United States Environmental Protection Agency

Presentation at U.S. Environmental Protection Agency

Science Advisory Board Animal Feeding Operations Emissions Review Panel

For Purposes of Discussion at

March 14-16, 2012 Animal Feeding Operation Emission Review Panel Open Public Meeting

ADDITIONAL INFORMATION

Clean-out

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Selection of Clean-out Broiler Predictor Variables for NH_3

NAEMS Data Submitted to EPA:
328 Daily NH_3 emissions observations
13 candidate predictor variables

Decaking Dataset:
239 Daily NH_3 emissions observations
13 candidate predictor variables

Full Litter Removal Dataset:
89 Daily NH_3 emissions observations
13 candidate predictor variables

Number of Valid Non-Negative Daily Emissions Values for Litter Removal Periods

Litter Removal Activity	House	Count of Valid Non-negative Daily Emissions Values					
		NH_3	H_2S	PM_{10}	$PM_{2.5}$	TSP	VOC
Decaking	CA1B House 10	51	55	6	0	0	0
	CA1B House 12	48	52	4	0	0	0
	KY1B-1 House 5	58	57	11	19	20	47
	KY1B-2 House 3	82	67	45	45	41	56
	Total	**239**	**231**	**66**	**64**	**61**	**103**
Full Litter Clean-Out	CA1B House 10	30	23	9	0	0	0
	CA1B House 12	30	23	5	0	0	0
	KY1B-1 House 5	21	8	5	1	5	18
	KY1B-2 House 3	8	8	3	3	3	5
	Total	**89**	**62**	**22**	**4**	**8**	**23**

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Comparison of Days on Site for Litter Removal and Grow-out Period

House	Total Monitoring Days on Site	
	Litter Removal	Grow-Out
CA1B House 10	125	648
CA1B House 12	122	651
KY1B-1 House 5	87	307
KY1B-2 House 3	97	282
Total	**431**	**1,888**

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Comparison of Days on Sites for Decaking and Full Litter Clean-out

House	Total Monitoring Days on Site	
	Decaking	Full Litter Clean-Out
CA1B House 10	62	63
CA1B House 12	58	64
KY1B-1 House 5	62	25
KY1B-2 House 3	88	9
Total	**270**	**161**

EEMs for Broiler Clean-out Periods

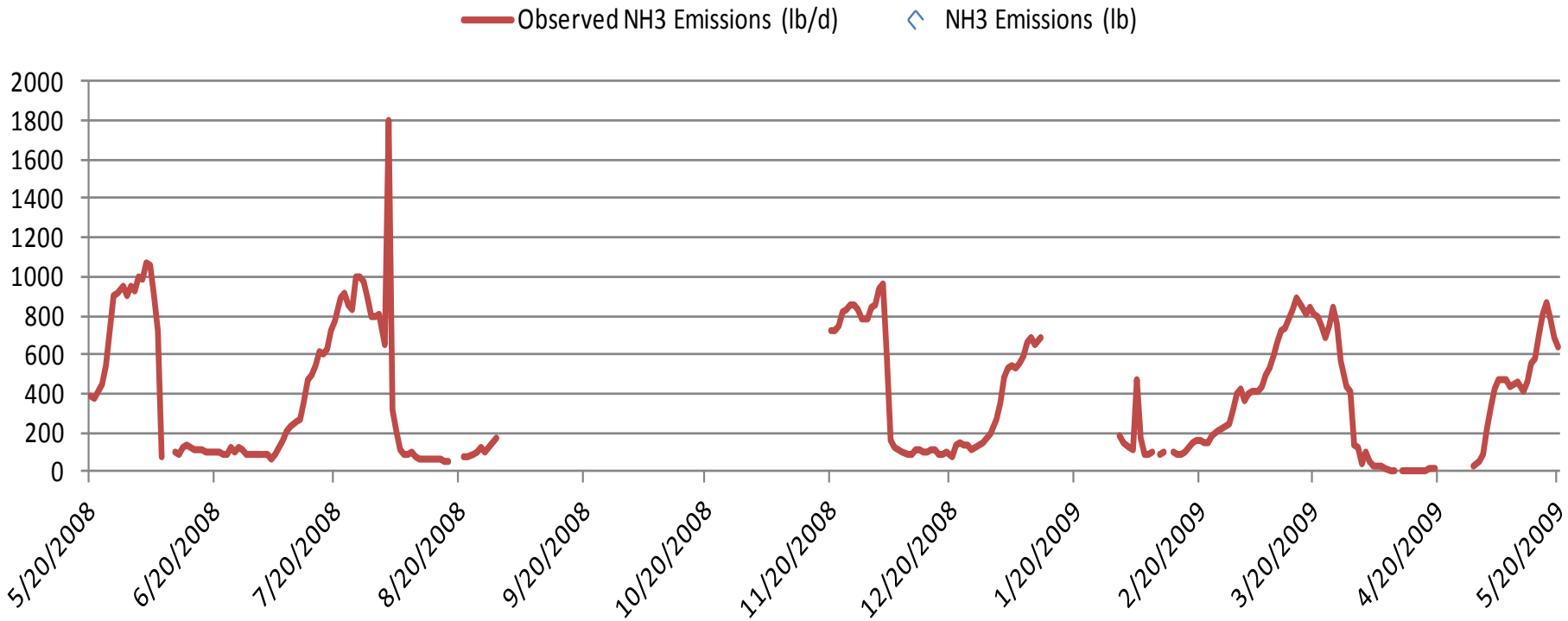
$$EF_{Weight-Day} = \frac{1}{n}\sum_{j=1}^{n}\left(\frac{[Total\ emissions]_j / [Number\ of\ days]_j}{[Total\ Weight]_j *}\right)$$

- where j indicates a unique litter removal period and n is the number of litter removal events (24 decaking and 12 full litter clean-out periods)

EEMs for Broiler Clean-out Periods

Flock No.	Cum. Bird Weight (1,000 kg)	Type of Litter Removal After Flock	Duration (days)	Emissions Factor (g pollutant/ kg bird-day)	NH_3 Emissions	
					(kg/ event)	(avg. kg/ d)
1	2,540	Decaking	8	0.006288	127.77	15.97
2	2,638	Decaking	10	0.006288	165.88	16.59
3	2,559	Decaking	7	0.006288	112.64	16.09
4	2,562	Decaking	9	0.006288	144.99	16.11
5	2,601	Full litter clean-out	13	0.003108	105.10	8.08
				Total annual emissions (kg) =	656.39	

Model Performance



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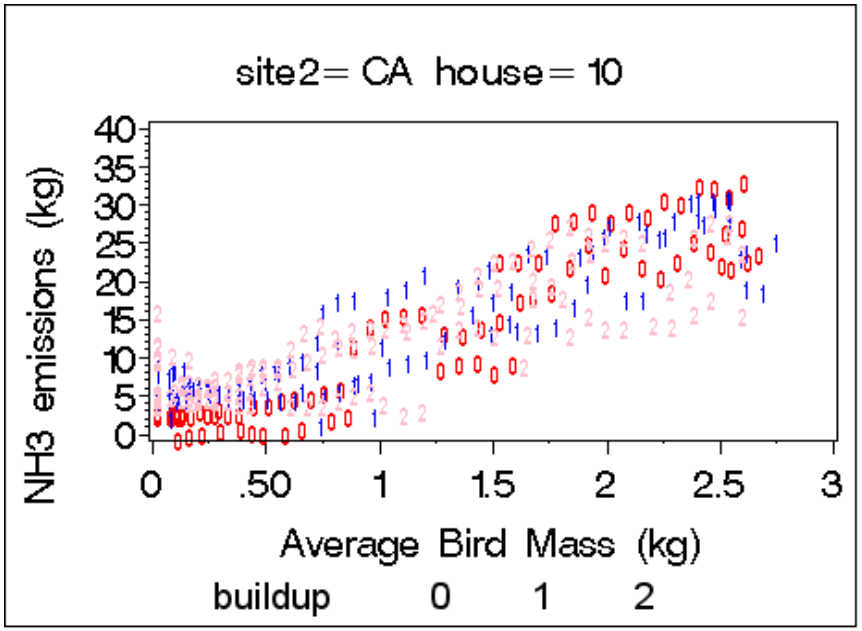
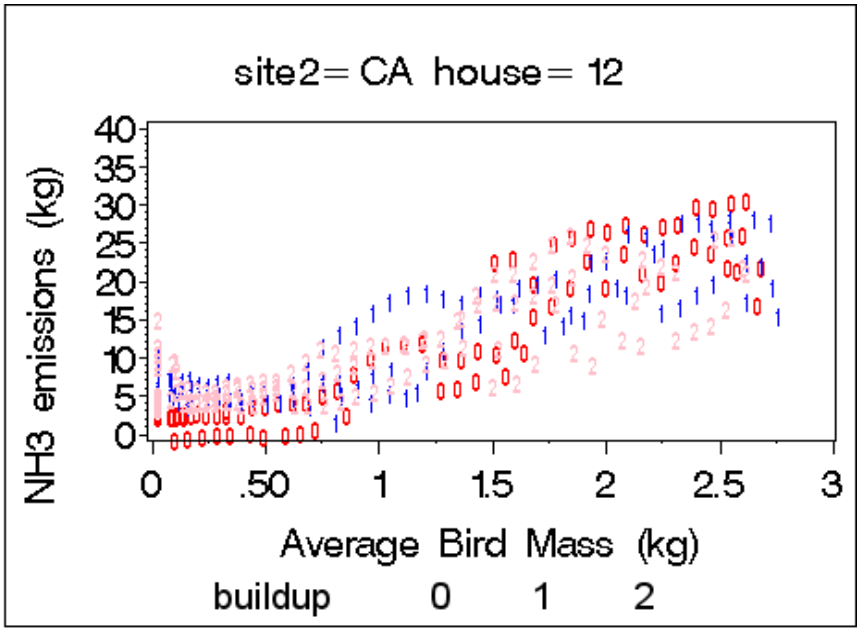
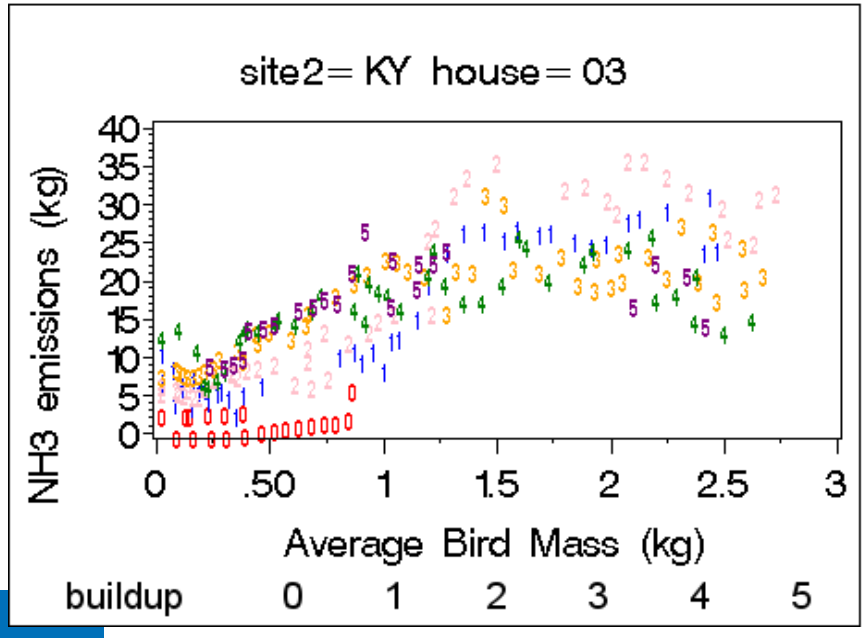
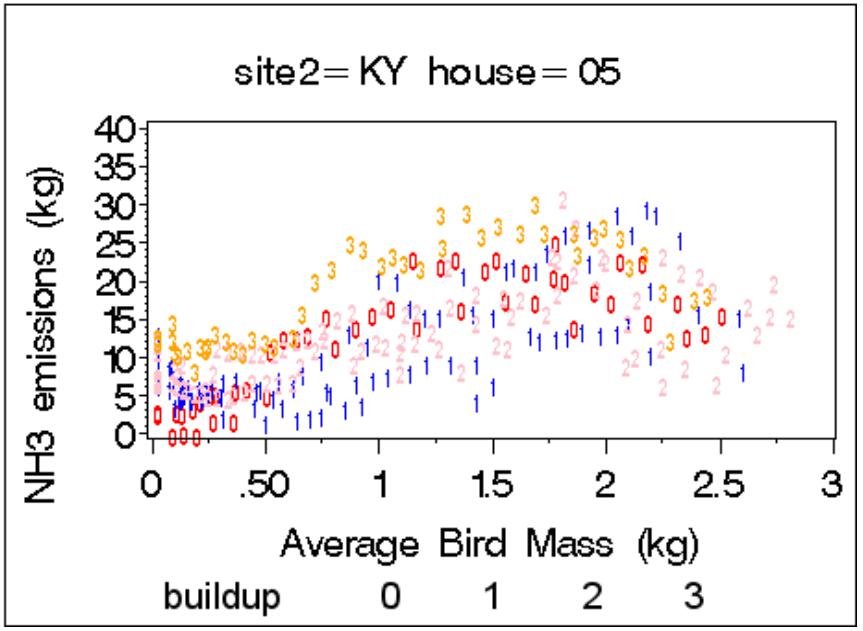
ADDITIONAL INFORMATION

Grow-out


site2= CA house= 10
NH3 emissions (kg)
0
5
10
15
20
25
30
35
40
0
.50
1
1.5
2
2.5
3
Average Bird Mass (kg)
buildup 0 1 2


site2= CA house= 12
NH3 emissions (kg)
0
5
10
15
20
25
30
35
40
0
.50
1
1.5
2
2.5
3
Average Bird Mass (kg)
buildup 0 1 2


site2= KY house= 03
NH3 emissions (kg)
0
5
10
15
20
25
30
35
40
0
.50
1
1.5
2
2.5
3
Average Bird Mass (kg)
buildup 0 1 2 3 4 5


site2= KY house= 05
NH3 emissions (kg)
0
5
10
15
20
25
30
35
40
0
.50
1
1.5
2
2.5
3
Average Bird Mass (kg)
buildup 0 1 2 3

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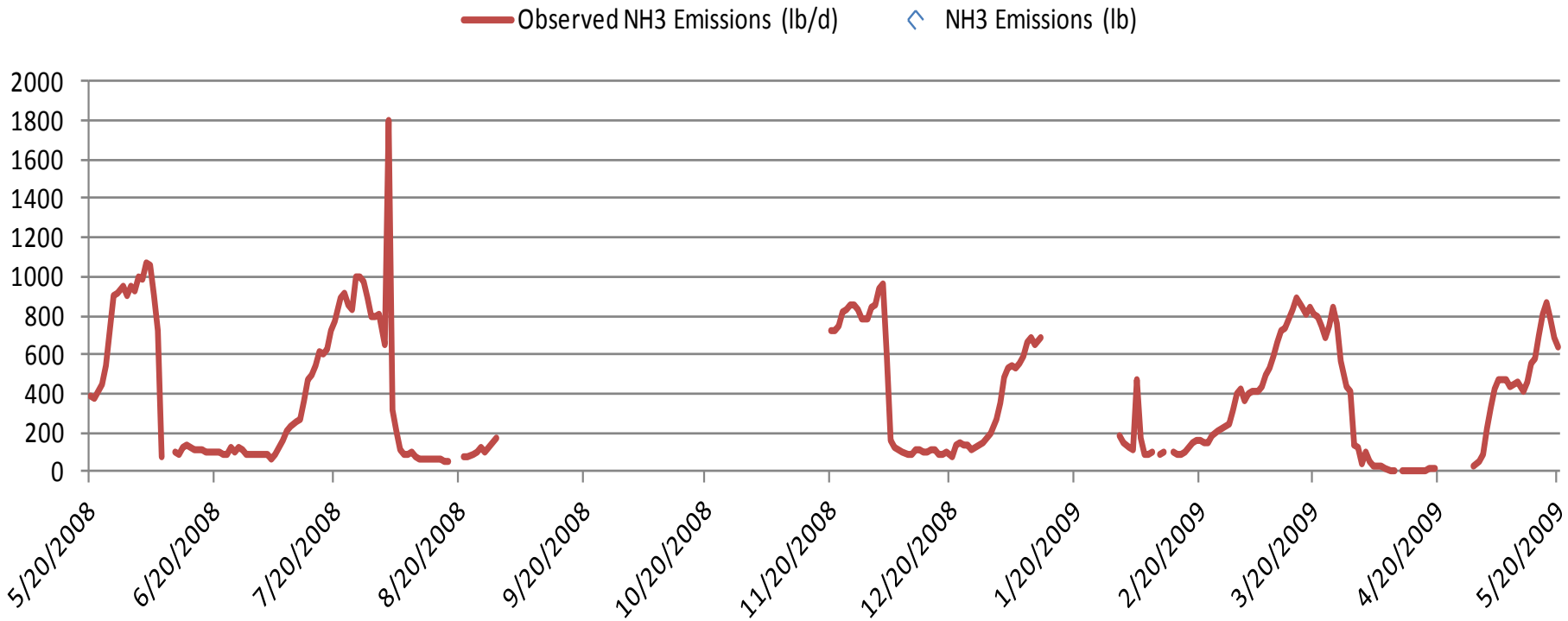
Candidate Mean Trend Variables (NH3)

EEM	Main Effects	Two-Way Interactions
I	*build, birds, avem, avem^2, avem^3*	*buildbirds, buildavem, buildavem^2, buildavem^3, birdsavem, birdsavem^2, birdsavem^3*
IA	Same as I EEM plus: *ta, ha, pa*	Same as I EEM plus: *buildta, buildha, buildpa, birdsta, birdsha, birdspa, avemta, avem^{2}ta, avem^{3}ta, avemha, avem^{2}ha, avem^{3}ha, avempa, avem^{2}pa, avem^{3}pa, taha, tapa, ha, pa*
IAC	Same as IA EEM plus: *tc, hc*	Same as IA EEM plus: *buildtc, buildhc, birdstc, birdshc, avemtc, avem^{2}tc, avem^{3}tc, avemhc, avem^{2}hc, avem^{3}hc, tatc, tahc, hatc, hahc, patc, pahc, tchc*

Model Performance



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Additional Lagoon Slides

ADDITIONAL MATERIAL

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Data limitations of Lagoon Liquid Parameters

- Dataset with farm and meteorological data (FA): 10,784
- Include just pH (FApH): 5,347
- Include just orp (FAorp): : 6,099
- Include just lagoon temperature (FAlt): : 6,158
- Include pH and orp (FApHorp): : 5,246
- Include pH and lagoon temp (FApHtl): : 5,256
- Include pH, orp, & lagoon temp (FAM): : 5,155

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Count of observations by site for each dataset

Animal	site	FA	FA-pH	FA-orp	FA-tl	FA-pH-orp	FA-pH-tl	FAM
Dairy	IN5A	2593	447	398	447	398	447	398
	WA5A	507						
	WI5A	312	2	23	37	2	2	2
sBG	IN4A	677	336	522	560	336	336	336
	NC4A	1193	1131	1178	1177	1131	1131	1131
	OK4A	1780	1307	1543	1543	1307	1307	1307
sGF	IA3A	1048						
	NC3A	1074	931	880	841	879	840	788
	OK3A	1600	1193	1555	1553	1193	1193	1193
ALL		**10784**	**5347**	**6099**	**6158**	**5246**	**5256**	**5155**

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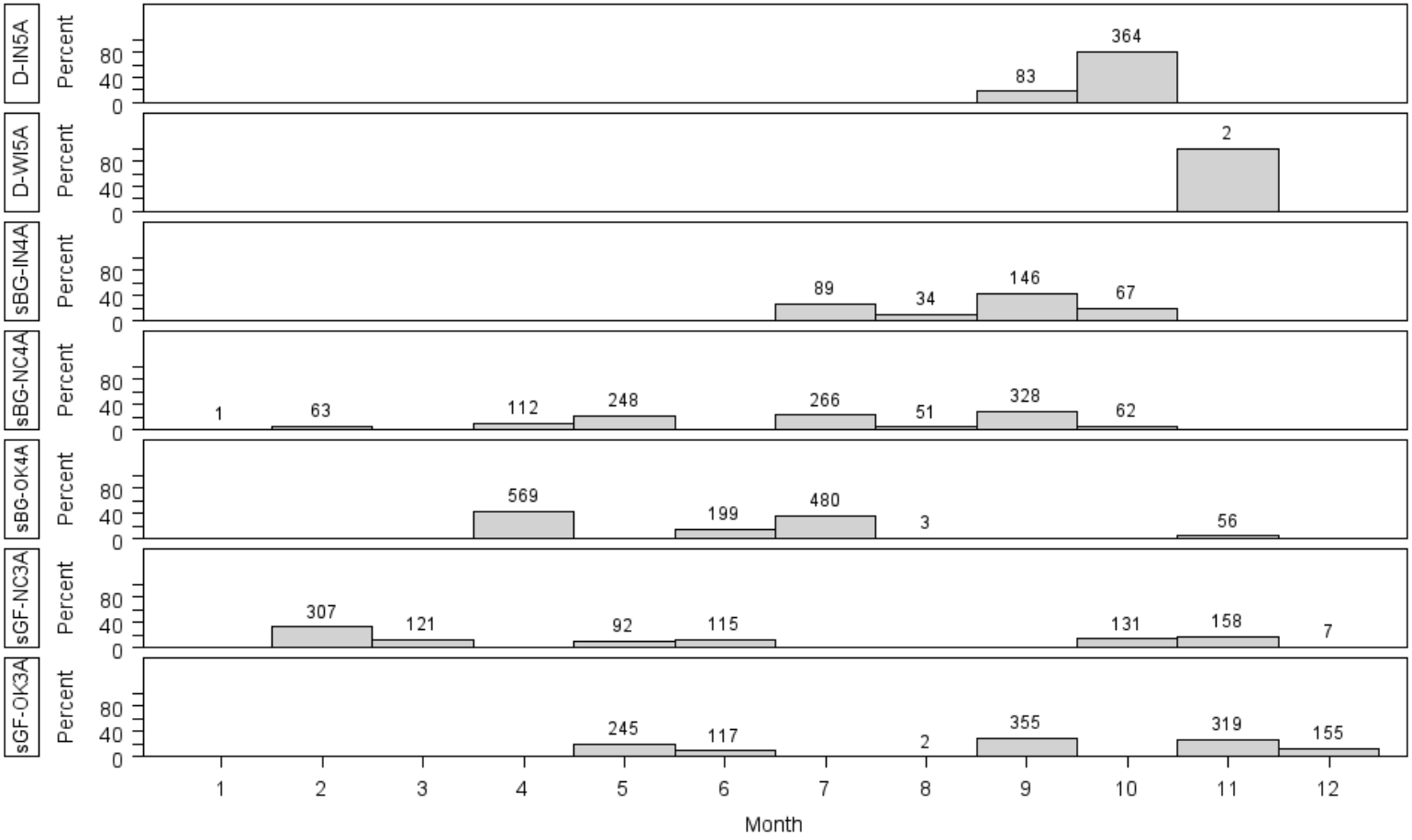
FA-pH



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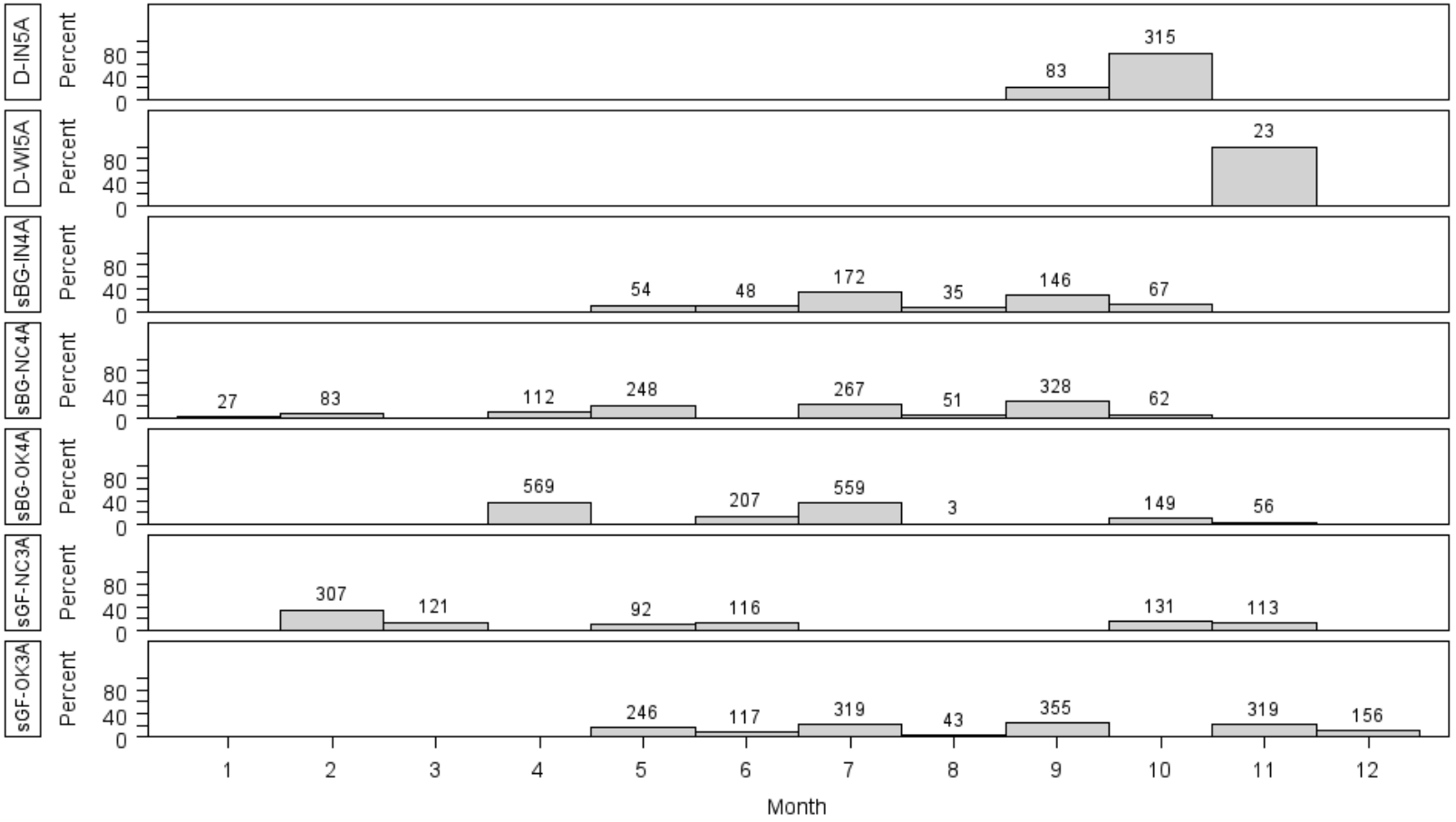
FA-orp



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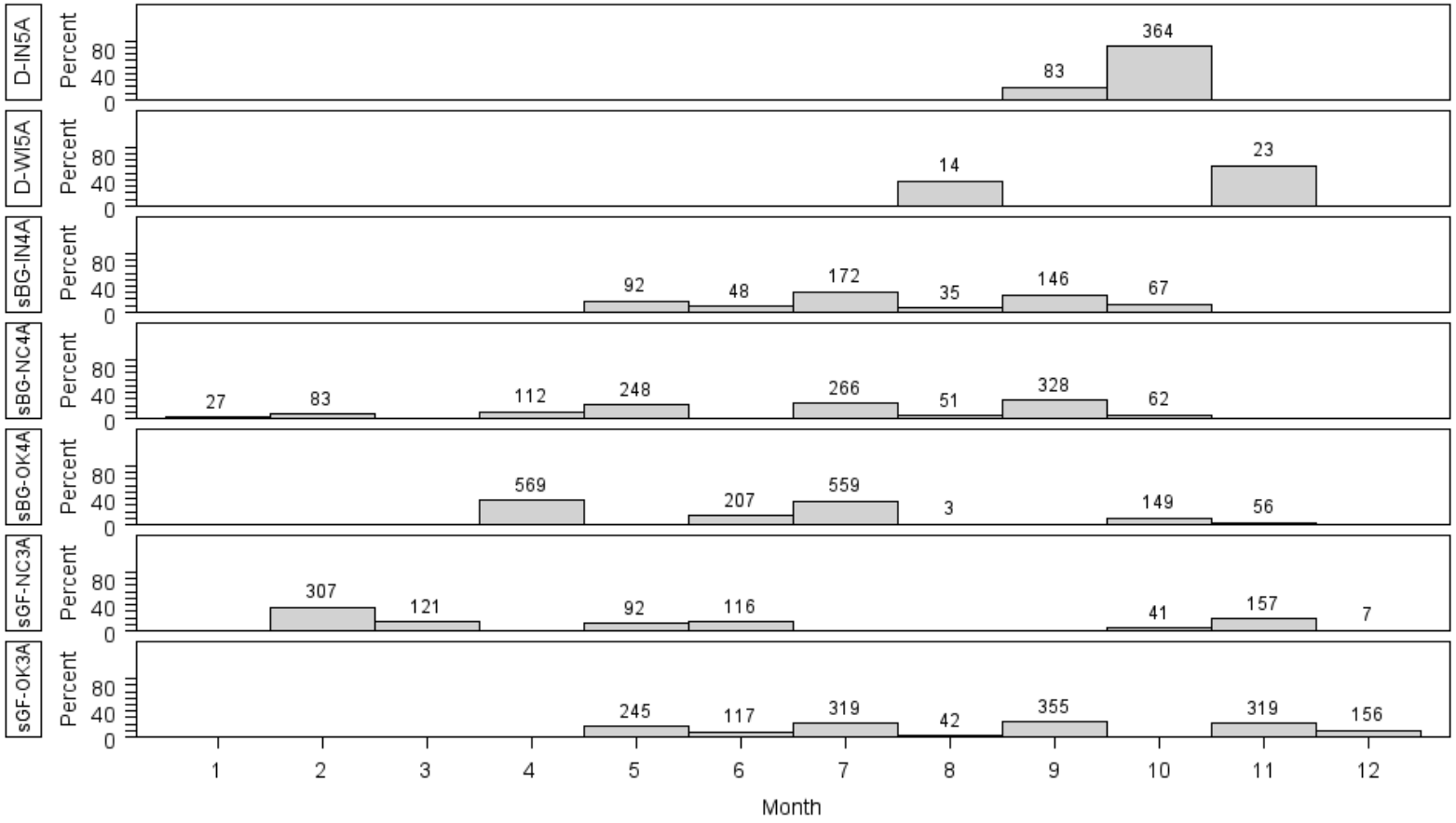
FA-tl



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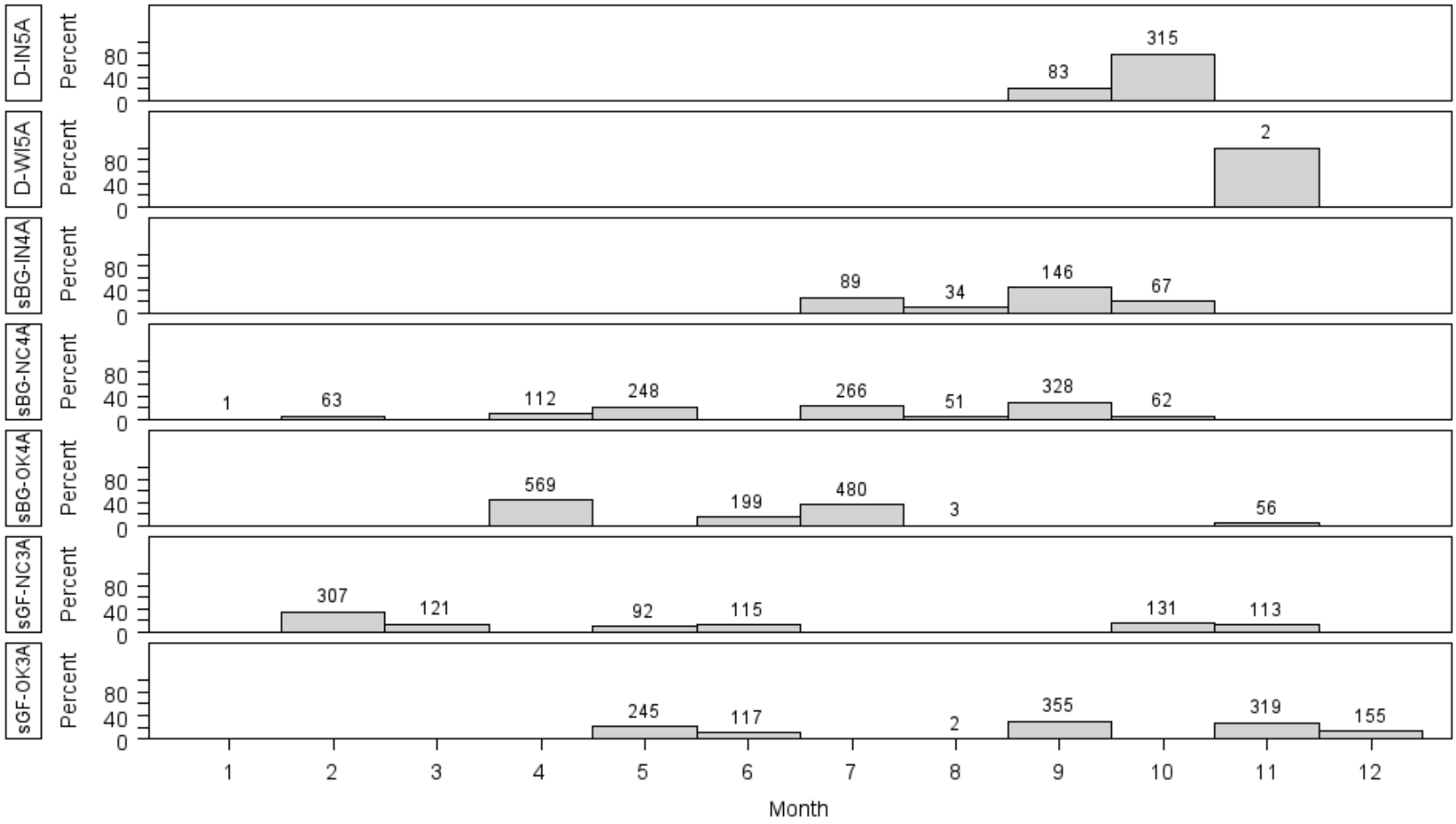
FA-pH-orp



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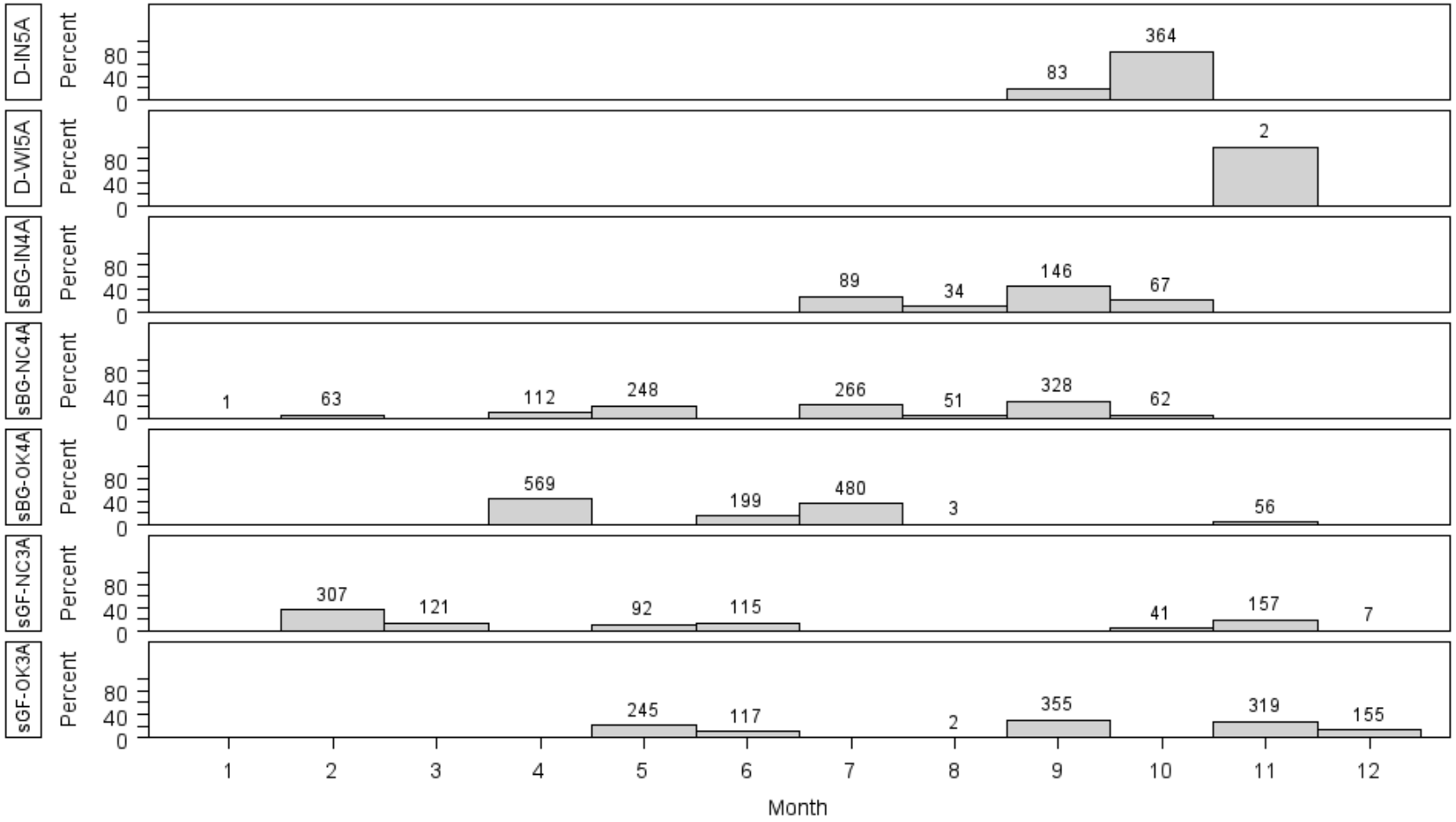
FA-ph-tl



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FAM