

# CDFA Alternative Manure Management Program FY 2016-17



## Quantification Methodology Development

October 16, 2017



# Overview of Presentation

- CARB's role in CDFA's Alternative Manure Management Program (AMMP)
- Quantification Methodology (QM) Development Approach
- Eligible Project Types and Approaches
- Areas of Improvement & Upcoming Contract Work

# California Air Resources Board's Role in CDFA's Alternative Manure Management Program

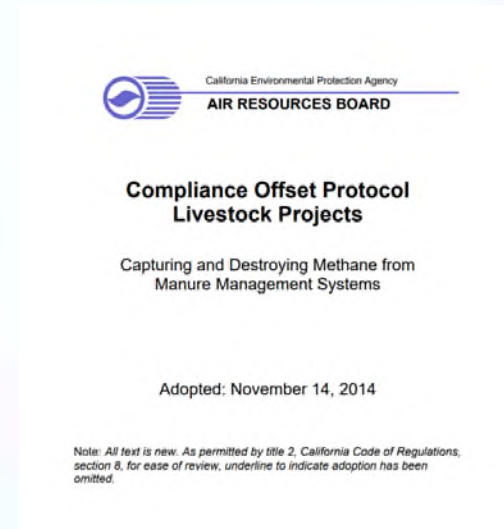
- CARB required by statute to develop QM for Greenhouse Gas Reduction Fund (GGRF) projects
- QMs provide a mechanism to estimate the net GHG benefits from project implementation
- Net GHG benefits result from:
  - Avoided CH<sub>4</sub> emissions from reduced anaerobic storage of dairy/livestock manure
  - Impact of fossil fuel use changes associated with new manure management practices
- CARB staff from other divisions participate in interagency Technical Advisory Committee (TAC) that reviews AMMP project applications

# AMMP QM Development

- Greenhouse Gas Reduction Fund Principles
  - Applies at the project-level
  - Aligns with the project types proposed for funding
  - Estimates GHG benefits from direct, onsite practices
  - Based on scientifically sound, peer-reviewed methods
- Other considerations
  - New program for FY 2016-17
  - Accelerated timeline for QM development
  - Reliance on existing, peer-reviewed literature and established (CARB Board approved) methods

# AMMP QM Development

- Decision to adapt the *CARB Compliance Offset Protocol for Livestock Projects* for the AMMP program
  - Vetted through regulatory process
  - Uses widely accepted methods
  - Though designed for digester projects, contains models and equations applicable to quantifying AMMP projects
- Provides consistency with approach used in CDFA's Dairy Digester Research and Development Program (DDRDP)



<https://www.arb.ca.gov/cc/capandtrade/protocols/livestock/livestock.htm>

# AMMP QM Development

California Climate Investments	CARB Offset Program
Incentive program	Regulatory compliance mechanism
Pre-project estimation	Post-project measurements

- In developing AMMP QM and GHG Calculator Tool, CARB considered:
  - Minimizing complexity for applicants
  - Balancing ease of use with flexibility
  - Default assumptions vs project-specific inputs

# Project Boundary

- **Includes**
  - CH<sub>4</sub> emissions associated with manure treatment/storage
    - Anaerobic lagoons, storage ponds, manure settling basins, dry lot deposits, compost piles, solid storage piles, etc.
  - Fossil fuel emissions associated with manure management, transport & storage
- **Excludes**
  - Carbon sequestration of manure applied to land
  - N<sub>2</sub>O accounting



# Eligible Project Types and Approaches

- Eligible project types
  - Initial list developed by CDFA
  - CARB evaluated practices
    1. To ensure they achieve net GHG reductions
    2. Determine availability of reliable GHG methods and/or factors
- General approach
  - Account for where manure is deposited and/or stored
    - ➔ % deposited on land & not collected, % entering wet/anaerobic system, % composted, etc.
  - Determine methane production associated with each treatment/storage practice
    - ➔ Methane conversion factor (MCF)



# Eligible Project Types and Approaches

## 1. Pasture-based management

- i. Conversion of a non-pasture livestock operation;
- ii. Increasing the amount of time livestock spend at pasture; and/or
- iii. Construction of a compost bedded pack barn.

## 2. Solid separation *in conjunction with:*

- a) Open solar drying;
- b) Closed solar drying;
- c) Forced evaporation with natural-gas fueled dryers;
- d) Daily spread;
- e) Solid Storage;
- f) Composting in vessel;
- g) Composting in aerated static pile;
- h) Composting in intensive windrows; or
- i) Composting in passive windrows.

## 3. Conversion from flush to scrape manure collection *in conjunction with one of (a) through (i).*

# Project Types Not Included in QM – Further Evaluation Needed

- Gasification and/or pyrolysis
  - Need to better understand and evaluate technology(ies)
  - GHG quantification challenges
  - Net energy balance
  - Potential criteria/toxics impacts
- Aerobic treatment & biological treatment
  - Broad range of potential technologies or practices
  - Need to evaluate specific practices
    - Effectiveness in reducing CH<sub>4</sub> emissions (measurements needed)
    - Required energy inputs
    - Potential impacts on nitrous oxide and ammonia

# Eligible Project Types and Approaches

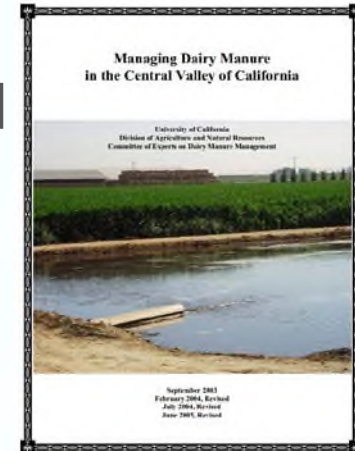
- **Default Factors**

1. % manure deposited on land and not collected

- Derived based on where cows spend their time
- Median values used from ranges available in 2003 UC Davis study
  - 20% for dairy cows in freestalls
  - 70% for dairy cows in open-lot corrals, dry cows and heifers
  - 90% for lactating dairy cows at pasture

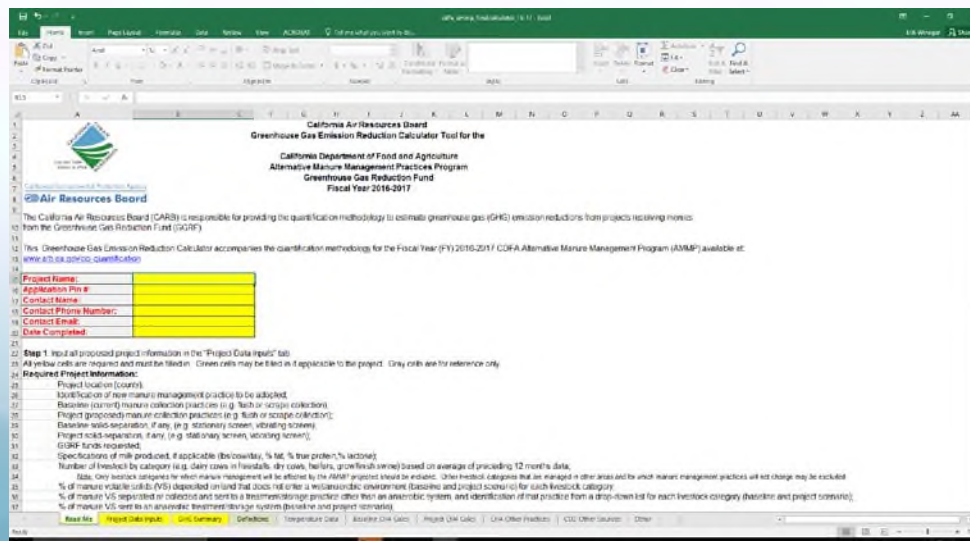
2. Solid separation efficiency defaults from Livestock Protocol

3. Scrape conversion default assumes milking parlors still flushed (90% scrape collection efficiency)



# AMMP GHG Calculator Tool

- User friendly
- Complex formulas built into Tool  
→ applicants only input project information
- Drop-down selections for most inputs
- Default values provided but allows flexibility for use of project specific factors when justified



# AMMP GHG Calculator Tool

## Input Proposed Project Information

<b>1. Project Location (county)</b>	Tulare
<b>2. New Practice to be Adopted</b>	2f - Solid separation with composting (in vessel)
<b>3a. Baseline Manure Collection</b>	Flush
<b>3b. Project Manure Collection</b>	Flush
<b>4a. Baseline Solid Separation</b>	Stationary Screen
<b>4b. Project Solid Separation</b>	Centrifuge
<b>5a. AMMP GGRF \$ Requested</b>	\$200,000.00
<b>5b. Total GGRF \$ Requested</b>	\$200,000.00
<b>6a. Milk Fat (%)</b>	4.00%
<b>6b. Milk true Protein (%)</b>	3.10%
<b>6c. Milk Lactose (%)</b>	4.70%
<b>6d. Milk Produced (lbs/cow/day)</b>	60
<b>ECM (kg milk/cow/day)</b>	27.55
<b>5 yr ECM (metric tons)</b>	75,483

# AMMP GHG Calculator Tool

Baseline Manure Management -- Enter data regarding management practices using averages of preceding 12 months

7. Identify livestock categories	8. Enter number of livestock by category (average of past 12 months)	9a. Enter % of manure volatile solids deposited on land and not entering wet/anaerobic environment Default	9b. Enter % manure VS separated prior to wet/anaerobic environment and sent to other treatment/storage Default	9c. (if applicable) Enter % VS sent to any other non-anaerobic treatment/storage	% of total manure VS entering anaerobic storage/treatment system (e.g. lagoon)
Lactating Dairy Cows (freestall)	1,500	20%	13.6%		66.4%
Cattle: dry cows	800	70%	5.1%		24.9%
Cattle: heifers (on feed)	400	70%	5.1%		24.9%
		pasture / dirt	composting - in vessel		

Identify current practice for separated solids

Identify other current treatment/storage practice

Energy Use Associated with Current Waste Management Practices

10. Electricity Consumed	MWh/yr	400
11a. Fuel Consumed	Diesel (Distillate No. 1 or 2, gal.)	700
11b. Fuel Consumed		
11c. Fuel Consumed		

\*Select Applicable Fuel(s) from List.

# AMMP GHG Calculator Tool

Project Manure Management -- Estimate Data Regarding Management Practices after Adoption of Alternative Practices					
Livestock categories	Number of livestock by category after adoption of new practices	12a. Enter % of manure volatile solids (VS) deposited on land and not entering wet/anaerobic environment Default ▾	12b. Enter % manure VS separated/collected and sent to other treatment/storage practice Default ▾	12c. (if applicable) Enter % VS sent to other non-anaerobic treatment/ storage practice	% of total manure VS entering anaerobic storage/treatment system (e.g. lagoon)
Lactating Dairy Cows (freestall)	1500	20.0%	40.0%		40.0%
Cattle: dry cows	800	70.0%	15.0%		15.0%
Cattle: heifers (on feed)	400	70.0%	15.0%		15.0%
		pasture / dirt	composting - in vessel		

Identify Other Post-Project Practice

## Projected Energy Usage after Adoption of Alternative Manure Mgmt. Practices

13. Electricity Consumed	MWh/yr	550
14a. Fuel Consumed	Diesel (Distillate No. 1 or 2, gal.)	1,100
14b. Fuel Consumed		
14c. Fuel Consumed		

\*Select Applicable Fuel(s) from List.

## 15. Description of Stationary and Mobile Sources associated with Manure Management Activities included in GHG Emission Calculations

Source Description	Fuel Type	Change in emissions relative to Baseline
Manure collection and transport equipment	Diesel (Distillate No. 1 or 2, gal.)	Increase



# AMMP GHG Calculator Tool

<b>Total Project GHG Emission Reductions over 5 years</b>	<b>Total Estimated Project GHG Reductions</b>	<b>16,414</b>	<b>mtCO2e</b>
<b>GHG reduction per \$ AMMP GGRF grant money requested over 5 years</b>	<b>GHG/(AMMP GGRF \$)</b>	<b>0.082</b>	<b>mtCO2e/\$ requested</b>
<b>GHG reduction per \$ Total GGRF grant money requested over 5 years</b>	<b>GHG/(Total GGRF \$)</b>	<b>0.082</b>	<b>mtCO2e/\$ requested</b>
<b>GHG reduction per unit energy-corrected milk over 5 years</b>	<b>GHG/ECM</b>	<b>0.22</b>	<b>mtCO2e/ mt ECM</b>
<b>GHG reduction per animal over 5 years</b>	<b>GHG/animal</b>	<b>6.08</b>	<b>mtCO2e/ animal</b>
Baseline CH4 emissions from anaerobic storage/treatment systems	BE_CH4 AS	8,447.12	mtCO2e/yr
Baseline CH4 emissions from non-anaerobic storage/treatment systems (including separated solids)	BE_CH4 NAS	128.18	mtCO2e/yr
Baseline CO2 emissions associated with current manure management practices	BE_CO2 other	128.86	mtCO2e/yr
<b>Total Annual Baseline GHG Emissions</b>	<b>BE_Total</b>	<b>8,704</b>	<b>mtCO2e/yr</b>
Project CH4 emissions from anaerobic storage/treatment systems	PE_CH4 EP	5,088.62	mtCO2e/yr
Project CH4 emissions from non-anaerobic storage/treatment systems (including separated solids)	PE_CH4 NAS	154.04	mtCO2e/yr
Project CO2 emissions associated with new manure management practices	PE_CO2	178.68	mtCO2e/yr
<b>Total Annual Project GHG Emissions</b>	<b>PE_Total</b>	<b>5,421</b>	<b>mtCO2e/yr</b>
<b>Total Annual Project GHG Emission Reductions</b>	<b>ER_Annual Total</b>	<b>3,283</b>	<b>mtCO2e/yr</b>

# Potential Areas of Improvement

- CARB is in process of contracting with the University of California for technical assistance to update the QM and GHG Calculator Tool
- Identified priority areas:
  1. Evaluation of default assumptions regarding manure deposited on land and not collected
  2. Review existing default factors for solid separation efficiency and recommend additional factors if possible

**Table C.6. Volatile Solids Removed Through Solids Separation**

Type of Solids Separation	Volatile Solids Removed (fraction)
Gravity	0.45
Mechanical:	
Stationary screen	0.17
Vibrating screen	0.15
Screw press	0.25
Centrifuge	0.50
Roller drum	0.25
Belt press/screen	0.50

# Potential Areas of Improvement

3. Evaluation of weeping wall solid separation systems
  - Refine volatile solid separation efficiency and methane conversion factor
  
4. Evaluation of additional manure management practices for potential inclusion in AMMP
  - Gasification and/or pyrolysis
  - Aerobic treatment (aeration/oxygenation)

# Process for Updating QM

- Opportunity to update AMMP QM for FY 2017-18
- Need peer-reviewed or Board-approved methods and data
- FY 2017-18 GGRF programs also on accelerated timeline
- Please send us suggestions and data for consideration in updating the AMMP QM and GHG Calculator Tool

# Contacts

- Quantification Methodologies and GHG Calculator Tools for GGRF programs available at: [www.arb.ca.gov/cci-quantification](http://www.arb.ca.gov/cci-quantification)

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