Investigation into the reportable cattle mortality level on sea voyage from Fremantle, Western Australia to Egypt, February 2010.

1. Purpose

To report on the investigation into the cause of mortalities in cattle exported by sea to Egypt, and to make recommendations with the objective of reducing the likelihood of a recurrence.

2. Summary

There were 16,460 cattle loaded on the vessel in Fremantle on 23 February 2010. There were 295 mortalities in the cattle which equates to a mortality percentage of 1.79%. The cattle are the subject of the investigation.

There were also 40,282 sheep loaded for export to Qatar as a second port of call after Egypt. There were 362 mortalities in the sheep, equivalent to a mortality rate of 0.90%. Since, the sheep did not exceed the reportable mortality level; they are not discussed further in this report.

The main cause of cattle mortality was reported to be pneumonia. There are a number of factors that can contribute to the development of pneumonia in cattle. In this case breed, lack of immunity to infectious pathogens, heat stress, deck conditions, stress of co-mingling, environment and transport are likely to have contributed to the development of pneumonia in these cattle.

Unavailability of crew and stockmen to clean the lower decks may have contributed to increased wet bulb temperatures and clinical heat stress on these decks. While there is insufficient information available to determine if this had a significant affect on mortality, failure to clean these decks may suggest that there was too low a ratio of stockmen and crew to animals on this voyage.

Records indicated there was no breakdown or interruption of livestock services, equipment or machinery on the vessel that could have contributed to the mortality.

The livestock export industry is currently undertaking a research project titled ‘Investigating Causes of Mortality in Cattle’. The objectives of this research are to develop standardised systems for ongoing collection of mortality data and to determine the causes of mortality in cattle exported live by sea, with an emphasis on bovine respiratory disease. This reportable mortality event reiterates the need for such research.

3. Information reviewed

The investigation into the mortality was completed by reviewing the following information:

1. Report from the exporter
2. End of Voyage and daily reports from the AQIS accredited veterinarian (AAV) who accompanied the consignment on board the vessel.
3. Records from the AAV who prepared the consignment.
4. Report from the Master of the vessel.
5. Report from the Australian Maritime Safety Authority (AMSA).
6. Report from the AQIS regional certifying officers.
7. Records from the registered premises.

4. Findings

There were 295 mortalities out of 16,460 cattle loaded which equates to a mortality rate of 1.79%. There were 28 mortalities for which no detailed information (including location on vessel, date of mortality and cause of death) is available. The analysis of mortality contained in this report only includes the 267 mortalities for which detailed information is available.

4.1 Chronology of events

A summary of events based on the daily voyage reports to AQIS is reported in Table 1. The reportable mortality trigger for cattle is 1%. The reportable mortality level was triggered on day 17 of the voyage.

Table 1 - Chronology of events showing cumulative mortality (count and percentage) by day.

Date	Day	Event	Cumulative mortality count	Cumulative Mortality %
19/02/2010-21/02/2010		16 460 cattle loaded in Fremantle.	0	0.00%
22/02/2010		Loading of 40 282 sheep completed.	0	0.00%
23/02/2010	1	Loading fodder in Kwinana Port. 3 Mortalities	3	0.02%
24/02/2010	2	Loading fodder in Kwinana completed. 4 mortalities.	7	0.04%
25/02/2010	3	3 mortalities.	10	0.06%
26/02/2010	4	Ship turned back to Geraldton to discharged injured seaman. 3 mortalities.	13	0.08%
27/02/2010	5	6 Mortalities.	19	0.12%
28/02/2010	6	4 Mortalities.	23	0.14%
01/03/2010	7	11 Mortalities.	34	0.21%
02/03/2010	8	6 Mortalities.	40	0.24%
03/03/2010	9	6 Mortalities.	46	0.28%
04/03/2010	10	Crossed equator. 7 Mortalities.	53	0.32%
05/03/2010	11	5 Mortalities.	58	0.35%
06/03/2010	12	13 Mortalities.	71	0.43%
07/03/2010	13	Stopped in Salalah (Oman) to pick up security guards. 15 Mortalities.	86	0.52%
08/03/2010	14	12 Mortalities.	98	0.60%
09/03/2010	15	14 Mortalities.	112	0.68%
10/03/2010	16	Stopped in Djibouti to drop off security guards. 23 Mortalities.	135	0.82%
11/03/2010	17	31 Mortalities.	166	**1.00%**

Date	Day	Event	Cumulative mortality count	Cumulative Mortality %
12/03/2010	18	31 Mortalities.	197	1.20%
13/03/2010 & 14/03/2010	19 & 20	Vessel arrived in Sokhna Port and commenced unloading cattle. 30 Mortalities.	227	1.38%
15/03/2010 & 16/03/2010	21 & 22	Unloading of cattle complete 40 Mortalities.	267	1.62%
		28 Mortalities for which detailed information is not available.	295	1.79%

4.2 Preparation in the Registered Premises

The cattle exported were assembled at five separate registered premises. A total of 16,522 head of cattle were received for this consignment between 1 and 17 February 2010. All cattle were sourced according to the Australian Standards for the Export of Livestock (ASEL) requirements and spent a minimum of one clear day in the registered premises. Sixteen mortalities occurred during the preparation period in the registered premises. The cause of mortality was mixed (seven respiratory disease, three musculoskeletal disease; six gastrointestinal disease). The treatment records indicate that no medication was administered to cattle cleared to leave the registered premises for loading.

The Egypt slaughter cattle protocol did not require a period of pre export isolation, or any treatments or vaccinations to be administered prior to export. No additional treatments or vaccinations were administered. All cattle were examined in the registered premises by an AQIS accredited veterinarian (AAV) during the 48 hours prior to loading and were found free of evidence of disease and fit to travel. The AAV records indicate 43 head of cattle were rejected at the registered premises. The majority (36), were rejected for eye problems, with the remainder rejected for ill thrift, bloat and lameness. In addition, AQIS veterinary officers inspected the cattle at the registered premises, following AAV inspection, and recorded the cattle to be in good health.

4.3 Loading onto the Vessel

The loading records indicate the stocking density of the cattle was in accordance with the minimum pen area required by the ASEL. The final heat stress risk assessment model indicated, at these stocking densities, the risk of mortality due to heat stress complied with the ASEL. The records also indicate that the amount of fodder and water loaded was in accordance with the ASEL. The records indicate that 1 animal was rejected at the port. This animal was displaying signs of weakness upon arrival at the port.

Livestock and fodder were loaded at Fremantle Port from 19 to 22 February, and additional fodder (1,500 metric tones) was loaded at Kwinana Port (South of Fremantle) on 23 and 24 February. Loading was conducted in this way because of the draft (vertical distance between the waterline and the bottom of the vessel) of the vessel. As such the vessel can only be fully loaded in a deep water berth. The exporter reported that a deep water berth had been booked in Fremantle Port, but that this was cancelled by the Port one day prior to loading. A

decision was taken to load the livestock and some of the fodder in Fremantle Port, where livestock loading facilities are available, and then move the vessel to Kwinana Port, (where a deep water birth was available) to load the remainder of the fodder. The exporter reported that if the deep water berth had been available in Fremantle Port, the vessel may have been able to sail as early as the evening of 22 February.

Under the ASEL, 'day one' of the voyage is officially reported as the first day at sea after leaving the port of loading. The daily reports prepared for this voyage and received by AQIS meet this requirement.

4.4 Conditions during the Journey and Cattle Health

i. Temperature, humidity and heat stress

Figure 1 shows the wet bulb temperature for each cattle deck by day as well as the heat stress threshold (HST) and mortality limit (ML) for adult Bos taurus cattle. Deck temperatures were sourced from the daily voyage reports. HST and ML values for Bos taurus cattle are shown because the majority of the cattle loaded (96%) were Bos taurus cattle.

Heat stress threshold is the maximum ambient wet bulb temperature at which heat balance of the deep body temperature can be controlled using available mechanisms of heat loss. The estimated HST is 30 degrees celcius for adult Bos taurus beef cattle and 32.5 degrees celcius for adult Bos indicus beef cattle. Mortality limit is the wet bulb temperature at which the animal will die. The estimated ML is 33.2 degrees celcius for adult Bos taurus beef cattle and 36 degrees celcius for adult Bos indicus beef cattle (Maunsell Australia Pty Ltd 2003).

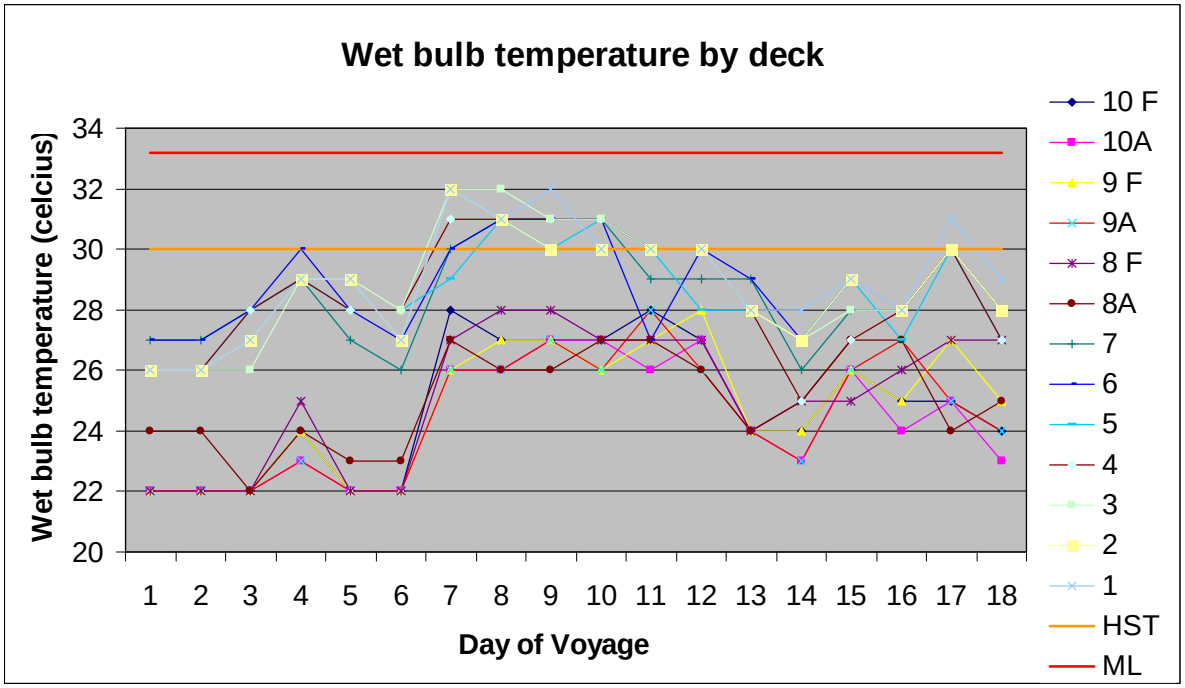

Figure 1 - Wet bulb temperatures by deck and day, heat stress threshold (HST) and mortality limit (ML) for adult Bos taurus cattle.

Decks 1 to 7 are fully enclosed and are refered to as the lower decks. Decks 8 to 10 are open and are refered to as the upper decks.

The available information indicates that there was a trend for the lower decks to record higher wet bulb temperatures than the upper decks. The information shows that Bos indicus

cattle were not exposed to temperatures in excess of their heat stress threshold or mortality limit on any day. Bos taurus cattle on some lower decks were exposed to temperatures above the heat stress threshold from days 7 to 12 and day on 17 of the voyage. The recorded wet bulb temperatures did not exceed the mortality limit on any deck on any day. However, the daily and end of voyage reports did record mortalities related to heat stress on days 17 and 18 of the voyage. The AMSA investigation postulated that 'hot spots' might exist as a result of airflow patterns across the pens.

The daily voyage reports also record the clinical heat stress experienced by cattle during the voyage. The heat stress scoring, as defined in Michael McCarthy's (2005) paper on shipboard conditions and animal performance, is shown in table 2.

Table 2 - Heat stress score definitions and clinical signs in cattle.

Score	Definition	Clinical Signs
One	Mild heat stress	Drooling and increased respiration rate of 80-100 breaths per minute (bpm)
Two	Moderate heat stress	Drooling, respiration rate of 100-120 bpm and occasional open mouth panting
Three	Severe heat stress	Drooling, respiratory rate greater than 120 bpm, open mouth panting and tongue out. Cattle will also have an agitated appearance, hunched stance and will often have their head down.

The daily voyage reports show that 'moderate to severe' heat stress occurred on decks 1 to 4 from day 3 to 18 of the voyage. 'Moderate to severe' heat stress was also recorded on decks 5 to 7 from day 12 to 18 of the voyage. There was no record of 'moderate to severe' or 'severe' heat stress on any of the upper decks on any day. These results are consistent with the recorded wet bulb temperatures reported in figure two.

The daily voyage reports document the respiratory character of the cattle during the journey. Table 3 shows the ASEL definitions for respiratory character.

Table 3 - Respiratory character score definitions in cattle.

Score	Definition
One	Normal
Two	Panting
Three	Gasping

On the lower decks, respiratory character was recorded as 'panting' from day 2 to 4 of the journey and 'panting to gasping' from day 11 to 18 of the journey. On the upper decks, respiratory character was recorded as 'normal to panting' from day 4 to 10 and 'panting' from day 11 to 18 of the journey. From day 19 until completion of the journey, the respiratory character was 'panting' on the lower decks and 'normal to panting' on the upper decks.

ii. Deck conditions

The daily reports from the vessel include information on deck conditions. Deck condition score definitions are provided in the LiveCorp Stockman's Handbook (LiveCorp 2006) and are outlined in table 4.

Table 4 - Deck condition score definitions.

Score	Definition
One	Good, dry conditions
Two	Wetter, but not serious conditions
Three	Very wet conditions that need cleaning out

The daily voyage reports indicate score three was recorded on the lower decks from day 13 of the voyage with no resultant cleaning out. The reason reported in the daily reports and end of voyage report was that washing could not be performed due to stability reasons. The stability of the vessel was assessed by AMSA and is discussed under section 6 of this report. The exporter later clarified that this was cited by the vessel Master to avoid assigning crew for this purpose when he felt they were diverted to other tasks such as carcass disposal.

The available information indicates that on the lower decks, wet bulb temperatures were higher and that the cattle on these decks experienced moderate to severe heat stress. The lack of deck washing on these decks may have contributed to this. There is insufficient information available to determine if the deck conditions had a significant affect on mortality.

iii. Treatments administered

An assessment of treatments administered to the stock was made as part of this investigation. Daily reports stated antibiotic, anti-inflammatory and other treatments were administered to the cattle during the voyage, and the exporter provided a record of the veterinary medicines used during the journey. Based on the records available, 1,656 cattle (10.1% of cattle loaded) were administered antibiotics to treat pneumonia. Other conditions that were treated included eye infections, lameness and travel injuries. No information was available as to the outcome of these treatments, including whether or not the treated animals were included in the mortality count.

4.6 Mortality by Cause

Mortality information received included the daily voyage reports, the end of voyage reports, a spreadsheet of mortality records prepared by the veterinarian during the voyage and a summary report on cause of mortality prepared by the veterinarian. The assessment of mortality by cause is based on the veterinarian's mortality spreadsheet which the on board veterinarian indicated is the most accurate record of mortality.

Post-mortems were performed each day, up to and including day 15 of the voyage. From day 16 onward the vessel was preparing to enter port and in port discharging cattle and post-mortems could no longer be performed. For the remainder of the voyage 124 carcasses were visually assessed and it was determined that mortality was likely due to a combination of pneumonia, inanition and heat stress. In addition to this, there were 25 cattle euthanased in the last three days of the voyage. 17 of these cattle were unable to rise and 8 were sick and were rejected by the Egyptian quarantine officials.

The veterinarian's mortality spreadsheet showed that 118 postmortems were performed up to and including day 15 of the voyage. A diagnosis was reached in 97 of these with 17 of the remaining animals being decomposed and 4 listed as unknown cause of mortality.

The veterinarian reported the following causes of mortality; 56.7% (55) due to pneumonia, 16.5% (16) due to a combination of inanition and pneumonia, 13.4% (13) due to abdominal diseases (bloat, rumenal indigestion, peritonitis and enteritis) and the remaining 13.4% (13) due to other causes (misadventure, inanition and septicaemia). Figure 2 shows the percentage of diagnosed mortality assigned to each category.

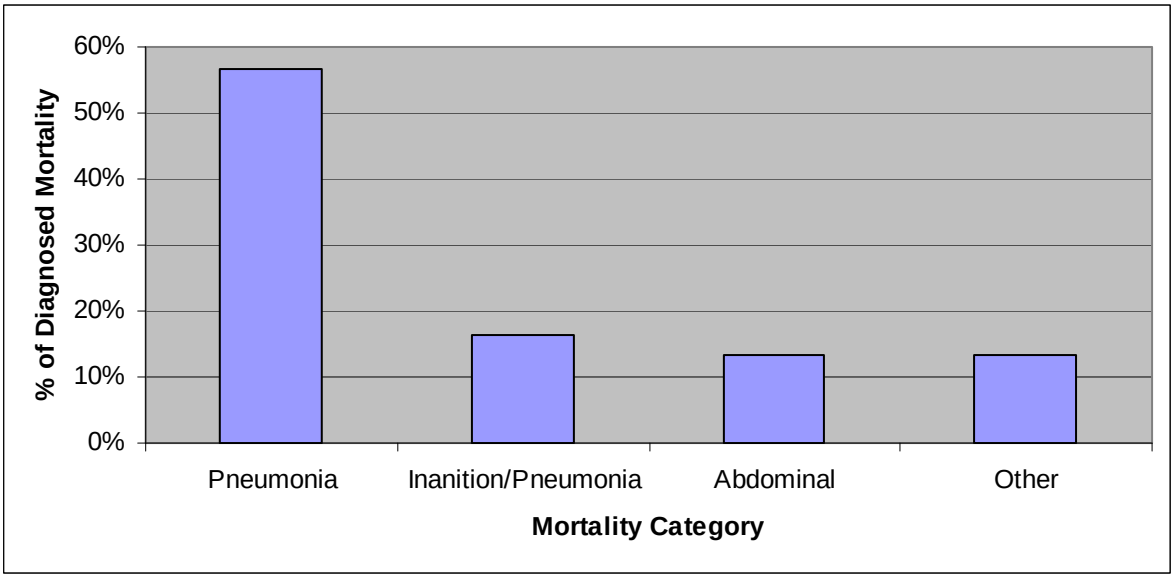

Figure 2 - Percentage of diagnosed mortality assigned to each category.

Pneumonia was the most important cause of mortality and was associated with 73.2% of the diagnosed mortalities. In addition to this, pneumonia was recorded as a contributing factor in the 124 mortalities that were visually assessed, meaning that pneumonia caused or contributed to 195 of the 267 (73.0%) mortalities that were recorded during the voyage.

4.7 Mortality by Day

Figure 3 shows the percentage of cattle that died each day based on information provided in the daily voyage reports. Combined daily reports were received for days 19 and 20 with a total of 30 mortalities, and also for days 21 and 22 with a total of 40 mortalities. In the figure below, the mortality recorded on the combined daily reports has been distributed evenly across the two days.

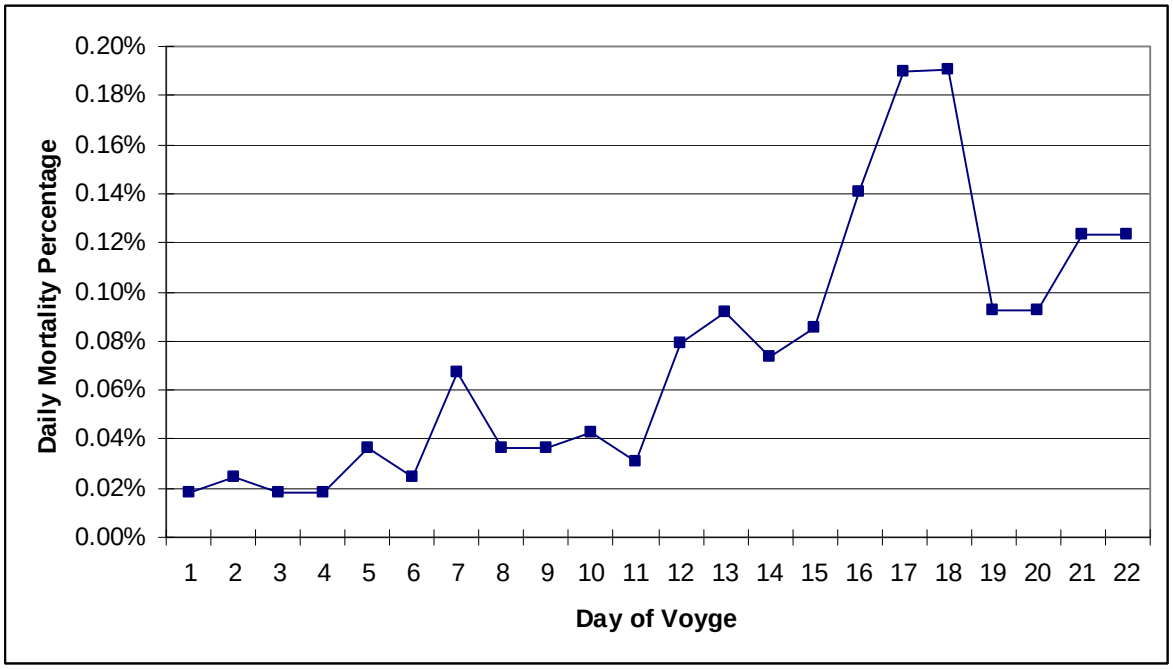

Figure 3 - Daily Mortality Percentage. The blue line indicates the percentage on animals that died each day (not cumulative).

The end of voyage report comments that mortalities for the first few days were low and started to rise on day 5 of the voyage as deck temperatures and humidity increased. The veterinarian's opinion was that initial mortalities were related to abdominal diseases, with mortalities due to pneumonia beginning from day four and increasing as the voyage progressed. Figure 3 shows that the daily mortality percentage increased sharply from day 12 and remained high for the duration of the voyage.

4.8 Mortality by line and cattle breed

Table 5 shows the mortality rate for each line of cattle as reported in the end of voyage report. The animals are categorised into lines is based on average weight.

Table 5 - Average weight, number loaded mortality count and mortality percentage by line of cattle.

Line of cattle	Average Weight	Number loaded	Mortality Count	Mortality %
Steer group one	277	4894	73	1.5%
Steer group two	325	4422	78	1.8%
Steer group three	382	2179	35	1.6%
Steer group four	476	4304	80	1.9%
Bull group one	295	219	1	0.5%
Bull group two	356	124	1	0.08
Bull group three	392	245	0	0
Bull group four	456	73	0	0

Mortality by breed is illustrated in Table 6 and is based on information provided by the exporter.

Table 6 - Number of cattle loaded, percentage of total shipment, mortality count, mortality percentage and percentage of total loss by breed.

Breed	Number	% of Total Shipment	Mortality Count	Mortality % for breed	% of Total Loss
Angus	10,073	61.2%	111	1.1%	41.6%
Simmental X	1,551	9.4%	59	3.8%	22.1%
Charolais X	584	3.5%	37	6.3%	13.9%
Wagyu	628	3.8%	12	1.9%	4.5%
Various	992	6.0%	14	1.4%	5.2%
Murray grey	575	3.5%	9	1.6%	3.4%
South devon	397	2.4%	9	2.3%	3.4%
Shorthorn	607	3.7%	8	1.3%	3.0%
Limousin X	332	2.0%	4	1.2%	1.5%
Gelbviegh	76	0.5%	3	3.9%	1.1%
Brahman X	629	3.8%	1	0.2%	0.4%
Hereford X	16	0.1%	0	0.0%	0.0%
Total	**16,460**		**267**		

The table shows that while 41.6 % of mortality occurred in Angus cattle these animals made up 61.2% of the total shipment. In comparison, 22.1% of mortality occurred in Simmental

cross cattle, but these animals only made up 9.4% of the shipment. Similarly, mortality was disproportionately high in Charolais cross.

The Bos indicus infused cattle experienced only one loss and the lowest percentage loss (excluding Hereford cross cattle). The veterinarian commented in the end of voyage report that the type of cattle loaded contributed significantly to the difficulty of the voyage.

The steers had higher mortality rates than the bulls on this voyage. It is also apparent that there was variation in mortality between breeds of cattle. There is insufficient information available to determine why these differences in mortality between classes and breeds of cattle occurred.

4.9 Mortality by Deck

Table 7 shows mortality by deck based on the end of voyage report. The number of cattle per deck is based on a load plan submitted by the exporter.

Table 7 - Mortality by deck including description of deck, number loaded, mortality count and mortality percentage.

Deck	Description	Number of Cattle Loaded	Mortality Count	Mortality %
1	Enclosed	904	13	1.4%
2	Enclosed	1412	31	2.2%
3	Enclosed	1216	23	1.9%
4	Enclosed	1295	24	1.9%
5	Enclosed	929	22	2.4%
6	Enclosed	848	15	1.8%
7	Enclosed	888	23	2.6%
8A	Open	616	4	0.6%
8F	Open	1617	7	0.4%
9A	Open	915	13	1.4%
9F	Open	2223	48	2.2%
10A	Open	920	14	1.5%
10F	Open	2677	31	1.2%

Mortality percentages were highest on decks two, five, seven and nine forward. According to the end of voyage report, steer group one and two were housed on lower decks 1 to 4, steer groups three and four were housed on decks 10 forward and 8 to 10 aft, and bulls on decks 5-9 forward.

There is insufficient information available to determine if the differences in mortality between decks were driven by cattle factors, deck factors or a combination of the two.

5. Discharge

Discharge of cattle occurred at Sokhna port from 13 to 15 March 2010. According to the relevant daily report, discharge was disrupted to move sheep to lower decks to maintain vessel stability. A total of 16 165 cattle were unloaded.

6. AMSA evaluation of the vessel upon return to Australia

The AMSA evaluation of this vessel concluded that there was no breakdown or interruption of livestock services, equipment or machinery that contributed to the mortality. They noted the possibility of hot spots existing in some areas of the vessel and also that failure to wash down the enclosed decks may have contributed to the mortality. AMSA investigated the mention of stability issues surrounding the vessel and found no indication of stability problems with this voyage.

7. Conclusion

Pneumonia was the most important cause of mortality and was associated with 73.2% of the diagnosed mortalities. There are a number of factors that can contribute to the development of pneumonia in cattle. In this case breed, lack of immunity to infectious pathogens (from either background vaccination or prior exposure to pathogens), heat stress, deck conditions, stress of co-mingling, environment and transport are likely to have contributed to the development of pneumonia in these cattle.

Other causes of mortality included inanition, bloat, rumenal indigestion, peritonitis, enteritis, misadventure and septicaemia. Twenty five cattle were euthanased in the last three days of the voyage.

The available information indicates that on the lower decks, wet bulb temperatures were higher and the cattle on these decks experienced moderate to severe heat stress. The lack of deck washing on these decks may have contributed to this. There is insufficient information available to determine if the deck conditions had a significant affect on mortality. However, failure to clean decks when indicated, as the crew was diverted to other tasks, may suggest that there was too low a ratio of stockmen and crew to animals on this voyage.

8. Recommendations

AQIS is considering applying the following conditions to consignments of cattle exported to, or through, the Middle East or North Africa by this exporter.

- The cattle must be vaccinated with a suitable product for bovine respiratory disease.
- The on board veterinary supplies should include:
    - antibiotics appropriate for the treatment of bovine respiratory disease at the rate of at least 100 cattle doses per 1000 head of cattle loaded.
    - anti-inflammatory drugs- flunixin or equivalent- at a rate of at least 50 cattle doses per 1000 head of cattle loaded.
- An additional accredited stockman is required to accompany the cattle.
- Cattle must be resident for 3 clear days in the registered premises immediately prior to export.
- Loading of fodder and water to be completed prior to completion of loading of livestock.
- The cattle must be provided with additional space over and above the ASEL requirements.
- The end of voyage report must include details of the suspected causes of mortality (based on post mortem examination findings where possible).

AQIS will consider applying these conditions on a case by case basis, taking into consideration the exporter's prior performance for each market, the number and type of cattle to be loaded, the time of year and the importing country's requirements (i.e. vaccination or pre-export isolation may be an importing country requirement). All or some of these conditions may be applied to consignments if AQIS determines that the condition(s) are necessary to address the risk of adverse animal health and welfare outcomes.

The exporter has proposed the following management strategies to reduce the risk of reoccurrence. AQIS accepts the exporter's decision to:

1. contract only cattle that have been through a suitable weaning practice;
2. consider developing a background vaccination protocol for bovine respiratory disease to ensure that cattle have maximum immunity to bovine respiratory disease on entering the registered premises;
3. allocate additional space (stocking density) on the vessel as a preventative management for higher risk cattle;
4. strategically consider the placement of high risk cattle when drafting the vessel load plan;
5. ensure depot, transport and loading arrangements are well planned to minimise delay of departure of the vessel;
6. enhance early identification of individual cattle suffering from fever by considering methods such as the addition of scanning thermometers to the veterinary equipment.
7. manage voyages to ensure that the Captain has sufficient resources to wash the decks without limitations (apart from restrictions applied under International Maritime Conventions). The decision to wash decks will made by the Captain in consultation with the onboard veterinarian and with regard to the health and welfare of the livestock.

The livestock export industry is currently undertaking a research project titled 'Investigating Causes of Mortality in Cattle'. The objectives of this research are to develop standardised systems for ongoing collection of mortality data and to determine the causes of mortality in cattle exported live by sea with an emphasis on bovine respiratory disease. This reportable mortality event reiterates the need for such research.

9. Actions and results for subsequent voyages

The exporter proposed the following additional risk management procedures for a subsequent consignment of 226 cattle exported to Qatar and Pakistan in April 2010:

1. An additional stockman to attend specifically to the cattle to accompany the voyage.
2. The cattle will receive an additional 50 per cent space over and above the Australian Standards for the Export of Livestock.
3. Additional bedding will be loaded.
4. Additional chaff will be loaded.
5. Specific antibiotics to treat bovine respiratory disease and clinical mastitis will be loaded.
6. No cattle more than 18 weeks pregnant at the time of departure will be loaded.
7. The cattle will be loaded on the deck that had the lowest incidence of mortalities from the previous consignment.

AQIS accepted the exporter's proposals and approved the consignment subject to the following condition:

- Cattle are loaded with at least 50% extra space above the ASEL and in accordance with the amended livestock management plan provided by the exporter, including appropriate antibiotics for clinical mastitis.

The result for this consignment was excellent with no mortality reported out of 226 cattle loaded.

A senior AQIS veterinary officer accompanied the subsequent consignment of cattle exported to Egypt by this exporter in June 2010. To reduce the risk of pneumonia related mortality, AQIS placed the following conditions on the consignment:

- The cattle are provided at least an additional 10 per cent space above the ASEL prescribed stocking density.
- Days loading the cattle on board the vessel to be included in the final calculation for feed, water and bedding provided.
- All feed, water, and bedding to be loaded prior to completion of loading of cattle.
- The on board veterinary supplies should include:
  - antibiotics appropriate for the treatment of bovine respiratory disease at the rate of at least 100 cattle doses per 1000 head of cattle loaded.
  - anti-inflammatory drugs- flunixin or equivalent- at a rate of at least 50 cattle doses per 1000 head of cattle loaded.
- The end of voyage report must include details of the suspected causes of mortality (based on post mortem examination findings where possible).

In addition, the exporter vaccinated all cattle for bovine respiratory disease in the registered premises. The result for the consignment with these conditions applied was 20 mortalities (17 at sea and 3 in port during unloading) reported out of 17,186 cattle loaded which equates to a mortality rate of 0.12%.

10. References:

1. Maunsell Australia Pty Ltd. 2003. LIVE.116 Development of a heat stress risk management model. Meat and Livestock Australia.
2. McCarthy, M (2005). LIVE.223 Pilot monitoring of shipboard environmental conditions and animal performance. Meat and Livestock Australia.
3. Ainsworth, R (2006). Stockman's Handbook Transportation of Cattle by Sea – Short & Long Haul Voyages. LiveCorp March 2006.