All-terrain Vehicle (ATV) Safety on Australian Farms

Briefing Paper prepared for the Farmsafe Australia Reference Group on ATV Safety

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1. Purpose

The purpose of this paper is to provide background information to members of the Farmsafe Australia Reference Group being convened to develop a national approach to reducing death and serious injury associated with ATV operation on Australian farms.

At its meeting in December 2001, the Farmsafe Australia Board resolved that a nationally agreed approach was necessary to prevent serious injury and deaths on farms. This should be considered in the context of the use of ATVs in various commodity groups, and of the evidence supporting preventative action. This project will result in an industry supported strategy to reduce injury and death due to ATV operation on farms in Australia.

The briefing paper summarises available information as at September 2006. It is noted that the Victorian Coroner is undertaking a coronial investigation into six deaths associated with ATVs in Victoria and two in Tasmania, and that further information may be available following that investigation.

2. The Problem

2.1 Deaths and Serious Injury

There are approximately 10 deaths associated with ATVs occurring each year in Australia, most associated with ATVs used in agriculture and horticulture.

There is a growing concern world-wide over the number of deaths and serious injury occurring in association with ATV operation in the context of agricultural use, as well as leisure use of the machine[1,2].

ATVs are in widespread use on Australian farms. They are used for:

- Personal travel around the farm
- Mustering of livestock
- Supervision of working field crews
- Inspection of crops, pastures, fences, water and livestock
- Towing and carrying of goods
- Spraying of weeds
- Shifting irrigation pipes
- Markers for aerial operations
- Recreation

[1] CDC. All-Terrain Vehicle-Related Deaths – West Virginia, 1985-1997. Morbidity and Mortality Weekly Report. January 1999;(48)1

[2] Moroney P, Doyle M, Mealy K. All-terrain vehicles – unstable, unsafe and unregulated. A prospective study of ATV-related trauma in rural Ireland. *Injury, Int J Care Injured* 34 (2003) 203-205

The National Farm Injury Data Centre (NFIDC) has established a *Register of ATV Deaths*, based on information sourced from the National Coroners' Information System (NCIS). The level of detail pertaining to these cases is variable, depending on the online availability of Police Reports and Findings Documents within the system.

As NCIS continues to develop and expand, our ability to search and extract data from the system will improve, and as a result it is possible that the number of ATV related fatalities over the July 2000 – January 2007 period will increase.

Table 1 – State and Year Splits of ATV Fatalities

	2000 (Jul-Dec)	2001	2002	2003	2004	2005	2006	2007	TOTAL
NSW	2	8	3	6	2	2	4	**1**	**28**
VIC		1	6	1	1	1	2		**12**
QLD		1	7	4	3	4			**19**
TAS	1		2	4	2	1			**10**
WA		1	2	1	3	2		**1**	**10**
SA			2			2			**4**
NT		1							**1**
TOTAL	**3**	**12**	**22**	**16**	**11**	**12**	**6**	**2**	**84**

Source: ACAHS Register of ATV Deaths

It is estimated that there may be approximately 10 deaths associated with ATV use on farms annually. However, it is important to note that Queensland only came online in 2001, therefore the 6 months from July to December 2000 excludes Queensland fatalities.

The availability of relevant documents to the case varies greatly between states. For example, as at November 2005, only 54% of NSW cases on NCIS have Police Reports attached. Therefore in some instances, there is a significant time delay in gaining access to further information about the case.

This estimated figure of 10 deaths per year represents an increase in annual death rates since the last comprehensive study of farm deaths for the period 1989-1992. During these four years only four ATV deaths were recorded[3].

The increase is assumed to be related to the increase in numbers of ATVs in use on Australian farms.

Of ATV riders surveyed by Schalk and Clarke, 8.2 percent had suffered injury associated with riding the ATV in the previous two years. Of 612 motorcycle riders

[3] Franklin R, Mitchell R, Driscoll T, Fragar *L. Farm-related fatalities in Australia. 1989-1992*. ACAHS and RIRDC. 2000. Moree

reported by the women on 182 farms, 8.4 percent were injured while riding an ATV in the previous two years.

Injury events occur through a complex interaction between the person, the agent of injury and the operating environment. We have attempted to identify risk factors for ATV associated death and serious injury from the information that is available. The following information has been distilled from analysis of the information relating to all ATV-related deaths and from the study of motorcycle riders and injury associated with motorcycles undertaken by Schalk and Fragar reported in 2000[4].

2.2 Human and Behavioural Risk Factors

The following provides information relating to human risk factors.

i) Age and Use

Riders of all ages are at risk of death, and risk most likely reflects exposure – in that the age range of those who have died broadly reflects the age distribution of farmers.

The majority of those who have died were ATV operators; however passengers and bystanders are also at risk.

The following table indicates age and operator status of those who died as a result of an ATV related activity.

Table 2 – Age and Operator Status of ATV Cases

Age (years)	Operator	Passenger	Bystander	Unknown	Total
0-5	3	5			**8**
6-15	6	7			**13**
16-25	9	1	1		**11**
26-45	16				**16**
46-65	21				**21**
66 plus	12	2	1	1	**16**
Total	**67**	**14**	**2**	**1**	**84**

Source: ACAHS Register of ATV Deaths

The rate of injury associated with ATV riding was shown to decline with rider age in the Schalk and Fragar study.

[4] Schalk T, Fragar LJ. *Injury Associated With Farm Motorcycles on Farms in Australia.* Moree: Australian Centre for Agricultural Health and Safety, 2000

ii) Gender

The majority of fatal ATV incidents involve males, but females are also at risk.

Thirteen of the 84 victims were female. Four females aged under 16 were passengers on the ATV and one was an operator. There was one 16 year old female operator, three female operators in their fifties and one aged over 65 years. Of the three deceased aged over 65, one female was a bystander, one was a passenger and another was of unknown status.

Table 3 – Age and Gender of ATV Cases

Age (years)	Male	Female	Total
0-5	6	2	**8**
6-15	10	3	**13**
16-25	10	1	**11**
26-45	16		**16**
46-65	18	3	**21**
+66	11	4	**15**
Total	**71**	**13**	**84**

Source: ACAHS Register of ATV Deaths

iii) Competency and Training

Detailed information regarding training and skills of riders associated with ATV-related deaths is only available for eight deaths before the Victorian Coroner, where no rider had undertaken formal training.

There is very limited information relating to rider training or skills in the *Register of ATV Deaths*, although several narratives on NCIS indicated that farmers had purchased their ATV in the last 12-24 months and that some operators had limited experience.

Over 97% of motorcycle riders (2 and 4 wheeled cycles) reported in the rider survey (Schalk and Fragar) that they had never participated in a formal motorcycle rider training course.

iv) Activity Being Undertaken

ATV-related deaths are associated with a wide range of work activities in agriculture and horticulture, including mustering, spraying pesticides, transporting and travelling on the property.

There are significant numbers of deaths associated with leisure operation of ATVs.

Of the 84 cases in the Register, 58 involved the use of an ATV that was either located or intended for use on an agricultural property. Another 19 were classified as non-agricultural and the remaining seven were of unknown status.

Just over half of the agricultural related cases were performing a work related task at the time of the incident; five were involved in a non-work activity and the final 22 were of unknown status.

Table 4 – Work context of activity of victim

Industry and Activity	Work Context	Non-Work Context	Unspecified Context	Total
Agriculture	**31**	**5**	**22**	**58**
Weed Control	*9*			
Mustering/herding/drafting	*9*			
Inspecting property/water/stock	*4*			
Structure maintenance	*1*			
Moving materials	*2*			
Transport	*3*			
Hunting	*3*			
Non-agricultural	**2**	**12**	**5**	**19**
Unknown industry			**7**	**7**
Total	**33**	**17**	**34**	**84**

Source: ACAHS Register of ATV Deaths

v) Speed

More information relating to speed of the ATV at time incident is needed.

Only 16 of the 84 cases had information on speed of the ATV at the time of incident;

- One case referred to speed being 'not excessive'
- One case was estimated to be travelling at 15-30 kph
- One case was estimated to be travelling at 30-45 kph
- Two cases were estimated to be travelling at 45-60 kph
- One case was estimated to be travelling at >60 kph
- One case had the throttle jammed on 'full'
- Nine cases were reported to be travelling at 'speed' or 'high speed'

Schalk and Fragar surveyed riders regarding the average and maximum speeds in relation to their agricultural industry. There was wide variation, with 80% of riders operating their cycles at average speeds of less than 50 kph, except in cane and cotton where speeds are reportedly higher. Animal handling industries tended to use lower speeds compared to cropping industries, with dairy industry reports the lowest.

The majority of motorcycle accidents reported by riders in this survey occurred at speeds of less than 30kph.

vi) Alcohol and Other Drugs

More information is needed relating to the role that alcohol and other drugs may play in ATV-related deaths and serious injury.

There were 12 cases where alcohol and/or drugs were detected. In ten of these cases, the deceased was operating the ATV under the influence. In the remaining two cases, the passenger was killed whilst the operator was under the influence.

2.3 Machine Risk Factors

i) Size, Make and Model of ATV

More information is needed relating to injury risk associated with size and design features of ATVs.

Information relating to engine capacity of the ATV was only available for 22 of the 84 incidents in the Register.

- Honda 650 – One rollover death
- Suzuki 500 – Two unspecified rollover deaths
- Polaris Sportsman 500 (6x6) – One rear rollover death
- Honda 450 – One rear rollover death
- Yamaha Kodiak 400 – One collision with vehicle death
- Yamaha 400 – One side rollover death
- Kawasaki 400 KFX – One death thrown from ATV
- Honda TRX 350 – One death thrown from ATV
- Yamaha YFZ 350 – One death thrown from ATV after collision
- Yamaha 350 – One collision with stationary object, one collision with tree
- Polaris Magnum 330 – One rollover death after collision with fence
- Suzuki 330 – One death from collision with fence
- Suzuki 300 Quadmaster – One death thrown from ATV
- Suzuki 250 – One side rollover death
- Suzuki 250 LT-F250 – One death thrown from ATV
- Yamaha 250 – One collision with tree death
- Suzuki 160 – One unspecified rollover death
- Unknown 100cc – One collision with vehicle death
- Unknown 50cc – One side rollover death
- ‘Mini’ ATV – One unspecified rollover death

ii) Rollover and Rollover Protection of Operator

There is a propensity for ATVs to rollover and cause serious injury to riders.

There are 36 cases within the *Register of ATV Deaths* that relate to the 'rollover' of the ATV. Of these; one was a front rollover, seven were side rollovers, eight were rear rollovers and the remaining 20 are unspecified. No information was available relating to whether there was fitment of any form of roll-over protective structure, which are not commonly used in Australia.

iii) Loading of ATVs

Loading of the ATV has been associated with rollover deaths. More information is needed to understand the role that loading plays in ATV rollovers.

One of the deaths associated with an ATV rollover had used the machine for carrying steel posts and another refers to the ATV moving a water pump.

Seven deaths associated with rollover referred to spraying weeds or having a spray tank, but limited detail was available. One of these spray tanks was noted to be 200L in capacity, with an estimated 80L of chemical. Another 50L spray tank was reported to be full. Another case refers to the ATV towing a spray unit.

There were 18 deaths involving a single passenger being carried on the ATV, one death when the ATV was carrying two passengers and two deaths when carrying three passengers.

One death involved towing a trailer of unknown size and load, another involving a passenger was towing a trailer with two 200L drums of liquid feed.

One case involved the towing of a trailer with three passengers on board.

iv) Maintenance of ATVs

More information is required on the roadworthiness of the ATV at time of incident, particularly tyre and brake condition.

Of the 84 cases in the Register, 76 have no information on the roadworthiness of brakes at the time of incident. Of the remaining eight, five were classed as 'roadworthy' and three as 'unsafe' or 'not roadworthy'.

Similarly, there is very limited information available on tyre condition. One case was reported to have excessive rear tyre pressure, another minimal tread. Four were specified as 'roadworthy', with the remaining unknown.

Two cases were noted as having unsatisfactory suspension.

The Schalk and Fragar study reported that poorer ATV maintenance regimes were associated with higher injury rates than those whose maintenance were more timely.

v) Other

In one death, it was noted that a tree branch had pierced the rear tyre causing the ATV to veer and crash.

2.4 Environmental Risk Factors

Terrain, slope and surface appear to play a key role in ATV-related deaths, and it appears that there are terrain limits for the operation of so-called 'all-terrain vehicles'.

Table 5 – Ground Surface at site of ATV fatal incident

Ground surface at accident site	No. of Cases
Public/Forestry Road or Track	14
On-farm Road/Track	8
Paddock	11
Hill/Mountain	3
Embankment	8
Farm Shed/garage	4
Irrigation Channel	2
River/Creek/Dam Bank	6
4WD/Bike Track	2
Beach/sandy track/dunes	5
Airstrip	1
House yard	1
Stock yard	1
Driveway	3
Loading Ramps	1
Footpath	1
Unknown	13
Total	**84**

Table 6 – Slope of terrain at site of ATV fatal incident

Slope of surface at accident site	No. of Cases
'Steep' or greater than 45 degrees	20
Undulating	1
'Slight' or less than 30 degrees	6
Level	9
Unknown/Not recorded	48
Total	**84**

Source: ACAHS Register of ATV Deaths

2.5 Mechanisms and Location of Injury

The mechanism of injury in the majority of cases was noted to be blunt force with the body part crushed between ATV and the ground or other surface, or contact of the body with a rock or tree or other surface, having been flung from the ATV.

The body part injured and associated with death was mostly the head and cervical spine, crush injuries and asphyxia.

Table 7: Cause of Death (1a)

Category	Injury	ICD 10 Code	No. of Cases
Circulatory System	Acute myocardial infarction	I21	1
	Chronic ischaemic heart disease	I25	1
Respiratory System	Other symptoms involving respiratory systems	R09	1
Head Injury	Fracture of skull and facial bones	S02	6
	Intracranial injury	S06	9
	Other and unspecified injuries of the head	S09	9
Neck Injury	Fracture of Neck	S12	5
	Injury of nerves and spinal cord at neck level	S14	1
	Injury of blood vessels at neck level	S15	1
	Crushing injury of neck	S17	2
Thorax Injury	Injury of other and unspecified intrathoracic organs	S27	3
	Crushing injury of thorax	S28	10
	Other and unspecified injuries of thorax	S29	1
	Injury of intra-abdominal organs	S36	1
	Crushing injury of abdomen, lower back and pelvis	S38	1
Hip/thigh Injury	Injury of blood vessels at hip and thigh level	S75	1
Multiple Injuries	Other injuries involving multiple body regions, NEC	T06	4
	Unspecified multiple injuries	T07	10
Other	Asphyxiation	T71	10
	Drowning	T75.1	1
	Unknown		6
Total			**84**

Source: ACAHS Register of ATV Deaths

In the Schalk and Fragar study of injury, riders injured on ATVs reported sprains (25.6%) and fractures (23.4%), whereas riders injured on 2-wheel motorcycles commonly sustained cuts/lacerations (23.5%). Bruising was an injury common to both machines with 23.4% and 22.3% of injured riders sustaining bruising on ATVs and 2-wheel motorcycles respectively. Lower leg injuries appear to be common for both ATV and 2- wheel motorcycle riders, although the percentage of injuries received varies considerably, 14.9% for ATVs and 21.6% for 2-wheel motorcycles. It was also observed that ATV riders commonly sustained injuries to the upper body, shoulder (12.8%) and wrist (8.5%), and trunk, ribs (10.6%), whereas 2-wheel motorcycle riders sustained injuries to the lower body, upper leg (11.0%) and ankle (10.0%).

Injury from ATVs occurred mainly due to rolling the machine (22.8%), hitting a stationary object (18.2%) or human error (11.4%). Human error has been defined for the survey as an incorrect action performed by the rider which has resulted in a detrimental effect, for example jamming the brakes on resulting in a skid.

2.6 General

These findings relating to Australian agriculture are consistent with the findings of a report by Rechnitzer et al[5] that described findings for 24 ATV deaths in the NCIS system, as well as data from the United States and New Zealand.

3. Intervention for Reducing Risk of Serious Injury and Death

OHS legislation and good injury prevention practice indicate that where possible, hazards of high risk should be controlled by 'higher order' controls i.e. controls that do not depend on the day to day behaviour of operators or bystanders to ensure their safety.

We have therefore used the Hierarchy of Control of workplace injury to consider the options for reducing risk of death and serious injury associated with ATV operation in Australia.

3.1 Eliminate the Hazard

The use of ATVs has been well established in Australian agriculture and horticulture. However, current uses in these industries need to be reviewed to determine whether these uses are sustainable in light of the real risk of death and serious injury.

3.2 Substitute for a Hazard of Lesser Risk

Use of ATV's in all terrains for such activities as mustering, spraying and transporting loads should be reviewed by the specific agricultural industries to determine the most appropriate vehicles and machines for these activities.

3.3 Improved Design or Engineered Solution

ATVs have undergone changes in the past, with the move away from manufacturing of 3-wheeled machines and toward design features for improved foot and leg protection.

[5] Rechnitzer G, Day L, Grzebieta R, Zou R and Richardson S. *All terrain vehicle injuries and deaths.* Monash University Accident Research Centre March 2003.

i) Reducing Risk Associated with Rollover

The propensity of the ATV to rollover needs to be addressed with either the design of an effective rollover protective structure for the ATV as it is currently designed, or, design of a vehicle that can be used for the key operations defined by the agricultural industries without risk of rollover injury.

ii) Reducing Risk of Rider Being 'Flung' from the ATV

Similarly, the number of deaths associated with being flung from the ATV need to be addressed in future design of the vehicle.

3.4 Administrative Controls and Safe Practice

Administrative controls that should be put in place have been defined by an interagency task force in New Zealand[6]. These should be reviewed in the light of Australian experience and the evidence for effectiveness.

Key controls include:

i) Age of Operators

Manufacturers of ATVs advise against young people less than 16 years riding ATVs, and this is supported by data on injury found by Schalk and Fragar.

Effective ways of ensuring that children are not put at risk in the farm setting need to be identified and implemented.

ii) Competencies for Safe Operation

Competency standards for operation of ATVs have been produced by the Rural Training Council of Australia, and are in use in rural vocational training programs. These need to be reviewed in light of the defined risk factors for ATV-related injury and death, and competency requirements for safe operation established.

Practical and effective ways of delivery of training and assessment of competencies need to be identified and implemented.

iii) No passengers

[6] OHSS. *Safe Use of ATVs on New Zealand Farms – Agricultural Guideline*. Occupational Health and Safety Service. November 2002

ATVs are not designed for passengers. Carrying passengers increases risk to both operator and the passenger.

Practical and effective ways of ensuring that passengers are not carried on ATVs in the farm workplace need to be identified and implemented.

iv) Loads

The specifications for safe loads to be carried or towed need to be established for the uses and conditions of operation.

Practical and effective ways of ensuring that load limits are not exceeded need to be identified and implemented.

3.5 Personal Protective Equipment

Head injury is associated with a significant number of ATV-related deaths.

Helmet standard specifications need to be established for safe use and conditions of different operations, including speed and risks associated with oncoming traffic.

Practical and effective ways of ensuring that helmets conforming to specified standards are worn during ATV operations need to be identified and implemented.

3.6 First Aid Training

Systems for effective emergency response, including access to people with first aid skills is a requirement for farm workplaces and practical ways to assist access to first aid training by farmers and farm workers need to be identified and implemented.

4. Issues to be Addressed

4.1 Improved Data Collection Relating to ATV Deaths and Serious Injury

The National Farm Injury Data Centre has established Registers of ATV Deaths and ATV Serious Injuries and has defined the data items needed to define key risk factors which, if addressed, could reduce risk.

Data items are listed in Appendix 1.

Persons investigating ATV deaths should be requested to provide this information to the National Farm Injury Data Centre

4.2 Terms of Reference for the Farmsafe Australia Reference Group for ATV Safety

The Terms of Reference for the Farmsafe Australia Reference Group for ATV Safety are as follows:

i) Membership

Chairman Farmsafe Australia: Don Sutherland
Deputy Chairman Farmsafe Australia: Andrew Forrest
National Farmers Federation: Denita Harris
Practicing farmers nominated from:

- AgForce: Richard Pietsch
- Northern Territory Cattle Council: Stuart Kenny
- Cotton Australia: Peter Hollingworth
- Victoria Farmers Federation: Graham Prince
- Tasmanian Farmers and Graziers Association: Warwick O'Connor

Past-Chaiman Farmsafe Australia: John Dawson
WorkSafe Victoria: Jane Burton
Workcover NSW: Bruce Marshall
QLD Workplace Health and Safety : Keith Ferguson
Tractor and Machinery Association: Vin Delahunty
NSW Farmers: Justin Crosby
Farmsafe QLD: Jamie Cupples
Australian Centre for Agricultural Health and Safety: Lyn Fragar (Convenor)
Australian Centre for Agricultural Health and Safety: John Temperley
Australian Centre for Agricultural Health and Safety: Antonia Hawkins
National Farm Injury Data Centre: Kirrily Pollock

ii) Terms of Reference

General

To oversee the development of a Farmsafe Australia National Strategy for Prevention of Serious Injury associated with use of ATVs on farms.

Tasks

1. Review of the data and research findings relating to the nature and scale of the injury problem.

   This will involve reviewing the source data and other reverence material that has been published, including the findings of the Victorian Coronial Inquiry into ATV deaths in Victoria and Tasmania

2. Review of the key uses of ATVs in agriculture and horticulture in Australia.

   This will involve surveying practicing farmers in the key agriculture and horticulture industries to better define the uses to which ATVs are put, options available to undertake these activities, and design requirements for machines to undertake these operations.

3. Review of currently available ATV operator training and its relevance to reducing injury risk

   This will involve careful consideration of what elements of training (specific competencies) are required to reduce injury risk.

4. Review of helmet standards for use on farm motorcycles.

   This will involve liaison with industry and Standards Australia, having examined the uses and operational conditions under which ATVs are used (eg speed), to determine the relevant helmet standard.

5. Review of design options for improved safety, including ROPS design research that is or has been undertaken.

   This will involve discussion with the ATV manufacturing and supply industry, having undertaken established the requirements of agriculture and horticulture industries.

6. Development of evidence based strategic approaches to reduce death and severe injury.

   This will involve working with government and industry leaders to establish mechanisms to ensure that findings are implemented.

Appendix 1: Data Requirements for ATV Deaths in Australia

Case ID
Event ID
Date of event
Data source
Address where event occurred
Location of event
Location of death
Agricultural industry
Agricultural enterprise
Agricultural work phase
Work related
Description of event
Cause of accident (ie. Rollover, thrown from ATV etc)

Human Risk Factors:

- Information relating to case
  - Age
  - Employment status
  - Occupation
  - Height
  - Weight
  - Other physical characteristics
  - Operator, pillion or bystander
  - Alcohol/ drugs/ mental state
  - Helmet
  - Other PPE
  - ATV Training
  - Medical cause of death
  - Additional autopsy details

- Information relating to operator
  - Age
  - Employment status
  - Occupation
  - Height
  - Weight
  - Other physical characteristics
  - Alcohol/ drugs/ mental state
  - Helmet
  - Other PPE
  - ATV Training

Machine Risk Factors:

- ATV make, model and size

Mechanical condition – brakes, tyres, etc
ROPS fitment – presence and description
Load – nature, weight, towed, where mounted etc

Environmental Factors:

Time of day of event
Weather
Light
Surface Conditions
Terrain
Slope
Speed of Operation