Pecos Valley Biomass Cooperative's Feasibility Study for Dry Lot Dairy Manure to Energy

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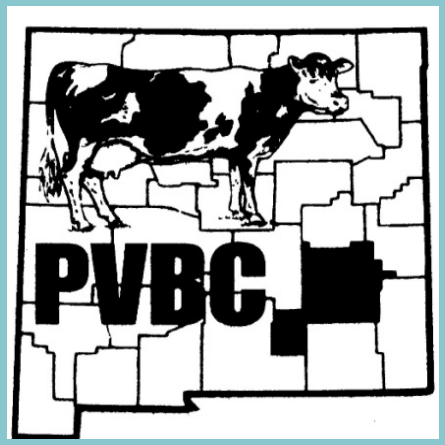
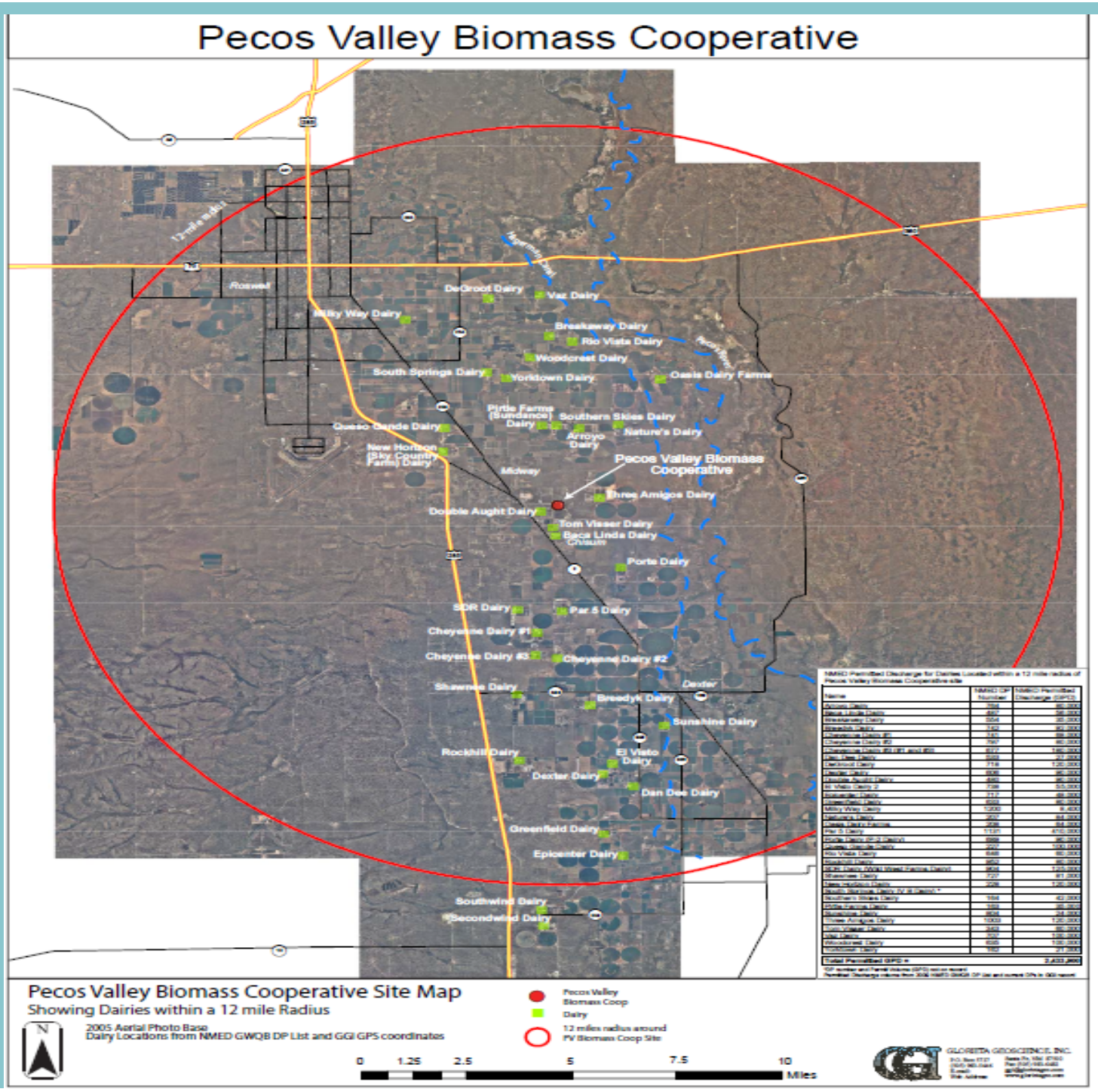


Renewable Energy
Education Field Day
October 26, 2011

Pecos Valley Biomass Cooperative



NMED Permitted Discharge for Dairies Located within a 12 mile radius of Pecos Valley Biomass Cooperative site

Name	NMED DP Number	NMED Permitted Discharge (GPD)
Acosta Dairy	764	60,000
Bosque Verde Dairy	1007	58,000
Breedyk Dairy	1064	60,000
Breedyk Dairy	743	60,000
Cheyenne Dairy #2	747	99,000
Cheyenne Dairy #3	797	60,000
Cheyenne Dairy #1 and #3	877	180,000
Dan Dee Dairy	1003	57,000
DeGroot Dairy	718	120,000
Dexter Dairy	808	60,000
Double Aught Dairy	1081	60,000
El Vista Dairy 2	738	55,000
Epicenter Dairy	717	60,000
Green Field Dairy	1003	60,000
Milky Way Dairy	1,200	9,400
Nakonia Dairy	1017	84,000
Oasis Dairy Farms	1036	84,000
Par 5 Dairy	1131	470,000
Pirtle Dairy (#2 Dairy)	1008	60,000
Queso Grande Dairy	1017	100,000
Rio Vista Dairy	648	60,000
Rockhill Dairy	1001	60,000
SDR Dairy (Mid West Farms Dairy)	1018	125,000
Shawnee Dairy	727	61,000
Sky Harbour Dairy	1036	120,000
South Springs Dairy (V.R Dairy) *		
Southern Skies Dairy	1164	42,000
Three Amigos Dairy	1003	120,000
Tom Visser Dairy	1003	60,000
Vaz Dairy	1017	120,000
Woodcrest Dairy	1035	120,000
Yorktown Dairy	1162	21,000
Total Permitted GPD =		2,403,400

*DP number and Permit Volume (GPD) not found
Permitted Discharge volume from 2006 NMED SWQB DP List and number DPs in GGI report

Pecos Valley Biomass Cooperative Site Map

Showing Dairies within a 12 mile Radius

2005 Aerial Photo Base
Dairy Locations from NMED GWQB DP List and GGI GPS coordinates

Pecos Valley Biomass Coop
Dairy
12 miles radius around PV Biomass Coop Site

0 1.25 2.5 5 7.5 10 Miles

GLORIETA GEOSCIENCE, INC.

Background

- NM = Dry lot dairies in hot arid conditions
- Traditional digestion has not been successful for this type of dairy production
- Pecos Valley Biomass Coop represents 23 dairies & 60,000 milking cows and was formed to identify suitable technologies
- DOE funding was provided to support completion of a comprehensive technical & economic feasibility study

Typical New Mexico Drylot Dairy

Feasibility Study Sampling

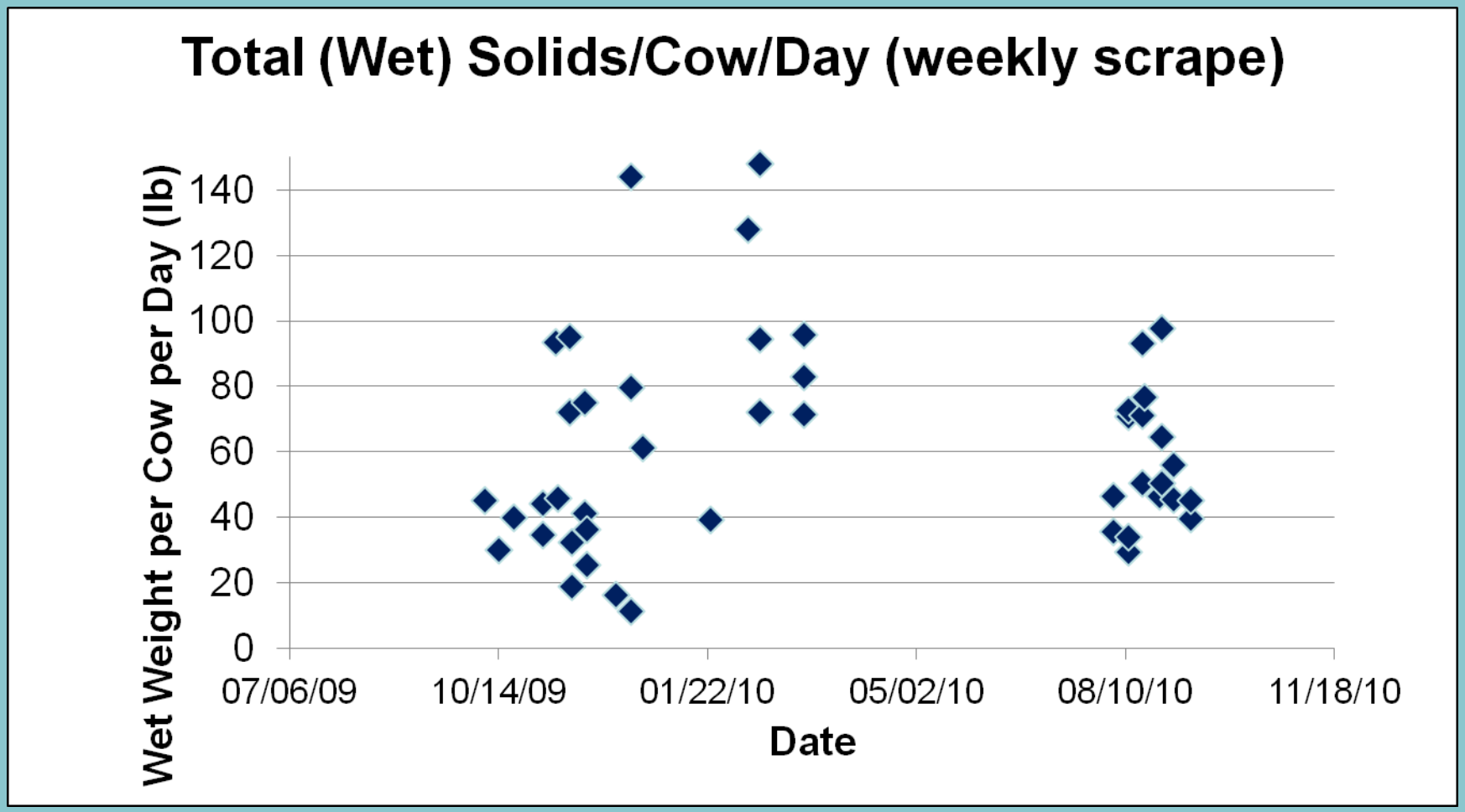
- Three different sample events to collect manure solids from 3 different sources:
  - Daily (feed apron) scrape
  - Weekly (whole corral area) scrape
  - Greenwater (milking parlor flush)
- Aug ‘09 – Mar ’10: 29 WS samples from 6 dairies (avg sample size = 46 tons)
- Aug ‘10 – Sep ‘10: 18 WS and DS samples, 3 dairies (avg size = 40 tons)
- Dec ‘10 – Mar ’11: 20 DS samples, 1 dairy, (avg sample size = 5.7 tons)

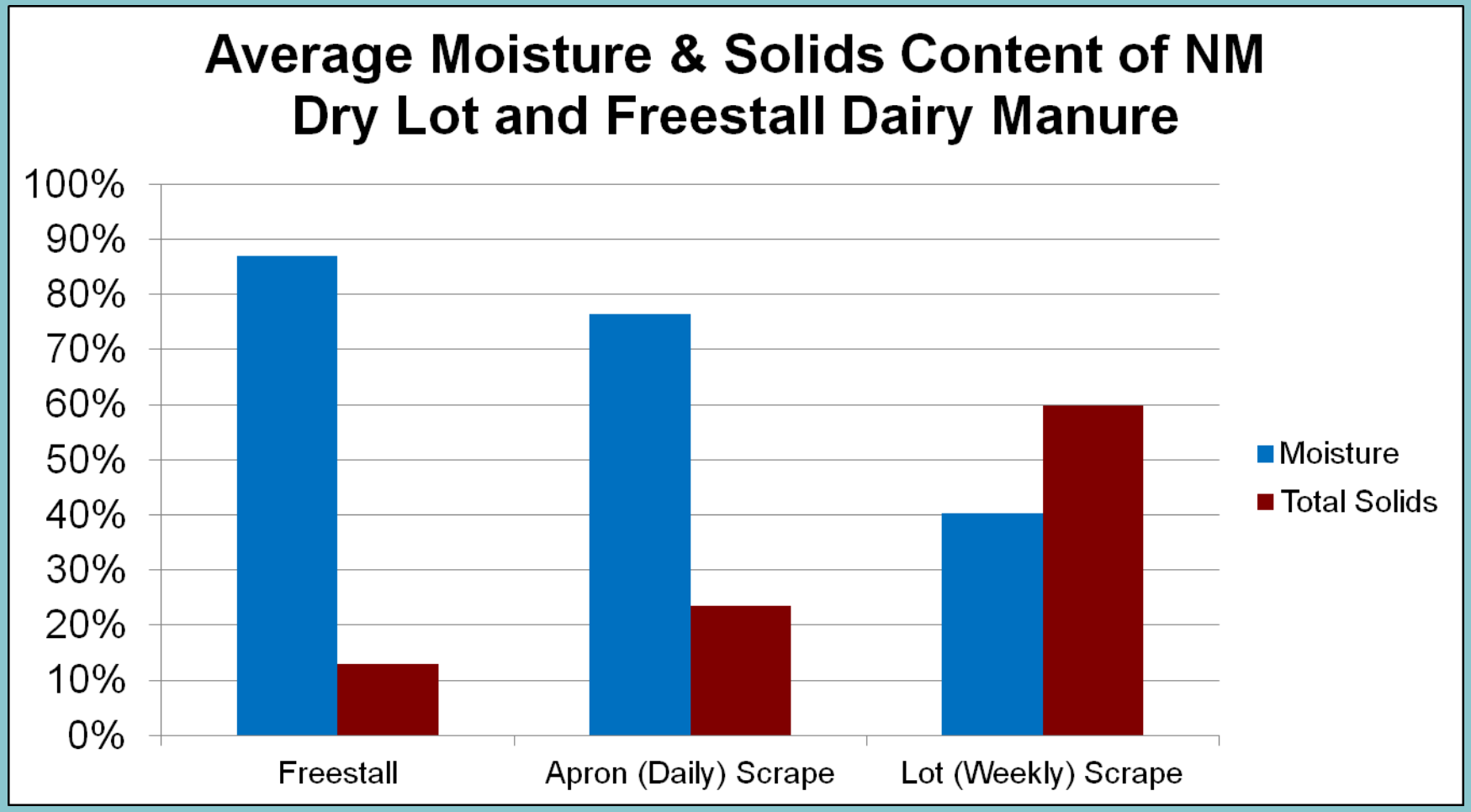
Sampling

Sampling

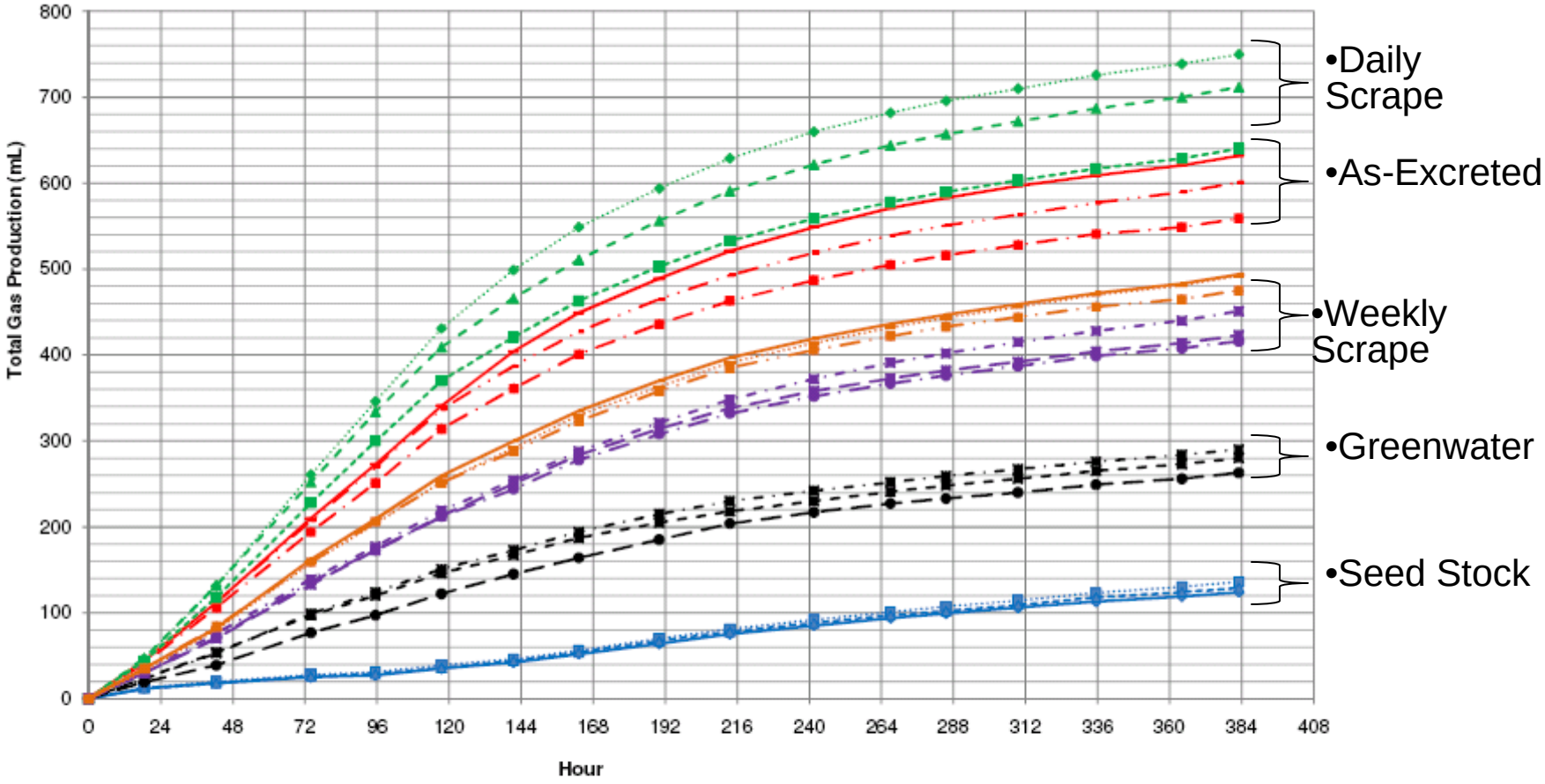
Sample Analysis

- Wet Chemistry (e.g. TS, VS, COD, BOD5, pH, N, P)
- Biomethane Production (BMP) potential
- Combustion (e.g. proximate/ultimate analysis, ash fusion temperature)

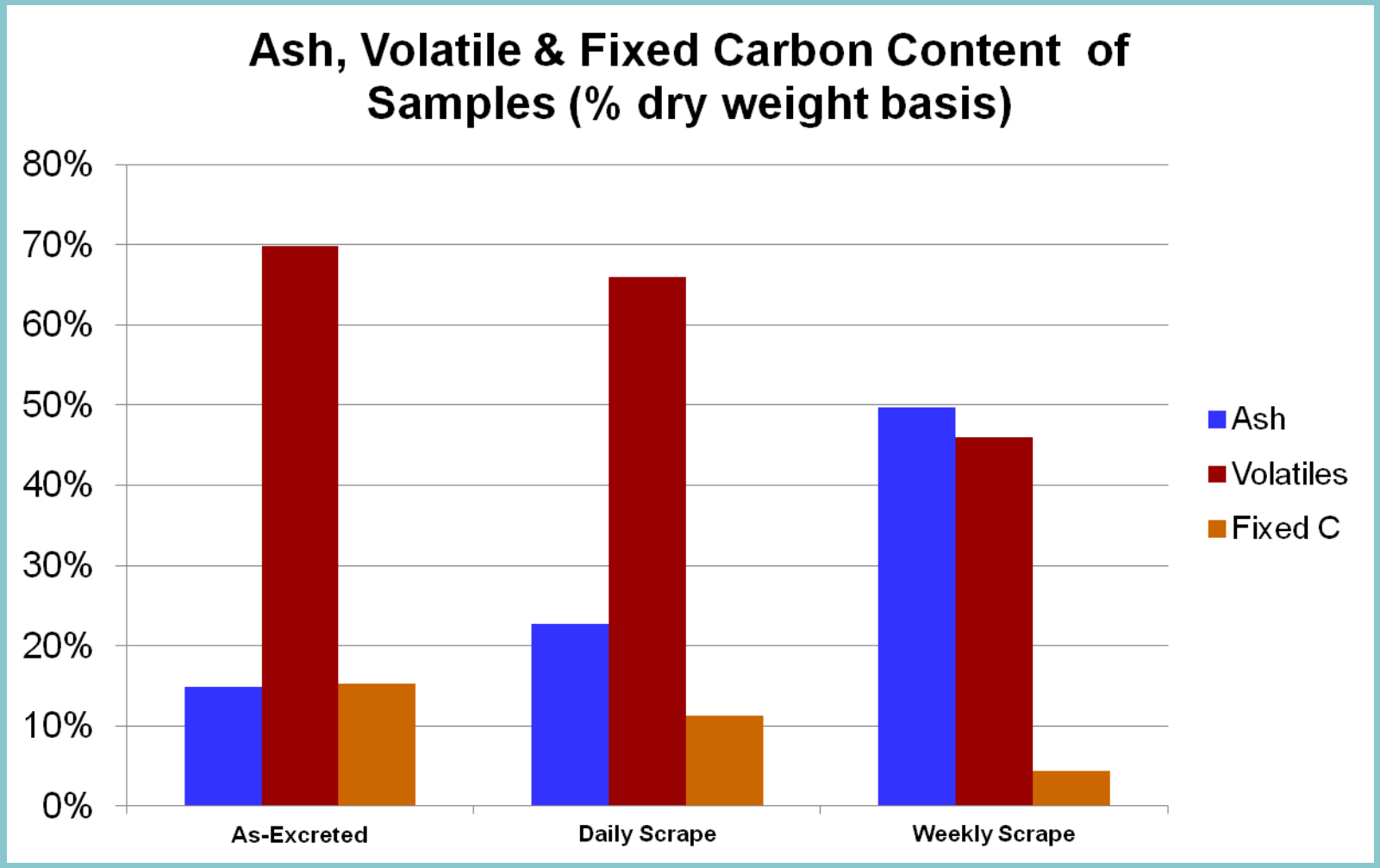

Total (Wet) Solids/Cow/Day (weekly scrape)
Wet Weight per Cow per Day (lb)
140
120
100
80
60
40
20
0
07/06/09
10/14/09
01/22/10
05/02/10
08/10/10
11/18/10
Date

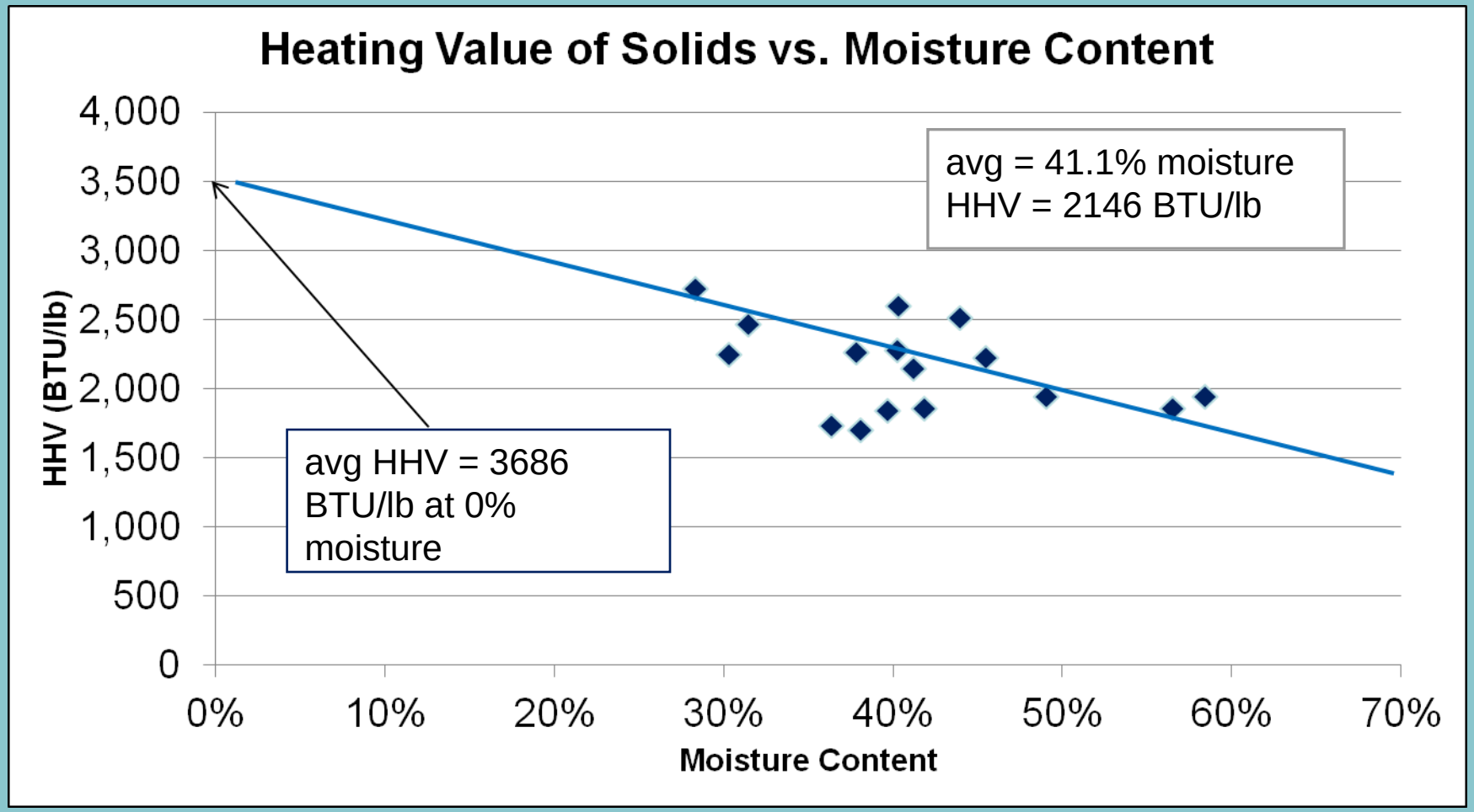

Average Moisture & Solids Content of NM Dry Lot and Freestall Dairy Manure
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Freestall
Apron (Daily) Scrape
Lot (Weekly) Scrape
Moisture
Total Solids

Sample Biomethane Potential (BMP) Testing Results



Average BMP for Weekly Scrape = 0.18 mL CH_4/mg VS loaded
Average BMP for Daily Scrape = 0.28 mL CH_4/mg VS loaded
Average BMP for As Excreted Manure = 0.32 mL CH_4/mg VS loaded


Ash, Volatile & Fixed Carbon Content of Samples (% dry weight basis)
80%
70%
60%
50%
40%
30%
20%
10%
0%
As-Excreted
Daily Scrape
Weekly Scrape
Ash
Volatiles
Fixed C

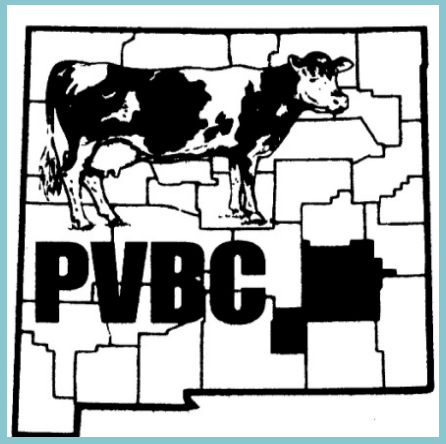

Heating Value of Solids vs. Moisture Content
HHV (BTU/lb)
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
0%
10%
20%
30%
40%
50%
60%
70%
Moisture Content
avg = 41.1% moisture
HHV = 2146 BTU/lb
avg HHV = 3686 BTU/lb at 0% moisture

Summary

- There is variation in quantity and quality of manure solids recovered between drylot dairies (attributed to variations in weather and dairy farm practices)
- The digestion potential of manure decreases over time as solids weather and are scraped/moved around the pen area

Summary – cont.

- Do not attempt to mix and digest all corral scrape solids
- Apron scrape manure solids (collected daily) have good digestion potential
- Corral scrape solids are not suitable for digestion unless inorganic fraction can be removed
- Drylot manure solids have combustion potential



Thanks to:

- Senator Jeff Bingaman
- US Department of Energy
- Mike McCloskey and Select Milk Producers, Inc.
- New Mexico Dairy Producers Association
- NMSU Dairy Extension