AWI Breech Strike R&D Technical Update
Maritime Museum, Sydney
20th August 2014

Dr John Steinfort
Steinfort Agvet Pty Ltd

Liquid Nitrogen Process (LN Process)… our innovative processes are designed to effect a reduction of tail and breech skin and wrinkles to reduce the associated susceptibility of flystrike in sheep.

- To achieve this outcome, we looked at highly wrinkled Merino sheep and sought to discover another process, with minimal impact on the animal, to significantly decrease tail and breech wrinkles and decrease the tendency for dag accumulation…. All of these factors being significant in managing merinos and minimising susceptibility to fly strike.

Steinfort AGVET Achieving Excellence in Veterinary Innovations

- We innovate and commercialise products and processes for the livestock industry
- Our aim is to improve livestock handling systems with focus on animal welfare.
- Veterinarian with 20 years rural practice experience in Vic.

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Current applications using Liquid Nitrogen (Liq N)

- Human medicine - removal of warts and some skin tumours and lesions
- Veterinary medicine - removal of squamous cell carcinomas in cattle (ocular & eye lid cancer) and cats (nasal tumours)

  - non surgical removal of sarcoids in horses

The cryogen effect of liquid nitrogen is utilised in these processes and in the sheep liquid nitrogen process.

Nitrogen is an element and comprises 78% of our atmosphere

Liquid nitrogen temperature is - 197 Degrees C

Nitrogen displaces oxygen within closed environments, resulting in oxygen depravation.

Adequate ventilation is required.

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How the Liquid Nitrogen Process works at a cellular level

- The cryogenic effect of liquid nitrogen freezes skin cells when applied topically.
- The cells of the skin freeze to temperatures of minus 50 degrees Celsius.
- Ice crystals form within the cells.
- Upon thawing, the intra cellular structures are damaged.
- Cellular lysis (destruction) results and healing takes place over a 6-8 week period.
- An eschar forms (a narrow strip of black dried skin) and sloughs off with it's associated wool
- A lineal scar forms where the 2 skin edges have reformed.
- Resultant skin reduction occurs decreasing excess skin wrinkles and stretches the natural bare areas on the breech and tail.

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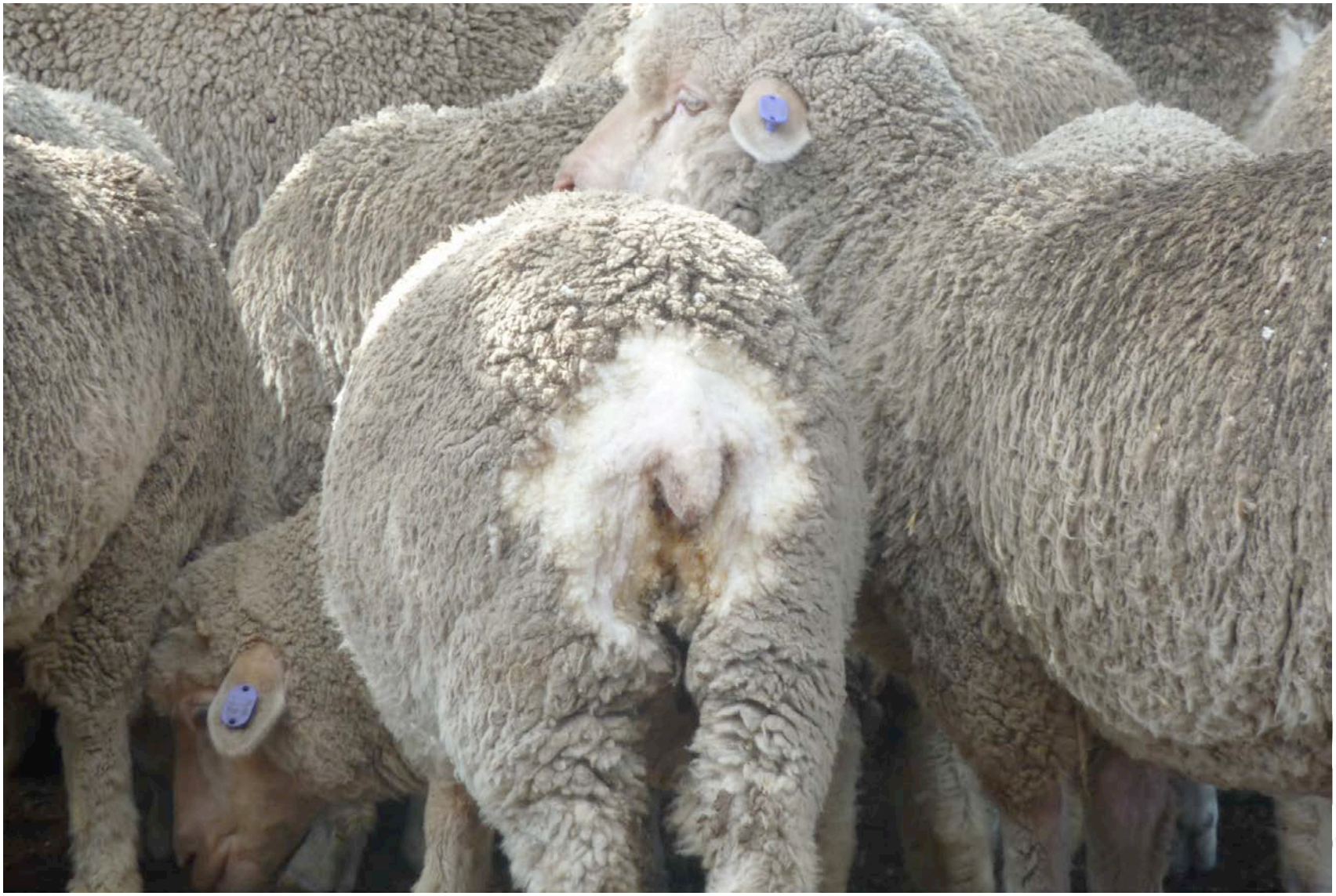
Tail bare skin

Unilateral (one sided) application of liquid nitrogen on tail and breach, causing one sided stretch of natural bare area

Liquid Nitrogen (LN) Process conducted on lambs at lamb marking.

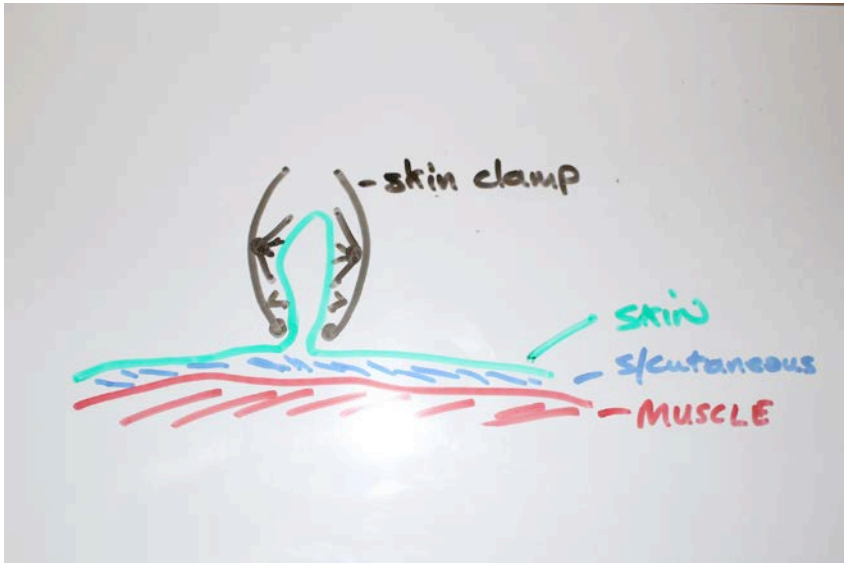


Liquid nitrogen processes requirements and how it works

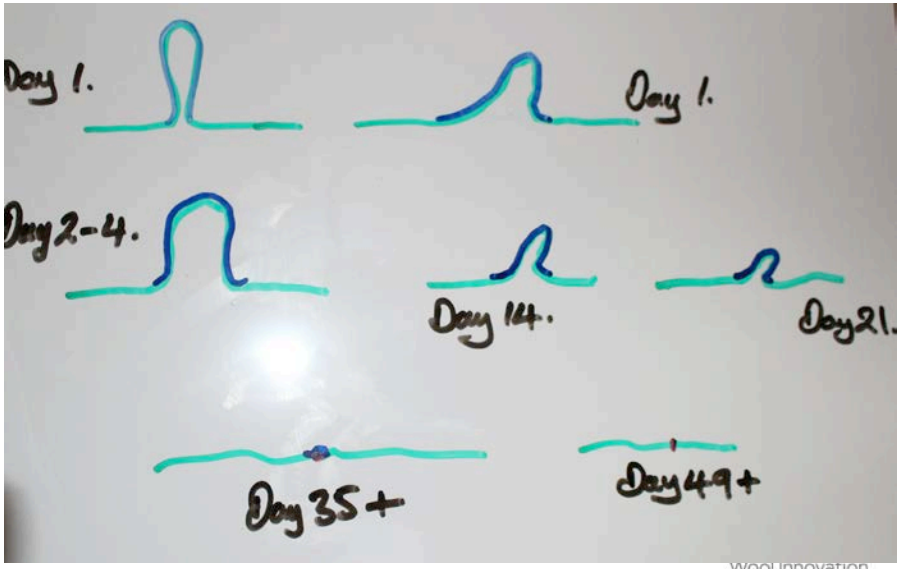
- Liquid Nitrogen Process results in a closed wound with slow effective healing. Resultant skin reduction depends upon the thoroughness of skin freeze (a variable seen in trials) and the amount of skin tenting at application.
- Resultant skin stretch is determined by the area of skin processed.
- Anatomical skin application areas are similar to surgical mulesing.
- Development of a 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

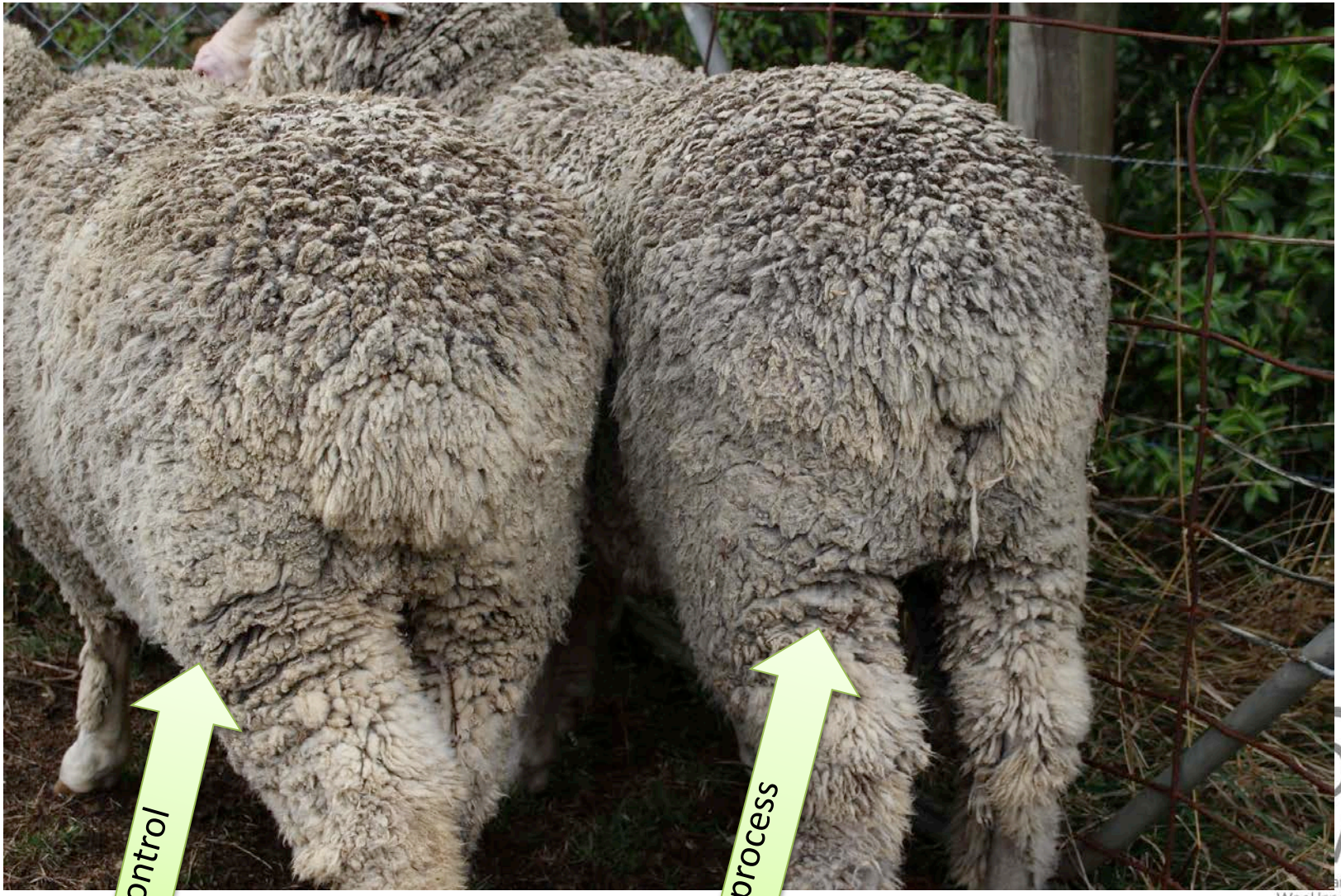


Liquid nitrogen application process



Liquid nitrogen process healing stages

The results of the liquid nitrogen process conducted on weaners



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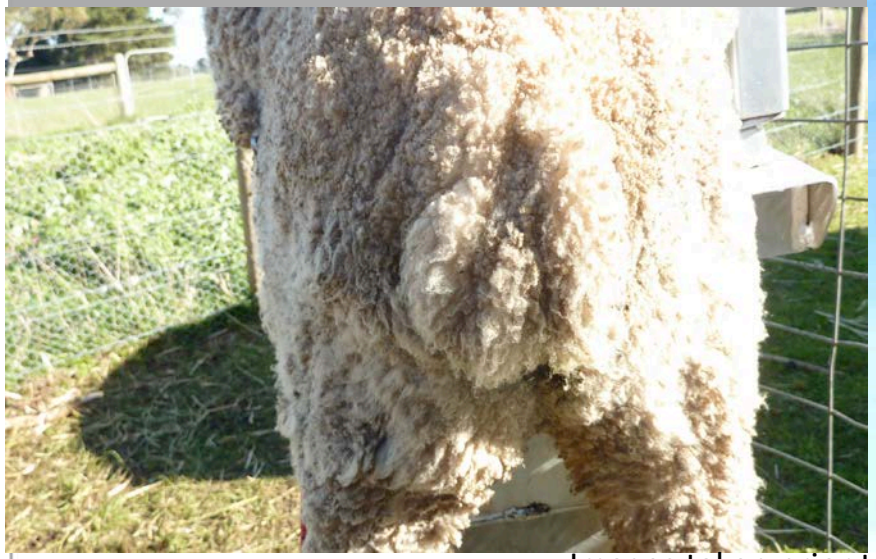
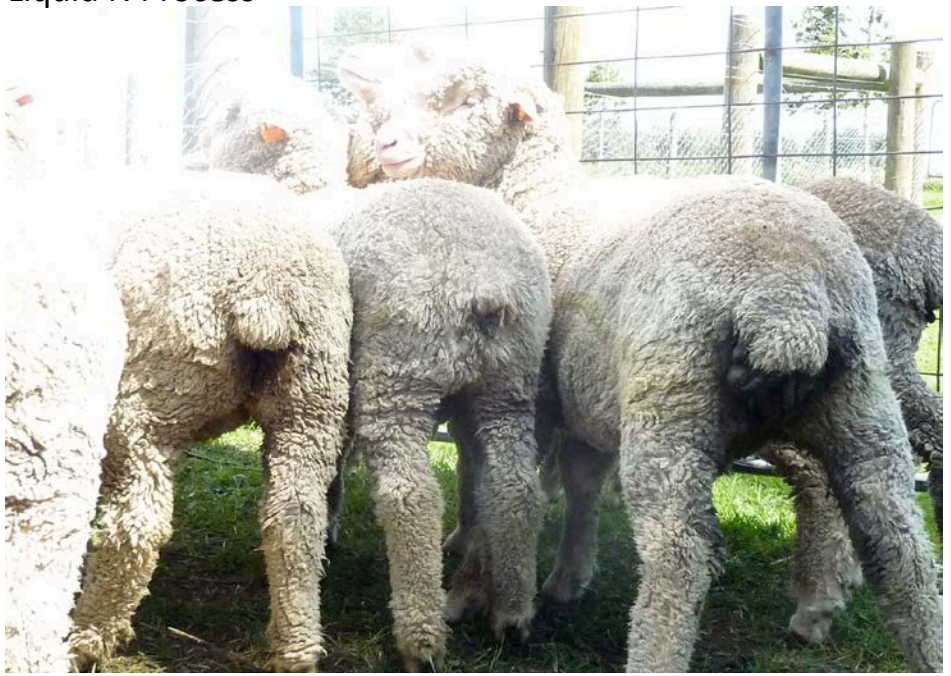
Weaner prior and after Liquid Nitrogen Process



Images taken prior to Liquid N Process

35 days post treatment (eschar lifted when crutched to take photo)

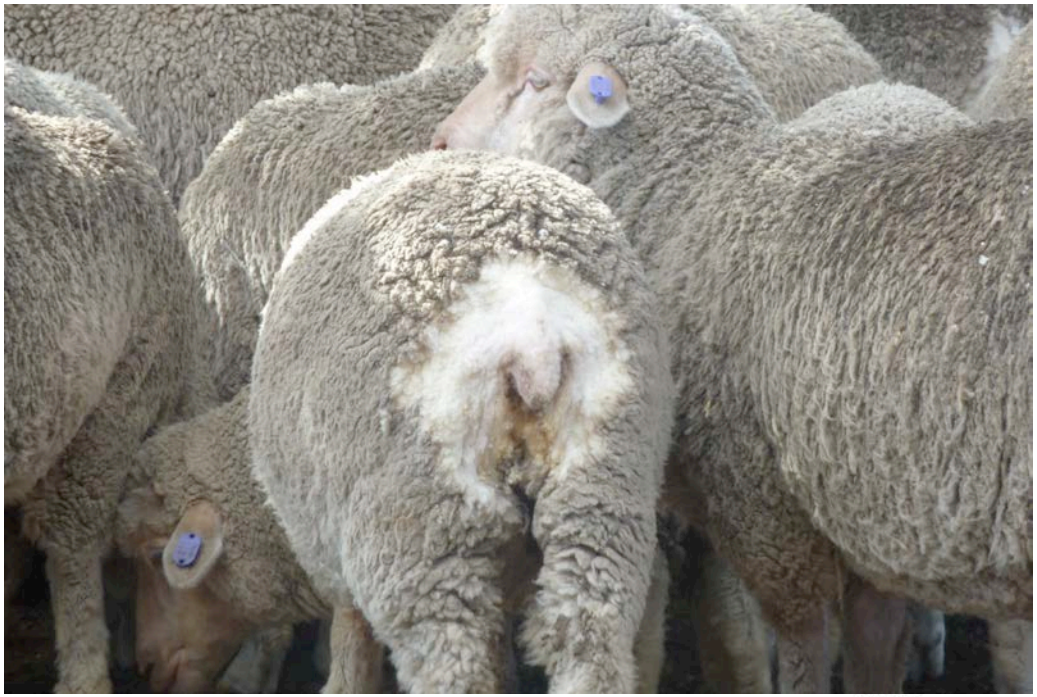


Centre weaner LN treated … others are controls

Liquid nitrogen process proof of concept trial

Trial measurements taken;

- Tail and breech wrinkle score reductions
- 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
Tail wrinkle less 1.9 Score
Breech wrinkle less 1.4 Score
Dag less 1.4 Score

	4 months post trial start			Revisit date 26/03/13		
Controls	Controls	Tail Score	Breech Score	Dag score	Breech Width	
	Blue 504	3.0	2.5	2.5	45.0	
	white 501	3.0	2.5	4.0	50.0	
	Green 507	3.0	2.0	1.0	30.0	
	Blue 512	3.5	3.0	1.5	35.0	
	Green 502	3.5	3.0	1.5	35.0	
	Black 515	4.0	3.0	3.0	30.0	
	Black 512	3.0	2.0	1.5	40.0	
	Green 503	4.0	3.0	5.0	45.0	
	Black 511	3.5	2.5	3.0	45.0	
	Blue 511	3.5	2.5	3.0		
	Green 506	3.5	3.0	3.0	45.0	
	White 507	3.0	2.0	2.0	40.0	
	Averages	**3.4**	**2.6**	**2.6**	**40.0**	
Day 1 WS	LIN Px	Tail Score	Breech Score	Dag score	Breech Width	
Tail score	Purple tags					
3.0	401	1.0	1.0	1.0	35.0	
5.0	408	1.0	1.0	2.5	45.0	Exc tail
3.0	407	1.0	1.0	1.0	50.0	Exc tail
4.5	425	1.5	1.0	1.0	50.0	VG wool strip
4.5	444	2.5	2.0	1.0	45.0	U bend part W
4.0	414	1.0	1.0	1.0	58.0	
4.5	442	1.5	2.0	1.0	30.0	
5.0	443	1.0	1.0	1.0	30.0	
4.0	446	1.0	1.0	1.5	40.0	
4.5	450	1.5	1.0	3.0	55.0	urine scold
5.0	402	1.0	1.0	1.0	40.0	
3.5	420	1.0	1.0	1.0	60.0	
4.5	454	1.5	1.0	1.0	30.0	
4.0	413	1.0	1.0	1.0	50.0	B Stretch Unilateral
2.0	405	1.0	1.0	1.0	55.0	
5.0	445	1.5	2.5	2.0	40.0	
3.0	406	1.0	1.0	1.0	35.0	
4.5	452	1.0	1.0	1.5	40.0	
4.5	458	2.5	1.0	1.5	43.0	LHS Wr Tail base
3.5	415	1.5	1.0	1.0	45.0	
5.0	416	2.5	1.0	1.0	45.0	
4.5	447	1.5	1.0	1.0	38.0	tail tip poor
4.5	410	1.0	1.0	1.0	40.0	Exc tail
	441	1.5	1.5	1.0	40.0	
3.0	411	2.0	1.0	1.5	50.0	Sim to S mules
4.5	426	1.5	1.0	1.5	35.0	
4.5	457	1.5	2.3	1.0	25.0	
4.5	432	1.5	1.0	1.0	60.0	VG Breech
4.5	456	2.5	1.5	1.0	50.0	
4.5	412	1.0	1.0	1.0	60.0	VG B Exc tail
3.0	401	1.0	1.0	1.0	35.0	
4.5	435	2.5	1.0	1.5	55.0	
	409	2.0	1.5	1.0	50.0	G Tail
3.0	433	1.0	1.0	1.0	60.0	Plain sheep
4.5	427	1.5	1.0	1.0	47.0	G Tail tip
3.0	417	1.5	1.0	1.0	50.0	G Tail tip
4.1	**Averages**	**1.4**	**1.2**	**1.2**	**44.9**	
Reduction in Scores		**-1.9**	**-1.4**	**-1.4**	**4.9**	

Next 2 slides

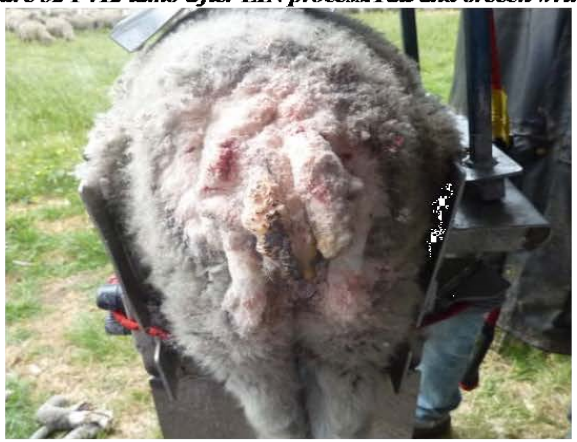
Lamb 412 prior to LN process and then at 5 weeks and 4 months

Following images show progressive photos of Trial Lamb Purple 412 on Day 1, 5 weeks and 4 months after Liquid Nitrogen Process application conducted at lamb Marking.

Picture 30 Trial lamb P 412 16/12/12

Picture 31 Crutched in cradle prior to LIN process Tail WS 4.5

Picture 32 P412 lamb after LIN process.Tail and breech wrinkles frozen. CLIK applied



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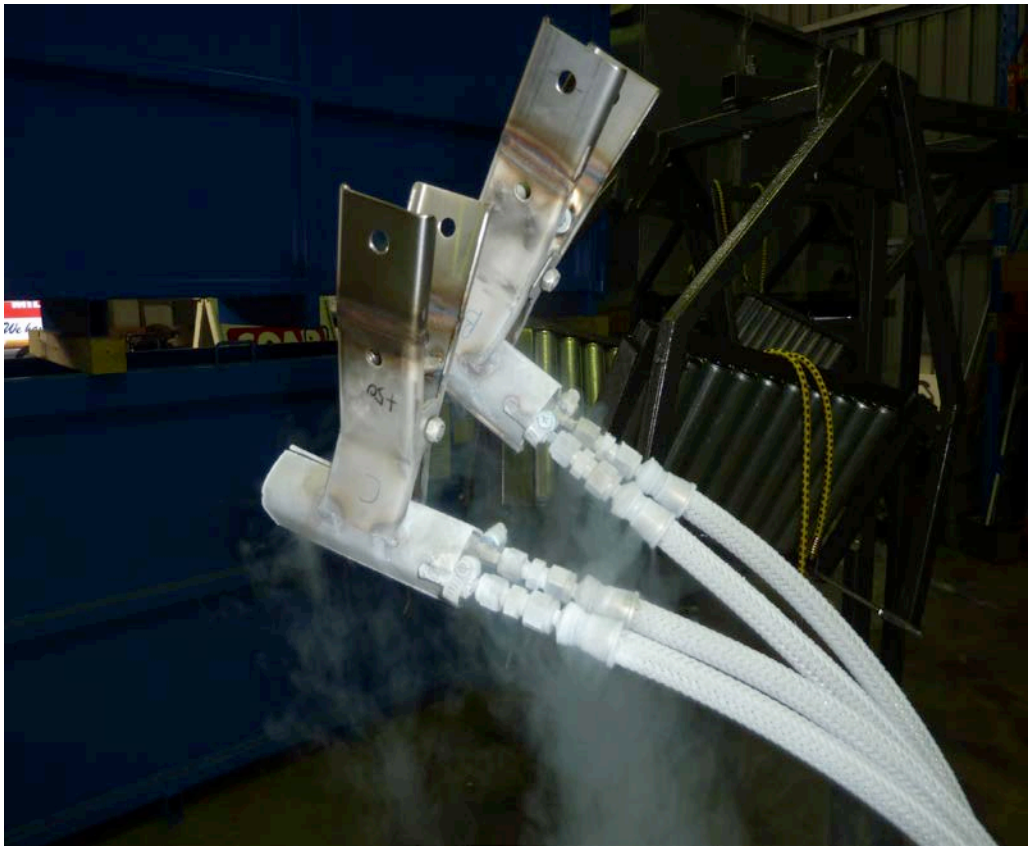
Picture 36 Breech Wrinkle Score 2 Lamb P412 5 weeks post Px

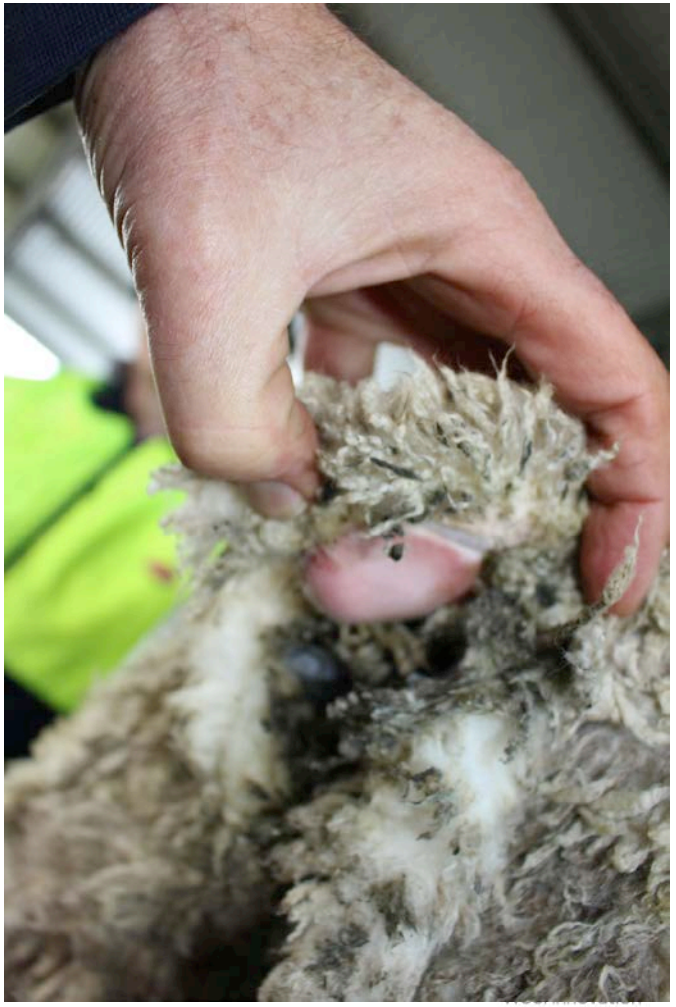
Picture 37 Tail Wrinkle score 1 Lamb P412 Length of Escher formation on breech pointed.

Tail and breech LIN process sites with scab and escher formation

Picture 38 At 4 Month Revisit (26/03/13) Lamb P412 Totally healed

Skin clamps and precision of LN application





Liquid nitrogen initial trials

32 days post LN process
(eschars lifted during crutching in preparation for photo)

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Overview of the liquid nitrogen application process

- The process is intended to be conducted in conjunction with lamb marking.
- Loose skin is tented up for LN processing using skin clamps.
- Skin clamps with LN dispensing bars are engineered to apply the LN to all 4 skin areas simultaneously.
- New Cradle design - more natural position with minimal restraint.
  - require access to loose skin to tent skin away from underlying tissues
- Liquid N skin application positions (clamp positions) similar to surgical mulesing.
- The LN Process produces bare skin edges on the tail.
- Commercial process aims - initially 500 lambs at lamb marking with resultant skin wrinkle score of 2.0 or less (from up to wrinkle score 5).
- Eventual aim is to process 1000 + per day.

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Costs and Savings

Costs

- Liquid nitrogen is approx. $4.50 per kg. This depends upon the degree of remoteness considering transport and storage logistics.
- Evaporative losses of 1 to 3% occur daily.
- Estimated usage per lamb or weaner depends upon wrinkle score and associated excess skin. Range from 200 to 400gms at this stage in process development.

Savings

- Minimal impact and set back to lambs
- Lifting lambs into upright cradles can be cumbersome however
- Design processes are in place to incorporate automatic loading into cradles.
- Crutching prior to application is not required
- Continue the momentum of improved market availability of non mulesed Australian Merino wool

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Commercialisation Process

- APVMA approval is not required, N is 78% of atmosphere
- First stage commercialisation process: Licence and train contractors and Steinfort Agvet provide services and technology support.
- Second stage: Further contractors and larger wool growers are trained and licensed
- Liquid nitrogen processing equipment is leased or purchased.
- Steinfort Ag Vet and affiliates to provide supply of liquid nitrogen to contractors and growers on location.

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Acknowledgements

- Acknowledge and thank AWI Ltd and Australian wool growers for their support in assistance in funding this development project.
- Acknowledge and thank the trial farm managers and owners who have supported us so generously in our trial work.
- Acknowledge our staff at Steinfort Agvet for their focus and innovative work.

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