

Supplementary

# Ammonia Emissions from Differing Manure Storage Facilities at Two Midwestern Free-Stall Dairies

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**Table S1.** Producer activities at the IN dairy.

Measurement Period	Dates	Activity
Fall 2008	9 November–30 November 2008	Clean Settling Pit 20 September 2008 9:00 am–12:30 pm
		Clean Settling Pit 30 October 2008 10:00 am–1:00 pm
		Clean Settling Pit 28 November 2008 9:00am–1:00pm
Winter 2008-9	1 December 2008–28 February 2009	Clean Settling Pit 20 December 2008 11:00 am–2:30 pm
		Clean Settling Pit 30 January 2009 10:30 am–2:00 pm
Spring 2009	1 March–31 May 2009	Clean Settling Pit 6 March 2009 9:30 am–12:30 pm
		Clean Settling Pit 14 April 2009 10:00 am–1:00 pm
Summer 2009	1 June–17 August 2009	Clean Settling Pit 4 June 2009 9 am–12 pm
		Clean Settling Pit 16 July 2009 9 am–1 pm

**Table S2.** Producer activities at the WI dairy.

Measurement Period	Dates	Activity
Summer 2007	17 July–28 August 2007	Bedding wood shavings, No events
Fall 2007	12 November–29 November 2007	Bedding wood shavings, No events
Winter 2007-8	29 November–18 December 2007	Bedding wood shavings, No events
Spring 2008	22 April–13 May 2008	Bedding wood shavings, No events

Summer 2008	24 June–15 July 2008	Bedding wood shavings 15 July 2008: Modification of wastewater routing: Pumped water from solids separator system to sand separator with excess water from solids separator pumped to lagoon 1
Fall 2008	20 October–11 November 2008	28 October 2008: Bedding changed to Recycled Sand 30 October–31 October 2008: Lagoon 1 wastewater emptied into trucks. 25 November 2008: Bedding changed to sand
Winter 2008-9	17 December 2008–7 January 2009	Bedded sand Modification of wastewater routing: For entire period water was sucked from parlor flush system and unloaded on top of ice in lagoon 1 (buried pipe plugged).
Spring 2009	9 March–7 April 2009	9 March–15 March 2009: Modification of wastewater routing: Water was sucked from parlor flush system and unloaded on top of ice in lagoon 1. 16 March 2009: Bedding changed to a mix of sand and recycled sand 23 March 2009: Bedding changed to recycled sand 6 April–7 April 2009: Lagoons 1 and 2 wastewater emptied into trucks.

**Table S3.** Comparison of emission methods (modified from Grant et al, 2013).

Location	N	Cbg	VRPM Emission	bLS-VRPM		RPM'=f(bLS)	
		Mean	Mean	Mean	Slope	Offset	
	(1/2 h)	(ppm)	(g s <sup>-1</sup> )	(g s <sup>-1</sup> )	(%)		(g s <sup>-1</sup> )
WI	249	0.032	0.326	-0.038	-12	0.839	0.084
IN	2535	0.041	0.303	-0.048	-16	0.395	0.175

**Table S4.** Visual manure storage characteristics.

Period	Date, Appearance	
	Wisconsin	Indiana
Summer 2007	17,18,19 July 2007 – 75% Crust	
	6 August 2007 – 90% Crust	
	7,9,28 August 2007 – 95–100% Crust	
Fall 2007	13,14 November 2007 – No crust	
	27 November 2007 – Frozen/ 4" Liquid Foam	
	28,29 November 2007 – Frozen	
Winter 2007-8	17 December 2007 – Frozen	
	18 December 2007 – Frozen	
Spring 2008	24 April 2008 – No crust	
	12,13 May 2008 – 80–85% Crust	
Summer 2008	24 June 2008 – 100% Crust	
	25 June 2008 – 100% Crust	
	14,15 July 2008 – 100% Crust	

Fall 2008	21 October 2008—Empty 22 October 2008—Empty 11 November 2008—Frozen	11,16,24 September 2008—No Crust, 8,9,10,22,27,28 October 2008—No Crust, 19,20 November 2008—No Crust,
Winter 2008-9	17,18 December 2008—Frozen 6,7 January 2009—Frozen	9 December 2008—Frozen, 10 December 2008—90% Frozen 11,29,30 December 2008—Frozen 12,21,23,29 January 2009—Frozen 9 February 2009—Frozen 13 February 2009—40% Frozen 25 February 2009—Frozen
Spring 2009	9 March 2009—90% Frozen 10 March 2009—95% Frozen 6,7 April 2009—No crust	11 March 2009—No crust 7,8,16,30 April 2009—No crust 5,22 May 2009—No crust 26 May 2009—60% Scum 28 May 2009—40% Scum and foam
Summer 2009		9,15,16,23 June 2009—10–20% Crust 2 July 2009—5% Crust 8 July 2009—25% Crust 9,10,15,16,20 July 2009—5–10% Crust 22,23 July 2009—No Crust 12,18 August 2009—2–5% Crust

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