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Machine Injuries on Australian Farms

– THE FACTS –

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1. Introduction

Agriculture and horticultural enterprises produce commodities of more than \$30 billion value per annum on around 145 000 enterprises spread across all states of Australia.

High rates of serious injury and deaths on Australian farms are of concern to agricultural industry agencies, farmers and farm enterprises and federal and state governments.

Farmsafe Australia, the national association of agencies with commitment to reducing injury risk on Australian farms, is implementing the National Farm Machinery Safety Strategy with key partners of representatives of agricultural industries, machinery manufacturers and suppliers.

Strategic approaches to reducing farm machinery injury risk are multifaceted and include:

- identifying elimination and substitution options
- improving design and engineering solutions
- administrative or work practice solutions, including education and skills development
- identification of requirements for personal protective clothing and equipment
- identification of incentives for adoption of improved systems
- ensuring compliance with regulatory requirements for supply of safe plant and equipment and safe operation in the farm workplace.

This document has been produced to provide guidance to those agencies and individuals who are working to reduce risk associated with operation of farm machinery on Australian farms. The publication is also available electronically for use by educators and speakers in their efforts to raise awareness and promote machinery safety, and for those whose role is the development of public and industry policy to improve safety.



2. Deaths of farmers and farm workers

Table 1 indicates the causes of non-intentional injury death of those persons whose occupation at time of death was listed as farmer, farm manager or farm worker, for the years 1999 to 2002. This data does not include on-farm fatalities of other occupational or non occupational groups such as students, tradespersons, contractors, children or visitors.

Machinery and powered equipment was associated with at least 8.5 percent of all non-intentional traumatic deaths of farmers, farm managers or farm workers. This proportion is 16.5 percent of injury fatalities if transport injuries occurring mainly on roads are excluded.

Table 1 Causes of injury deaths of those whose occupation was farm manager or agricultural worker who died in Australia, 1999-2002 (ICD 10-AM)

Code No	Descriptions	99	00	01	02	Z	%
V01-09	Pedestrian injured in transport accidents	8	14	15	7	44	5.3
V10-19	Pedal cyclist injured in transport accidents	0	0	1	0	1	0.1
V20-29	Motor cycle rider injured in transport accidents	9	4	10	10	33	4.0
V30-39	Occupant of three wheeled motor vehicle injured in transport accident	0	0	1	0	1	0.1
V40-49	Car occupant injured in transport accident	50	57	54	68	229	27.8
V50-59	Occupant of pick-up truck or van injured in transport accident	2	1	7	0	10	1.2
V60-69	Occupant of heavy transport vehicle injured in transport accident	1	1	1	2	5	0.6
V80-89	Other land transport accidents	27	12	19	19	77	9.3
V80	<i>Animal ridden</i>	(1)	(1)	(2)	(1)	(5)	(0.6)
V84	<i>Special vehicle mainly used in agriculture (tractors)</i>	(10)	(7)	(10)	(6)	(33)	(4.0)
V86	<i>Special all-terrain vehicle (ATV)</i>	(5)	(2)	(5)	(8)	(20)	(2.4)
V90-94	Water transport accidents	0	3	1	2	6	0.7
V95-97	Air & space transport accidents	2	3	5	1	11	1.3
W00-19	Falls	15	10	25	13	63	7.6
W20-49	Exposure to inanimate mechanical forces	17	19	8	17	61	7.4
W20	<i>Struck by thrown, projected or falling object</i>	(6)	(5)	(4)	(5)	(20)	(2.4)
W23	<i>Caught/crushed/jammed/pinched in or between objects</i>	(1)	(1)	(1)	(1)	(4)	(0.5)
W25	<i>Contact with sharp glass</i>	(0)	(0)	(0)	(1)	(1)	(0.1)
W29	<i>Other powered hand tools & household machinery</i>	(0)	(0)	(0)	(1)	(1)	(0.1)
W30	<i>Contact with agricultural machinery</i>	(3)	(5)	(2)	(3)	(13)	(1.6)
W31	<i>Contact with other and unspecified machinery</i>	(0)	(1)	(1)	(1)	(3)	(0.4)
W33-34	<i>Firearms</i>	(6)	(6)	(0)	(4)	(16)	(1.9)
W50-64	Exposure to animate mechanical forces	3	0	2	0	5	0.6
W65-74	Accidental drowning and submersion	5	4	11	5	25	3.0
W75-84	Other accidental threats to breathing	3	5	3	8	19	2.3
W85-99	Exposure to electric current, radiation and external ambient air temperature and pressure	1	2	3	2	8	1.0
X00-X09	Exposure to fire, smoke and flames	4	5	8	6	23	2.8
X10-X19	Contact with heat and hot substances	0	0	0	1	1	0.1
X20-29	Contact with venomous animals and plants	1	0	1	1	3	0.4
X30-39	Exposure to forces of nature	1	2	0	1	4	0.5
X40-49	Accidental poisoning and exposure to noxious substances	16	9	9	4	38	4.6
X50-57	Overexertion, travel and privation	0	1	0	0	1	0.1
X58-59	Accidental exposure to other and unspecified factors	28	38	26	42	134	16.2
Y40-84	Complications of medical and surgical care	3	2	1	1	7	0.8
Y85-89	Sequelae of external causes of morbidity and mortality	5	2	7	2	16	1.9
Total		201	194	218	212	825	100

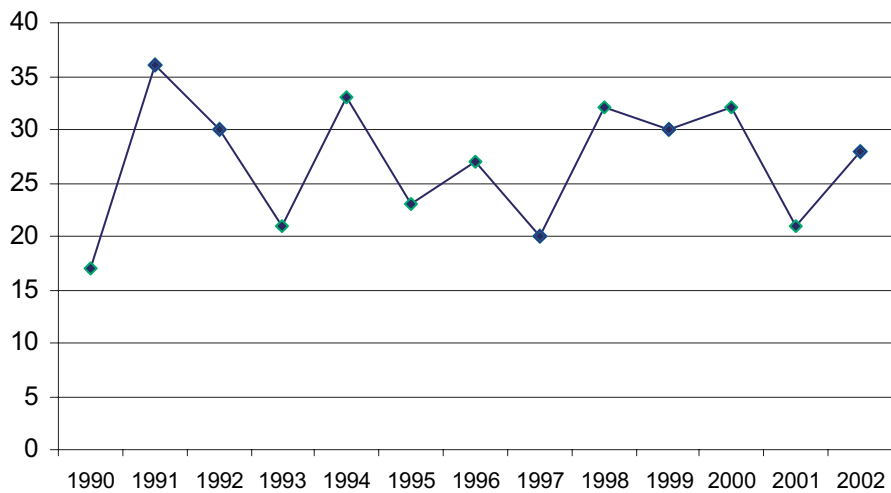
Source: ABS Deaths Database, HOIST NSW Health

3. Machinery deaths of farmers and farm workers

Figure 1 has been produced using ABS deaths data for 2 periods 1990-1998, where the coding system used was the ICD-9 code, and 1999-2001 where the coding changed to ICD-10. This has made direct comparison between these periods difficult, as definitions for each category have been substantially changed. Deaths data between 1990-1998 includes death due to agricultural machinery and other machinery, and between 1999-2001 includes death due tractors and exposure to inanimate mechanical forces.

Deaths due to “falls” (a proportion of which were from machinery) or ATVs are not included in this estimation.

Figure 1 Estimated number of Australian machinery related deaths of those whose occupation was farmer, farm manager and agricultural worker at time of death, Australia 1990-2001



Source: ABS 1990-1998, 1999-2001



4. Farm machinery related deaths 1989-1992

The most comprehensive study of farm related deaths was carried out by examination of coronial files for deaths occurring on farms during the period 1989-1992.

During this period 22.3 percent of traumatic deaths on Australian farms were associated with plant and equipment, including workshop equipment (Table 2).

Table 2 Agent of non-intentional injury death on Australian farms, 1989-1992

Agent	Work deaths	related	Bystander deaths	Other on-farm deaths	Total
Vehicle	70		43	13	126
Aircraft	46		0	0	46
Plant and equipment	113		24	2	139
Materials	12		0	1	13
Dam/River/Creek	15		46	9	70
Power lines	11		0	1	12
Other farm structure	20		14	5	39
Horse and other animal	26		4	10	40
Hazardous substances	3		1	2	6
Trees being felled	17		3	2	22
Fire/smoke	4		0	13	17
Other working environment	10		1	4	15
Firearms	18		5	4	27
Other	8		1	6	15
Total	373		142	72	587

Source: Franklin et al (2000)



5. Breakdown of farm machinery related deaths 1989-1992

Breakdown of the 1989-1992 data indicates that tractors were the single most common machine associated with traumatic death. Other items of plant, machinery and equipment that were associated more than once were:

- grain auger
- posthole digger
- tillage and seeding equipment
- earth moving equipment
- slasher
- pump
- harvesting machine
- fertiliser spreader.

Table 3 Plant and machinery agents of death by working status in Australia, 1989-1992

Agent	Working	Bystander	Total	% of deaths
Mobile farm machinery and plant				
Tractor	68	19	87	14.8
Linkage	-	1	1	0.2
Tillage/seeder	2	1	3	0.5
Fertiliser spreader	2	-	2	0.3
Earth moving equipment	3	-	3	0.5
Harvesting machine	2	-	2	0.3
Grain auger	6	-	6	1.0
Slasher	2	1	3	0.5
Hay baler	1	-	1	0.2
Posthole digger	4	-	4	0.7
Other mobile farm machinery nec	8	2	8	1.4
Total farm machinery and plant	98	24	122	20.8
Fixed plant and equipment				
Pump	3	-	3	0.5
Generator	1	-	1	0.2
Feed mixer	1	-	1	0.2
Other fixed plant equipment nec	4	-	4	0.7
Total fixed plant and equipment	9	-	9	1.5

Source: Franklin et al (2000)



6. Workers' compensation claims Australia-wide

Australia-wide there are around 1000 workers' compensation claims made each year for injury associated with powered machinery and equipment in the agriculture and horticulture industries (Table 4). This represents 23.7 percent of all claims in these industries.

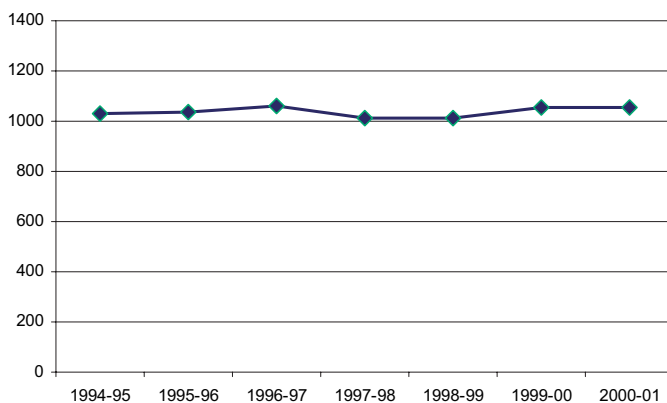
Table 4 Workers' compensation claims in agriculture and horticultural industries, all states 1994/95-2000/01

Agency	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	Total
Machinery & (mainly) fixed plant	339	311	285	275	326	288	288	2112
Mobile plant & transport	592	619	687	636	605	672	672	4483
Powered equipment, tools & appliances	102	106	87	100	79	96	96	666
Subtotal plant and machinery	1033	1036	1059	1011	1010	1056	1056	7261
Non-powered hand-tools, appliances & equipment	787	782	694	712	713	780	780	5248
Chemicals & chemical products	67	35	41	58	42	46	46	335
Materials & substances	361	337	315	365	376	328	328	2410
Environmental agencies	779	813	709	814	705	722	722	5264
Animal, human & biological agencies	847	861	831	886	890	834	834	5983
Other & unspecified agencies	543	578	548	525	591	700	700	4185
Total	4417	4442	4197	4371	4327	4466	4466	30686

Source: NOSI1 and NOSI2 Databases, NOHSC website January 2004

Note: excludes all journey claims

Figure 2 Number of workers' compensation claims relating to operation of powered machinery and equipment in agriculture and horticultural industries, Australia 1994/95-2000/01



Source: NOHSC NOSI Databases

7. Workers' compensation claims by industry

The highest number of workers' compensation claims relating to plant and machinery are made in the horticulture and mixed farming industries (Table 5). It would be expected that the cropping industries would have higher rates of machinery related injury in light of worker exposure to powered machinery in the course of crop production.

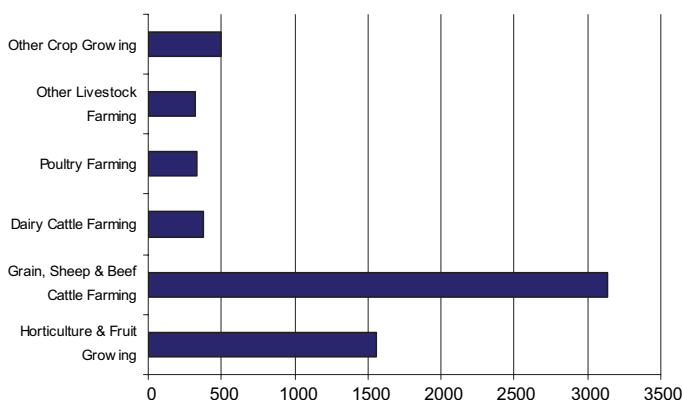
Table 5 Workers' compensation claims by rural industry and agent of injury, Australia 1994/95-1999/00

Agency	Horticulture & Fruit Growing	Grain, Sheep & Beef Cattle	Dairy Cattle	Poultry	Other Live-stock	Other Crop	Total
Machinery & (mainly) fixed plant	382	1030	74	144	88	117	1835
Mobile plant & transport	1017	1833	268	158	198	351	3825
Powered equipment, tools & appliances	154	271	31	32	37	30	555
Subtotal plant and machinery	1553	3134	373	334	323	498	6215
Non-powered handtools, appliances & equipment	2038	1200	213	471	236	316	4474
Chemicals & chemical products	121	88	19	26	16	30	300
Materials & substances	655	752	149	154	155	242	2107
Environmental agencies	1761	1627	265	292	272	337	4554
Animal, human & biological agencies	135	3555	391	312	651	88	5132
Other & unspecified agencies	1289	1171	199	256	258	316	3489
Total	7552	11527	1609	1845	1911	1827	26271

Source: NOS11 Database, NOHSC website January 2004

Note: excludes all journey claims

Figure 3 Total workers' compensation claims associated with plant and machinery by rural industry, Australia 1994/95-1999/00



Source: NOS11 Database, NOHSC website

8. Workers' compensation claims associated with machinery and fixed plant

Table 6 Workers' compensation claims associated with machinery and (mainly) fixed plant by mechanism of injury, 1994/95-1999/00

Breakdown agency	Falls, trips & slips of a person	Hitting objects with a part of the body	Being hit by moving objects	Sound & press-ure	Body stress-ing	Other & un-specified -mechan-isms of injury	Total
Cutting, slicing, sawing machinery	8	66	101	np	34	8	223
<i>Mech. shears/slicers/guillotine</i>	(0)	(15)	(19)	(np)	(12)	(np)	(53)
<i>Circular saws</i>	(0)	(12)	(12)	(np)	(np)	(np)	(27)
<i>Other powered saws</i>	(0)	(10)	(9)	(0)	(6)	(0)	(24)
<i>Lathes</i>	(0)	(0)	(8)	(0)	(0)	(0)	(8)
<i>Grinders</i>	(0)	(11)	(29)	(0)	(0)	(0)	(40)
<i>Cutting/slicing food machines</i>	(0)	(np)	(16)	(0)	(np)	(0)	(21)
Crushing/pressing/rolling machinery	8	6	69	np	18	0	107
<i>Power presses</i>	(6)	(np)	(19)	(0)	(12)	(0)	(40)
Heating/cooking/baking equipment	np	np	9	0	9	0	50
Cooling/refrigeration plant & equipment	0	0	np	0	np	0	np
Conveyors & lifting plant	74	47	248	0	75	9	454
<i>Mechanical power mechanisms</i>	(0)	(np)	(7)	(0)	(6)	(0)	(16)
<i>Conveyor belts & escalators</i>	(0)	(9)	(61)	(0)	(9)	(0)	(79)
<i>Caneloaders, haybale stackers</i>	(6)	(np)	(6)	(0)	(9)	(np)	(26)
<i>Power hoists</i>	(28)	(np)	(16)	(0)	(8)	(np)	(61)
<i>Lifts dumbwaiters</i>	(np)	(0)	(np)	(0)	(np)	(0)	(11)
<i>Cranes</i>	(np)	(0)	(7)	(0)	(0)	(0)	(10)
<i>Forklift trucks</i>	(22)	(9)	(64)	(0)	(11)	(np)	(109)
<i>Other conveyor & lifting plant</i>	(7)	(16)	(86)	(0)	(28)	(np)	(139)
Electrical installation	0	np	10	0	26	np	59
Filing/bottling/packageing plant	0	6	13	np	18	0	39
Other plant & equipment	37	233	218	23	361	10	891
<i>Sheep shearing plant</i>	(np)	(203)	(121)	(6)	(296)	(np)	(636)
<i>Water mains/pipe/valves/taps</i>	(10)	(6)	(12)	(0)	(25)	(np)	(63)
<i>Sewerage mains/pipes</i>	(0)	(np)	(np)	(0)	(6)	(np)	(10)
<i>Other & unspecified machine</i>	(25)	(19)	(81)	(16)	(31)	(6)	(181)
Total machinery and fixed plant	130	364	671	34	543	30	1827

Source: NOSI1 Database, NOHSC website January 2004

Note: excludes all journey claims

Workshop equipment, conveyor belts, forklifts, hoists and shearing plant should be priorities for injury prevention programs.

9. Workers' compensation claims associated with mobile plant and transport

Table 7 Workers' compensation claims associated with mobile plant and transport by mechanism of injury, 1994/95-1999/00

Breakdown Agency	Falls, trips & slips of a person	Hitting objects with a part of the body	Being hit by moving objects	Sound & pressure	Body stress-ing	Other & un-specified mechanisms	Total
Self propelled plant	106	39	171	np	63	20	405
Self-propelled harvesters	(61)	(24)	(99)	(0)	(34)	(7)	(225)
Graders/dozers/ snow ploughs	(16)	(np)	(15)	(np)	(10)	(np)	(54)
Excavators/ backhoes	(np)	(0)	(10)	(0)	(7)	(0)	(22)
Front-end loaders	(7)	(np)	(24)	(0)	(7)	(np)	(46)
Semi-portable plant	14	31	70	0	54	np	172
Pneumatic tools	(np)	(9)	(7)	(0)	(np)	(0)	(24)
Compressors pumps	(10)	(14)	(38)	(0)	(36)	(np)	(102)
Hydraulic equip nec	(0)	(np)	(17)	(0)	(np)	(0)	(28)
Other mobile plant	404	120	532	16	358	67	1505
Tractors	(246)	(48)	(207)	(19)	(136)	(60)	(719)
Ploughs/harrows/ cultivators	(22)	(14)	(58)	(0)	(27)	np	(124)
Ride-on mowers	(7)	(np)	(10)	(0)	(np)	(np)	(25)
Wheelbarrows	(0)	(np)	(np)	(0)	(16)	(0)	(22)
Trolleys/handcarts	(27)	(29)	(56)	(0)	(88)	(np)	(203)
Trailers/caravans	(79)	(16)	(88)	(0)	(45)	(np)	(229)
Other mobile plant	(21)	(np)	(87)	(np)	(33)	(0)	(148)
Road transport	385	63	165	6	111	948	1685
Trucks/semi-trailers/ lorries	(238)	(16)	(53)	(np)	(50)	(63)	(424)
Buses/trolleybuses/ minibuses	(np)	(0)	(np)	(0)	(np)	(0)	(np)
Cars/stationwagons/ vans/utes	(62)	(18)	(41)	(0)	(22)	(135)	(281)
Motorcycles/trailbikes	(39)	(26)	(52)	(0)	(27)	(729)	(876)
Other road transport	(40)	(0)	(17)	(0)	(11)	(8)	(76)
Total	925	260	951	25	592	1055	3826

Source: NOS11 Database, NOHSC website January 2004

Note: excludes all journey claims

Prevention of injuries associated with operation of harvesters, dozers, front-end loaders, pumps, tractors, cultivating equipment, trucks, motorcycles and other vehicles should be among priorities for injury prevention.

10. Workers' compensation claims associated with powered equipment, tools and appliances

Table 8 Workers' compensation claims associated with powered equipment, tools and appliances by mechanism of injury, 1994/95-1999/00

Breakdown Agency	Falls, trips & slips of a person	Hitting objects with a part of the body	Being hit by moving objects	Sound & pressure	Body stressing	Heat, radiation & electricity	Total
Workshop & worksite tools & equipment	np	52	106	np	37	41	245
<i>Abrasive/cutting powered tools</i>	<i>(0)</i>	<i>(32)</i>	<i>(66)</i>	<i>(0)</i>	<i>(6)</i>	<i>(np)</i>	<i>(106)</i>
<i>Electric drills</i>	<i>(0)</i>	<i>(11)</i>	<i>(12)</i>	<i>(0)</i>	<i>(11)</i>	<i>(np)</i>	<i>(35)</i>
<i>Arc welding equipment</i>	<i>(0)</i>	<i>(0)</i>	<i>(6)</i>	<i>(0)</i>	<i>(7)</i>	<i>(16)</i>	<i>(28)</i>
<i>Oxy-acetylene equipment</i>	<i>(0)</i>	<i>(0)</i>	<i>(0)</i>	<i>(0)</i>	<i>(np)</i>	<i>(18)</i>	<i>(22)</i>
Kitchen & domestic equipment	0	9	11	0	14	np	40
Office & electronic equipment	0	0	np	0	15	0	16
Garden & outdoor powered equipment	6	65	59	0	41	0	171
<i>Lawnmowers</i>	<i>(np)</i>	<i>(9)</i>	<i>(8)</i>	<i>(0)</i>	<i>(np)</i>	<i>(0)</i>	<i>(20)</i>
<i>Chainsaws</i>	<i>(0)</i>	<i>(48)</i>	<i>(35)</i>	<i>(0)</i>	<i>(19)</i>	<i>(0)</i>	<i>(100)</i>
<i>Weapons</i>	<i>(0)</i>	<i>(np)</i>	<i>(np)</i>	<i>(0)</i>	<i>(7)</i>	<i>(0)</i>	<i>(15)</i>
<i>Other powered equipment</i>	<i>(np)</i>	<i>(np)</i>	<i>(7)</i>	<i>(0)</i>	<i>(11)</i>	<i>(0)</i>	<i>(25)</i>
Pressure based equipment not elsewhere classified	0	np	10	np	19	np	46
Other powered equipment, tools & appliances	0	np	11	np	15	0	31
Total	10	135	199	np	141	49	549

Source: NOS11 Database, NOHSC website January 2004

Note: excludes all journey claims

Workshop equipment and **chainsaws** should be included as priorities for injury prevention programs.



11. Noise emissions

Noise on farms has been well established as posing risk of noise induced hearing loss and tinnitus in farmers and farm workers. The following table indicates noise levels associated with various machinery, equipment and activities on rural properties with recommended exposure limits.

Table 9 Average noise levels and recommended exposure limits for common farm machinery and activities.

Machinery/worker position during normal operating conditions	Noise level at operator's ear Average & Range (95% CI) LAeq dB(A)	Recommended exposure limits without hearing protection. <i>NB: Noise exposure risk for each activity in the day is cumulative toward the overall noise exposure risk.**</i>
Air compressors	86 (77- 95)	7 hrs (15 mins - 8 hrs+)
All terrain vehicles (ATVs)	86 (84 - 87)	7 hrs (4 - 8 hrs)
Angle grinders	98 (96 - 100)	20 mins (15 - 30 mins)
Others in workshop	90 (87 - 93)	2 hrs (1 - 5 hrs)
Augers	93 (89-96)	1 hr (30 mins - 3 hrs)
Bench grinders	99 (94 - 104)	18 mins (5 mins - 1 hr)
Others in workshop	89 (82 - 96)	3 hrs (40 mins - 8 hrs)
Bulldozers	99 (97 - 100)	18 mins (15 - 30 mins)
Chainsaws	106 (104 - 107)	3 mins (2 - 5 mins)
Others stacking wood	96 (93 - 99)	40 mins (15 - 50 mins)
Circular saws	99 (98 - 101)	18 mins (10 - 20 mins)
Others in workshop	89 (84 - 94)	3 hrs (1 - 8 hrs)
Cotton module press	86 (85 - 88)	6 hrs (4 - 8 hrs)
Cotton picker	81 (78 - 85)	8 hrs (8 hrs+)
Farm trucks	85 (83 - 88)	8 hrs (4 - 8 hrs)
Forklifts	84 (81-88)	8 hrs (4 - 8 hrs)
Firearms	Lpk 140+ dB	no exposure
Harvesters	83 (75 - 91)	8 hrs (2 - 8 hrs)
Irrigation pumps	100 (96 - 104)	15 mins (5 -30 mins)
Motorbikes - 2 wheel	81 (70 - 92)	8 hrs (1.5 - 8 hrs+)
Packing shed workers	80 (78 - 82)	8 hrs (8 hrs+)
Shearers	86 (84 - 87)	7 hrs (4 - 8 hrs)
Others in shed	80 (77-83)	8 hrs (8 hrs+)
Sugarcane harvester	86	7 hrs
Tractors with cabins	76 (75 - 78)	no limit
Av. increase with radio on	3 - 5 dB	8 hrs (8 hrs+)
Others in field	85 (80 - 90)	8 hrs (2 - 8 hrs+)
Tractors without cabins	92 (90 - 93)	1.5 (1 - 2) hrs
Others in field	82 (78 - 86)	8 hrs (6 - 8 hrs+)

* Sample sizes less than 5

Source: Farmsafe Australia. Noise injury prevention strategy.(2002)

** For example: If exposed to a noisy activity for half the recommended daily limit (eg. Angle grinder for 10 min of a 20 min daily limit), the remaining noise exposure in the day should not exceed half the recommended daily limit for another activity (eg. A limit of 4 hrs instead of 8hr on a tractor with a radio).

Farm managers need to ensure that workers and farm machinery operators are protected from damaging noise levels.

References

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4. National Occupational Health and Safety Commission: *The NOHSC Online Statistics Interactive National Workers Compensation Statistics Databases NOSI1 and NOSI2*. Website www.nohsc.gov.au 2004.

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Machine Injuries on Australian Farms

– THE FACTS –

Agriculture and horticultural enterprises produce commodities of more than \$30 billion value per annum on around 145 000 enterprises spread across all states of Australia.

High rates of serious injury and deaths on Australian farms are of concern to agricultural industry agencies, farmers and farm enterprises and federal and state governments.

This document has been produced to provide guidance to those agencies and individuals who are working to reduce risk associated with operation of farm machinery on Australian farms. The publication is also available electronically for use by educators and speakers in their efforts to raise awareness and promote machinery safety, and for those whose role is the development of public and industry policy to improve safety.

Downloads can be obtained from:

www.rirdc.gov.au



Australian Centre for Agricultural Health and Safety