AWI Breech Strike R&D Technical Update
Maritime Museum, Sydney
12th July 2016

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Steinfort AgVet Pty Ltd

Liquid Nitrogen Process

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A review of the Liquid Nitrogen Process

By Dr John Steinfort BVSc
Steinfort Agvet Pty Ltd
Sponorship with AWI

July 2016
3/15 June Court Warragul Vic

Innovative technologies and processes for livestock for the 21st Century
Partnership
Animal welfare and managing animals

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The results of the Liquid Nitrogen process conducted on weaners

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A review of the Liquid Nitrogen Process

Liquid Nitrogen Uses

1. Metal Industry … metallurgy/ shrinkage/clearing of blockages
2. Medical and veterinary fields… Cryogenics, pathology, AI ET, genetics, skin surgery and cryosurgery

OH&S requirements are:

- Adequate ventilation
- Personal protective gear

Appropriate suitability for wide logistical distribution and handling

A review of the Liquid Nitrogen Process

Cryosurgery

1. Closed wound
2. Neural and vascular disruption
3. Initial bruise
4. Swelling
5. Contraction
6. Rejection
7. Lineal scar
8. Skin tightening

Open Wounds

1. Open wound
2. Initial exudation
3. Granulation
4. Epithelialisation
5. Lineal or star scar formation
6. Skin tightening

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Differences between primary, secondary and tertiary “burns”
Tertiary skin burns (whole depth) less painful

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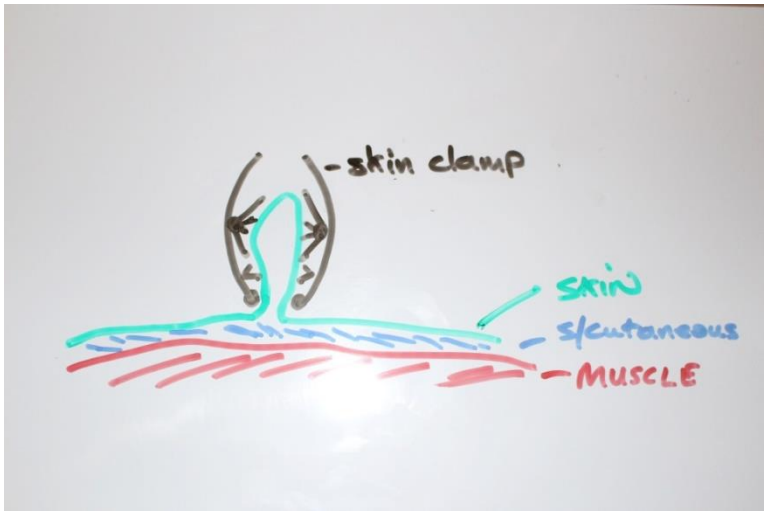
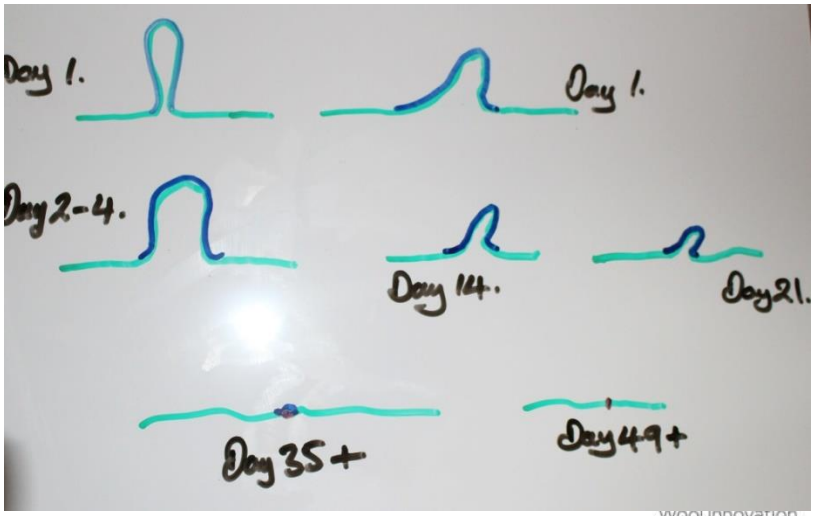
Liquid nitrogen processes requirements & how it works

- Liquid Nitrogen Process results in a closed wound with slow effective healing
- Resultant skin reduction depends upon the thoroughness of skin freeze (a variable seen in trials) and the amount of skin tenting at application.
- Anatomical skin application areas are similar to surgical mulesing.
- Specific cradle design– enables good access to skin wrinkles.

- An initial scoping welfare assessment was undertaken by Dr Ian Colditz & Dr Alison Small CSIRO, conclusion … minimal impact
- Detailed welfare study with CSIRO underway



Liquid nitrogen application process



Liquid nitrogen process healing stages

Liquid nitrogen process developments 2013

Liquid Nitrogen Process (LN P)… processes are being engineered and designed to reduce tail and breech wrinkles with bare skin around the tail edges and tip and are designed to have minimal animal impact.

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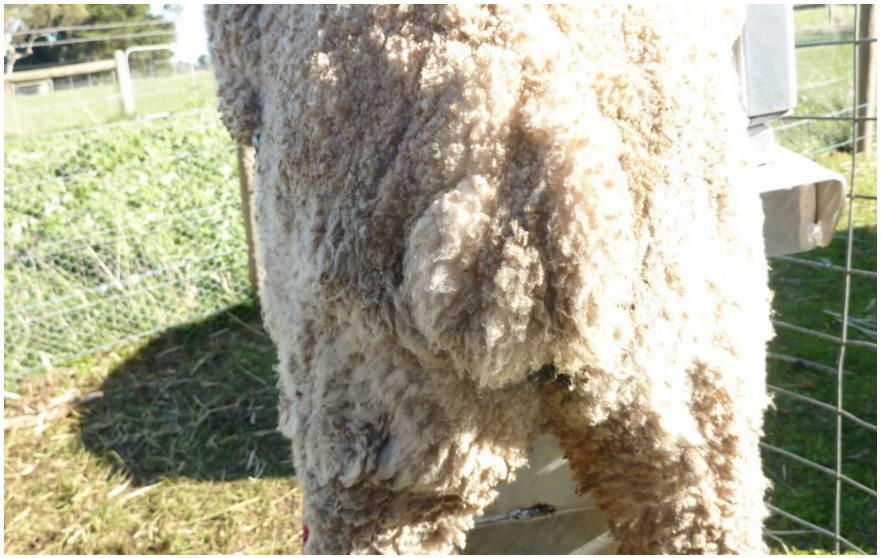
Weaners



Images taken prior to Liquid N Process

35 days post LN Process (freshly crutched)

Central weaner LN Px … others are controls

Liquid nitrogen process “commercial” trial April 2015

Source: AWI

Post treatment:

Tail and breech wrinkles frozen, thaws quickly

Preliminary welfare assessment encouraging

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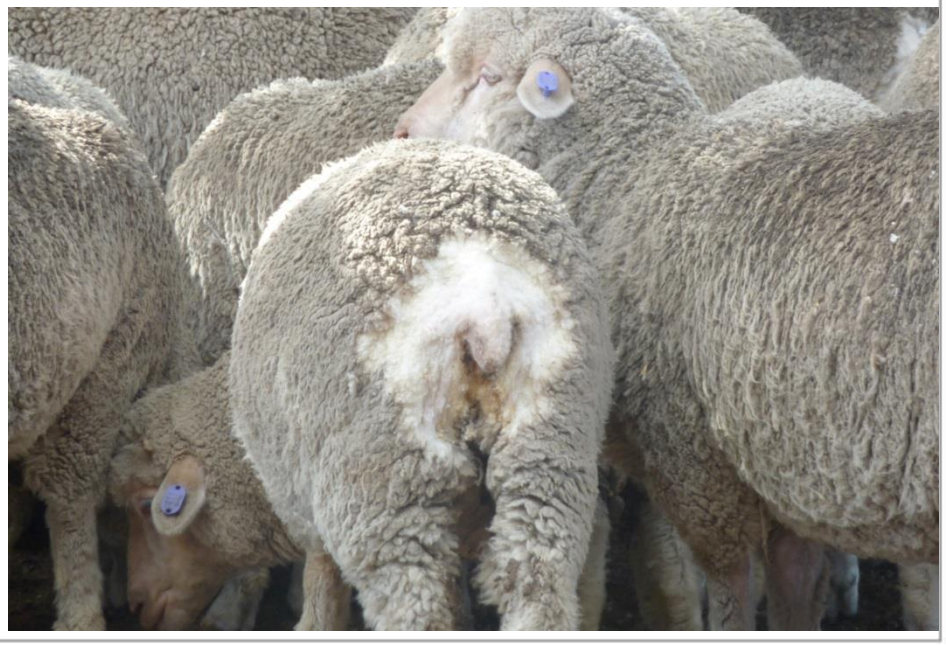
Liquid nitrogen process proof of concept trial

Trial measurements taken:

- Tail and breech wrinkle score reduction
- Breech stretch
- Dag score differences
- Tail skin width
- Bare skin at tail margins



Case Study Stage 1 trial

12 Control
36 Liquid Nitrogen

After 4 months: LN treated animals compared to controls

Tail wrinkle	1.9 Score Lower
Breech wrinkle	1.4 Score Lower
Dag	1.4 Score Lower

Average Scores LNP treated day 0 to 4 mths

Tail wrinkle	3.4 to 1.4
Breech wrinkle	2.6 to 1.2
Dags	2.6 to 1.2

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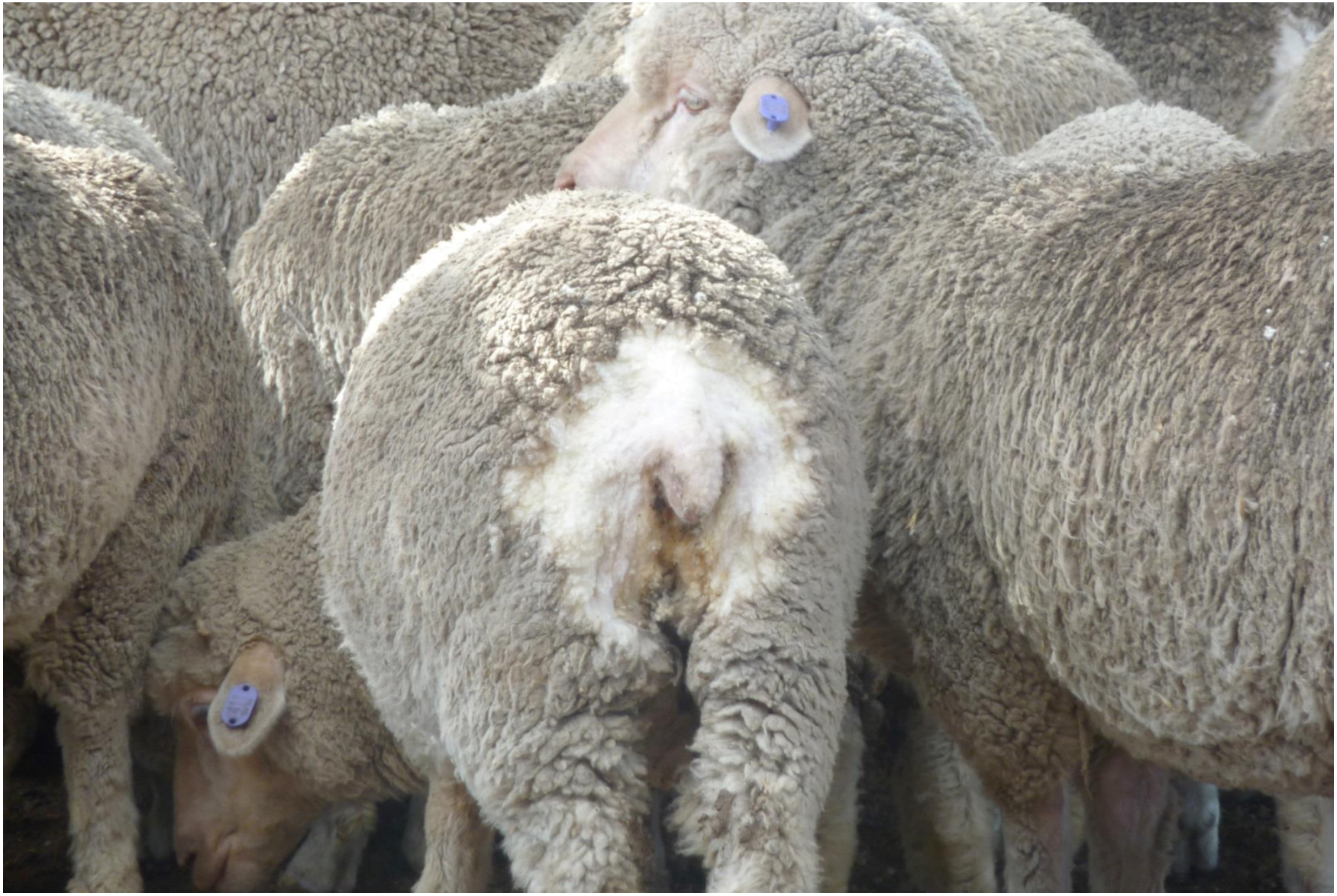
Liquid Nitrogen (LN) process applied to lambs at lamb marking



Liquid Nitrogen Process "commercial" trial April 2015

Weaners released from yards after the LN process

Stage 2 Results of Liquid Nitrogen Process

Owner											
Property	**M Crawford**									Agrregate score legend	
LNP Date	**2.10.2015**									1= Highly Wrinkled	
Weaners										10 = Very Plain	
Revisit	**13.2.2016**										
LNP	**Tail Wrinkle Score**		**Breech Wrinkle Score**		**Breech**	**Side Tail Bare Skin**		**Tail end**	**Overall Score T + B =**		**Aggregated**
Lamb ID	**1 = Good 5 = Poor**		**1 = Good 5 = Poor**		**Width mm**	**1 = Good 2 = Poor**		**Bare skin**			**Scores**
	L	**R**	**L**	**R**		**L**	**R**		**Tail (T)**	**Breech (B)**	
9	1.5	1	1	1	95	1	1	2	4	5	**9**
12	1	1	1	1	80	1	1	2	4	5	**9**
39	1	1	1	1	80	1	1	2	4	5	**9**
24	1	1	1	1	90	1	1	2	4	5	**9**
16	1	1	1	1	95	1	1	2	4	5	**9**
22	1	1	1	1	75	1	1	1	5	5	**10**
2	1	1	1	1	68	1	1	2	4	5	**9**
28	1	1	1.5	1	60	1	1	2	4	4	**8**
32	1	1	1	2.5	65	1	1	2	4	4	**8**
23	2	1	1	1	85	1	1	2	4	4	**8**
7	1	1	1	2	65	1	2	2	4	4	**8**
14	1	1	1	2	75	1	1	2	4	3.5	**7.5**
37	1	1	1	1	55	1	1	2	5	4	**9**
1	1	1	1	1	90	1	1	2	5	5	**10**
10	1	1	1	1	85	1	1	2	5	5	**10**
6	2	2	2	1	45	2	2	2	2.5	3.5	**6**
13	2	2	1	1	70	2	1	2	3	5	**8**
17	1.5	1.5	1	1.5	42	1	1	2	3	4	**7**
40	1.5	1.5	1	1	60	1	1	2	3	4	**7**
38	1	1	1	1	60	1	1	2	5	5	**10**
Mulesed											
SM1	1	1	1	1	95	1	1	1	4	5	**9**
SM2	1	1	1	1	85	1	1	1	5	3.5	**8.5**
SM3	1	1	1	1	95	1	1	1	5	5	**10**
SM4	1	1	1	1	105	1	1	1	5	5	**10**

Further studies super fine wool merino lambs

Manager Richard McShane - Mokanger Pastoral Mokanger Vic

Day 1 12th Nov 2015, processed at lamb marking

Photo immediately post process, Clik® applied (pink)

Pen of lambs post processing

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Further studies super fine wool merino lambs

Manager Richard McShane Mokanger Pastoral Mokanger Vic

Day 2 after LN P

Playful behaviour

Further studies super fine wool merino lambs

Manager Richard McShane Mokanger Pastoral Mokanger Vic

RV 12/2/16; 3 months post processing

Animal 25

Animal 16

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Further studies LNP with weaner merinos near Hamilton Vic

Pilot Trial with Matthew Crawford “Woodside”

Date Of LN Process 6/10/15 RV 12/2/16 4 months later

Animal 24 LNP

Animal 1 Mulesed

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Liquid Nitrogen - Costs and Savings

Costs

- Liquid Nitrogen cost, royalty and equipment hire fee is approx. $2 per lamb/weaner. Depends upon animal size, wrinkle score and remoteness.
- Evaporative nitrogen losses occur.
- Current development work is targeting one operator to process up to 800 sheep per day.

Benefits

- Larger numbers of non-mulesed plain breech sheep and non-mulesed wool availability
- Crutching/shearing 6 weeks prior for weaners is required
- Lambs can be LN processed in conjunction with lamb marking
- Closed wound during skin healing process with minimum welfare impact

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Liquid Nitrogen Process

Next Objectives

- Fine tuning equipment requirements for animal flow
- Reduce variability of results between sheep
- Take part in detailed CSIRO welfare study
- Independent trials with University of Melbourne (Dr John Larsen)
- Further 8 properties participating in commercial trials in Vic late 2016
- Commercial availability in 2017

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Commercialisation Plan

- LNP conducted either at lamb marking or on weaners

Certified Providers of LNP:

- Contractors
- SAV contractors
- Certified wool growers

- LN P Certification for woolgrowers for wool declaration

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*This publication is based on information presented at the Australian Wool Innovation Limited (**AWI**) National Wool Research and Development Technical Update on Breech Flystrike Prevention held on 12th July 2016. Some information in this publication has been contributed by one or more third parties and licenced to AWI, and AWI has not verified whether this information is correct.*

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