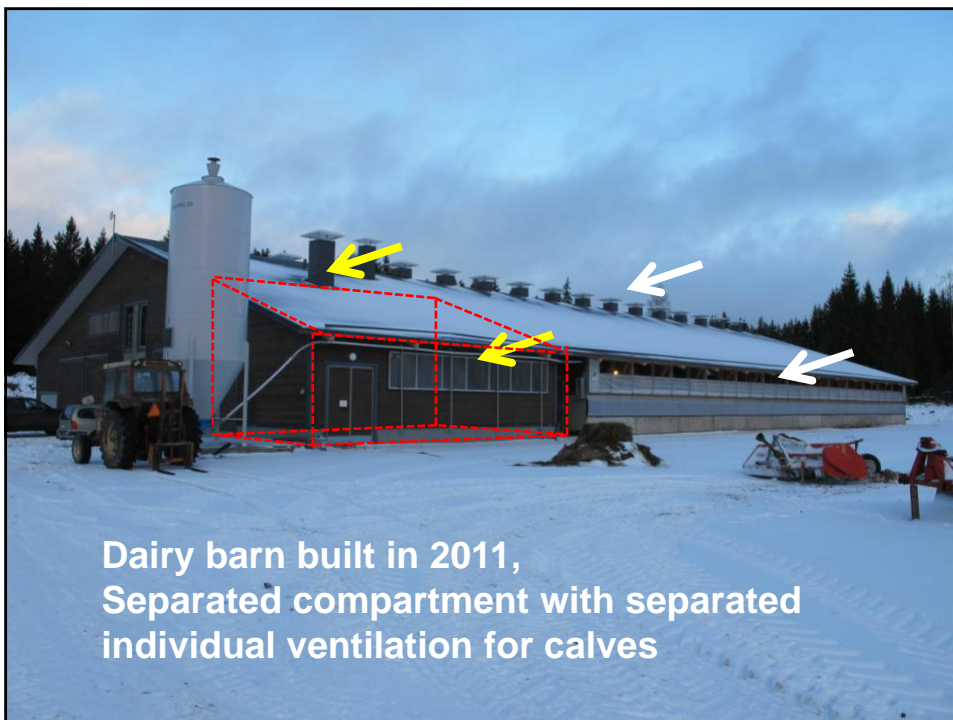




**Positive pressure tube ventilation
For calf barns**

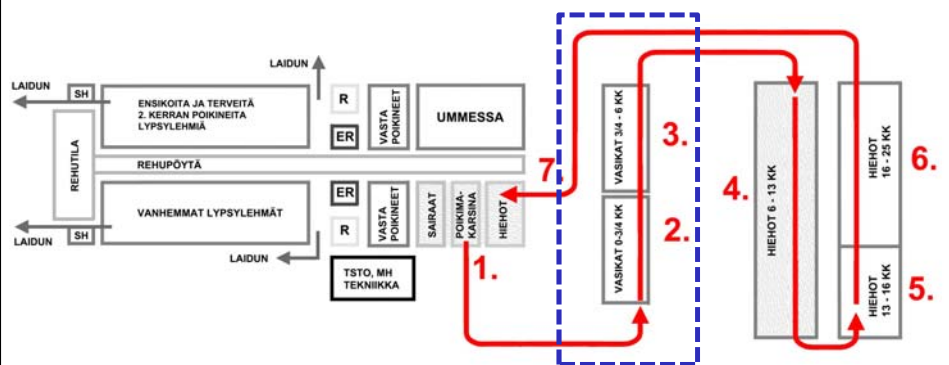
Tapani Kivinen
MTT
Agrifood Research Finland
Animal Production Research



Dairy barn built in 2011,
Separated compartment with separated
individual ventilation for calves



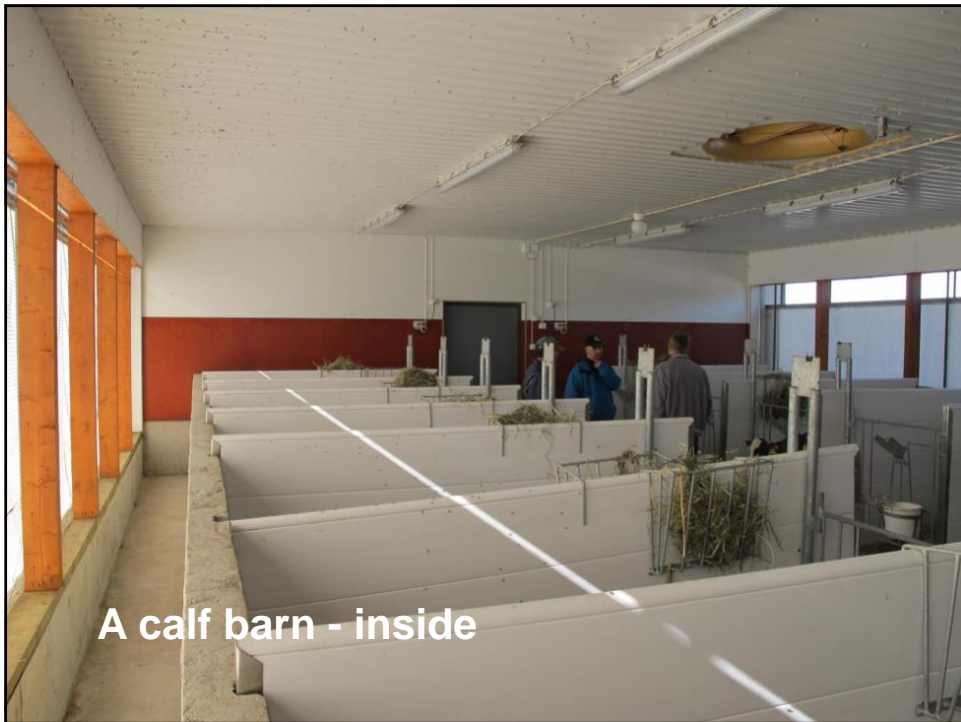
Today we recommend dairy producers to build
separate buildings for milking cows, calves and
heifers



Reason: disease prevention

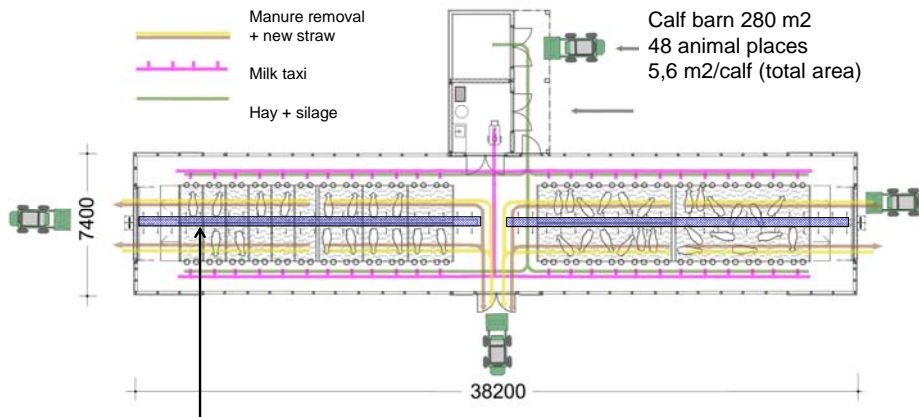


A calf barn - outside



A calf barn - inside

Simple and functional calf barn (expandable)



Positive pressure tube for blowing air into the barn

**Positive pressure means slight over pressure,
However it has no negative impact on constructions because
air escapes freely through curtains, chimneys, doors etc.**

**Precision air blow flushes
Standing unclean air away
From the boxes**





Tube system is aplicable in old barns, too.

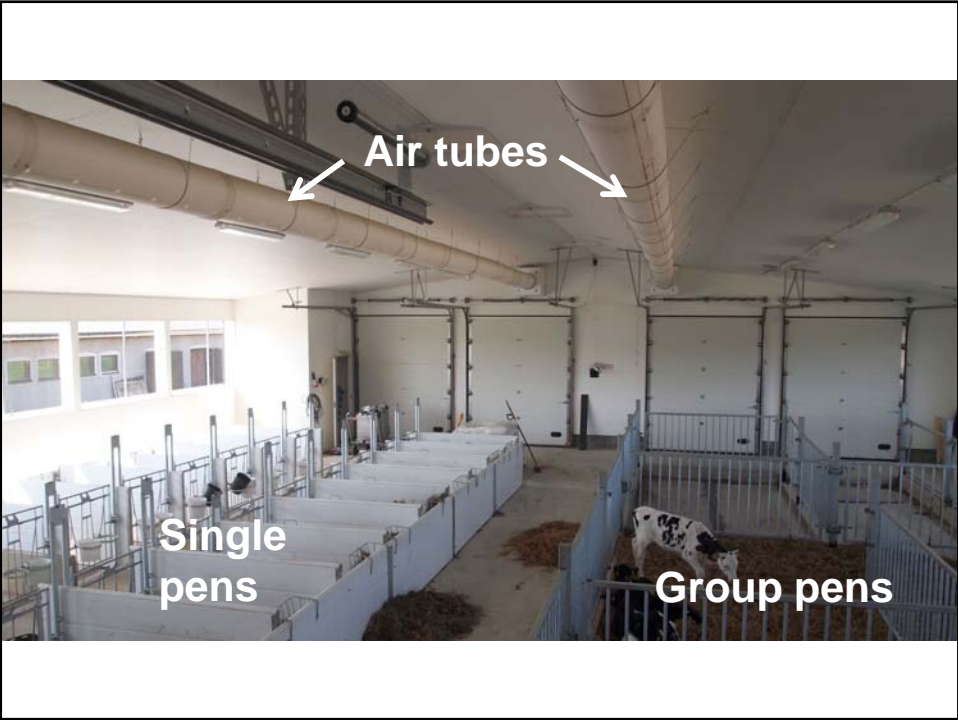


Tube system is aplicable in old barns, too.



A new calf barn in Middle Finland

Where measurements were done



Air tubes

Single pens

Group pens

Planning tool = excel based programm

Dimensions of barn		Fan sizing and selection	
Length	37.01 ft / 11.28 m	Min. ft ³ /min per animal	30 ft ³ /min / 0.014 m ³ /s
Width	20.00 ft / 6.10 m	Total cfm based on animal #	237 ft ³ /min / 0.112 m ³ /s
Minimal interior ht	7.00 ft / 2.13 m	Total cfm for 4 air changes/hr	419 ft ³ /min / 0.198 m ³ /s
Maximum interior ht	10.00 ft / 3.05 m	Volume of barn/animal	786 ft ³ /animal / 22.27 m ³ /animal
Interior volume of barn	6291 ft ³ / 178 m ³	Fan cfm rating at 0% H ₂ O	676 ft ³ /min per fan / 0.319 m ³ /s per fan
Maximum # of animals	8 head	Est. fan ft ³ /min at 0.15 % H ₂ O	575 ft ³ /min per fan / 0.271 m ³ /s per fan
Tube specifications & height		Aperture ratio, discharge coefficient, and static pressure	
Length of tube	36 ft / 10.98 m	Area, one "set" of holes	2.1 in ² / 13.6 cm ²
Diameter of tube	10.0 in / 25 cm	Number of "sets" of holes	33 sets
Proximal tube air speed	1053 ft/m / 5.35 m/s	Aperture ratio (a ² /A)	0.30
Length/diameter ratio	43	Discharge Coefficient C _{discharge}	0.62
Height, bottom of tube	8.0 ft / 2.44 m	Static Pressure	0.15 % H ₂ O / 36.7 Pascals
Air speeds		Spacing of perforated holes	
Target air speed	60 ft/m / 0.30 m/s	Hole intervals	13 in / 33 cm
Discharge speed from holes	1175 ft/m / 5.97 m/s	Clock position of Holes	
Diameter of holes		Expected throw distance to target air speed	
Row 1, hole diameter	1.25 in / 3.2 cm	Trajectory distance to target	Horizontal distance to target
Row 2, hole diameter	0.75 in / 1.9 cm	Height at target	Height at target
Row 3, hole diameter	0.75 in / 1.9 cm	Speed	Speed
Row 4, hole diameter	0.00 in / 0.0 cm	Expected throw distance, Metric	Expected throw distance, Metric
		Trajectory distance to target	Horizontal distance to target
		Height at target	Height at target
		Speed	Speed
		Expected throw distance, Metric	Expected throw distance, Metric
		Trajectory distance to target	Horizontal distance to target
		Height at target	Height at target
		Speed	Speed

Designed by Dr. Ken Nordlund et al. – University of Wisconsin USA

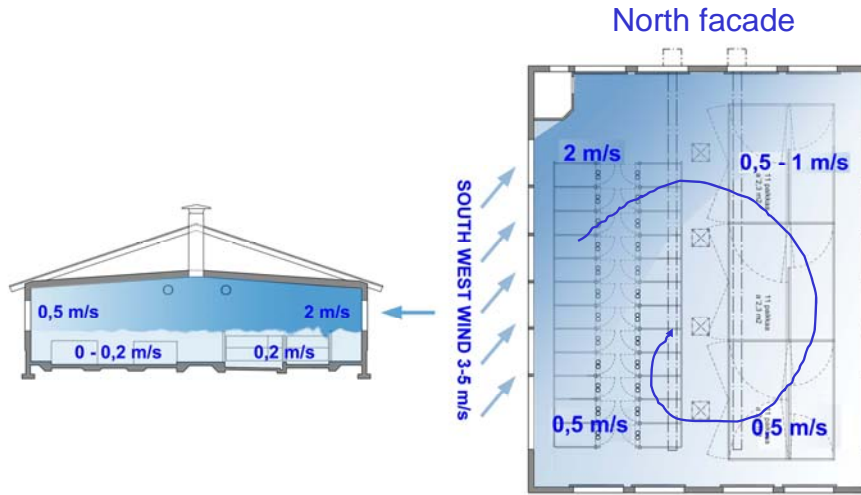
Using the "Positive Pressure Tube Calculator, Version 5.0" to design positive pressure tube ventilation systems for calf barns

Ken Nordlund, DVM, Arturo Gomez, DVM, Tom Bennett, BS, Rebecca Brotzman, DVM
 School of Veterinary Medicine
 University of Wisconsin-Madison
 Madison, WI 53706

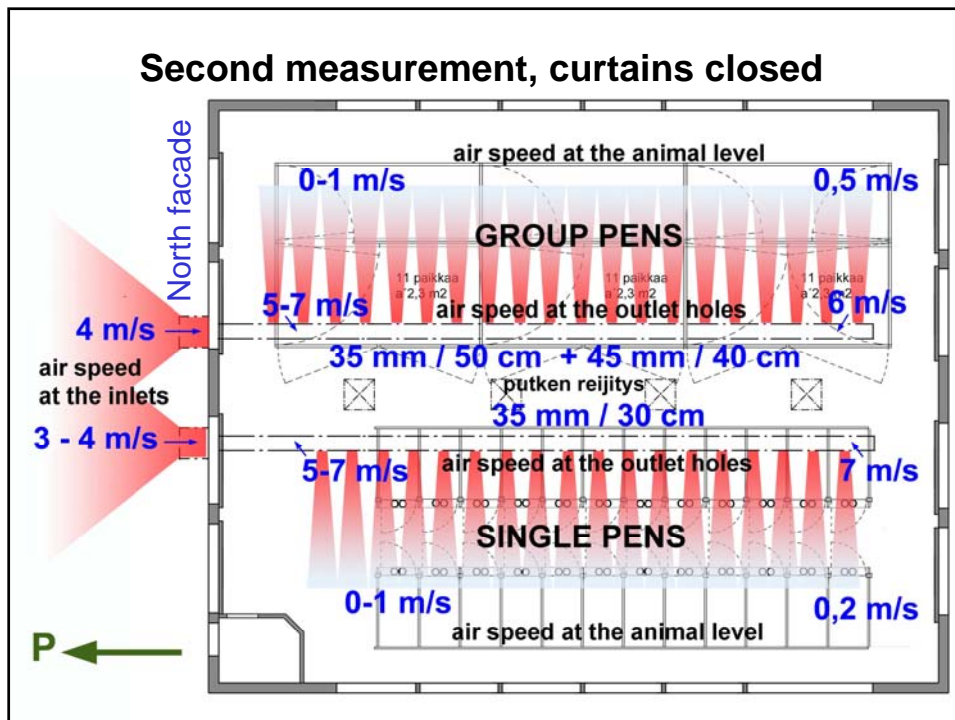
INTRODUCTION

This paper supports the Excel spreadsheet "Positive Pressure Tube Calculator, Version 5.0." Developed in 2011 and modified in 2012, the spreadsheet is used in the design of new positive pressure tube systems for calf barns. It can also be useful for the analysis of the performance of existing systems. The calculator is also useful for the design of tube systems for use in heifer and adult cattle environments, providing heat abatement and ventilation with fresh air. The scope of this paper will focus on the design of calf barn systems, followed by a discussion on the analysis of existing systems.

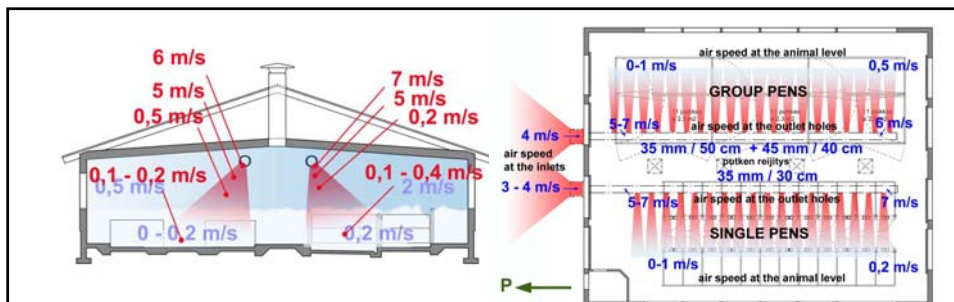
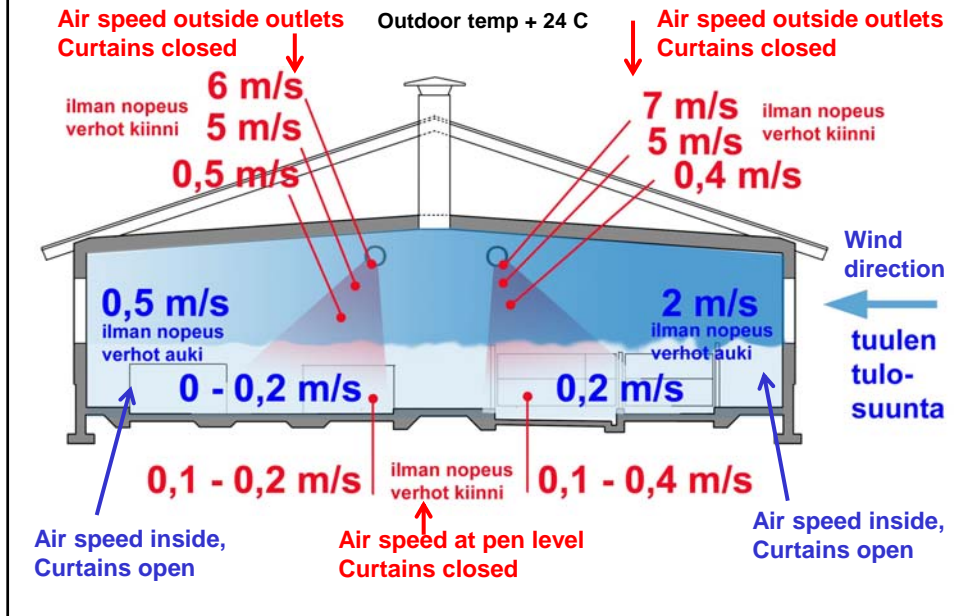
First measurement, curtains open



Second measurement, curtains closed



Second measurement, curtains closed

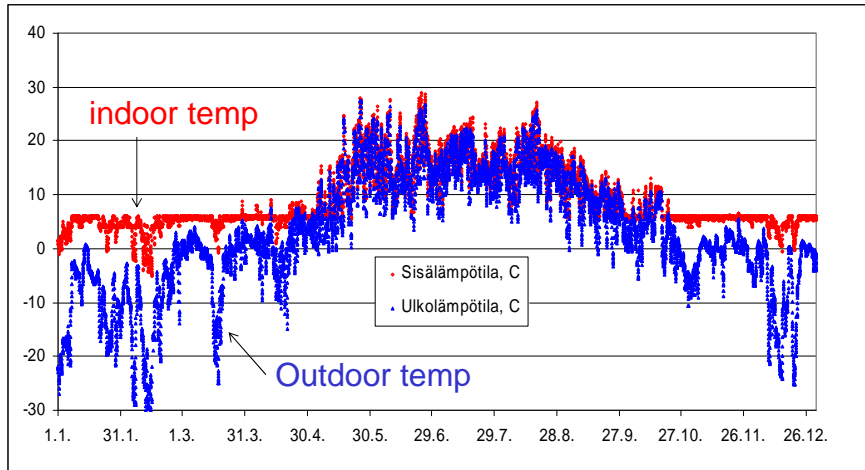


Positive pressure tube ventilation performance

Spatial volume is 1020 m³ (15 x 20 x 3,4 m)
Blown air quantity is 1900 m³ per hour
This is equivalent to 1,9 (2) changes per hour
No harmful draught on animal level

This can be considered as sufficient basic ventilation rate!
When the target is to flush the boxes at animal level!
(in winter, curtains closed)
(in summer, no wind)

Typical outdoor and indoor temperatures (hour by hour) in natural ventilated curtain barn for 120 dairy cows in Finland
 (measurements and simulation 2011 by VTT & MTT)



Air exchange rate and outdoor temperature in naturally ventilated dairy barn with curtains

(measurements and simulation 2011 by VTT & MTT)

