; household income and intensity of production. The survey also provides a number of irregularly-collected additional modules, on subjects such as animal health and welfare; agri-environment activities; and energy usage. The survey results are analysed by robust Farm Type, size and economic performance. The survey provides potentially valuable Business Indicators for use in evaluating livestock diets and productivity for methane emission calculations, including, for example, estimates of concentrate use per animal and indices of fecundity and mortality.

The survey has been used to investigate how financial performance depends on the setting of business targets. The survey can be split into four sectors: agriculture; agri-environment; diversification; and single payment. The economic performance of a farm can be split between these sectors – revealing very large differences between the best and worst performers, and the key sources of farm income. The survey can be used to estimate potential technical and efficiency improvements, by comparison of best and worst performers, and the resulting reductions in gaseous emissions due to associated reductions in fertiliser use and similar.

4.5 Alison Bromley – Cattle Tracing Service and Animal Production Statistics

Presented on the Cattle Tracing System. The Cattle Tracing Scheme (CTS) has GB coverage and is part of the RADAR (Rapid Analysis and Detection of Animal Related Risks) data framework. It can provide regional data on cattle populations and deaths, attributed with cattle breed, age, sex and purpose. A similar system exists for Northern Ireland. Since 2005, the CTS has replaced the June Agricultural Survey for cattle numbers. There are c. 50 breeds recorded by the system. The RADAR system can also provide movement data for pigs and sheep.

Presented on Slaughter Surveys. A monthly survey of UK slaughterhouses provides Country level data on the numbers of cattle, sheep and pigs slaughtered for the food chain and the average carcass weights. There are no regional data, and no data for different types of breed. Overall average weights are available for calves, steers, young bulls, heifers and adult cattle. There is pressure to reduce the sample size. The survey is of c. 100 slaughter houses in England and Wales.

4.6 David Farnall – Nutrient Balances

Presented on the calculation of UK Nutrient Balances for nitrogen and phosphorus, a secondary data set based on the integration of a number of primary data sources. Nutrient balances can be calculated at the soil surface or farm gate. The balances

are estimated by integrating data on crop areas, livestock numbers, fertiliser and manure inputs, and crop and livestock yields with nutrient coefficients developed by experts within research projects. The results provide a high level indicator of environmental pressures but there is no explicit calculation of the loss pathway. Results are available from the year 2000 at country level. The data does not support farm level estimates. The best possible resolution is regional due to limits on availability of data. The balance can be disaggregated into inputs and removals, and by source.

4.7 Lindsey Clothier – Linking of Datasets

Presented on the linkage of data sets. This can be achieved by using attributes on farm type, farm size, scheme membership and option uptake. Experience to date has been on behalf of Defra Observatory projects and has therefore focussed on England. Common farm identifiers include County Parish Holding (CPH) number (main and local) and Business Identifiers. There are difficulties in matching data sets, but for statistical purposes at national and regional scale, these can generally be overcome. Different identifiers are used for different tasks, e.g. June Agricultural Survey and Environment Scheme membership. The Single Payment Scheme can be used to obtain geo-referenced Field Level data from the Rural Payments Agency and mapping of grassland (permanent and temporary) and crop. Agri-environment Scheme data can be used to locate specific options and behaviours, e.g. organic farming. Reminder that the Cattle Tracing Scheme is a full census each year, and is accurate to County scale. Annual Sheep and Goats Inventory is a December survey of all holdings with sheep.

5. Identification of Relevant Datasets

Throughout the day, the workshop attendees were invited to identify additional statistics and data sets relevant to the improved Inventory. It was recognised that existing work by the AHDB and others for the industry Road Maps had already identified many data sets, but these generally were focussed on England. This information would be collected by liaison with the industry representatives.

Generally national agricultural datasets are available for each country and reported under the common themes of: farmland use; farm labour; farm livestock; agricultural income; and farm structure. The potential additional data sources identified included:

- Centre for Dairy Information – Annual report on UK National Dairy Herd of registered animals and contains data on animal populations by breed, calving interval, longevity and performance statistics. However, some breeds are more prevalent in the registered compared to non-registered populations (<http://www.ukcows.com/theCDI/>);
- Land Parcel Identification System and Rural Land Registry (part of the Land Registry) for the improved mapping of land use and participation in agri-environment schemes with respect to climate and soil condition;
- FQUAS – Farm Quality Assurance Scheme (Northern Ireland) Industry administered scheme that is audited and ensures that certain agri-environmental and animal welfare standards are followed on participating farms;

- Defra Fallen Cattle Survey (c. 30,000 animals per annum);
- Farm and national stratified surveys of soil properties, including the Representative Soil Sampling Survey, to establish statistical distributions of baseline soil properties for input to computer models;
- Agri-environment scheme payments and options databases (e.g. ELS, HLS, OELS, Tir Cynnal and Tir Gofal) for tracking change in farm practice;
- Catchment Sensitive Farming database of uptake of diffuse pollution mitigation options – managed by Environment Agency;
- Power industry data on the quantity of poultry litter that is incinerated rather than spread to land;
- NHS and FSA data sets on the food chain;
- Industry farm carbon auditing and bench marking data (e.g. CALM tool);
- Farm records collected using Nutrient Management Systems (e.g. PLANET tool) and for NVZ record keeping;
- Supermarket records of supplier auditing;
- Records of Farm Assurance Schemes;
- National Poultry Register;
- RADAR data on horse and deer population;
- AHDB and EBLEX carcass weight survey;
- AHDB crop and livestock benchmark data;
- Defra dataset of all organic producers, provided by certification bodies;

The workshop discussion on the availability of national level datasets also raised a number of issues for consideration by the project team:

- Greatest concern was expressed over the restrictions on copyright and confidentiality that might prevent agricultural and environmental data being regularly accessed or used in an Inventory calculation that is intended to be open and free to use to all stakeholders;
- The linkage of national slaughter statistics to the Cattle Tracing System to enable estimation of slaughter weights by breed and purpose was seen to be critical for tracking the effects of changes in livestock management;
- There is a need to make sure that data acquisition and improvements in methodology made now are consistent with potential future Tier 3 calculations, possibly made for representative and complete model farm systems rather than based on statistical data for individual crop areas and livestock types;

- There is a need to reconcile national level statistics on local production, import and sales of inputs with survey statistics of on farm use of materials, for example, the use of chemical fertilisers.

6. Afternoon Session

A priority objective for the Inventory is to be able to report emissions by region, sector and possible commodity. We need to be able to disaggregate the Inventory to better understand the emissions sources and to monitor progress in emission reductions. But this involves more than just a reporting need, as disaggregation is also required so that we use the appropriate emission coefficient for contrasting physical environments and land or stock management practices. Table groups were therefore asked to discuss and report back on priority actions or challenges for the AC0114 team in achieving this improved disaggregation.

6.1 Meeting the Structural Needs of an Improved Inventory

This first afternoon discussion asked table groups to identify priority actions for the AC0114 team where there is a clear Inventory data need and challenge in either a) finding relevant statistics, or b) making links between existing data sets. Attendees were broadly grouped by agricultural sector and asked to discuss the factors that might influence emission calculations and reporting, such as management, geographic (such as rainfall and soil properties) and marketing of outputs (such as farm assurance schemes and drivers for uptake of mitigation methods).

The sections below summarise the key points made in discussion.

6.1.1 Beef and Sheep

- The beef and sheep sector was identified as the most difficult sector to characterise due to the variety of management systems and opportunistic character of farmers in this sector.
- A link between slaughter weight statistics and the Cattle Tracing System was seen as the most valuable improvement in data collection – potentially enabling the identification of different types of production systems based on animal age and weight at slaughter.
- There was a need for more detail in beef finishing systems, and knowledge of beef versus dairy origin for young stock; and improved information on calving intervals and the numbers of fallen stock (for sheep as well as cattle).
- Knowledge of field stocking rates is seen as a critical parameter for accurate emission calculations, taking account, for example, of effects of soil compaction on nitrous oxide emissions.
- Farm assurance schemes were proposed as a source of information on feeding practice and uptake of mitigation methods; and the stable isotope method was proposed as a potential method for identifying the type of diet and location of animals. Electronic Identification (EID) for sheep was also identified as a location tracking tool.

- It was emphasised that animal health and welfare and disease are key factors affecting production efficiency. Most farms are not at maximum efficiency, and improvements in welfare may lead to reductions in emissions over the production life cycle. This implies that the Inventory requires a health related emissions factor modifier for each type of livestock.
- The use of industry data to monitor improvements in livestock management and system efficiency is critical to tracking reductions in emissions associated with improvements in industry practice. For example, the EBLEX business pointers reports.
- There is a need to define spatial scale at the outset of the project: location is relevant to farm inputs rather than farm products, whilst gaseous emissions are a global impact – hence reporting unit may be very different from calculation unit. The spatial unit of calculation and reporting is important for identification of sources and allocating responsibility for management.

6.1.2 Dairy

- The dairy system was seen as having better monitoring and record keeping than other sectors, but it is not necessarily true that we are recording the correct indicators for emissions calculations.
- Improved emissions calculations depend on a correct definition or categorisation of dairy breeds and production systems, such as grass versus concentrate fed, each with important differences in the efficiency of use of inputs, body weight, longevity, lactation number, calving interval and yields that each affect emissions.
- Monitoring the health status of dairy animals and the effects of sub-clinical disease was identified as critical to tracking feasible improvements in emissions through improved stock management.
- It was proposed that disaggregation of surveys of fertiliser use by robust farm type (or similar) would improve estimates of nitrogen use and nitrous oxide emissions that are apportioned to the dairy sector.
- The increasing uptake of Carbon Footprinting and audits in the Dairy industry was seen as a significant potential source of farm practice data. However, it was cautioned that the existing accredited models are all different in some way and the auditors are not presently sharing the collected data.
- It was suggested that as emissions from dairy farms are dependent on the whole farm system and life cycle of animals that emissions calculations might be improved by modelling representative model farms, and then extrapolating to the UK efficiency data from the Farm Business Survey and Farm Practice Surveys.

6.1.3 Arable, Pigs and Poultry

- A detailed sensitivity analysis of the Inventory calculation is necessary to help identify need for indicators and data, and focus resources wisely.

- It is right to take a ‘big society’ approach to data collation – but sometimes too much time can be spent in collecting data from multiple partners / contributors when sometimes it is more efficient to collect data yourself. The linkage between datasets is important – but is costly in terms of time.
- Farm assurance schemes (Red Tractor) covers, e.g., up to 90% of dairy farms and may be a useful source of information. The industry GHG Action Plan Team is investigating this and will collaborate with project AC0114 on data that can be derived from assurance schemes
- Monitoring of large pig and poultry farms under Integrated Pollution Prevention and Control (IPPC) may be a valuable source of practice data, but there are issues with a lack of data on the fate of manures produced on these farms.
- The British Survey of Fertiliser Practice (BSFP) surveys some aspects of manure management, but a more detailed manure practice Survey (a complement to the BSFP) is required. This applies to all types of animal, but the BSFP is heavily directed towards arable, cattle and sheep farms due to the stratification of the sample, so pig and poultry farms are under-represented in the current survey structure. It was suggested that a few additional pig and poultry farms should be included in the BSFP.
- Characterisation of feeding practices is critical to calculation emissions from pig and poultry farms. Data on total feedstuff production are available from feed companies, but no statistics are available at farm level. This is especially important regarding forage and on-farm production of feed.
- As future resource for national surveys is an issue, it was suggested that a feeding practice survey along similar lines to the BSFP could be integrated with the BSFP, possibly for alternate years. However, any additional questionnaires need to be carefully thought through and need to be “smart”, to avoid burdening farmers with more additional surveys.
- The poultry industry is characterised by a small number of large producers that enables us to take a case study approach.

6.2 Horizon Scanning Data Requirements

This second discussion in the afternoon asked table groups to identify priority data needs for the tracking of change in farm practices, industry structure and efficiency of production. Many of the points raised were an echo of earlier discussion and so are presented as a short list:

- A common theme to all groups was the integration of the Cattle Tracing System with data on carcass weights, from which to infer agricultural systems, animal life spans and feed intake, and efficiencies of production. It was also believed that the tracking of information on cattle sires would allow identification of high efficiency individuals that could be used to influence breeding programs. This work has already been trialled under the BovIS system in Northern Ireland.
- Indicators of animal health and growth efficiency (such as calving interval, slaughter weight for age and urea nitrogen in milk) would also be of value in

monitoring the potential for reductions in emissions per unit of output. Better data on indoor/outdoor livestock, organic or non-organic management and manure management practices was also proposed. The potential for extending Farm Business Survey benchmarking to include greenhouse gas mitigation measures was also discussed - a Defra funded study is currently looking at the potential for this (project code SERP 1011/5).

- Indicators of soil physical quality, such as the extent of soil compaction and number of farms adopting reduced traffic practices, were identified as potentially useful for monitoring impact of improved soil management on nitrous oxide emissions. Future tracking of the adoption of precision farming, end-use of produce (e.g. wheat for bread, feed, bio fuels), forage maize production and anaerobic digestion was also recommended as developing areas for potential inclusion in surveys/data collection.
- It was also stated that there is a need to consider that if greenhouse gas mitigation measures lead to an increase in imports, there will be a lack of progress overall.
- The incorporation of the drivers for change in the structure of the Inventory (e.g. Nitrate Vulnerable Zones, Farm Assurance schemes and Agri-Environment scheme participation) was recognised as useful in mapping mitigation uptake.
- A fundamental in the selection of future indicators and statistics used by the Inventory was that the data sources must be available without payment or legal issues.

6.3 General Issues:

The afternoon discussions raised a number of general issues for the AC0114 project team to take account of in their re-structuring work. These were that:

- We must remember not to constrain our efforts to just the UK in acquiring relevant data;
- Clarity is required on what is needed for the Inventory calculation versus wider analysis for drivers of change.
- We need to plan for the effects of changes in legislation (e.g. CAP) that need to be accounted for in an improved Inventory design.
- It would be positive if the farm practice data needs for the Inventory mapped directly onto key messages for the Industry.
- We need to be very careful about burdening farmers with plans for additional surveys to support an improved Inventory;
- We need to be sensitive to the long-term availability of datasets and the implications of changing sample size for support of regional as opposed to national calculations and reporting;
- Any survey data used in the Inventory methodology needs to be large enough to establish statistical correlations between ranges of farm practice variables, as

opposed to simply establishing average practice. These ranges and covariance tables are critical to the calculation of the uncertainty in the inventory.

- Different methods of data collection are designed for different purposes and it is not always appropriate to integrate datasets.
- We need to allow for the multiple enterprises on farm and distinguish this from the convenience of the Robust Farm Type definition.
- We are encouraged to identify intended and unintended inefficiencies in farm systems and explore how best to monitor this as part of the tracking of changes in farm practice.
- Empirical validation of Inventory calculations would be helpful in terms of ensuring accuracy.

7. Conclusion to Workshop

Paul McDonnell and Steven Anthony thanked the delegates for their contributions, and the team at Defra York for organising and hosting the workshop.

This first workshop under the AC0114 project proved a valuable introduction to the people and datasets that will be consulted by the project team. Good relationships were established with the Defra analysts based at York that were immediately followed up by a meeting on the following day. Informal positive feedback was also given later by David Garwes who chairs the industry Project Advisory Group for project AC0115 (methane emissions).

A brief summing up of some of the more important issues that had been raised for consideration by the AC0114 project team was given. These included:

- The need to establish a robust typology of farm systems, representative of the life cycle of animals, and recognising that any one farm may be composed of a number of systems enterprises;
- The importance of an uncertainty and sensitivity analysis of the existing and potential improved inventory structures to prioritise future data collection by government and industry;
- The resource constraints on existing national level statistics and proposals for linking data sets, that may limit collection of new data;
- The limited accuracy of national level data sets on farm structure and practice at regional scale that will constrain their integration with local scale physical data (such as soils and climate) that determine emissions factors;
- The priority need for further local meetings and discussion on the availability of national level statistics for Wales, Scotland and Northern Ireland.

The workshop concluded with notification of key engagement activities for 2011, including:

- An ‘Inventory Requirements’ workshop to be held in March. This will focus on reviewing a detailed definition of a farm systems typology with industry representatives;
- Launch of a GHG Platform web site that will become a resource for relevant reports and listings of included data sets, and a calendar of project events;
- Scoping of the requirements and content for a UK wide Farm Practice Survey targeted at the needs of the improved Inventory.

The AC0114 project is dependent on support and expertise in government and industry throughout the UK. We welcome your feedback on this workshop and your future expert input. This project has representatives distributed throughout the UK and we are willing to make presentations at seminars and stakeholder meetings to share data and expertise.

Feedback and further discussion by contact with:

Laurence Smith (Organic Research Centre)
Tom Misselbrook (North Wyke Research)