



Australian Government
Department of Agriculture

Mortality Investigation Report 53

Sheep exported by air to Singapore in October 2014

May 2015



Summary

On 2 October 2014, 2,200 sheep were exported by International Livestock Export (ILE) by air from Perth to Changi, Singapore. There were 174 mortalities during the flight, a mortality rate of 7.91 per cent. This exceeds the reportable mortality level for sheep of two percent as prescribed by the *Australian Standards for the Export of Livestock (Version 2.3) April 2011* (ASEL).

The investigation found that the airline's explanation of inadequate ventilation due to an underperforming air conditioning pack is the most likely cause of the mortalities.

Introduction

On 2 October 2014, 2,200 sheep were exported by air from Perth to Changi, Singapore. There were 174 mortalities during the flight, a mortality rate of 7.91 per cent. This exceeds the reportable mortality level for sheep of two percent as prescribed by the *Australian Standards for the Export of Livestock* (ASEL). The department requested information from the exporter and the airline to investigate the cause of mortalities and to determine if any action is required to reduce the likelihood of a recurrence. Both the airline and the exporter provided all the information requested. The Agri-Food and Veterinary Authority (AVA) of Singapore provided an investigation report of their findings and the cause of the mortalities.

From April 2005 until this incident there were 12,022 sheep exported by air from Perth to Singapore in 14 consignments with 5 mortalities reported. Of these 10, consignments with a total of 11,106 sheep were exported by ILE with 5 mortalities reported.

ILE is experienced in the export of sheep by air. They have had one previous reportable mortality incident when exporting sheep by air. This was a consignment of sheep exported from Perth to Malaysia in 2009.

Investigation findings

Pre-export preparation

Sheep exported in this consignment were shorn merino wethers. The sheep were sourced from seven properties in Western Australia and entered pre-export quarantine on the 24 and 25 September 2014. There were two lambs rejected on arrival, one due to fly strike and one due to lameness. Three mortalities occurred at the approved premises during pre-export quarantine. Before export, the sheep were categorised based on live weight and accustomed to the feed and close social groupings. The Department of Agriculture and Food Western Australia, confirmed that the sheep complied with the Singapore slaughter sheep health certification including that the animals were sourced from districts in which infectious and contagious disease are under control and that Australia is free from foot and mouth disease, rinderpest, peste des petitis ruminants and contagious caprine pleuropneumonia for a period of six months before export.

An Australian Government Accredited Veterinarian (AAV) inspected the sheep on 30 September 2014 in pre-export quarantine and confirmed the sheep were free from clinical signs of infectious and/or contagious diseases at this time. No sheep were rejected at this inspection.

The animals were also inspected by a departmental veterinary officer (DVO) on 30 September 2014. During this inspection three animals were rejected. Two due to pink eye and one due to tail stump de-gloving.

Loading onto the aircraft

The sheep were transported from the approved premises to Perth International Airport by truck on 2 October 2014; the most direct route was travelled.

The sheep were loaded into 21 three tiered wooden crates and 15 two tiered wooden crates. A DVO was present during unloading from trucks and loading into crates which occurred between 10:00 am to 3:30 pm. The DVO reported that loading proceeded quickly and without incident. No sheep were rejected at this time.

The floor area of each tier of the crates was 6.13m². Twenty three or twenty four sheep were loaded onto each tier giving an average pen area of 0.242m² per head. The minimum pen area requirements specified in ASEL are determined by live weight. The average live weight for sheep in each crate was 43kg. Stocking density was in compliance with ASEL.

Prior to loading of the livestock, all aircraft doors were opened for at least an hour with the Auxiliary Power Unit (APU) running to allow for adequate ventilation. All air-conditioning packs were operated at high flow and low temperature settings to provide ventilation and cooling. The last crate was loaded onto the plane at 5:45pm. The ambient temperature at Perth airport at 3 pm on 2 October 2014 was 22.9°C (BOM).

After loading was completed the captain signed the *Special Load Notification to Captain* and the relevant documentation was handed over. The special load notification confirms the captain was aware that live sheep were being carried and notified the temperature requirements. The flight departed at approximately 6:20pm.

Crates

Crates used for this consignment complied with IATA guidelines.

Load plan

The load plan for the main deck for this consignment is shown at attachment 1. All triple tier crates and 7 double tier crates were loaded on the main deck. Eight double tier crates were loaded on the lower deck. The number of mortalities in each crate is indicated.

The airline reports that following pre-flight ground checks the aircraft was serviceable and released from Perth for service.

The airline advised they were unable to provide the department with information about past consignments using similar load plans stating that this information was not available.

In Flight

Special load notification documents to the captain state that the holds are to be kept as close to 10°C as possible. Aircraft data provided by the airline show that temperature readings reached 35°C on the main forward monitor and 26°C on the main aft monitor.

It is considered likely that temperatures inside the crates may have been higher than those recorded in the holds by the aircrafts temperature monitoring system. The pilot briefly inspected the holding area and following this the temperature setting was lowered to 4°C, the lowest temperature setting available on the Environmental Control System (ECS). The lights were also turned off in an attempt to reduce heat production.

ASEL does not require an AAV or accredited stockperson to be on board; however the exporter provided a stockperson to travel with this consignment. The stockperson did not enter the cargo area during the flight.

The total flight duration was around 5 hours and 30 minutes which was as expected.

The airline reports that there was no significant turbulence experienced during the flight.

Mortalities

Upon arrival in Changi around 11:30pm on 2 October 2014, 174 sheep were found dead. The mortalities primarily occurred in the upper tiers of the pens located in the forward main deck compartment of the aircraft as shown in attachment 1. Eighty eight per cent of mortalities occurred on the third tier and 12 per cent on the second tier of the triple tier crates. No mortalities were recorded on the lower deck which was composed only of the smaller double tiered crates. A post mortem investigation was performed by the Agri-Food and Veterinary Authority of Singapore (AVA). Upon arrival the AVA noted that ammonia levels in some crates were particularly high. A diagnosis of death due a fatal heat prostration (heat stroke) or air circulation failure within the air craft was made. This was based on the observation that distribution of deaths was mostly limited to top tiers, animals were panting on arrival and took water readily, hot body temperature of carcasses, no clinical signs of infectious or contagious disease, Australian health certificate certifying healthy animals were loaded and the high mortality rate that occurred in short time span of flight duration. Eight carcasses were sent to the AVA laboratory for post mortem, which further supported the diagnosis of a fatal heat prostration, with infectious or contagious diseases ruled out based on gross examination and microbiology.

The remainder of the sheep in the consignment are reported to have arrived in reasonable condition although some were showing signs of heat stress and dehydration. These sheep were dispatched to various mosques with no health issues reported.

Ground checks

Upon discharge of the sheep in Singapore the aircraft underwent ground maintenance checks. These checks included testing the aircraft temperature control and distribution of airflow. It was observed that the performance of one of the three air conditioning packs was relatively lower compared to the other two. This underperforming air-conditioner pack may have lead to a reduction in airflow.

Cause of Mortalities

From the information available inadequate ventilation in the forward cargo hold causing increased temperature, humidity, carbon dioxide and ammonia levels is suspected as the most likely cause of the mortalities.

Reports provided by the airline indicate that the air conditioning system was fully functional before loading the sheep, although after 2 hours into the flight it was noted that the temperature had reached 35°C in the forward cargo area and remained at this temperature for the remainder of the flight. After arriving in Changi a climate control system analysis showed one of the three air-conditioning packs was reported to be underperforming. The underlying cause for inadequate ventilation is reported by the airline to be an intermittent defect in this air conditioning pack during the flight.

Historical information

The department has reviewed historical data on mortality events during air transport of livestock. The data shown in table 1 confirms that mortalities in sheep exported by air are a rare event.

Year	2010	2011	2012	2013	2014
Total Sheep exported	21 201	30 865	23 688	35 875	39844
Total mortalities	3	42	0	45	177
Number of consignments	82	94	118	135	141
Mortalities as a percentage	0.01	0.14	0	0.13	0.44

Table 1: Summary of export of sheep by air and mortalities 2010 to 2014

Table 2 lists consignments similar to this one where full freighters of sheep have been exported between the period 2010 to 2014. The table shows that consignments similar to this one are routinely exported with successful outcomes.

Date	Load Port	Destination	Load Count	Mortalities	Aircraft type
This consignment	Perth	Singapore	2200	174	747-400
Dec 2014	Sydney	Malaysia	1350	0	747-400
Oct 2014	Perth	Malaysia	1440	0	747-400
Sept 2014	Sydney	Malaysia	1445	3	747-400
July 2014	Sydney	Malaysia	1213	0	747-400
May 2014	Perth	China	1247	0	B744F
Mar 2014	Perth	Malaysia	1737	0	747-400
Dec 2013	Perth	Malaysia	1480	0	747-400
Oct 2013	Perth	Malaysia	2290	0	747-400
Oct 2013	Perth	Singapore	2220	1	747-400
Oct 2013	Melbourne	China	1344	0	Not recorded
Aug 2013	Perth	Malaysia	2362	0	747
Aug 2013	Melbourne	China	1224	0	Not recorded
Jul 2013	Melbourne	China	1238	0	Not recorded
Mar 2013	Perth	Malaysia	1922	0	747
Oct 2012	Perth	Singapore	2400	0	Not recorded
May 2012	Sydney	Malaysia	1405	0	Not recorded
Dec 2011	Perth	Qatar	2169	1	Not recorded
Dec 2011	Perth	Qatar	2085	1	Not recorded
Dec 2011	Perth	Qatar	2217	32	Not recorded

Nov 2011	Perth	Singapore	2306	4	Not recorded
Oct 2011	Perth	Malaysia	2242	0	Not recorded
Oct 2011	Perth	Malaysia	2150	0	Not recorded
Oct 2011	Perth	Malaysia	2481	0	Not recorded
Feb 2011	Perth	Malaysia	2086	0	Not recorded
Dec 2010	Sydney	Malaysia	1135	0	Not recorded
Nov 2010	Perth	Malaysia	2443	0	Not recorded
Nov 2010	Perth	Singapore	1737	0	Not recorded
Nov 2010	Perth	Singapore	1905	0	Not recorded
Sept 2010	Melbourne	China	1279	0	Not recorded
Mar 2010	Perth	Malaysia	1133	0	Not recorded

Table2: Summary of full freighter exports of sheep by air

Conclusions

Inadequate ventilation is the most likely cause of the mortalities. The high mortality of sheep in the upper decks of the crates is consistent with inadequate ventilation causing increased temperature, humidity, carbon dioxide and ammonia levels during the flight.

There was no significant differences identified in the preparation and procedures used for this consignment compared with previous consignments.

Actions

The airline reports they have undertaken several actions in response to this incident including:

- Changed several components of the air conditioning pack on this aircraft. As of 16 April 2015 and after resuming carriage of livestock no further mortalities or other issues have been reported.
- Added additional checks to the climate control system before clearance of the aircraft for transport of livestock.
- Provided extra briefing to crew about the importance of monitoring the environmental control system when transporting livestock.

In determining whether further regulatory action should be applied to the export of livestock by air the department has reviewed historical data on mortality events during air transport of livestock. Based on this information and the findings of this investigation no further regulatory action has been taken at this time. However, as a result of this and other air mortality events, industry is undertaking further research to identify and address the risks identified for the transport of livestock by air. The department will continue to monitor and investigate air mortalities and will consider the research findings, when available, to determine whether further regulatory requirements should be applied.

References

Bureau of Meteorology (2014). *Perth Airport, Western Australia, October 2014 Daily Weather Observations*, Australian Government. viewed 12th November 2014.
<http://www.bom.gov.au/climate/dwo/201410/html/IDCJDW6110.201410.shtml>)

Attachment 1 - Loading Plan & Mortalities

Main Deck

A1	A2	B1	CR	DR	ER 20 (3)	FR 20 (3) 7 (2)	GR 20 (3)	HR 19 (3)	JR 4 (2)	KR 4 (3)	LR	MR	PR	RR 1 (3)	SR	T
			CL	DL	EL 19 (3)	FL 20 (3)	GL 21 (3)	HL 4 (2)	JL 7 (3)	KL 2 (3)	LL	ML	PL	RL	SL 6 (2)	



Lower Deck

11P	12P	21P	22P	23P	31P	32P	41P	42P	45R	51	52
									45L		

No colour = vacant space

Blue = Double tiered crate

Orange = Triple tiered crate

Details of each box:

- Crate location at top of box eg FR
- Number of mortalities listed below in bold eg **20**
- Bracketed number is the tier number where the mortalities occurred eg (3)