

Final report

Improving human performance – evaluation of exo-suit manual assist devices

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Abstract

Notwithstanding progress in meat processing automation, many tasks remain manual for the foreseeable future. This partnership project with Meat & Livestock Australia (MLA) was arranged to evaluate the current generation of manual assistance devices, also known as exoskeletons, across various sites from farm to processing, warehousing to retail ready operations.

The project included 8 milestones, involving trials with the exoskeleton devices at different locations nationally. Each milestone included the following:

- Pre-milestone meeting; objectives of the milestone, expectations of site, support provided.
- Site visit
- Initial demonstration
- Fitting training
- Task assessment and evaluation for trial
- Task analysis
- Fitting individuals
- Ongoing support
- Data collection questionnaires
- Logistics of transporting devices
- Data collection and reporting

Application for use of the devices was identified in a number of different areas including; cold stores, the boning room, slaughter floor, loading area and retail ready. Feedback from the workforce regarding the comfort, level of support and ease of use was varying. In almost all cases where fatigue scores were measured, there was a reduction in rating of fatigue after wearing the devices. Arguably the most successful areas within facilities were the dry/clean areas such as cold stores/loading area.

A facility participating in this trial, has placed orders for a significant number of exoskeletons to be used throughout their organisation, indicating the success identified.

Challenges found consistently throughout the project included the following; lack of volunteers, lack of volunteer commitment to trialling the devices over multiple days, operational demands conflicting with trial objectives, incorrect fitting or device adjustments not being made due to lack of site facilitation.

The potential for significant benefits within the industry has been found. The key outcome from this project is that further investigation via an internally supported and endorsed trial, is justified.

The Ottobock Bionic Exoskeleton range is constantly developing. A variety of products are available to meet different applications with the meat industry. In addition, Ottobock encourage feedback from the industry in order to develop a product that meets specific requirements. An example of this is the development of hygienic coverings for the devices.

Executive summary

Background

This project was undertaken to understand if exoskeletons are a viable option to reduce the risk associated with manual tasks within the Meat and Livestock industry. Despite the advance of

engineering controls and automation within the industry, there remains a number of tasks that remain a manual process. This can be due to financial viability, space constraints or lack of available options. This report is designed to inform MLA and the wider industry as to how successful exoskeletons can be as a control, and for them to consider implementation within their business. The results may assist in appropriate task identification, the requirements for a successful trial and if a trial of the devices is justified.

Objectives

- Task evaluation, analysis and documentation to determine if the exoskeleton is appropriate
- Fitting training and supporting documentation
- Evaluation of feedback from the workforce involved in the milestone
- Reporting on the results of each milestone and any recommendations

Methodology

- Pre-milestone meeting
- Site visit; initial demonstration, fitting training, task assessment, analysis and evaluation for trial, fitting individuals
- Ongoing support regarding adjustments throughout the trial
- Data collection questionnaires
- Reporting

Results/key findings

Application for use of the devices was identified in a number of different areas of meat processing facilities. Feedback from the workforce trialling the devices was both positive and negative. Arguably the most successful areas within facilities were the dry/clean areas such as cold stores/loading area. Results were heavily impacted by lack of volunteers, lack of commitment from volunteers onsite, and operational demands.

Benefits to industry

Tasks were identified within the industry that are the correct application for use of the devices. There was consistently positive feedback for the use of the devices in certain areas of the facility/location throughout the project. The challenges faced during trials are known and can be addressed.

Future research and recommendations

The results justify further investigation into the use of the exoskeleton devices within the meat industry. Trials would require consideration of the challenges faced within this project.

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1. Background

Workers at sites within the meat & livestock sector are often exposed to hazards that place them at risk of musculoskeletal injuries. These hazards include forceful exertion, awkward postures and repetitive work. Examples of forceful exertion includes cold store packing, chiller hand work and hock and horns. Examples of awkward postures and repetitive work includes loading truck container, evisceration and packing trim. The average cost of a workers compensation claims in the food manufacturing industry is \$47,708.00 in WA, for example (WorkCover WA, 2019).

Performing this type of manual work also exposes workers to muscular fatigue which inhibits performance especially at the end of a shift and the end of a working week. The exoskeleton devices attempt to address these issues by providing an external support to the body. This reduces the force that the worker is required to generate reducing the risk of muscle strain and the development of fatigue. Returning workers to their normal duties after they have suffered an injury can be difficult due lack of available lighter duties and fear of re-injury. These devices provide the opportunity to return workers to their normal duties whilst exposing them to reduced forces as their injury recovers.

The results of this project are designed to inform the industry as to how successful exoskeletons can be as a control, and for them to consider implementation within their business. The results may assist in appropriate task identification, the requirements for a successful trial and if a trial of the devices is justified.

2. Objectives

- Task evaluation, analysis and documentation to determine if the exoskeleton is appropriate. This was completed for every milestone. Manual task risk assessments were included with the submission of each milestone report.
- Fitting training and supporting documentation
This was provided to every location at the start of each milestone with supporting documentation, both printed and online training modules. Additional support was offered/provided throughout each milestone. Operational demands at certain sites made provision of support challenging.
- Evaluation of feedback from the workforce involved in the milestone
Feedback that was collated was evaluated and included in reported. For some locations minimal to know feedback was gathered or provided.
- Reporting on the results of each milestone and any recommendations
Results were included in the end of milestone report for each location.

3. Methodology

In collaboration with MLA, communication with a number of sites that had previously expressed interest in exoskeletons were invited to participate in this study. Once a site confirmed their interest, a pre-milestone meeting was arranged. This meeting was to explain the background to the project and the methodology. At this stage expectations for site involvement were also discussed and the site visit arranged.

During the site visit the features and functions of the devices was presented to site, as well as re-visiting the background, methodology and expectations of the trial. After the first milestone, tasks found to be successful as well as challenges faced were shared. The aim being learn from each milestone. Task assessment, analysis and evaluation also look place during the site visit to determine which tasks the devices were appropriate for and would assist. A site selected champion was trained on fitting and the first set of volunteers were fitted. Site were encouraged to take baseline data and then periodically throughout the trial.

Follow up support was encouraged over the course of the trial. Task analysis reporting, evaluation of any feedback provided was also undertaken. This was collated in milestone reporting.

4. Results

4.1 Harvey Beef, WA

4.1.1 Cold Stores

Three tasks were trialled by separate workers within the Cold Stores department; backX-S for palletising (1 hour by one worker and 4 hours by another worker), backX-S for wrapping pallets (1-2 repetitions of the task by one worker) and both the backX-S and shoulderX for loading containers (1 hour and 4 hours by two different workers).

Objectively, the backX-S device appeared to facilitate the movements involved in the task of palletising and verbal feedback from the workers selected in the trial was that they could feel the support the device was providing. The refrigerated environment of the cold stores meant that the addition of this tool did not impact the workers heat regulation. Also, as the Cold Stores do not have the high-level food hygiene requirements of elsewhere in the plant, the device was able to be utilised without modification.

Feedback from the workers that trialled the device for short periods of time was that they did not have time to get used to the device and in some cases that the device was restrictive. Particular mention was made to the pallet wrapping task and the device profile impeding movement between pallets. These limitations could be associated with the acclimatisation period required to become used to a new piece of PPE, and was highlighted by management as a stage the workers tend to go through when a new piece of equipment is mandated. Please see appendix E for feedback forms.

It was noted by management that the backX-S devices warranted further investigation for use within the Cold Stores environment to determine staff satisfaction over a longer period and with a broader sample of workers. Also, gathering other data measures, including cost-benefit metrics, may justify further uptake for this department. Consideration could be taken to store pallets with more space between them as a solution to concerns raised when wrapping pallets.



4.1.2 Boning Room

Three tasks within the Boning Room were reviewed and deemed appropriate for trial. Hindquarter boning where the shoulderX was trialled by 3 workers (30 minutes, 1 hour and 1 hour duration each), packing trim where the backX-S was trialled by 1 worker (2 hours) and dry vac where the backX was trialled by 1 worker (1 hour).

The backX-S device appeared to support the tasks of packing trim and dry vac due to the prolonged forward flexed posture required for these tasks, especially trim packing where there is the additional barrier of the box for trim to be scooped into. Feedback from the worker completing the trial for packing trim was positive, reporting the device provided support and she felt a reduction in fatigue in her back, despite such a short period.

The hindquarter boning task was chosen with the understanding the hook hand stays static in an elevated position, which could be supported by the device. This was not the case, as the hook hand provided a gravity assisted pulled force which the v3 shoulderX works against. The task was therefore deemed not appropriate for this task. This was supported by feedback from the workers trialling the shoulderX for this task. Again, this area of the processing plant is refrigerated eliminating any heat discomfort element, and due to the low profile of the backX-S most of the device was covered by existing PPE.

The backX-S device warranted further investigation within the Boning Room environment with more substantial trials to determine staff adherence and perceived benefit as well as cost benefit metrics. Consideration could be made in further trials to arrange operational elements of the role to rotate around multiple tasks that would benefit or at least not be affected by wearing the device. Temporary covering was used over the device within this department and a more permanent solution would need to be investigated for more extensive trials.

4.1.3 Slaughter Floor

The shoulderX was trailed on a number of different tasks including hock and horn removal, first leg change-over, flanking and at the evisceration table. The backX-S was trailed for a short period on similar tasks. The same worker, proficient in all of these areas completed this trial over a period of 2 hours.

Feedback from the worker was that the device assisted with parts of each task, and for the most-part did not impede on the other elements of the tasks. The same was found for the backX-S device. The hock and horn removal task as well as the first leg change out require lifting of a tool to shoulder height. The tool is on a hydraulic mechanism to assist with the weight, however feedback from the worker wearing the shoulderX device was that the suitX device assisted further with the weight. The worker involved in the trail for this department was enthusiastic and provided constructive feedback.

4.1.4 Retail Ready

The backX-S device was used in the Retail Ready department for the task of loading mince and for de-bagging for a period of 30 minutes in total. The loading mince task already utilises a 'no lift' mechanical device, minimising the requirement for forward trunk flexion and the suitX device was therefore deemed of no further assistance with this task. For the de-bagging task where workers are required to lean into a deep trolley to lift out multiple cuts of meat requiring repetitive forward bending, feedback was positive that the suitX device had the potential to assist with this task.

This area of the plant has high level hygiene requirements; however, the device fitted underneath a larger size of PPE and therefore did not require additional covering. There was no heat impact as this department is also refrigerated.

4.2 Wagstaff, VIC

4.2.1 Loading Area

The Palletising task within the Loading Area was deemed appropriate for the trial. The V2 backX-S was trialled by DC. The trial commenced on 13 May 2021 when the worker wore the device for 70 minutes whilst performing this task. The V2 backX-S device supported the low back of the worker completing this task. It assisted with lifting boxes of meat from the conveyor onto the pallet for the bottom three layers. Please see below Images 1 and 2.

The first five lifts of the task were performed with the device turned off. The device was then turned onto instant mode (low back support is initiated as soon as the worker bends forwards). The worker immediately reported reduced low back strain with floor to waist lifting. The worker also commented that it increased use of the legs (squatting) when performing this type of lift and that the device assisted him in returning to a standing posture from the bottom of the squat once the box had been placed on the pallet. The device was worn over the top of the worker's clothing.

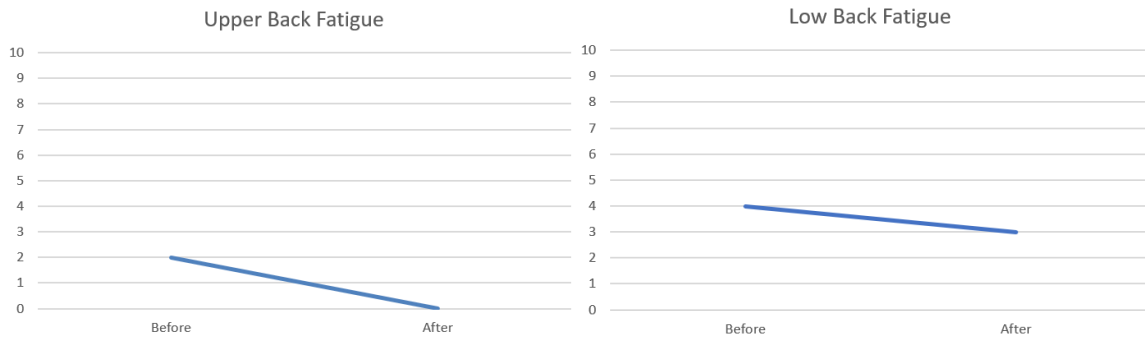
Feedback from the worker completing the trial was that the device provided the low back a lot of support and reduced the force the body is required to generate to perform floor to waist lifting with the boxes of meat. Also, the device encouraged the worker to lift with their legs.

The worker reported reduced fatigue after 70 minutes completing this task with the V2 backX-S (low back fatigue reduced from 4/10 to 3/10, shoulder fatigue reduced from 3/10 to 0/10, upper arm fatigue reduced from 2/10 to 1/10, upper back fatigue reduced from 2/10 to 0/10). Neck fatigue remained at 0/10, hip fatigue remained at 2/10, thigh, calf and ankle fatigue remained at 0/10. Please see below in Table 3 and Graphs 1 and 2.

Table 3

Fatigue	Before	After
Neck	0	0
Shoulder	3	0
Upper arm	2	1
Upper back	2	0
Low back	4	3
Hip	2	2
Thigh	0	0
Calf	0	0
Ankle	0	0

Fatigue is scored out of 10 (10 is very, very tired, 0 is not tired at all)
Data collected on 13 May 2021



Graphs 1 and 2

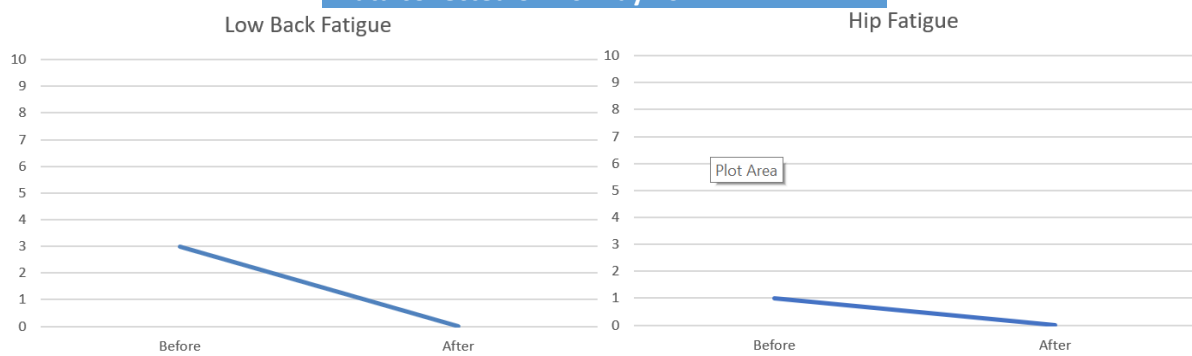
Across 17, 18 and 19 May 2021 the worker used the V2 backX-S twice for two hours to complete Palletising.

On 20 May 2021 the worker used the V2 backX-S for 60 minutes to complete Palletising (low back fatigue reduced from 3/10 to 0/10 and hip fatigue reduced from 1/10 to 0/10). Neck and shoulder fatigue remained at 4/10. Upper arm, upper back, thigh, calf and ankle fatigue remain at 0/10. The worker reported the V2 backX-S reduced fatigue and soreness and made it much easier to lift boxes of meat below waist level and provided great lower back support. Please see Table 4 and Graphs 3 and 4.

Table 4:

Fatigue	Before	After
Neck	4	4
Shoulder	4	4
Upper arm	0	0
Upper back	0	0
Low back	3	0
Hip	1	0
Thigh	0	0
Calf	0	0
Ankle	0	0

Fatigue is scored out of 10 (10 is very, very tired, 0 is not tired at all)
Data collected on 20 May 2021



Graphs 3 and 4



Please see questionnaires in 10.4.1 Palletising – Baseline Questionnaire 13 May 2021, 10.4.2 Palletising – Periodic Questionnaire 13 May 2021, 10.4.3 Palletising – Periodic Questionnaire 20 May 2021 and 10.4.4 Palletising – Baseline Questionnaire 20 May 2021.

The worker reported it did not impact on peripheral tasks such as taking boxes off the conveyor, carrying boxes or lifting boxes above waist level. The worker also reported the device was comfortable, easy to put on and take off, intuitive and had no impact on their balance. Comments included:

“It was like I didn’t have to do the lifting – like someone else was doing it”

In regards to putting on / off – “very easy – can do in 30 seconds”

The worker stated they preferred the V2 backX-S for Palletising to the V3 shoulderX for Sixway and that if given the option they would definitely use the V2 backX-S to perform the Palletising task.

4.2.2 Boning Room

Several tasks within the Boning Room were reviewed. The Sixway task was deemed appropriate for the trial. The V3 shoulderX was trialled by one worker. The trial commenced on 13 May 2021 when the worker wore the device for 2 hours whilst performing this task. The V3 shoulderX device supported the shoulders of the worker completing this task. In particular it assisted with the overhead lift with the left shoulder as the worker took the carcass off the conveyor.

Initially the device was trialled with a white coat covering the device. This restricted the worker’s shoulder movement and pulled the device backwards. Consequently, the device was trialled with a poncho. This proved to be a suitable method of covering the device as it did not restrict the worker’s movement or move the device. The poncho, however, did tear open on the right side above the shoulder. The device was initially trialled with the right and left shoulders adjusted so the support of the device was maximal at 90 degrees. However, the Sixway task requires workers to elevate their left shoulder to 120 degrees to lift the animal from the conveyor. The device was adjusted so that the left shoulder support was maximal at 120 degrees. In addition, the front straps were tied down to hold the front of the device steady.

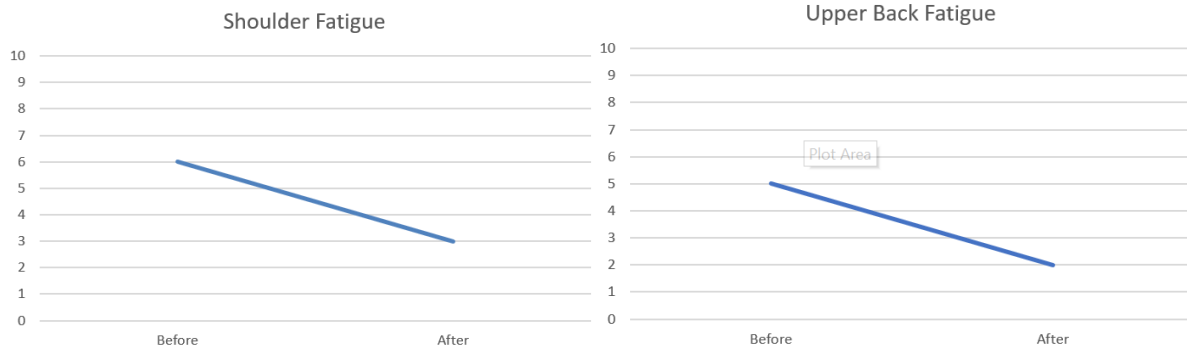
Feedback from the worker completing the trial was that the device reduced the force through the shoulders when lifting the carcass from the conveyor. The worker reported it did not impact on peripheral tasks such as putting parts in the crates and using the bandsaw to cut the carcass. The worker reported reduced fatigue after 2 hours completing this task with the V3 shoulderX (shoulder fatigue reduced from 6/10 to 3/10, upper back fatigue reduced from 5/10 to 2/10, low back fatigue reduced from 5/10 to 4/10, neck, thigh, calf and ankle fatigue reduced from 1/10 to 0/10). Upper arm and hip fatigue increased from 1/10 to 2/10. Please see below in Table 5 and Graphs 5 and 6.

The worker also reported improved task performance, the device was intuitive and that it did not affect their balance. The worker was neutral on whether the device was easy to put on and take off. However, the worker reported the device was cumbersome, awkward and mildly uncomfortable.

Fatigue	Before	After
Neck	1	0
Shoulder	6	3
Upper arm	1	2
Upper back	5	2
Low back	5	4
Hip	1	2

Table 5:

Thigh	1	0
Calf	1	0
Ankle	1	0
Fatigue is scored out of 10 (10 is very, very tired, 0 is not tired at all) Data collected on 13 May 2021		



Graphs 5 and 6

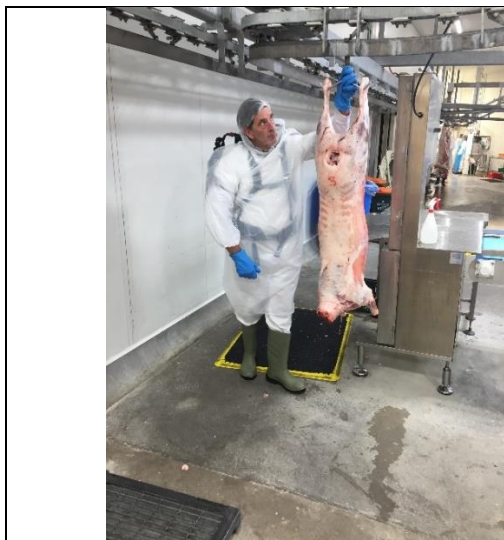


Image 1: Overhead reach with the V3 shoulder X.



Image 2: Overhead lift of carcass with the V3 shoulderX.

Please see questionnaires in 10.4.5 Sixway – Baseline Questionnaire 13 May 2021, 10.4.6 Sixway – Periodic Questionnaire 13 May 2021 and 10.4.7 Sixway – Final Questionnaire 20 May 2021.

4.3 Australian Country Choice, QLD

4.3.1 Slicing

Slicing in the boning room was deemed appropriate for the trial. Originally the V2 backX-S was trialled by ND but after feedback on the sizing issue the V3 backX-S was provided. The trial commenced on 18th August 2021 when the worker wore the V2 backX-S device for 1 run, approximately 1hr 25 mins whilst performing her task. The V3 backX-S device was then trialled on the 19 August 2021 which supported the low back of the worker completing the task. However, due to ND height she felt it was restrictive in terms of reaching for the meat. She was also unable to get her knives on. Please see images 1 and 2 below.

ND had the device set to instant mode (low back support as soon as the worker bends forwards). ND immediately reported decreased back effort when trialling the device in the physio room but then when in the boning room the device seemed to get in her way and was too big for her given her stature. The device was worn over the top of her clothes with a generic poncho worn over the top to protect the device.

Feedback from the worker completing the trial was that although the device felt like it supported her back it inhibited her reaching for meat. This was already an issue for this worker given her height prior to the trial. Another complaint was the inability to not be able to put her knives on due to the device being around her waist.

The worker reported increased fatigue after the first run with the V2 backX-S. From her comments it was because the device was too big for her. Prior to the trial her fatigue scores included: low back fatigue 6/10, shoulder fatigue 6/10, and neck fatigue 5/10. Additional areas of fatigue were documented including; elbow 7/10, hands 8/10 and feet 6/10 (10 = very tired and 0 = not tired at all). ND did not complete the periodic questionnaire correctly and the final questionnaire was not completed at all due to ending the trial early. Therefore, comparison in terms of suitX influence on fatigue is unable to be discussed.

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Image 1: Reaching forward to get meat V2 backX-S from the slicing bench



Image 2: Collecting meat from the bins with V3 backX-S

Please see questionnaires in 10.4.1 Slicing – Baseline Questionnaire 18 August 2021, 10.4.2 Slicing – Periodic Questionnaire 25 August 2021.

Some of the workers comments included:

“Very restrictive, every time I bent forward the chest plate would move up into my throat and choke me”

“Was unable to reach the meat on the belt. Couldn’t put my knives on.”

4.3.2 Quarter Saw

Several tasks within the Boning Room were reviewed. The Quarter Saw task was deemed appropriate for the trial. The V3 shoulderX was trialled by one worker. The trial commenced on 18 August 2021 when the worker wore the device for 1 hour 25 mins whilst performing this task. The V3 shoulderX device supported the shoulders of the worker completing this task. In particular it assisted with the overhead pull with the right shoulder as the worker took the quarter saw through the rib cage of the carcass. Please see image 3 below.

Initially the device was trialled with a white coat covering the device. This restricted the worker’s shoulder movement and pulled the device backwards. Consequently, the device was trialled with a poncho. This proved to be a suitable method of covering the device as it did not restrict the worker’s movement or move the device. The poncho, however, did have a tear on the right side above the shoulder. The device was initially trialled with the right and left shoulders adjusted so the support of the device was maximal at 90 degrees. However, the Quarter Saw task requires workers to elevate their shoulders to 110 degrees to control the Quarter Saw down into the carcass.

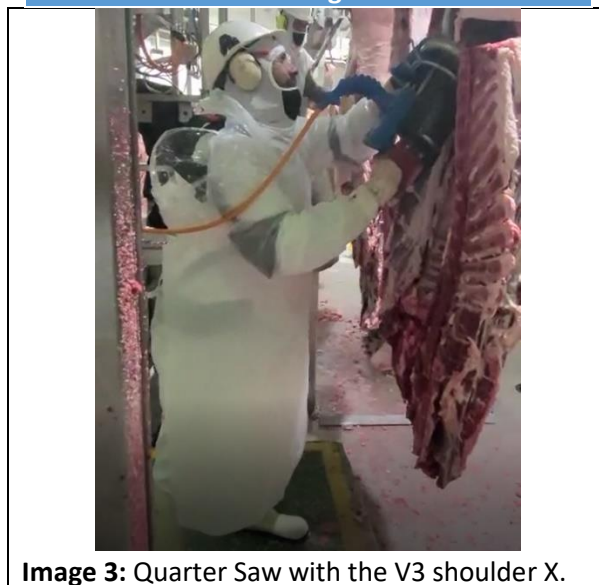
Feedback from the worker completing the trial was that the device was uncomfortable at times and felt restrictive especially prior to utilising the tailor-made poncho. The worker reported fatigue prior to the trail of V3 shoulderX as; neck 6/10, shoulder 8/10, upper arm 5/10, upper back 5/10, low back 7/10, hip 8/10, thigh 8/10, calf 8/10 and ankle fatigue 8/10. Fatigue seemed to increase when completing the periodic questionnaire for most body areas. Please see below in Table 5.

The worker reported that with the tailor-fitted poncho it was easier to put on and off, it was intuitive to use and it didn't affect balance. However, while it felt good to wear, he felt his work was restricted. This worker only utilised the device twice prior to going on annual leave and thus did not complete the entire week.

Table 5

Fatigue	Before	After
Neck	6	8
Shoulder	8	8
Upper arm	5	8
Upper back	5	8
Low back	7	8
Hip	8	6
Thigh	8	0
Calf	8	0
Ankle	8	0

Fatigue is scored out of 10 (10 is very, very tired, 0 is not tired at all)
Data collected on 26 August 2021



Please see questionnaires in 10.4.5 Quarter Saw – Baseline Questionnaire 18 August 2021, 10.4.6 Quarter Saw– Periodic Questionnaire 26 August 2021.

4.3.3 Palletising

The palletising in the boning room task was deemed appropriate for the trial. The V3 backX-S was trialled by JS. The trial commenced on 25 August 2021 when the worker wore the device for 60 mins whilst performing the task of palletising in the boning room. The worker indicated during the demo how it felt like it would help with lifting from floor to waist but just felt a bit strange with it on. Please see image 4 below.

Again, the device was set to turn on instantly to give support as soon as the worker bent forward. The device was worn on top of the clothes and no poncho was required as a generally dry area.

Prior to the trial the fatigue levels indicated include: neck 5/10, shoulder 9/10, upper arm 9/10, upper back 10/10, hip 6/10, thigh 8/10, calf 1/10 and ankle fatigue 1/10. Fatigue levels after the one attempt at utilising the device were recorded a couple of days later, the comparison is seen below in table 6.

Feedback from the worker was that it wasn't too bad just felt strange with device on. Feedback provided to the worker included manual handling technique correction as it was noted during the trial his technique was not adequate.

Other comments included:

“it got in the way of my moving around a fair bit”

Fatigue	Before	After
Neck	5	7
Shoulder	9	8
Upper arm	9	9
Upper back	10	8
Low back	10	8
Hip	6	1
Thigh	8	5
Calf	1	2
Ankle	1	4
Fatigue is scored out of 10 (10 is very, very tired, 0 is not tired at all) Data collected on 26 August 2021		

Table 6

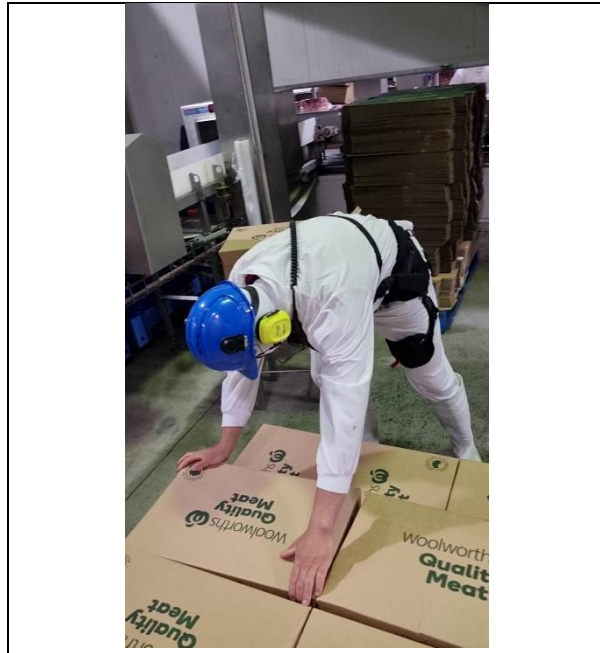


Image 4: Floor to waist lift with V3 backX-S lifting box of meat from bottom layer of the pallet.

4.4 Teys, QLD

4.4.1 Loadout Area

The Palletising task within the Loadout Area was deemed appropriate for the trial. The V2 backX-S was trialled by CW. The trial commenced on 7th October 2021 when the worker wore the device for 2 days before advising of it getting in the way. Trial was ceased until V3 backX-S was delivered for trial. The V2/V3 backX-S device supported the low back of the worker completing this task. It assisted with lifting boxes of meat from the conveyor onto the pallet for the bottom three layers. However, CW indicated overall it made him more tired as there was increased effort when it came to walking around with the device on. Please see below Graph 1.

The first five lifts of the task were performed with the device turned off. The device was then turned onto instant mode (low back support is initiated as soon as the worker bends forwards). The worker immediately reported reduced low back strain with floor to waist lifting. The worker also commented that it increased use of the legs (squatting) when performing this type of lift and that the device assisted him in returning to a standing posture from the bottom of the squat once the box had been placed on the pallet. The device was worn over the top of the worker's clothing but under his jacket.

Feedback from the worker completing the trial was that the device provided the low back a lot of support and reduced the force the body is required to generate to perform floor to waist lifting with the boxes of meat. Also, the device encouraged the worker to lift with their legs but increased tiredness due to increased effort when it came to walking.

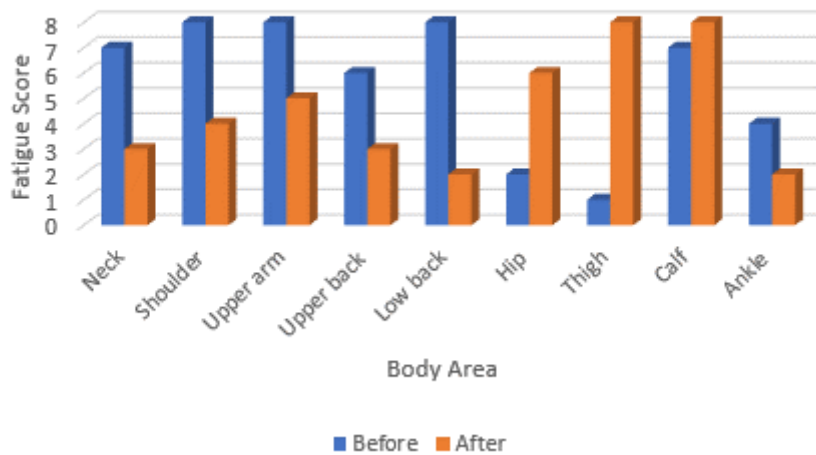
The worker reported reduced fatigue after 70 minutes completing this task with the V2 backX-S (low back fatigue reduced from 8/10 to 2/10, shoulder fatigue reduced from 8/10 to 4/10, upper arm fatigue reduced from 8/10 to 5/10, upper back fatigue reduced from 6/10 to 3/10, neck fatigue reduced from 7/10 to 3/10). However, hip fatigue increased from 2/10 to 6/10 and thigh fatigue from 1/10 to 8/10, which is in line with his mention of increased fatigue when walking. Calf and ankle fatigue remained similar between questionnaires with calf being 7/10 and 8/10 respectively and ankle being 4/10 to 2/10. Please see below in Table 3 and Graph 1.

Table 3

Fatigue	Before	After
Neck	7	3
Shoulder	8	4
Upper arm	8	5
Upper back	6	3
Low back	8	2
Hip	2	6
Thigh	1	8
Calf	7	8
Ankle	4	2

Fatigue is scored out of 10 (10 is very, very tired, 0 is not tired at all)
Data collected on 13 May 2021

Fatigue Comparison Pre- and Post- Trial



Graph 1

Please see questionnaires in 10.6.1 Palletising – Baseline Questionnaire 7th October 2021, 10.6.2 Palletising – Periodic Questionnaire 21st October 2021, 10.4.3 Palletising – Completion Questionnaire 21st October 2021, 10.6.3

The worker reported it did not impact on peripheral tasks such as taking boxes off the conveyor, carrying boxes or lifting boxes above waist level. The worker also reported the device was

comfortable, neutral with ease to put on and take off, intuitive to use and had minimal impact on their balance. Comments included:

“It didn’t really affect my balance but I did have moments where it did very minor”

“It had its moments where it was very easy but also really hard but overall wasn’t too bad to put on and off”.

The worker stated they preferred the V2 backX-S for Palletising to the V3 shoulderX for Sixway and that if given the option they would definitely use the V2 backX-S to perform the Palletising task.

4.4.2 Slaughter Room

Two tasks within the slaughter room were reviewed. The feather boning and Halal process. Both were deemed appropriate for the program The backX-S device was utilised for the Halal process and the ShoulderX was used for feather boning. SS wore the V3 backX-S device which commenced on the 20/10/21 to support his back while performing the Halal process. The device was worn for 2 hours on day 1 and then utilised again for the remained of his working week.

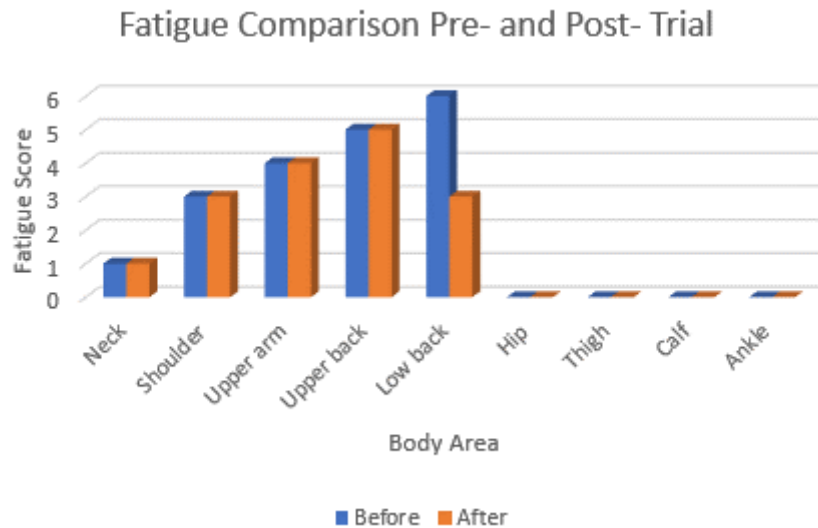
SS advised the device assisted in supporting his back but the team member struggled with the bulkiness of the device combined with his normal PPE. SS advised he dropped his knife on occasions. SS saw out the trail and as the week went on the bulkiness didn’t become normalised and he continued to drop his knife through the week. Comments included:

“Helped with back but too bulky, kept dropping my knife”

Fatigue feedback by SS included that there was a decrease in lower and upper back fatigue (lower back fatigue reduced from 6/10 to 3/10 and upper back 5/10 to 2/10). The Neck, shoulder and upper arm fatigue remained unchanged (neck 1/10, shoulder 3/10, upper arm 4/10) Table 4 and Graph 2.

Table 4

Fatigue	Before	After
Neck	1	1
Shoulder	3	3
Upper arm	4	4
Upper back	5	5
Low back	6	3
Hip	0	0
Thigh	0	0
Calf	0	0
Ankle	0	0
Fatigue is scored out of 10 (10 is very, very tired, 0 is not tired at all)		
Data collected on 20 May 2021		



Graph 2

JN trialled the shoulderX device on the 1st November to support his bilateral shoulders while performing the feather boning task on the slaughter floor. Unfortunately, the trial for this device was ceased on day 1 as JN reported pain in bilateral shoulders. A revised fit was trialled but pain still persisted and thus JN did not complete any additional questionnaires. Due to staffing commitments JN was unable to be taken out of production again for another fitting which also limited to ability to complete the trial.

JNs fatigue scores on the baseline questionnaire indicated high fatigue in the shoulder, upper arm and upper back. Please refer to Table 5 below.

Table 5

Fatigue	Before	After
Neck	3	0
Shoulder	6	0
Upper arm	7	0
Upper back	6	0
Low back	3	0
Hip	0	0
Thigh	3	0
Calf	2	0
Ankle	0	0

Fatigue is scored out of 10 (10 is very, very tired, 0 is not tired at all)
Data collected on 20 May 2021

Please see questionnaires in 10.6.4 Halal Process – Baseline Questionnaire 21st October 2021, 10.6.5 Halal Process – Periodic Questionnaire 27th October 2021, 10.4.3 Halal Process – Completion Questionnaire 27th October 2021, 10.6.6 and Feather boning – Baseline Questionnaire 15th October 2021, 10.6.13

4.4.3 Boning Room

Several tasks within the Boning Room were reviewed. The boning blades and general boning tasks was deemed appropriate for the trial. The V3 shoulderX was trialled by one worker performing the blading and the V3 backX-S on another doing general boning tasks. The trial commenced on 7th October 2021 when the worker wearing the V3 shoulderX device wore it for 2 hours initially whilst performing the blading task. The V3 shoulderX device supported the shoulders of the worker completing this task. In particular it assisted with the overhead position of his bilateral shoulders when having to take his knife from above into the carcass. However overall, the feedback from the device trial was that it was not appropriate for the task. As force is required to bring the knife from the top down the extra resistance in lowering the arm increased hydration needs of team member.

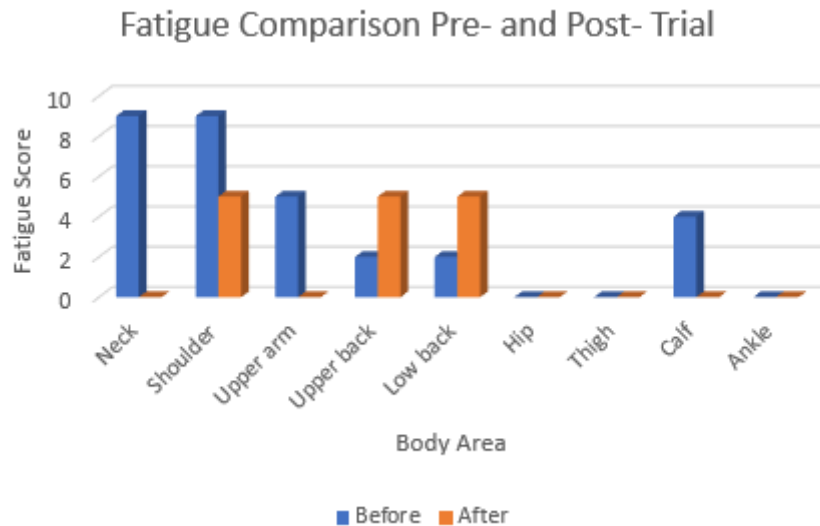
SH complained of shoulder pain after day 1 therefore, the trial was ceased until a video meeting with Suit-X in America was organised. This occurred the following week, which allowed an improved fit and to provide better feedback for the trial. The adjustments made helped decrease the shoulder pain experienced by SH but the device was still not suitable overall for this task.

The device was used with the blue protective coat on but this made it hard to put the device on and off. It did however, protect the device from the elements in the boning room i.e. blood. It was also mentioned that their balance was affected scoring 4/10 in the periodic questionnaire.

Feedback from the worker completing the trial was that the device reduced the force through the shoulders when lifting the knife but it created an issue with where to put his knives, which are normally hung around his waist. The worker reported it did not impact on peripheral tasks such as putting parts in the chutes. The worker reported reduced fatigue after completing the task with the V3 shoulderX for the shoulder, neck, upper arm and calf (shoulder fatigue reduced from 9/10 to 5/10, neck fatigue reduced from 9/10 to 0/10, upper arm fatigue reduced from 5/10 to 0/10 and calf fatigue from 4/10 to 0/10). However, there was an increase in fatigue for the upper and lower back (fatigue increased for upper back from 2/10 to 5/10 and lower back from 2/10 to 5/10). There was no change in fatigue seen in the hips, thigh and ankle (hips, thigh and ankle fatigue 0/10). Please see below in Table 5 and Graph 3.

Table 5

Fatigue	Before	After
Neck	9	0
Shoulder	9	5
Upper arm	5	0
Upper back	2	5
Low back	2	5
Hip	0	0
Thigh	0	0
Calf	4	0
Ankle	0	0
Fatigue is scored out of 10 (10 is very, very tired, 0 is not tired at all)		
Data collected on 13 May 2021		



Graph 3

4.5 Lamb Processing Plant

4.5.1 Palletising – Cold Stores

The task of Palletising was reviewed and confirmed as appropriate for trial with the backX-S suitX exoskeleton. The acclimation period was completed on site visit day 1 for a 4.5-hour period. Feedback after the acclimation period was that the worker ‘got used to the device’ and strongly agreed that the device was comfortable to wear. The worker advised he felt his performance was substantially better while using the device and strongly agreed that the device was easy to put on and take off (Appendix C). At the end of the trial, feedback from the worker was that he would wear the device again for his work, although he noted additional weight of the suitX towards the end of the working week. He felt it would definitely be useful in his work and that it met his expectations (Appendix D). A comparison in the results of the fatigue scores pre- and post-trial can be seen in Table 3 and Graph 1 below. There was a reduction in fatigue or no change in all but one body area. A one-point increase in fatigue score was reported for the hips.

Fatigue	Before	After
Neck	3	1
Shoulder	3	1
Upper arm	1	1
Upper back	5	1
Low back	5	3
Hip	3	4
Thigh	6	4
Calf	3	3
Ankle	1	1

Fatigue is scored out of 10 (10 is very, very tired, 0 is not tired at all)
Data collected in December 2021

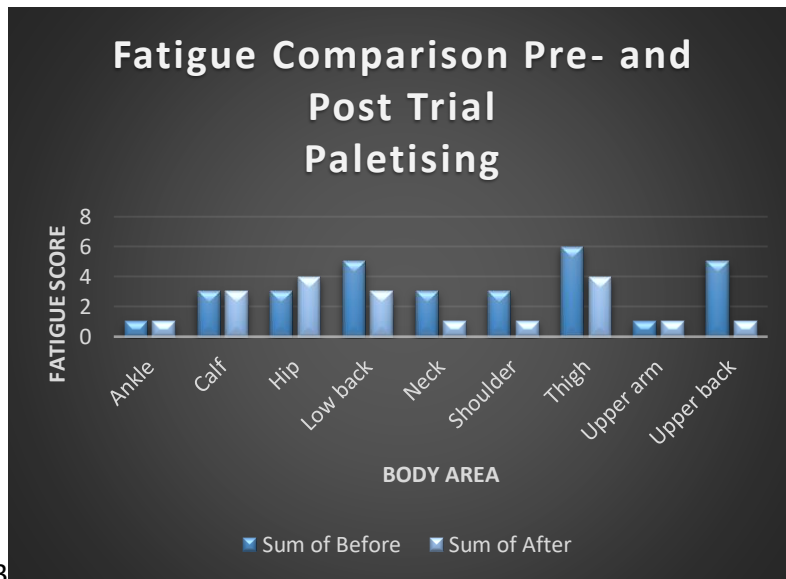


Table 3

Graph 1

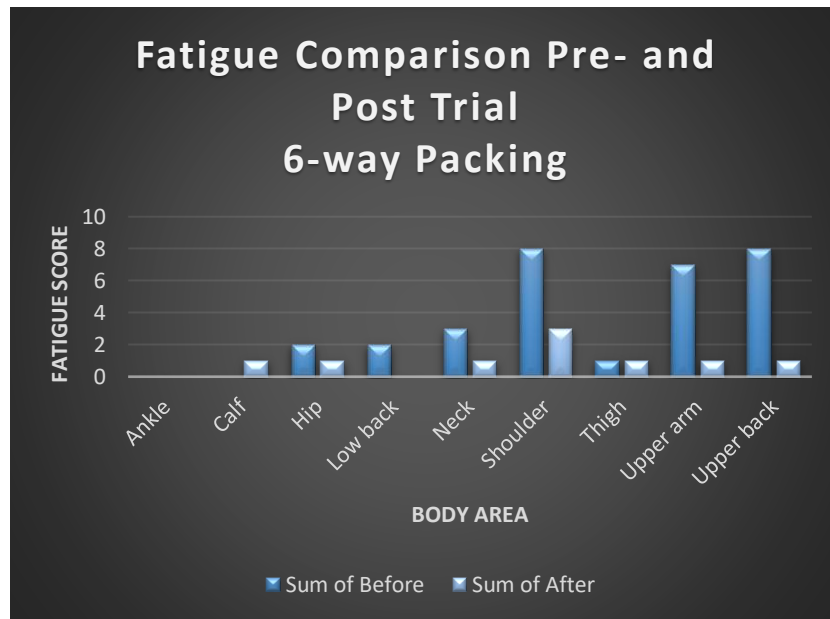
4.5.2 6-way Packing – Boning Room

The task of 6-way packing was reviewed and confirmed as an appropriate task for trial with the shoulderX device. The worker trialling the device reported right shoulder discomfort at times from this task. The acclimation period was complete on-site visit day 1 for 4 hours. Feedback after the acclimation period was that the worker was neutral regarding the level of comfort of the device, commenting that they felt fatigued after extended use. They reported feeling restricted with the high production rate and that the device somewhat negatively affected their performance. The worker reported that other PPE they were required to wear restricted the ability to use as well as don/doff the device (Appendix F). At the end of the trial, feedback from the worker remained the same as post-the acclimation period, reported they felt it would not be useful for their role. However, results from the fatigue comparison pre- and post-trial, shown in Table 4 and Graph 2 below shows up to a 7-point reduction in fatigue for all body areas with the shoulders as the only area unchanged.

Fatigue	Before	After
Neck	3	2
Shoulder	8	8
Upper arm	7	1
Upper back	8	1
Low back	2	0
Hip	2	1
Thigh	1	1
Calf	0	1
Ankle	0	0

Fatigue is scored out of 10 (10 is very, very tired, 0 is not tired at all)
Data collected in December 2021

Table 4



Graph 2

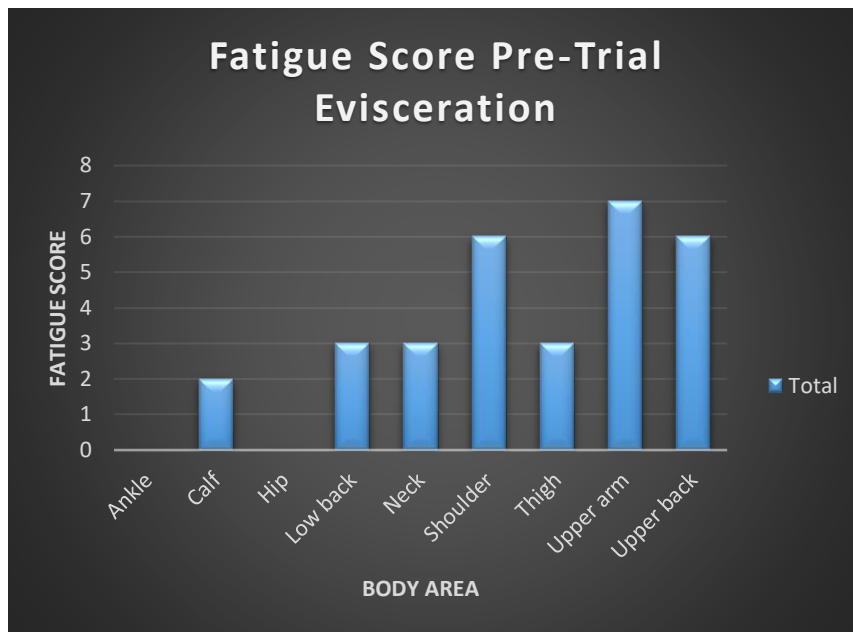
4.5.3 Evisceration

The task of evisceration was reviewed and confirmed as appropriate for trial with the backX-S suitX exoskeleton. The worker trialling the backX-S device reports discomfort in the upper trapezius muscles at times during this task. The acclimation period was completed on site visit day 2 for a 4-hour period. Feedback after the acclimation period was that the additional heat experienced wearing the device was uncomfortable. The worker did report that the support for the lower back was noticeable wearing the device, however perspiration increased. Also, regular washing of apron PPE was made more difficult with the device. The worker strongly agreed that the device was easy to put on and take off (Appendix I). The worker declined to continue the trial after the acclimation period due to the discomfort from the additional heat. This meant that final fatigue scores were not measured.

Fatigue	Before	After
Neck	3	-
Shoulder	6	-
Upper arm	7	-
Upper back	6	-
Low back	3	-
Hip	0	-
Thigh	3	-
Calf	2	-
Ankle	0	-

Fatigue is scored out of 10 (10 is very, very tired, 0 is not tired at all)
Data collected in December 2021

Table 5



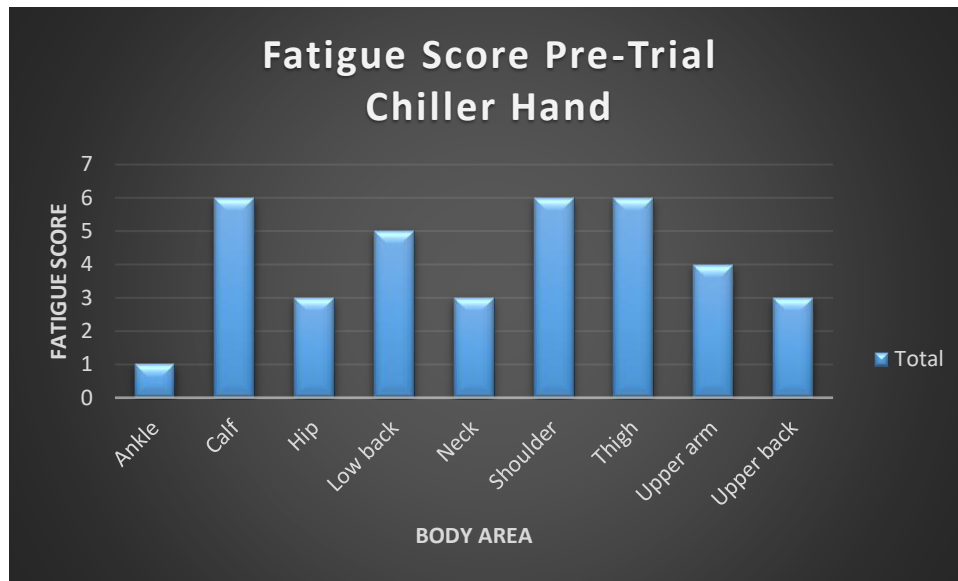
Graph 3

4.5.4 Chiller hand

The tasks completed by the Chiller Hand, pushing and sorting carcasses was reviewed and confirmed as an appropriate task for trial with the shoulderX device. The worker trialling the device reported no muscle discomfort during the role. The acclimation period was complete on-site visit day 2 for 4 hours. Feedback after the acclimation period was that the device was reasonably comfortable to wear, although would benefit from more padding on the shoulders. The worker reported that the exoskeleton somewhat positively affected performance, best used when starting to feel strain. The worker also strongly agreed that the device was easy to put on and take off (Appendix L). The end of trial questionnaire was not completed. This meant the final fatigue scores were not measured.

Fatigue	Before	After
Neck	3	-
Shoulder	6	-
Upper arm	4	-
Upper back	3	-
Low back	5	-
Hip	3	-
Thigh	6	-
Calf	6	-
Ankle	1	-
Fatigue is scored out of 10 (10 is very, very tired, 0 is not tired at all)		
Data collected in December 2021		

Table 6



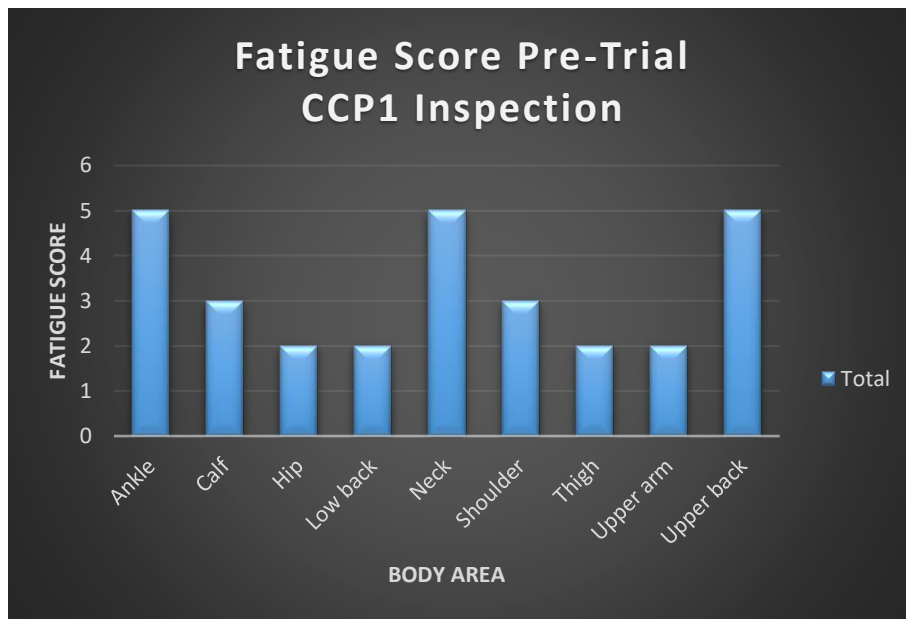
Graph 3

4.5.5 CCP1 Inspection

The task of CCP1 Inspection was reviewed and confirmed as appropriate for trial with the shoulderX suitX exoskeleton. The acclimation period was completed on site visit day 2 for a 4-hour period. Feedback after the acclimation period was that the additional heat experienced wearing the device was uncomfortable. The worker did report that their performance during the task was substantially better wearing the device and strongly agreed that the device was easy to get on and off. The worker strongly agreed that the device was easy to put on and take off (Appendix N). The worker declined to continue the trial after the acclimation period due to the discomfort from the additional heat. This meant that final fatigue scores were not measured.

Fatigue	Before	After
Neck	5	-
Shoulder	3	-
Upper arm	2	-
Upper back	5	-
Low back	2	-
Hip	2	-
Thigh	2	-
Calf	3	-
Ankle	5	-
Fatigue is scored out of 10 (10 is very, very tired, 0 is not tired at all)		
Data collected in December 2021		

Table 5



Graph 3

4.6 JBS Brooklyn, VIC

4.6.1

During the initial visit, following demonstration of the devices, tasks were recommended for trial. A site representative was training in fitting. Site advised that the trial was due to commence in one weeks' time due to operational factors. Contact with site was attempted to facilitate fitting and to offer support. This was declined by site. At the end date of the trial, site provided results which can be seen in Appendix 10.4 D – JBS Exoskeleton Trial – Week 3 Report. The outcome of these trials were that the facility have placed orders for a considerable number of exoskeleton devices.

4.7 Coles Retail Ready Operations, NSW

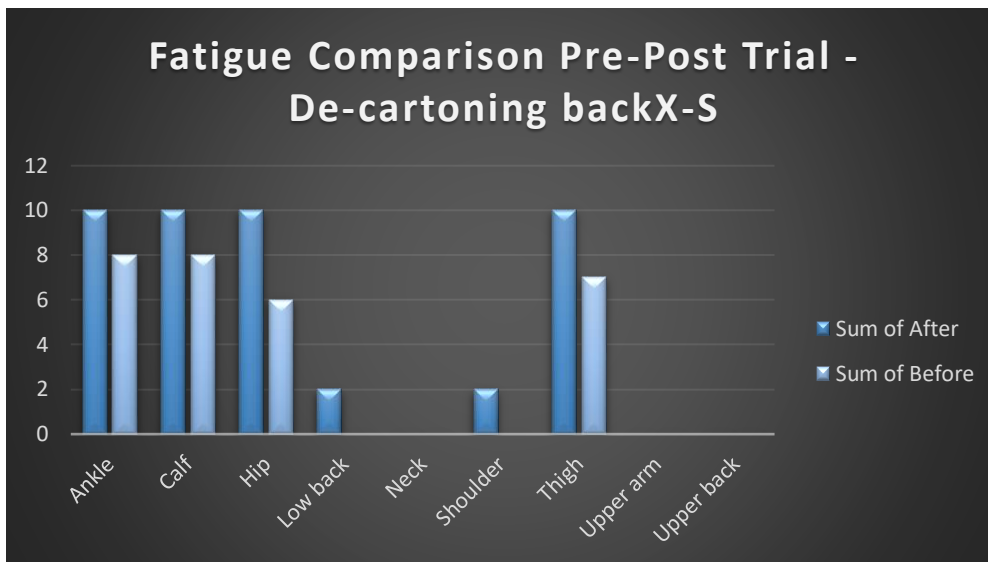
4.7.1 De-cartoning (backX-S)

The task of De-cartoning was reviewed and confirmed as appropriate for trial with the backX-S suitX exoskeleton. The worker did not complete the assessment at baseline prior to the trial. The first questionnaire was completed after 3-5 hours of wear. At this stage the worker advised that they felt stiff and that mobility was lowered making the task harder. The end of trial questionnaire completed was after 6-8 hours. It is unclear if this was on the same day. Feedback at this stage was that the device made the task more difficult. A comparison in the results of the fatigue scores pre- and post-trial can be seen in Table 3 and Graph 1 below.

Fatigue	Before	After
Neck	0	0
Shoulder	0	2
Upper arm	0	0
Upper back	0	0
Low back	0	2
Hip	6	10
Thigh	7	10
Calf	8	10
Ankle	8	10

Fatigue is scored out of 10 (10 is very, very tired, 0 is not at all tired) Data collected March 2022

Table 3



Graph 1

5 Conclusion

Application for use of the devices was identified in a number of different areas including; cold stores, the boning room, slaughter floor, loading area and retail ready. Feedback from the workforce regarding the comfort, level of support and ease of use was varying. In almost all cases where fatigue scores were measured, there was a reduction in rating of fatigue after wearing the devices. Arguably the most successful areas within facilities were the dry/clean areas such as cold stores/loading area.

Challenges found consistently throughout the project included the following; lack of volunteers, lack of volunteer commitment to trialling the devices over multiple days, operational demands conflicting with trial objectives, incorrect fitting or device adjustments not being made due to lack of site facilitation. Challenges with the device design specific to the meat industry includes; how to cover the devices in order to maintain hygiene standards required for the industry and subsequently. Additionally, for the devices to be used in areas that require additional equipment in the wet areas (e.g. knives), the cover needs to accommodate access to this equipment.

The potential for significant benefits within the industry has been found. The key outcome from this project is that further investigation via an internally supported and endorsed trial, is justified.

5.1 Key findings

- Exoskeleton devices, namely the backX-S and shoulderX, are suitable for a number of applications within the meat industry.
- Successful implementation of the devices within the meat industry environment, relies heavily on the workforce expectation, understanding of the devices, the fitting and adjustments, as well as the willingness to accept a new piece of PPE for certain tasks.
- The sites knowledge of fitting and adjusting device settings is key to addressing concerns of the workforce and setting the device up for the application.
- For the devices to be used in wet areas, a practical solution needs to be found to covering/cleaning the devices.

5.2 Benefits to industry

Tasks were identified within the industry that are an ideal use case for the devices. There was consistently positive feedback for the use of the devices in certain areas of the facility/location throughout the project. These include:

- Palletising
- Load-out
- Truck loading
- Reject-packing

Positive feedback was also found for tasks at certain locations:

- Packing trim
- Dry-vac

- Chiller-hand work

Additional benefits include that the challenges faced during trials are known and can be addressed. When compared to the costs associated with a workers compensation claim, for example \$47,708.00 (WorkCover WA, 2019), the cost benefit of the devices are clear.

6 Future research and recommendations

The results justify further investigation into the use of the exoskeleton devices within the meat industry. Trials would require consideration of the challenges faced within this project with particular attention on the following:

- Number of volunteers; ensuring enough volunteers to lessen the impact of unknown operational demands
- Expectations; including volunteers from the initial stages of the project so that understand and are committed to the project through the acclimation stage
- Site champion able to prioritise the project, assist with data collection at baseline, throughout the trial and at the end of the trial
- Site champion training and competency check pre-trial and engaging in support to assist the success of the trial
- Working groups to consider the requirements of hygiene covers that meet the needs of the meat industry
- Longer time frames for trial of the devices

7 References

WorkCover WA. (2019) *Worker's Compensation in Western Australia 2016/17 to 2018/19*.
Queensland worker's Compensation Scheme statistics 2020-21

7 Appendices

7.1 Risk Assessments - Harvey Beef, WA

7.1.1 Appendix A – Palletising – Risk Screen

Manual Task Risk Screen

Life Ready
Biosymm

Task Name: Palletising Date: 18/01/2021
Work Area: Cold Stores - Harvey Beef Assessor: Ruth Lennon

Task Description:

A Cold Stores General Hand employee works 8 hour shifts palletising cartons of meat product. They lift cartons (up to 27.2kg) from waist height, off the conveyor belt and carry it over to the designated pallet. They then stack the cartons, in a floor to waist lift onto the pallet, starting from the bottom with six cartons on each level and stacking up to six cartons deep (36 cartons each pallet). Up to 2500 cartons are palletised per day by a team of two workers.



Critical Physical Demands:

- *Constant floor to waist lift and carry of up to 27.3kg
- *Constant standing, walking, forward bending, forward reaching

List of Tools & Materials:

- *PPE; helmet, gloves, warm clothing, hi-vis

Risk Factors to Consider / Environmental Conditions:

- *Musculoskeletal injury: repetitive movement, forceful exertion
- *Refrigerated temperature
- *Crushing, pinch point injury

Recommendations Made: Yes - see addendum

Manual Task Risk Screen - Addendum



Risk:

*>90% of the health working male population (>90% of the female population) are unable perform a floor to waist lift and carry of up to 27.2kg on an constant basis with an acceptable risk of injury (Blankenship)
* The average cost of a Workers Compensation injury is \$47,708.00 (WorkCover WA)

Recommendations / Considerations:

- 1) Consider implementation of suitX device v3 back-5 which provides 13.6kg of support. 80-85% of the health working male population (<10% of the female population) are able to perform a floor to waist lift and carry of up to 13.6kg on an constant basis with an acceptable risk of injury (Blankenship)
- 2) Consider implementation of spring pallet leveller to reduce to risk associated with floor to waist lifting and bending *this would not address the risk associated with carrying.
- 2) Consider task rotation to reduce time spent on this task to up to 2/3 of the day or less. 30-35% of the health working male population (>90% of the female population) are able perform a floor to waist lift and carry of up to 27.2kg on an frequent basis with an acceptable risk of injury (Blankenship)
- 3) Consider task specific manual handling training, including task normalisation education.

Action Plan:

Meeting date:

Attendees:

Outcome:

Summary:

This assessment was completed as part of a joint project with MLA and Life Ready Biosymm investigating the use of exoskeletons in the meat industry. The repetitive movements and forceful exertion in this task expose workers to a high risk of injury. A risk screen has identified the task as potentially hazardous with a risk matrix score of high (15). The recommendations listed need to be reviewed and discussed with all key stakeholders, from which more recommendations may result.



Risk Rating Matrix					
Consequence →	Trivial (1) Injuries resulting in a First Aid Environmental: No effect of minor on-site effects that are rectified rapidly with an negligible residual effect. Minor Load that does not lead to contamination.	Minor (2) Injuries resulting in an MTI Environmental: Localised with very short-term (weeks) effects. Easily rectified. Minor impact on rare and endangered flora/fauna. Onsite chemical release, which is contained without outside assistance.	Severe (3) Injuries resulting in LTIs or multiple MTIs Environmental: Localised with short term effects (< 2 yrs) easily rectified. Moderate impact upon cultural & heritage sites or rare/endangered flora/fauna Chemical release contained with outside assistance.	Major (4) Up to 2 fatalities or up to 4 individuals with life threatening injuries / permanent disabilities or multiple LTIs Environmental: Major off-site impact. Long term (> 2 yrs), severe effects. Rectification difficult. Major impact in an area of high conservation value or significance.	Catastrophic (5) More than 2 fatalities or more than 4 individuals with life threatening injuries / permanent disabilities Environmental: Effects widespread, viability of threatened eco-systems or species affected or permanent major changes.
Likelihood ↓					
Frequent (5) This event is expected to occur once a year or more	Low 5	Intermediate 10	High 15	Extreme 20	Extreme 25
Occasional (4) The event may occur occasionally in the life of the asset	Low 4	Low 6	Intermediate 12	High 16	Extreme 20
Unlikely (3) The event is unlikely to occur in the life of the asset, but it is possible	Negligible 3	Low 6	Intermediate 9	High 12	High 15
Remote (2) The event is not anticipated to occur for the asset at this location	Negligible 2	Negligible 4	Low 6	Intermediate 8	High 10
Hypothetical (1) The event is theoretically possible, but has never occurred on a similar asset	Negligible 1	Negligible 2	Negligible 3	Low 4	Intermediate 5
Hierarchy or Preferred Order of Control <i>(1) being the most effective control</i>					
(1) Eliminate the hazard, remove the hazard or process from the workplace.		(3) Isolate the hazard, i.e. installing screen or barriers, marking off hazardous areas		(5) Administrative control, introducing work practices that reduce the risk, i.e. limiting the amount of time a person is exposed to a particular hazard	
(2) Substitute or replace the hazard or hazardous work practice with a less hazardous one.		(4) Engineer the hazard out i.e. modifications to tools or equipment, guarding to machinery		(6) Personal protective equipment should be considered only when other control measures are not practicable or to increase protection	

1)



v3 backX-S suitX exoskeleton device designed to support forward bending and lifting floor to waist.

2)



7.1.2 Appendix B – Hindquarter boning – Risk Screen

Manual Task Risk Screen



Task Name:	Hindquarter boning	Date:	20/01/2021
Work Area:	Boning Room - Harvey Beef	Assessor:	Ruth Lennon

Task Description:

One of tasks within the Boning Room is hindquarter boning. This involves the Boner standing on an adjustable height platform at the end of the boning line, using one hand named the hook hand to hook into the meat to help pull (estimated up to 20kg force) meat from the bone. The other hand, the knife hand, is used to cut the meat from the bone as it moves along the line. A team of 6-7 Boners stand at different positions on the line and rotate along as the rump moves through. They will work on 45-60 bodies of cattle per hour for up to 8 hours. They do rotate between other tasks along the Boning line with similar demands although at varying heights.

Critical Physical Demands:

- *Constant forward reaching, standing, trunk and wrist movement
- *Frequent pull force (estimated up to 20kg)
- *Frequent forward reaching

List of Tools & Materials:

- *PPE; chain vest, chain sleeve, gloves, apron, knife belt, helmet, ear protection

Risk Factors to Consider / Environmental Conditions:

- *Musculoskeletal injury: repetitive movement, forceful exertion, sustained postures
- *Refrigerated temperature
- *Crushing, pinch point injury, risk of being hit by movement objects, risk of laceration

Recommendations Made:

Yes - see addendum

Manual Task Risk Screen - Addendum

Life Ready
Biosymm

Risk:

*85-90% of the health working male population (30-35% of the female population) are able perform a pull force of up to 20kg on an frequent basis with an acceptable risk of injury (Blankenship)

* The average cost of a Workers Compensation injury in the food production manufacturing industry is \$47,708.00 (WorkCover WA)

Recommendations / Considerations:

1) Consider implementation of a beef boning unit to replace the action of the hook hand and estimated 20kg pull force required for this task.

2) Ensure task rotation to reduce time spent on this task to up to 2/3 of the day or less. >95% of the health working male population (>90% of the female population) are able perform a pull force of 20kg on an occasional basis with an acceptable risk of injury (Blankenship)

3) Consider task specific manual handling training, including task normalisation education.

*Not an appropriate task for the use of the suitX exoskeleton device due to the dynamic nature of the hook hand movement.

Action Plan:

Meeting date:

Attendees:

Outcome:

Summary:

This assessment was completed as part of a joint project with MLA and Life Ready Biosymm investigating the use of exoskeletons in the meat industry. The forceful exertion in this task expose workers to a low risk of musculoskeletal injury. A risk screen has identified the task as potentially hazardous with a risk matrix score of low (6). The recommendations listed need to be reviewed and discussed with all key stakeholders, from which more recommendations may result.



Risk Rating Matrix					
Consequence →	Trivial (1) Injuries resulting in a First Aid Environmental: No effect of minor on-site effects that are rectified rapidly with a negligible residual effect. Minor Lead that does not lead to contamination.	Minor (2) Injuries resulting in an MTI Environmental: Localised with very short-term (weeks) effects. Easily rectified. Minor impact on rare and endangered flora/fauna. One-to chemical release, which is contained without outside assistance.	Severe (3) Injuries resulting in LTIs or multiple MTIs Environmental: Localised with short term effects (< 2 yrs) easily rectified. Moderate impact upon cultural & heritage sites or rare/endangered flora/fauna. Chemical release contained with outside assistance.	Major (4) Up to 2 fatalities or up to 4 individuals with life threatening injuries / permanent disabilities or multiple LTIs Environmental: Major off-site impact. Long term (> 2 yrs) severe effects. Rectification difficult. Major impact in an area of high conservation value or significance.	Catastrophic (5) More than 2 fatalities or more than 4 individuals with life threatening injuries / permanent disabilities Environmental: Effects widespread, viability of threatened eco-systems or species affected or permanent major changes.
Likelihood ↓					
Frequent (5) This event is expected to occur once a year or more	Low 5	Intermediate 10	High 15	Extreme 20	Extreme 25
Occasional (4) The event may occur occasionally in the life of the asset	Low 4	Low 8	Intermediate 12	High 16	Extreme 20
Unlikely (3) The event is unlikely to occur in the life of the asset, but it is possible	Negligible 3	Low 6	Intermediate 9	High 12	High 15
Remote (2) The event is not anticipated to occur for the asset at this location	Negligible 2	Negligible 4	Low 6	Intermediate 8	High 10
Hypothetical (1) The event is theoretically possible, but has never occurred on a similar asset	Negligible 1	Negligible 2	Negligible 3	Low 4	Intermediate 5
Hierarchy or Preferred Order of Control <i>(1) being the most effective control</i>					
(1) Eliminate the hazard, remove the hazard or process from the workplace.		(3) Isolate the hazard, i.e. installing screen or barriers, marking off hazardous areas		(5) Administrative control, introducing work practices that reduce the risk, i.e. limiting the amount of time a person is exposed to a particular hazard	
(2) Substitute or replace the hazard or hazardous work practice with a less hazardous one		(4) Engineer the hazard out i.e. modifications to tools or equipment, guarding to machinery		(6) Personal protective equipment should be considered only when other control measures are not practicable or to increase protection	



*clip from promotional video for beef boning unit

7.1.3 Appendix C - Hock and horn removal – Risk Screen

Manual Task Risk Screen

Life Ready
Biosymm

Task Name: Hock and horn removal Date: 20/01/2021
Work Area: Slaughter Floor - Harvey Beef Assessor: Ruth Lennon

Task Description:

One of the tasks on the Slaughter Floor is removal of the hocks for each body of beef and horns, as required. The worker stands on a metal platform, lifts the hock cutter (estimated 10kg) waist to shoulder from its holding position, with the assistance of pneumatic support, and removes the two front hocks from the animal, this may require an overhead lift for some workers. The hock cutter is then replaced and the skin near the hocks cut with a knife before moving along the chain. Workers will complete this task for up to 85 bodies of beef per hour and complete a 2 hour rotation on this task (approx. 170 bodies of beef).

Critical Physical Demands:

Constant push force (estimated 10kg)
Frequent waist to shoulder lift (estimated up to 10kg)
Frequent standing, forward reaching and gripping
Occasional overhead lift (estimated up to 10kg)

List of Tools & Materials:

Hock cutter
Knife
PPE; hair net, helmet, ear protection, apron, gum boots, gloves, chain vest and sleeve, knife belt

Risk Factors to Consider / Environmental Conditions:

*Musculoskeletal injury: repetitive movement, forceful exertion, awkward postures
*Hot environment
*Slips, trips and falls
*Hand injury; laceration or crushing

Recommendations Made: Yes - see addendum

Manual Task Risk Screen - Addendum



Risk:

*80-85% of the healthy working male population (30-35% of females) are able to perform a 10kg waist to shoulder lift on a frequent basis with an acceptable risk of injury (Blankenship).
*65-70% of the healthy working male population (<10% of females) are able to perform a 10kg overhead lift on a frequent basis with an acceptable risk of injury (Blankenship).
*Rapid Upper Limb Assessment score of 5 - medium risk, further investigation and change soon required.
* The average cost of a Workers Compensation injury in the Food Manufacturing industry is \$47,708.00 (WorkCover WA - June 2020 report)

Recommendations / Considerations:

1) Consider implementation of suitX device v3 shoulderX for this task and other tasks on the Slaughter Floor with similar physical demands for waist to shoulder lifting and reaching e.g. 1st leg changeover and flanking.
2) Consider task specific manual handling training.

Action Plan:

Meeting date:

Attendees:

Outcome:

Summary:

This assessment was completed as part of a joint project with MLA and Life Ready Biosymm investigating the use of exoskeletons in the meat industry. The repetitive movement and awkward postures in this task expose workers to a low risk of injury. A risk screen has identified the task as potentially hazardous with a risk matrix score of low (6). The recommendations listed need to be reviewed and discussed with all key stakeholders, from which more recommendations may result.



Risk Rating Matrix					
Consequence →	Trivial (1) Injuries resulting in a First Aid Environmental. No effect of minor on-site effects that are rectified rapidly with a negligible residual effect. Minor Lead that does not lead to contamination.	Minor (2) Injuries resulting in an MTI Environmental. Localised with very short-term (weeks) effects. Easily rectified. Minor impact on rare and endangered flora/fauna. On-site chemical release, which is contained without outside assistance.	Severe (3) Injuries resulting in LTIs or multiple MTIs Environmental. Localised with short term effects (< 2 yrs), easily rectified. Moderate impact upon cultural & heritage sites or rare/endangered flora/fauna. Chemical release contained with outside assistance.	Major (4) Up to 2 fatalities or up to 4 individuals with life threatening injuries / permanent disabilities or multiple LTIs Environmental. Major off-site impact. Long term (> 2 yrs), severe effects. Rectification difficult. Major impact in an area of high conservation value or significance.	Catastrophic (5) More than 2 fatalities or more than 4 individuals with life threatening injuries / permanent disabilities Environmental. Effects widespread, viability of threatened eco-systems or species affected or permanent major changes.
Likelihood ↓					
Frequent (5) This event is expected to occur once a year or more.	Low 5	Intermediate 10	High 15	Extreme 20	Extreme 25
Occasional (4) The event may occur occasionally in the life of the asset	Low 4	Low 8	Intermediate 12	High 16	Extreme 20
Unlikely (3) The event is unlikely to occur in the life of the asset, but it is possible	Negligible 3	Low 6	Intermediate 9	High 12	High 15
Remote (2) The event is not anticipated to occur for the asset at this location	Negligible 2	Negligible 4	Low 6	Intermediate 8	High 10
Hypothetical (1) The event is theoretically possible, but has never occurred on a similar asset	Negligible 1	Negligible 2	Negligible 3	Low 4	Intermediate 5
Hierarchy or Preferred Order of Control (1) being the most effective control					
(1) Eliminate the hazard, remove the hazard or process from the workplace.		(3) Isolate the hazard, i.e. installing screen or barriers, marking off hazardous areas		(5) Administrative control , introducing work practices that reduce the risk, i.e. limiting the amount of time a person is exposed to a particular hazard	
(2) Substitute or replace the hazard or hazardous work practice with a less hazardous one		(4) Engineer the hazard out i.e. modifications to tools or equipment, guarding to machinery		(6) Personal protective equipment should be considered only when other control measures are not practicable or to increase protection	

7.1.4 Appendix D – Packing trim – Risk Screen

Manual Task Risk Screen



Task Name: Trim Packing Date: 20/01/2021
 Work Area: Boning Room - Harvey Beef Assessor: Ruth Lennon

Task Description:

One of the tasks within the Boning Room is packing trim. As the body of cattle moves through the boning room, meat is cut away and moved through the facility via conveyor belts. Smaller cut offs of meat (up to 0.5kg) named "trim" come along the conveyor and the worker scoops the trim from the belt and into boxes. It is then weighed and moved to a different section within the facility for further processing. During an 8 hour shift staff rotate from this task, to other tasks within the packing area of the boning room with similar physical demands roughly every 2 hours.

Critical Physical Demands:

- *Frequent pull force up to 0.5kg
- *Occasional trunk flexion, forward reaching and standing.

List of Tools & Materials:

*PPE; hair net, ear protection, apron, gum boots, full white uniform, gloves

Risk Factors to Consider / Environmental Conditions:

- *Musculoskeletal injury: repetitive movement and sustained postures
- *Refrigerated temperature

Recommendations Made: Yes - see addendum

Manual Task Risk Screen - Addendum



Risk:

*The musculoskeletal risk associated with the postures adopted during this task are rated as medium risk, further investigation and change soon as per the Rapid Entire Body Assessment tool (REBA)
* The average cost of a Workers Compensation injury in the Food Manufacturing industry is \$47,708.00 (WorkCover WA - June 2020 report)

Recommendations / Considerations:

- 1) Consider implementation of suitX device v3 back-S which provides up to 13.6kg of support in the forward flexed posture.
- 2) Investigate options for a flat hook/scoop tool with appropriate handle to reduce the barrier reach required in this task (photos below).
- 2) Consider a variation in the ergonomic arrangement of the work task to reduce or remove the barrier where the box sits and minimise distance from the worker to the conveyor belt, therefore minimising the trunk flexion required for this task.
- 3) Consider task specific manual handling training in techniques to minimise the effects of prolonged postures.

Action Plan:

Meeting date:

Attendees:

Outcome:

Summary:

This assessment was completed as part of a joint project with MLA and Life Ready Biosymm investigating the use of exoskeletons in the meat industry. The prolonged postures in this task expose workers to a moderate risk of injury. A risk screen has identified the task as potentially hazardous with a risk matrix score of intermediate (10). The recommendations listed need to be reviewed and discussed with all key stakeholders, from which more recommendations may result.



Risk Rating Matrix					
Consequence →	Trivial (1) Injuries resulting in a First Aid Environmental: No effect of minor on-site effects that are rectified rapidly with a negligible residual effect. Minor Lead that does not lead to contamination.	Minor (2) Injuries resulting in an MTI Environmental: Localised with very short-term (weeks) effects. Easily rectified. Minor impact on rare and endangered flora/fauna. On-site chemical release, which is contained without outside assistance.	Severe (3) Injuries resulting in LTIs or multiple MTIs Environmental: Localised with short term effects (< 2 yrs) easily rectified. Moderate impact upon cultural & heritage sites or rare/endangered flora/fauna. Chemical release contained with outside assistance.	Major (4) Up to 2 fatalities or up to 4 individuals with life threatening injuries / permanent disabilities or multiple LTIs Environmental: Major off-site impact. Long term (> 2 yrs) severe effects. Rectification difficult. Major impact in an area of high conservation value or significance.	Catastrophic (5) More than 2 fatalities or more than 4 individuals with life threatening injuries / permanent disabilities Environmental: Effects widespread, stability of threatened eco-systems or species affected or permanent major changes.
Likelihood ↓					
Frequent (5) This event is expected to occur once a year or more	Low 5	Intermediate 10	High 15	Extreme 20	Extreme 25
Occasional (4) The event may occur occasionally in the life of the asset	Low 4	Low 8	Intermediate 12	High 16	Extreme 20
Unlikely (3) The event is unlikely to occur in the life of the asset, but it is possible	Negligible 3	Low 6	Intermediate 9	High 12	High 15
Remote (2) The event is not anticipated to occur for the asset at this location	Negligible 2	Negligible 4	Low 6	Intermediate 8	High 10
Hypothetical (1) The event is theoretically possible, but has never occurred on a similar asset	Negligible 1	Negligible 2	Negligible 3	Low 4	Intermediate 5
Hierarchy or Preferred Order of Control <i>(1) being the most effective control</i>					
(1) Eliminate the hazard, remove the hazard or process from the workplace.		(3) Isolate the hazard, i.e. installing screen or barriers, marking off hazardous areas		(5) Administrative control , introducing work practices that reduce the risk, i.e. limiting the amount of time a person is exposed to a particular hazard	
(2) Substitute or replace the hazard or hazardous work practice with a less hazardous one.		(4) Engineer the hazard out i.e. modifications to tools or equipment, guarding to machinery		(6) Personal protective equipment should be considered only when other control measures are not practicable or to increase protection	

REBA

Life Ready
Biosymm

Score	Level of MSD Risk
1-2	negligible risk, no action required
2-3	low risk, change may be needed
4-7	medium risk, further investigation and change soon
8-10	high risk, investigate and implement change
11+	very high risk, implement change



Scooping hook tool. This would reduce the requirement for the barrier reach.

7.2 Risk Assessments -nWagstaff, VIC

7.2.1 Appendix A – Hand Loading Trucks – Risk Screen

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Biosymm

Manual Task Risk Screen

Task Name:	Hand Unloading Trucks	Date:	12/05/2021
Client/ Site:	Wagstaff - Cranbourne East	Assessor:	James Ryan
Work Area:	Loading Area	Review Date:	12/05/2021

Task Description:

Workers in the loading area will manually load trucks with boxes of meat (up to 29kg). A forklift will be used to load a pallet of meat into the trucks. Workers will push/pull an electric pallet jack (up to 1kg) to position the pallet as close as possible to where they are loading to reduce carry distance. Workers will lift and carry boxes from the pallet into the truck (between floor level and overhead). This task is performed by workers for the duration of their shift. Trucks can hold up to 1400 boxes. Workers will lift and carry up to 600 boxes per shift.

Critical Physical Demands


- Constant floor to waist lift and carry of up to 29kg
- Constant walking
- Frequent waist to shoulder and overhead lift of up to 29kg
- Frequent push/pull force of up to 1kg
- Frequent overhead reach
- Infrequent stair climbing
- Mass grasp
- Critical balance

List of Tools & Materials

- High vis
- Steel cap boots
- Electric pallet jack

Risk Factors to Consider/ Environmental Conditions

- Musculoskeletal injury
- Slips, trips, falls
- Pinch point injury



Recommendations Made: Yes - see addendum



Manual Task Risk Screen - Addendum

Risk / Considerations:

*<10% of the healthy working female and male population are able perform a floor to waist, waist to shoulder, overhead lift and carry of up to 29kg on a constant basis (frequent basis for waist to shoulder and overhead lift) with an acceptable risk of injury (Blankenship).
*Rapid Entire Body Assessment (REBA) score of 12 = high risk, investigate and implement change.
*The average cost of a Workers Compensation injury in the food production industry is \$47,708.00 (WorkCover WA).

Recommendations:

- 1) Consider implementation of trucks that can be loaded by forklift to eliminate manual handling.
- 2) Consider implementation of the v3 shoulderX-S suitX device to support the lifting overhead and between waist and shoulder level.
- 3) Consider implementation of the v2 backX-S suitX device to support the below waist lifting.
- 4) Consider implementation of a height adjustable pallet stack to reduce frequency of below waist lifting.
- 5) Consider task specific manual handling training, including task normalisation education.

Action Plan:

Meeting date:

Attendees:

Outcome:

Summary:

This assessment was completed by Life Ready Biosymm whilst investigating the use of exoskeletons in the meat industry. The forceful exertion and repetitive nature of this task exposes workers to a moderate risk of musculoskeletal injury. A risk screen has identified the task as potentially hazardous with a risk matrix score of intermediate (12). The recommendations listed need to be reviewed and discussed with all key stakeholders, from which more recommendations may result.

Life Ready
Biosymm

Recommendations

v3 shoulderX-5



v2 backX-5



Loading trucks via forklift



Risk Rating Matrix

Consequence	Risk Rating Matrix				
	Trauma (1) Injury resulting in a first aid Environmental: No effect of noise on site affects but can be avoided rapidly with an negligible residual effect. Minor 1 and 2nd aid work not need to be completed.	Minor (2) Injury resulting in an 80% Environmental: Localized with some environmental impacts. Early medical. Minor impact on work and management. Residuals: Double treatment sessions, which is not bad and without visible acceptance.	Severe (3) Injury resulting in 70% or higher (30%) Environmental: Localized with some severe effects in 2 previously defined. Moderate impact on work and management. Residuals: Double treatment sessions, which is not bad and without visible acceptance.	Major (4) Injury resulting in up to 2 individuals with the following impact: permanent disability or more. The environmental impact off site is very serious. Residuals: Double treatment sessions, which is not bad and without visible acceptance.	Catastrophe (5) Major: 2 individuals or more. More than 4 individuals with the following impact: permanent disability or more. The environmental impact off site is very serious. Residuals: Double treatment sessions, which is not bad and without visible acceptance.
Frequency (F) The event is expected to occur once a year or more	Low 1	Intermediate 18	High 18	Extreme 24	Extreme 24
Occasional (F) The event may occur occasionally in the life of the asset	Low 3	Low 6	Intermediate 12	High 18	Extreme 24
Rarity (F) The event is likely to occur in the life of the asset, but it is possible	Negligible 2	Low 4	Intermediate 8	High 12	High 18
Exceptional (F) The event is not anticipated to occur in the asset or its lifetime	Negligible 1	Negligible 2	Low 4	Intermediate 6	High 12
Hydrological (F) The event is frequently possible but has never occurred in a similar event	Negligible 1	Negligible 2	Negligible 3	Low 4	Intermediate 6

Height adjustable pallet stack



REBA Scoring

Score	Level of MSD Risk
1-2	negligible risk, no action required
2-3	low risk, change may be needed
4-7	medium risk, further investigation and change seen
8-10	high risk, immediate and significant change
11+	very high risk, implement change

7.2.2 Appendix B – Sixway – Risk Screen



Manual Task Risk Screen

Task Name:	<u>Sixway</u>	Date:	<u>12/05/2021</u>
Client/ Site:	<u>Wagstaff - Cranbourne East</u>	Assessor:	<u>James Ryan</u>
Work Area:	<u>Boning Room</u>	Review Date:	<u>12/05/2021</u>

Task Description:

Workers in the boning room will stand at the bandsaw table as the carcasses (lamb and goats) move through the boning room hooked onto an overhead conveyor. They will reach overhead to lift the carcass off the conveyor and place it on the bandsaw table. Workers will use a bandsaw to cut the carcass into up to 6 pieces. 2 carcasses are handled per minute and up to 700 carcasses are handles per worker per shift. Carcasses weigh up to 40kg.

Critical Physical Demands

Constant waist to shoulder and overhead lift of up to 40kg
 Constant push force of up to 15kg (estimated)
 Constant forward and overhead reach
 Frequent standing and walking
 Mass grasp, fine hand use
 Critical balance

List of Tools & Materials

Whites: apron and pants
 Hair and beard nets
 Steel cap boots
 Gloves
 Bandsaw

Risk Factors to Consider/ Environmental Conditions

Musculoskeletal injury
 Slips, trips, falls
 Pinch point injury



Recommendations Made:

Yes - see addendum



Manual Task Risk Screen - Addendum

Risk / Considerations:

*<10% of the healthy working female and male population are able perform a waist to shoulder and overhead lift of up to 40kg and a push force of up to 15kg on a constant basis with an acceptable risk of injury (Blankenship).
*Rapid Entire Body Assessment (REBA) score of 13 = high risk, investigate and implement change.
*The average cost of a Workers Compensation injury in the food manufacturing industry is \$47,708.00 (WorkCover WA).

Recommendations:

- 1) Consider implementation of robot tower to automate cutting of carcasses.
- 2) Consider implementation of the v3 shoulderX-S suitX device to support the lifting overhead and between waist and shoulder level.
- 3) Consider a reduction to the time spent on this task to up to 1/3 of the day or less. 60-65% of the healthy working male population (<10% of the female population) are able perform a waist to shoulder and overhead lift of up to 40kg on an occasional basis with an acceptable risk of injury (Blankenship). >95% of the healthy working male population (>90% female) are able to perform a push force of up to 15kg on an occasional basis with an acceptable risk of injury (Blankenship).
- 4) Consider task specific manual handling training, including task normalisation education.

Action Plan:

Meeting date:

Attendees:

Outcome:

Summary:

This assessment was completed by Life Ready Biosymm whilst investigating the use of exoskeletons in the meat industry. The forceful exertions and repetitive nature of this task exposes workers to a moderate risk of musculoskeletal injury. A risk screen has identified the task as potentially hazardous with a risk matrix score of intermediate (12). The recommendations listed need to be reviewed and discussed with all key stakeholders, from which more recommendations may result.

Life Ready
Biosymm

v3 shoulderX-5



Recommendations

Risk Rating Matrix

Consequence	Risk Rating Matrix				
	Trivial (1) Minor (2) Moderate (3) Major (4) Catastrophic (5)	Trivial (1) Minor (2) Moderate (3) Major (4) Catastrophic (5)	Trivial (1) Minor (2) Moderate (3) Major (4) Catastrophic (5)	Trivial (1) Minor (2) Moderate (3) Major (4) Catastrophic (5)	Trivial (1) Minor (2) Moderate (3) Major (4) Catastrophic (5)
Frequency (F) This event is expected to occur once a year, at least.	Low 1	Intermediate 10	High 10	Extreme 100	Catastrophic 100
Occasional (O) This event may occur occasionally in the life of the asset.	Low 5	Intermediate 5	Intermediate 10	High 10	Catastrophic 50
Infrequent (I) This event is unlikely to occur in the life of the asset, but it is possible.	Negligible 2	Low 5	Intermediate 5	High 10	High 10
Rare (R) This event is not a foreseeable event for the asset at this location.	Negligible 1	Negligible 2	Low 5	Intermediate 5	High 10
Highly Probable (HP) This event is highly probable, but it is not expected to occur at a given point.	Negligible 1	Negligible 2	Negligible 1	Low 5	Intermediate 5

Severity or Potential Order of Consequence (1) being the most critical severity

(1) Eliminate the hazard, remove the hazard or process from the workplace.
(2) Reduce the hazard, remove the hazard or process from the workplace.
(3) Reduce the hazard, remove the hazard or process from the workplace.
(4) Reduce the hazard, remove the hazard or process from the workplace.
(5) Reduce the hazard, remove the hazard or process from the workplace.

REBA Scoring

Score	Level of MSD Risk
1-2	negligible risk, no action required
3-5	low risk, change may be needed
6-7	medium risk, further investigation and change recommended
8-10	high risk, immediate action required
11+	very high risk, implement change

7.2.3 Appendix C – Sorting and Cleaning – Risk Screen



Manual Task Risk Screen

Task Name: Sorting And Cleaning Date: 12/05/2021
 Client/ Site: Wagstaff Assessor: James Ryan
 Work Area: Iron Room Review Date: 12/05/2021

Task Description:

Parts (slides and gambles - which hang carcasses in the production facility) in crates (up to 50kg) on a trolley will be transported via forklift to the iron room. Crates will be pulled onto a rise and fall. The rise and fall is operated by hand controls to elevate the crate to bench level. Workers will pull the crates onto the bench and sort parts into crates of slides and crates of gambles. Crates of parts are hoisted into the chemicals/oil/water to clean them. Crates are then lifted between floor and waist level onto a trolley to be returned into the production facility. This task will be performed by one worker for their entire. Up to 30 tubs will be handled by this worker each shift. Up to 8 tubs are loaded onto each trolley.

Critical Physical Demands

Frequent pull force of up to 20kg
 Frequent standing and walking
 Occasional floor to waist lift of up to 50kg
 Occasional bending, squatting and forward reach
 Mass grasp, fine hand use
 Critical balance

List of Tools & Materials

Reds: apron and pants
 Hair and beard nets
 Forklift
 Trolley
 Crates

Risk Factors to Consider/ Environmental Conditions

Musculoskeletal injury
 Slips, trips, falls
 Pinch point injury



Recommendations Made:

Yes - see addendum



Manual Task Risk Screen - Addendum

Risk / Considerations:

*<10% of the healthy working female and male population are able perform a floor to waist lift of up to 50kg on an occasional basis with an acceptable risk of injury (Blankenship).
*85-90% of the healthy working male population (25-30% female) are able to perform a pull force of up to 20kg on a frequent basis with an acceptable risk of injury (Blankenship).
*Rapid Entire Body Assessment (REBA) score of 12 = high risk, investigate and implement change.
*The average cost of a Workers Compensation injury in the food manufacturing industry is \$47,708.00 (WorkCover WA).

Recommendations:

- 1) Consider implementation of rise and fall in the iron room as well as outside at the bench to eliminate 50kg floor to waist lift and replace with 20kg pull.
- 2) Consider implementation of the v2 backX-S suitX device to support the below waist lifting.
- 3) Consider task specific manual handling training, including task normalisation education.

Action Plan:

Meeting date:

Attendees:

Outcome:

Summary:

This assessment was completed by Life Ready Biosymm whilst investigating the use of exoskeletons in the meat industry. The forceful exertions and repetitive nature of this task exposes workers to a moderate risk of musculoskeletal injury. A risk screen has identified the task as potentially hazardous with a risk matrix score of intermediate (12). The recommendations listed need to be reviewed and discussed with all key stakeholders, from which more recommendations may result.

Life Ready
Biosymm

Recommendations

v2 backX-5



Risk Rating Matrix

Consequence	Risk Rating Matrix				
	Trivial (1) Injury resulting in no lost time Environmental: No effect of noise or vibration Ergonomic: No effect of force or motion No significant noise or vibration No significant force or motion	Minor (2) Injury resulting in up to 3 days lost time Environmental: Limited effect of noise or vibration Ergonomic: Minor effect of force or motion No significant noise or vibration No significant force or motion	Severe (3) Injury resulting in 3 to 10 days lost time Environmental: Moderate effect of noise or vibration Ergonomic: Moderate effect of force or motion Significant noise or vibration Significant force or motion	Major (4) Injury resulting in up to 30 days lost time Environmental: Significant effect of noise or vibration Ergonomic: Significant effect of force or motion Very significant noise or vibration Very significant force or motion	Catastrophic (5) Injury resulting in more than 30 days lost time Environmental: Severe effect of noise or vibration Ergonomic: Severe effect of force or motion Extremely significant noise or vibration Extremely significant force or motion
Likelihood (L)					
Improbable (1) This event is expected to occur once in 100 or more years	Low 1	Intermediate 10	High 18	Catastrophic 30	Catastrophic 30
Unlikely (2) This event may occur occasionally in the life of the asset	Low 2	Low 6	Intermediate 12	High 18	Catastrophic 30
Probable (3) This event is likely to occur in the life of the asset, but is avoidable	Negligible 3	Low 6	Intermediate 9	High 12	High 15
Frequent (4) This event is not avoidable under any circumstances	Negligible 4	Negligible 4	Low 6	Intermediate 8	High 10
Highly Probable (5) This event is unavoidable under any circumstances	Negligible 5	Negligible 5	Negligible 5	Low 6	Intermediate 8

Severity or Worked Hours of Exposed

(1) Negligible (2) Low (3) Intermediate (4) High (5) Catastrophic

(1) Trivial (2) Minor (3) Severe (4) Major (5) Catastrophic

(1) Negligible (2) Low (3) Intermediate (4) High (5) Catastrophic

REBA Scoring

Score	Level of MSD Risk
1-2	Negligible risk, no action required
2-3	Low risk, change may be needed
4-7	Medium risk, further investigation and change soon
8-10	High risk, investigate and implement change
11+	Very high risk, implement change

7.3 Risk Assessments – Australian Country Choice

7.3.1 Appendix A – Slicing – Risk Screen



Manual Task Risk Screen



Task Name:	Slicing	Date:	18/08/2021
Client/ Site:	Australian Country Choice - BNE	Assessor:	Alycia Garriock
Work Area:	Boning Room	Review Date:	

Task Description:

On a daily basis slicers are required to cut product to spec and remove defects. This is done at the slices table in the boning room. Slicers are required to pull meat off the moving belt which can sometimes be up to 25kg pieces of meat. When slicing slicers are required to manually handle the meat to move it into positions ideal for slicing. Once complete the meat is pushed back onto the moving belt. There is time pressure with this job and they are required to work in a cold environment. Slicers work a 7.8 hour day which is broken down into 5 runs a day, 5 days a week. They are subject to working an extra 30mins overtime on all days they work if required.

Critical Physical Demands

Constant standing, forward bend and forward reach
 Constant push force of the knife into the meat, variable pressures depending on meat and knife and pushing the meat back on the conveyor.
 Frequent pull force to move meat weighing up to 25kg

List of Tools & Materials

Belt with knives and stone (sometimes up to 2 or 3 stones)
 Hook
 PPE: Hard hat, hearing protection, steel cap boots, balaclava, apron, whites (uniform), glasses, mesh

Risk Factors to Consider/ Environmental Conditions

Musculoskeletal injury
 Slips, trips, falls
 Noise pollution: wear hearing muffs
 Environmental conditions: cold temperatures 6 to 7 degrees



Recommendations Made: Yes - see addendum



Manual Task Risk Screen - Addendum

Risk / Considerations:

* Risk of musculoskeletal injury to the shoulder and back for this task has a risk matrix score of high (likely/moderate). This is due to the frequent pull force combined with sustained forward flexion and forward reach.
* REBA score was 12, indicating a high risk and change needs to be implemented
* Anthropometric considerations; the current bench height is at 1000mm. The 50th percentile for women's elbow height sits at 989mm. The width of the slicing bench is 530mm and the moving belt 670mm. The 50th percentile for women's forward reach grip sits at 703mm. Hooks are provided to staff but it is still noted overreaching for meat off the moving belt is required.
* ACC has 10 employees currently being treated by the onsite physio for back, shoulder and upper limb pain from this work area currently.
* The average cost of a Workers Compensation injury in food manufacturing industry \$47,708.00 (WorkCover WA, 2019).

Recommendations:

- 1) Back SuitX devices to support the lower back with the constant forward bend
- 2) Appropriate length hooks to allow employees who have a shorter stature to reach the meat without overstretching
- 3) Auto meat pushers on the moving belt to bring the meat closer to the slicers to grab

Action Plan:

Meeting date:

Attendees:

Outcome:

Summary:

This assessment was completed during the MLA exoskeleton study at Australian Country Choice Brisbane. The constant repetitive reaching and forward bend exposes workers to a high risk of injury. A risk screen has identified the task as potentially hazardous with a risk matrix score of high (likely/moderate) to the lower back and shoulder. The exoskeleton will be trialled for a week by the worker and feedback provided after the trial and collated for the milestone report.



Risk Assessments



		Consequence			
Likelihood	Insignificant	Minor	Moderate	Major	Severe
Almost Certain	Medium	High	High	Extreme	Extreme
Likely	Medium	Medium	High	Extreme	Extreme
Possible	Medium	Medium	High	High	Extreme
Unlikely	Low	Medium	Medium	High	High
Rare	Low	Low	Medium	High	High

REBA Score	Risk Level	Action
1	Negligable	None necessary
2 - 3	Low	May be necessary
4 - 7	Medium	Necessary
8 - 10	High	Necessary soon
11 - 15	Very High	Necessary now

7.3.2 Appendix B – Quarter Saw – Risk Screen



Manual Task Risk Screen

Task Name:	<u>Quarter Saw</u>	Date:	<u>18/08/2021</u>
Client/ Site:	<u>Australian Country Choice - BNE</u>	Assessor:	<u>Alycia Garriock</u>
Work Area:	<u>Boning Room</u>	Review Date:	<u></u>

Task Description:

On a daily bases quarters are required to saw the rib cage with the quarter saw which is suspended above head. A pull force is required of <5kg on a frequent basis. The saw then retracts automatically when the operator lets go. The quarterer is in a constant forward bend position when performing this task to apply pressure onto the saw. Teams consist of up to 5-6 staff who rotate throughout the shift. Shifts consist of 5 runs lasting 1hr and 45mins each. A break is had after each run and team members rotate tasks at this point.

Critical Physical Demands

Constant standing, forward bend and above shoulder reaching
 Frequent pull force of 5kg of quarter saw
 Power grip

List of Tools & Materials

Quarter saw
 PPE: Hard hat, hearing protection, steel cap boots, balaclava, apron, whites (uniform), glasses

Risk Factors to Consider/ Environmental Conditions

Musculoskeletal injury
 Slips, trips, falls
 Noise pollution: wear hearing muffs
 Environmental conditions: cold temperatures 6 to 7 degrees



Recommendations Made: Yes - see addendum



Manual Task Risk Screen - Addendum



Risk / Considerations:

- * The risk of a musculoskeletal injury to the shoulder on the risk matrix is a possible/moderate, resulting in a risk matrix score of high. This is due to the constant forward bend and above shoulder reaching.
- * This task has a REBA score of 10, indicating a high risk of injury is likely, investigation is required and implementation of change to minimise injury risk is beneficial
- * ACC has one employee currently been treated by the onsite physio for shoulder pain from this work area
- * The average cost of a Workers Compensation injury in food manufacturing industry \$47,708.00 (WorkCover WA, 2019).

Recommendations:

- 1) SuitX shoulder; will help to support the arm above 70 degrees and minimise shoulder injuries caused by fatigue
- 2) Making sure the saw blade is always sharp to minimise force needed to cut through the carcass
- 3) Increase task rotation to minimise fatigue

Action Plan:

Meeting date:

Attendees:

Outcome:

Summary:

This assessment was completed during the MLA exoskeleton study at Australian Country Choice Brisbane. The constant above shoulder reaching expose workers to a high risk of injury. A risk screen has identified the task as potentially hazardous with a risk matrix score of high (possible/moderate) to the lower back and shoulder. The exoskeleton will be trialled for a week by the worker and feedback provided after the trail and collated for the milestone report.



Risk Screens



Likelihood	Consequence				
	Insignificant	Minor	Moderate	Major	Severe
Almost Certain	Medium	High	High	Extreme	Extreme
Likely	Medium	Medium	High	Extreme	Extreme
Possible	Medium	Medium	High	High	Extreme
Unlikely	Low	Medium	Medium	High	High
Rare	Low	Low	Medium	High	High

REBA Score	Risk Level	Action
1	Negligable	None necessary
2 - 3	Low	May be necessary
4 - 7	Medium	Necessary
8 - 10	High	Necessary soon
11 - 15	Very High	Necessary now



Queensland



How many workplace incidents?
71,000 incidents
There are around 71,000 general workplace injuries a year in Queensland, affecting one in every 35 workers. One in every 85 workers suffers a serious injury.

How many workplace deaths?
deaths
Approximately 39 workers die each year as a result of a workplace injury.

At what cost?
paid
Around \$680 million is paid out annually for workers' compensation claims.

Workdays lost?
days lost
On average 43 days are lost for injuries needing time off work.

What's causing the injuries?

All other mechanisms	18%
Maneuvering manual tasks	23%
Being hit by moving objects	17%
Being hit by falling objects	17%
Slips, trips and falls	17%
Reaching objects with a part of the body	15%

Which industry?
Manufacturing workers are two and a half times more likely to suffer a general workplace injury compared to other workers.

Which age group?
Males between 25 and 34 years represent one in six general workplace injuries.



Manufacturing



How many workplace incidents?
11,500 incidents
There are 11,500 general workplace injuries in manufacturing a year, affecting one in every 35 manufacturing workers. One in every 50 manufacturing workers suffers a serious injury.

How many workplace deaths?
deaths
Approximately three manufacturing workers die each year as a result of a workplace injury.

At what cost?
paid
Around \$74 million is paid out annually for manufacturing workers' compensation claims.

Workdays lost?
days lost
In manufacturing, 32 days are lost for injuries needing time off work.

What's causing the injuries?

All other mechanisms	17%
Maneuvering manual tasks	30%
Being hit by moving objects	23%
Reaching objects with a part of the body	20%

Which jobs?
Labourers are the most commonly injured in manufacturing, with one in every six labourers suffering a work injury.

Which age group?
One in four injuries in manufacturing affect workers aged between 25 and 34 years.



7.3.3 Appendix C – Palletising – Risk Screen



Manual Task Risk Screen



Task Name:	<u>Stack Down Pallets</u>	Date:	<u>25/08/2021</u>
Client/ Site:	<u>Australian Country Choice - BNE</u>	Assessor:	<u>Alycia Garriock</u>
Work Area:	<u>Boning Room</u>	Review Date:	<u></u>

Task Description:

On a daily basis stack down staff are required to stack down boxes for up to 2 hours (more if conveyor is broken). There is approximately 30 pallets a shift with approximately 42 boxes on them. Boxes can weight up to 30kg. Stack down staff are rostered 8.8hours a day with 2 x 30 min breaks equalling, 7.8hours of work. The boxes are stacked 6 to 7 rows high, with 6 boxes per row, equalling approximately 1260 boxes per shift. This task is performed between 2 to 3 workers within the shift. The box dimensions are approximately 16cmx56cmx37cm. If the boxes are stacked 7 high with the pallet being 20cm high the boxes start off at a height of 132cm and the last row being at a height of 36cm.

Critical Physical Demands

Frequent floor to waist, waist to shoulder and above head lifting of up to 30kg

List of Tools & Materials

Boxes of meat (up to 30kg)
Pallet
PPE; balaclava, hard hat, hearing muffs, gum boots, whites

Risk Factors to Consider/ Environmental Conditions

Musculoskeletal injury
Slips, trips, falls
Pinch point injury
Factory environmental conditions: cold room, time pressure



Recommendations Made: Yes - see addendum



Manual Task Risk Screen - Addendum



Risk / Considerations:

- * Only <10% of the healthy, working, male and female population can perform a 30kg waist to shoulder and above shoulder lift on an frequent basis with an acceptable risk of injury (Blankenship)
- * Only 20-25% of the healthy, working, male (<10% female) population can perform a 30kg floor to waist lift on a frequent basis with an acceptable risk of injury (Blankenship).
- * Anthropometric considerations; 50 percent of the Australian female population have a shoulder height of 130cm or below
- * ACC has had one employee been treated by the onsite physio for back and shoulder pain from this work area currently
- * The average cost of a Workers Compensation injury in food manufacturing industry \$47,708.00 (WorkCover WA, 2019).

Recommendations:

- 1) Exo Skeleton back and shoulder which would help support the lower back and shoulder with the heavy repetitive lifting
- 2) Pallet lifter would minimise floor to waist lifting and the excessive reaching to get the boxes at the back of the pallet.

Action Plan:

Meeting date:

Attendees:

Outcome:

Summary:

This assessment was completed during the MLA exoskeleton study at Australian Country Choice Brisbane. The heavy repetitive lifting expose workers to a high risk of injury. A risk screen has identified the task as potentially hazardous with a risk matrix score of high (likely/moderate) to the lower back and shoulder. The exoskeleton will be trialled for a week by the worker and feedback provided after the trail and collated for the milestone report.

Life Ready
Biosymm



V2 backX-S

Recommendations



V2 backX-S



Pallet Lifter



Likelihood	Consequence				
	Insignificant	Minor	Moderate	Major	Severe
Almost Certain	Medium	High	High	Extreme	Extreme
Likely	Medium	Medium	High	Extreme	Extreme
Possible	Medium	Medium	High	High	Extreme
Unlikely	Low	Medium	Medium	High	High
Rare	Low	Low	Medium	High	High

Queensland



How many workplace incidents?
71,000 incidents
There are around 71,000 general workplace injuries a year in Queensland, affecting one in every 35 workers. One in every 85 workers suffers a serious injury.

How many workplace deaths?
deaths
Approximately 39 workers die each year as a result of a workplace injury.

At what cost?
paid
Around \$686 million is paid out annually for workers' compensation claims.

Workdays lost?
days lost
On average 43 days are lost for injuries needing time off work.

What's causing the injuries?

All other mechanisms 18%	Hazardous manual tasks 33%
Hitting objects with a part of the body 15%	Falls, trips and slips 17%
Being hit by moving objects 17%	

Which industry?
Manufacturing workers are two and a half times more likely to suffer a general workplace injury compared to other workers.

Which age group?
Males between 25 and 34 years represent one in six general workplace injuries.



Manufacturing



How many workplace incidents?
11,500 incidents
There are 11,500 general workplace injuries in manufacturing a year, affecting one in every 15 manufacturing workers. One in every 50 manufacturing workers suffers a serious injury.

How many workplace deaths?
deaths
Approximately three manufacturing workers die each year as a result of a workplace injury.

At what cost?
paid
Around \$74 million is paid out annually for manufacturing workers' compensation claims.

Workdays lost?
days lost
In manufacturing, 32 days are lost for injuries needing time off work.

What's causing the injuries?

All other mechanisms 21%	Hazardous manual tasks 30%
Hitting objects with a part of the body 30%	Being hit by moving objects 19%

Which jobs?
Labourers are the most commonly injured in manufacturing, with one in every six labourers suffering a work injury.

Which age group?
One in four injuries in manufacturing affect workers aged between 25 and 34 years.



7.4 Risk Assessments - Teys, QLD

7.4.1 Appendix A – Palletising – Risk Screen



ErgoAnalyst Preliminary Risk Screen



Task Name:	Palletising	Date:	14/10/2021
Client/ Site:	Tey's	Assessor:	Alycia Garriock
Work Area:	Load Out Area	Review Date:	

Task Description:

Working in load out area 4-5 workers take boxes of meat from a roller conveyor at waist height and place boxes onto corresponding pallets located to the side or behind the worker. Boxes are placed on the pallets between below waist and shoulder height. Once a pallet is full the worker then retrieves an electric pallet jack (EPJ), uses a pumping action to raise the EPJ and then manoeuvres the pallet by pushing/ pulling the EPJ to a different area to be removed by the forklift. Workers are required to push the weight of several boxes along the roller conveyors to the strapping machine. Workers in the frozen palletising section are required to lift standard box weights of 27.2kg. Workers in the chilled palletising area lift boxes of varying weights (<30kg). Load out processes approximately 15000 boxes per day. Chilled area processes approximately 6000 of these boxes. Chilled export area moves approximately 500 boxes per day

Critical Physical Demands

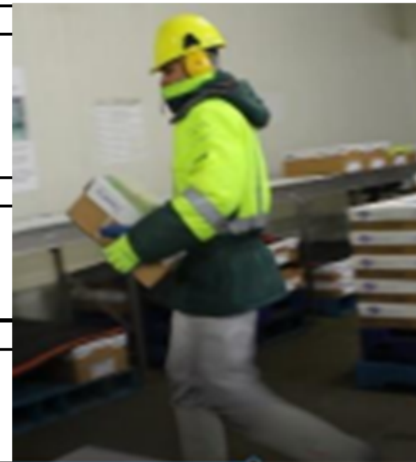
Constant floor to waist, waist to shoulder lifting and carry of up to 30kg
 Constant push/pull 15kg
 Constant walking, standing, truck rotation
 Power grip

List of Tools & Materials

PPE; high vis uniform, steel cap boots, hard helmet, hearing protection, hair net, freezer jacket, gloves

Risk Factors to Consider/ Environmental Conditions

Musculoskeletal injury
 Slips, trips, falls
 Pinch point injury
 Environmental conditions: noise and cold (2degrees)



Recommendations Made: Yes - see addendum



Manual Task Risk Screen - Addendum



Risk / Considerations:

- * Less than 10% of the healthy, working, male and female population can perform a 30kg floor to waist and waist to shoulder lift on a constant basis with an acceptable risk of injury (Blankenship)
- * The average cost of a Workers Compensation injury in food manufacturing industry \$47,708.00 (WorkCover WA, 2019).

Recommendations:

- 1) Investigate Suit-X back device, which may help to support the lower back and shoulder with the heavy repetitive lifting.
- 2) Pallet lifters would minimise floor to waist lifting and the excessive reaching to get the boxes at the back of the pallet

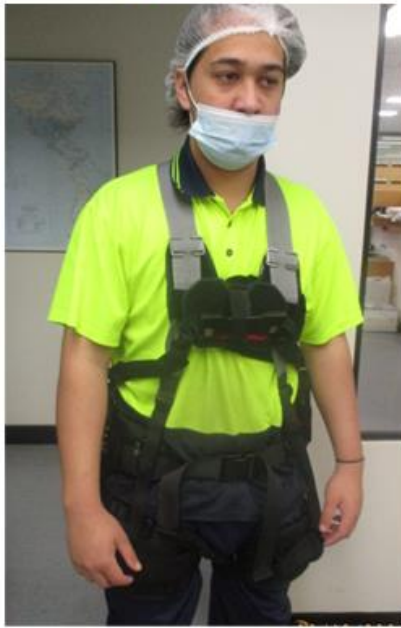
Action Plan:

Meeting date: 14/10/2021
Attendees: Alycia Garriock (physio), Neil Lynch (Manager of Health and Safety Teys)
Outcome: Refer to P.PSH.1240 Teys Milestone 4 Report-20211114

Summary:

This assessment was completed during the MLA exoskeleton study at Teys Beenleigh, Brisbane. The heavy repetitive lifting expose workers to a high risk of injury. A risk screen has identified the task as potentially hazardous with a risk matrix score of high (likely/moderate) to the lower back and shoulder. The exoskeleton will be trialled for a week by the worker and feedback provided after the trial and collated for the milestone report.

Life Ready
Biosymm



Suit-X Back V2

Recommendations



Pallet lifter



Likelihood	Consequence				
	Insignificant	Minor	Moderate	Major	Severe
Almost Certain	Medium	High	High	Extreme	Extreme
Likely	Medium	Medium	High	Extreme	Extreme
Possible	Medium	Medium	High	High	Extreme
Unlikely	Low	Medium	Medium	High	High
Rare	Low	Low	Medium	High	High

7.4.2 Appendix B –Halal Process – Risk Screen



ErgoAnalyst Preliminary Risk Screen



Task Name:	Halal Process	Date:	20/10/2021
Client/ Site:	Teys Beenleigh	Assessor:	Alycia Garriock
Work Area:	Slaughter Floor	Review Date:	

Task Description:

One worker working on the slaughter floor on a 14cm platform washes his hands and knife between each head of cattle. He steps down from the platform and walks a short distance to the moving cattle belt. The worker steps on to the cattle belt and bends forward to below knee height to check the eye reflexes with the back of the hand and makes several slicing cuts to the cattle's throat. Each shift slaughters 600-750 head of cattle. This job could be performed for an entire shift or as part of a rotation. As this is a specialist role with religious requirements this role is usually performed for an entire shift.

Critical Physical Demands

Constant standing forward bending and forward reaching
 Constant power grip
 Frequent walking

List of Tools & Materials

Knives,
 stone,
 PPE; hard hat, hearing protection, anti cut apron, apron, whites, steel cap gum boots

Risk Factors to Consider/ Environmental Conditions

Musculoskeletal injury
 Slips, trips, falls
 Pinch point injury
 Environmental conditions: noise and cold



Recommendations Made: Yes - see addendum



Manual Task Risk Screen - Addendum



Risk / Considerations:

- * The risk of a musculoskeletal injury to the back on the risk matrix is a possible/moderate, resulting in a risk matrix score of high. This is due to the constant forward bend.
- * This task has a REBA score of 10, indicating a high risk of injury is likely, investigation is required and implementation of change to minimise injury risk is beneficial
- * The average cost of a Workers Compensation injury in food manufacturing industry \$47,708.00 (WorkCover WA, 2019).

Recommendations:

- 1) SuitX back; will help to support the back when in a forward bend position and reduce any back injuries caused by fatigue
- 2) Making sure the knife is always sharp to minimise force needed to cut through the carcass
- 3) Increase task rotation to minimise fatigue where possible

Action Plan:

Meeting date: 20/10/2021

Attendees: Alycia Garriock (physio), Neil Lynch (Manager Health and Safety)

Outcome: Sitta to trail the suitx back device for a week and provide feedback via the studies questionnaires.

Summary:

This assessment was completed during the MLA exoskeleton study at Teys Beenleigh, Brisbane. The constant forward bend expose workers to a high risk of injury. A risk screen has identified the task as potentially hazardous with a risk matrix score of high (possible/moderate) to the lower back. The exoskeleton will be trialled for a week by the worker and feedback provided after the trail and collated for the milestone report.



Recommendations and Risk Screens



Suitx Back V2

REBA Score	Risk Level	Action
1	Negligable	None necessary
2 - 3	Low	May be necessary
4 - 7	Medium	Necessary
8 - 10	High	Necessary soon
11 - 15	Very High	Necessary now

Likelihood	Consequence				
	Insignificant	Minor	Moderate	Major	Severe
Almost Certain	Medium	High	High	Extreme	Extreme
Likely	Medium	Medium	High	Extreme	Extreme
Possible	Medium	Medium	High	High	Extreme
Unlikely	Low	Medium	Medium	High	High
Rare	Low	Low	Medium	High	High

7.4.3 Appendix C – Boning Blades – Risk Screen



ErgoAnalyst Preliminary Risk Screen



Task Name:	<u>Boning Blades</u>	Date:	<u>1/11/2021</u>
Client/ Site:	<u>Teys Beenleigh</u>	Assessor:	<u>Alycia Garriock</u>
Work Area:	<u>Boning Room</u>	Review Date:	<u></u>

Task Description:

Two workers from each chain working in the boning room on a height adjustable platform removing the blade bone from the carcass using a boning knife and hook. Once the meat is removed it is thrown onto the boning chute which is located directly in front of the worker below floor height. Once the blade bone is removed it is placed in an alternate chute which is located behind the worker. Each shift bones 600-750 head of cattle (1200-1500 sides). This job could be performed for an entire shift or as part of a rotation. There are 28-30 boners working each shift.

Critical Physical Demands

Constant standing, forward bend and above shoulder reaching
 Constant power grip, pushing/pulling knife through carcass and manoeuvring carcass

List of Tools & Materials

Knives,
 Stone,
 PPE - hard hat, whites, anti cut apron, hearing protection, steel cap gum boots,

Risk Factors to Consider/ Environmental Conditions

Musculoskeletal injury
 Slips, trips, falls
 Pinch point injury
 Environmental conditions: noise and cold temperatures



Recommendations Made: Yes - see addendum



Manual Task Risk Screen - Addendum



Risk / Considerations:

- * The risk of a musculoskeletal injury to the lower back on the risk matrix is a possible/moderate, resulting in a risk matrix score of high. This is due to the constant forward bend.
- * This task has a REBA score of 10, indicating a high risk of injury is likely, investigation is required and implementation of change to minimise injury risk is beneficial
- * The average cost of a Workers Compensation injury in food manufacturing industry \$47,708.00 (WorkCover WA, 2019).

Recommendations:

- 1) SuitX back, will help to support the lower back instantly into forward flexion and reduce injuries caused by fatigue
- 2) Making sure the knives are always sharp to minimise force needed to cut through the carcass
- 3) Increase task rotation to minimise fatigue

Action Plan:

Meeting date: 01/11/2021

Attendees: Alycia Garriock (physio) and Neil Lynch (Manager Health and Safety Tey's)

Outcome: Shaun and Arron to trail the suitx back device for a week and provide feedback via the studies questionnaires.

Summary:

This assessment was completed during the MLA exoskeleton study at Tey's Beenleigh, Brisbane. The constant forward bending exposes workers to a high risk of injury. A risk screen has identified the task as potentially hazardous with a risk matrix score of high (possible/moderate) to the lower back. The exoskeleton will be trialled for a week by the worker and feedback provided after the trail and collated for the milestone report.

Life Ready
Biosymm



Suitx Back V2

Recommendations and Risk Screens



REBA Score	Risk Level	Action
1	Negligable	None necessary
2 - 3	Low	May be necessary
4 - 7	Medium	Necessary
8 - 10	High	Necessary soon
11 - 15	Very High	Necessary now

Likelihood	Consequence				
	Insignificant	Minor	Moderate	Major	Severe
Almost Certain	Medium	High	High	Extreme	Extreme
Likely	Medium	Medium	High	Extreme	Extreme
Possible	Medium	Medium	High	High	Extreme
Unlikely	Low	Medium	Medium	High	High
Rare	Low	Low	Medium	High	High

7.4.4 Appendix D – Feather Boning – Risk Screen



ErgoAnalyst Preliminary Risk Screen



Task Name:	Feather Boning	Date:	14/10/2021
Client/ Site:	Tey's Beenleigh	Assessor:	Alycia Garriock
Work Area:	Slaughter Floor	Review Date:	

Task Description:

Two workers standing on a static raised work platform (2 steps high). Workers are performing the same role on alternate carcasses. Using a whizzer knife the worker removes each rib bone from the carcass (up to 12 times per carcass). The worker does not place the whizzer knife down between each carcass and did not place the whizzer knife down whilst observed (six carcasses). All tasks are performed between waist and above head height. Each shift slaughters 600-750 head of cattle. This job could be performed for an entire shift or as part of a rotation.

Critical Physical Demands

Constant standing, above shoulder reaching
 Constant power grip, pulling force of whizz knife through carcass
 Frequent walking

List of Tools & Materials

Whizz knife
 PPE; hard hat, hearing protection, steel cap gumboots, apron, anti cut apron, gloves

Risk Factors to Consider/ Environmental Conditions

Musculoskeletal injury
 Slips, trips, falls
 Pinch point injury
 Environmental conditions: noise



Recommendations Made: Yes - see addendum



Manual Task Risk Screen - Addendum



Risk / Considerations:

- * The risk of a musculoskeletal injury to the shoulder on the risk matrix is a possible/moderate, resulting in a risk matrix score of high. This is due to the constant above shoulder reaching.
- * This task has a REBA score of 10, indicating a high risk of injury is likely, investigation is required and implementation of change to minimise injury risk is beneficial
- * The average cost of a Workers Compensation injury in food manufacturing industry \$47,708.00 (WorkCover WA, 2019).

Recommendations:

- 1) SuitX shoulder; will help to support the back when reaching above shoulder and reduce any shoulder injuries caused by fatigue
- 2) Increase task rotation to minimise fatigue where possible

Action Plan:

Meeting date: 14/10/2021
Attendees: Alycia Garriock (physio), Neil Lynch (Manager Health and Safety Teys)
Outcome: Shaun to trail the suitx shoulder device for a week and provide feedback via the studies questionnaires.

Summary:

This assessment was completed during the MLA exoskeleton study at Teys Beenleigh, Brisbane. The constant above shoulder reaching expose workers to a high risk of injury. A risk screen has identified the task as potentially hazardous with a risk matrix score of high (possible/moderate) to the shoulder. The exoskeleton will be trialled for a week by the worker and feedback provided after the trial and collated for the milestone report.

Risk Screens



	Consequence				
Likelihood	Insignificant	Minor	Moderate	Major	Severe
Almost Certain	Medium	High	High	Extreme	Extreme
Likely	Medium	Medium	High	Extreme	Extreme
Possible	Medium	Medium	High	High	Extreme
Unlikely	Low	Medium	Medium	High	High
Rare	Low	Low	Medium	High	High

REBA Score	Risk Level	Action
1	Negligible	None necessary
2 - 3	Low	May be necessary
4 - 7	Medium	Necessary
8 - 10	High	Necessary soon
11 - 15	Very High	Necessary now

7.5 Risk Assessments – Lamb Processing Plant

7.5.1 Appendix O – Shackling

Manual Task Risk Screen

Life Ready
Biosymm

Task Name:	Shackling	Date:	8/12/2021
Work Area:	Slaughter Room	Assessor:	Ruth Lennon

Task Description:

After the animal is stunned, they enter the slaughter floor via a chute. The staff member on the shackling station is required to lift the hind legs of the animal and shackle them to the overhead conveyer. This requires a forward bend, pull force (estimated up to 20kg) and a waist to shoulder lift (estimated up to 30kg). As this task is being completed, the Slaughter-person is carrying out his duty on the same platform. If this occurs prior to the staff member shackling the animal, there can be residual involuntary muscle twitches from the animal. Two staff on the shackling station rotate every 15 minutes of a 9 hour shift. Approximately 4500 animals are processed daily.

Critical Physical Demands:

Frequent waist to shoulder lift up to 30kg
 Frequent pull force estimated up to 20kg
 Frequent standing, forward bending, forward bending and power grip

List of Tools & Materials:

*White tunic and pants	*Gloves
*Apron	*Gum-boots
*Hair-net	

Risk Factors to Consider / Environmental Conditions:

*Musculoskeletal injury: high exertion, awkward postures, repetitive movement/loading
 *Entanglement
 *Adverse environment
 *Time pressure
 *Confined space

Recommendations Made: Yes - see addendum

Manual Task Risk Screen - Addendum



Risk:

- * <10% of the healthy, working, male population can perform a 30kg waist to shoulder lift on an frequent basis with an acceptable risk of injury (Blankenship).
- * Injury Management at [redacted] report a high number of injuries reported have been associated with this task.
- * The average cost of a worker's compensation claim in the food manufacturing industry is \$55, 905 (WorkCover WA - Manufacturing; Aug 2021).

Recommendations / Considerations:

- 1) To eliminate the waist to shoulder lift, consider engineering a retractable shackle that the worker on this station would pull down to the animal, rather than having to lift waist to shoulder. 80-85% of the healthy working male population, are able perform an frequent pull force (up to 10kg) with an acceptable risk of injury (Blankenship).
- 2) Investigate the option of re-directing the current conveyor to come lower over the shoot for shackling. This would eliminate the waist to shoulder lift and pull currently required.
- 3) Consider review of the Paexo Shoulder exoskeleton. The increase in profile from this device is on the back of the worker, this eliminates the entanglement risk associated with the suitX shoulderX device.
- 4) Increase the pool of staff able to complete this task to reduce the number of rotations being completed in throughout a shift.

Action Plan:

Meeting date: TBC
Attendees:
Outcome:

Summary:

This assessment was completed as part of a joint project between the MLA and Life Ready Biosymm, investigating the use of exoskeletons in the meat industry. The forceful exertion in this task expose workers to a high risk of musculoskeletal injury. A risk screen has identified the task as potentially hazardous with a risk matrix score of High (40). The recommendations listed need to be reviewed and discussed with all key stakeholders, from which more recommendations may result.



THE CONSEQUENCE/PROBABILITY MATRIX - RISK SCORE

Consequence V Probability	EXTREME (10) Death multiple severe injuries. Plant & building loss \$250 K +	MAJOR INJURY (8) Extensive injuries, loss of production capability Large financial losses \$100 K +	MODERATE INJURY (5) First aid treatment No production lost time Internally contained Some financial losses \$10 K +	MINOR INJURY (4) First aid treatment No production lost time Internally contained Some financial losses \$500 +	INSIGNIFICANT (3) No injuries Near miss Hazard Low financial loss \$50 +
Almost certain (10)	100	80	50	40	30
Likely (8)	80	64	40	32	24
Possible (5)	60	48	30	24	18
Unlikely (5)	50	40	25	20	15
Rare (3)	30	24	15	12	9

Extreme risk (50) or above. Immediate action required HIGH PRIORITY

High Risk (30-49) Management attention needed; hazard must be considered as NOT controlled

Moderate Risk (20-29) hazards must be examined against current standards to determine whether the hazard is adequately controlled

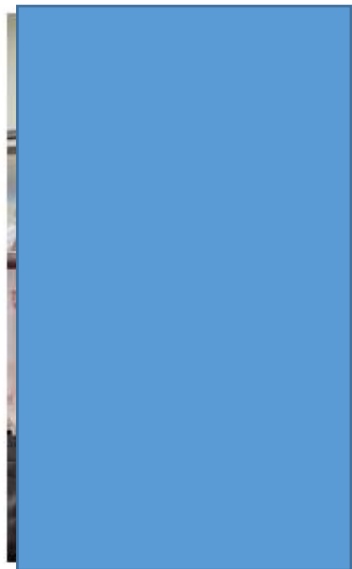
Low Risk (0-19) manage by routine procedures

Recommendations - Images

1)



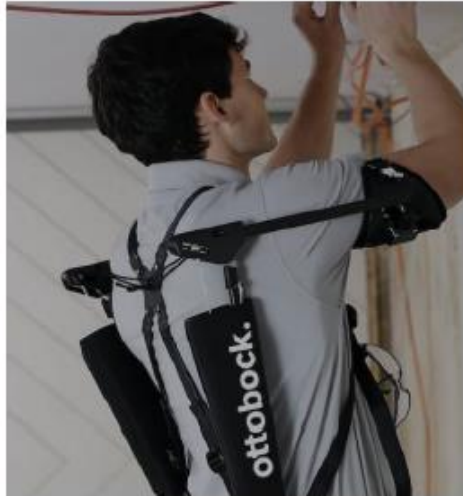
Engineering input would be required to design a retractable shackle that the worker could pull down to the animal to eliminate the waist to shoulder lift currently required.



Consider bringing the conveyer lower for shackling, following the path of the red line shown in the image.

Recommendations - Images

3)



Ottobock

Paexo Shoulder by Ottobock. The profile sits behind the worker, rather than the suitX device seen on the right.



suitX

Life Ready
Biosymm

7.5.2 Appendix P – Evisceration



Manual Task Risk Screen

Task Name:	<u>Evisceration</u>	Date:	<u>13th December 2021</u>
Client/ Site:	<u>[Redacted]</u>	Assessor:	<u>Ruth Lennon</u>
Work Area:	<u>Slaughter floor</u>	Review Date:	<u>TBC</u>

Task Description:

On the slaughter floor, the animal passes through each station for further processing. When it reaches the evisceration stage, the worker on that station will bend forward and forward reach into the carcass to lift out the paunch in a floor to waist lift (estimated up to 30kg). The worker will then twist to deposit the paunch onto the conveyer belt for processing. Between 3 - 5 staff members rotate around the evisceration station every 30 minutes of a 9 hour shift. Approximately 4500 animals are processed daily.

Critical Physical Demands

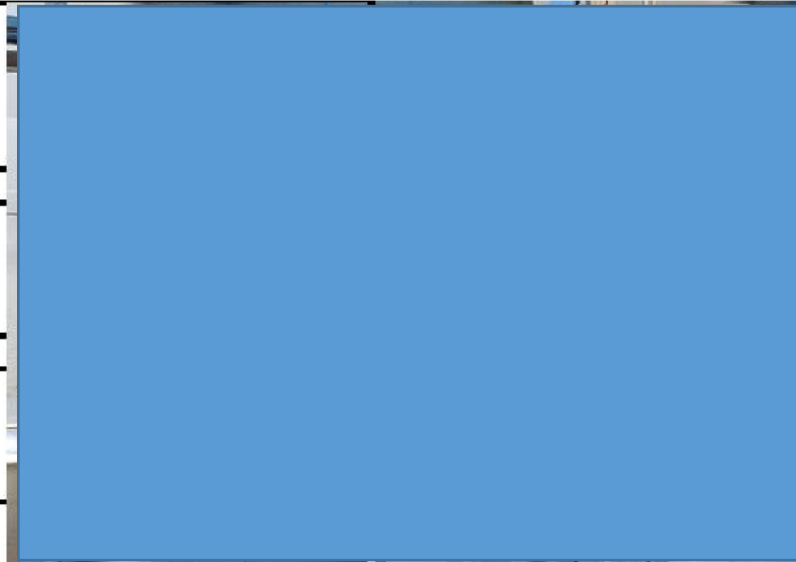
Constant floor to waist lift (estimated up to 30kg)
 Constant forward bend and forward
 Occasional standing

List of Tools & Materials

*Knife
 *Knife belt
 *PPE: white tunic and trousers, hair-net, apron, gloves, gum-boots

Risk Factors to Consider/ Environmental Conditions

Musculoskeletal injury; high exertion, awkward posture, repetitive movement
 Slips, trips, falls
 Adverse environment
 Time pressure



Recommendations Made:

Yes - see addendum



Manual Task Risk Screen - Addendum

Risk / Considerations:

Risk of musculoskeletal injury: likely/moderate (40). This is due to high exertion forces.

* <10% of the healthy, working, male population (<10% of the female population) can perform a 30kg floor to waist lift on an constant basis with an acceptable risk of injury (Blankenship).

* Injury Management at [REDACTED] report a high number of injuries reported have been associated with this task.

* The average cost of a worker's compensation claim in the food manufacturing industry is \$55, 905 (WorkCover WA - Manufacturing: Aug 2021).

Recommendations:

1) Investigate the use of the suitX v3 backX-S device for this task. This device is designed to reduce the loading on the lower back during forward bending and lifting floor to waist which the evisceration task requires.

2) Consider task specific manual handling training.

3) Consider increased number of staff in the rotation for this task.

Action Plan:

Meeting date: TBC

Attendees:

Outcome:

Summary:

This assessment was completed as part of a joint project between the MLA and Life Ready Biosymm, investigating the use of exoskeletons in the meat industry. The forceful exertion in this task expose workers to a high risk of musculoskeletal injury. A risk screen has identified the task as potentially hazardous with a risk matrix score of High (40). The recommendations listed need to be reviewed and discussed with all key stakeholders, from which more recommendations may result.



THE CONSEQUENCE/PROBABILITY MATRIX - RISK SCORE

Consequence V Probability	EXTREME (10) Death multiple severe injuries. Plant & building loss \$250 K +	MAJOR INJURY (8) Extensive injuries, loss of production capability Large financial losses \$100 K +	MODERATE INJURY (5) First aid treatment No production lost time Internally contained Some financial losses \$10 K +	MINOR INJURY (4) First aid treatment No production lost time Internally contained Some financial losses \$500 +	INSIGNIFICANT (3) No injuries Near miss Hazard Low financial loss \$50 +
Almost certain (10)	100	80	50	40	30
Likely (8)	80	64	40	32	24
Possible (5)	60	48	30	24	18
Unlikely (5)	50	40	25	20	15
Rare (3)	30	24	15	12	9

Extreme risk (50) or above. Immediate action required HIGH PRIORITY

High Risk (30-49) Management attention needed; hazard must be considered as NOT controlled

Moderate Risk (20-29) hazards must be examined against current standards to determine whether the hazard is adequately controlled

Low Risk (0-19) manage by routine procedures

Recommendations

1)



The v3 backX-S by suitX. This is a passive exoskeleton designed to reduce the load on the lower back muscles during forward bending

7.5.3 Appendix Q – Chiller-hand



Manual Task Risk Screen

Task Name:	<u>Chiller-hand</u>	Date:	<u>13th December 2021</u>
Client/ Site:	<u>[Redacted]</u>	Assessor:	<u>Ruth Lennon</u>
Work Area:	<u>Cold Stores</u>	Review Date:	<u>TBC</u>

Task Description:

Once the animal has been processed it moves along the chain to the cold store. Here the carcass is marshalled to the correct area and pushed along by the Chiller-hand. The Chiller-hand will push up to five carcasses at a time which can weight up to 25kg each to the appropriate location (estimated up to 50kg push force). Up to 5 Chiller-hands will work a 9 hour shift rotating each hour between marshalling the carcasses and pushing the carcasses. Approximately 4500 carcasses will pass through to the chiller daily.

Critical Physical Demands

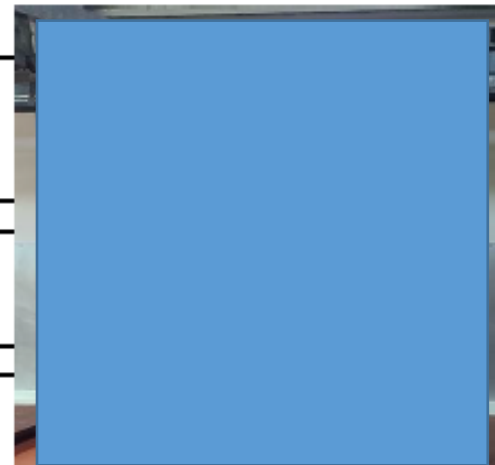
Constant forward bend, forward reaching, and walking
 Frequent push force (estimated up to 50kg)
 Occasional standing

List of Tools & Materials

*PPE: white tunio and trousers, hair-net, apron, gloves, gum-boots

Risk Factors to Consider/ Environmental Conditions

Musculoskeletal injury: high exertion, awkward posture, repetitive movement
 Slips, trips, falls due to slippery surfaces
 Adverse environment: cold
 Time pressure



Recommendations Made:

Yes - see addendum



Manual Task Risk Screen - Addendum

Risk / Considerations:

Risk of musculoskeletal injury: likely/moderate (40). This is due to high exertion forces.

* <10% of the healthy, working, male population (<10% of the female population) can perform a 60kg push force on a frequent basis with an acceptable risk of injury (Blankenship).

* The average cost of a worker's compensation claim in the food manufacturing industry is \$55, 905 (WorkCover WA - Manufacturing: Aug 2021).

Recommendations:

1) Investigate the use of the suitX v3 shoulderX device for this task. This device is designed to reduce the loading on the shoulders when elevated above 60 degrees which tasks within the Chiller Hand role requires.

2) Consider task specific manual handling training.

3) Consider adjusting the Safe Work Procedure to recommend up to 2 carcass are pushed at one time. 60-65% of the healthy, working, male population can perform a 20kg push force on a frequent basis with an acceptable risk of injury (Blankenship).

Action Plan:

Meeting date: TBC

Attendees:

Outcome:

Summary:

This assessment was completed as part of a joint project between the MLA and Life Ready Biosymm, investigating the use of exoskeletons in the meat industry. The forceful exertion in this task expose workers to a high risk of musculoskeletal injury. A risk screen has identified the task as potentially hazardous with a risk matrix score of High (40). The recommendations listed need to be reviewed and discussed with all key stakeholders, from which more recommendations may result.



THE CONSEQUENCE/PROBABILITY MATRIX - RISK SCORE

Consequence V Probability	EXTREME (10) Death multiple severe injuries. Plant & building loss \$250 K +	MAJOR INJURY (8) Extensive injuries, loss of production capability Large financial losses \$100 K +	MODERATE INJURY (5) First aid treatment No production lost time Internally contained Some financial losses \$10 K +	MINOR INJURY (4) First aid treatment No production lost time Internally contained Some financial losses \$500 +	INSIGNIFICANT (3) No injuries Near miss Hazard Low financial loss \$50 +
Almost certain (10)	100	80	50	40	30
Likely (8)	80	64	40	32	24
Possible (5)	60	48	30	24	18
Unlikely (5)	50	40	25	20	15
Rare (3)	30	24	15	12	9

Extreme risk (50) or above. Immediate action required HIGH PRIORITY

High Risk (30-49) Management attention needed; hazard must be considered as NOT controlled

Moderate Risk (20-29) hazards must be examined against current standards to determine whether the hazard is adequately controlled

Low Risk (0-19) manage by routine procedures

Recommendations

1)



The v3 shoulderX by suitX. This is a passive exoskeleton designed to reduce the load on the shoulders when elevated more than 60 degrees, either sustained or in a waist to shoulder or overhead lift.

7.6 Risk Assessments – JBS Brooklyn, VIC

7.6.1 Appendix Q – Chiller-hand



Manual Task Risk Screen

Task Name:	Packing	Date:	4/02/2022
Client/ Site:	JBS - Brooklyn	Assessor:	James Ryan
Work Area:	DMM	Review Date:	4/02/2022

Task Description:

Workers in DMM will stand and walk around the room manually handling individual pieces of meat (up to 5kg) and boxes of meat between the tub beneath the chute, the conveyor, pallets and stillages. Workers bend forwards and reach into the tub beneath the chute to lift individual pieces of meat (up to 5kg) into boxes on the line. More than 250 repetitions are performed each shift. The boxes (up to 28kg) are closed with a lid and strapping by the machine before being lifted from the line to a pallet or a stillage. Typically boxes loaded into the stillages weigh up to 15kg and boxes loaded onto a pallet weight up to 28kg. Lifting boxes onto a pallet and a stillage can require below waist lifting. Lifting boxes onto a stillage can also require an overhead lift. More than 250 repetitions of lifting boxes of meat are performed each shift. Workers are also required to ma

Critical Physical Demands

Constant floor to waist, waist to shoulder lift and carry of up to 28kg
 Constant forward reach, bending and squatting
 Frequent standing and walking
 Occasional above shoulder lift of up to 15kg
 Occasional overhead reach

Mass grasp

List of Tools & Materials

High vis
 Steel cap boots
 Pallets
 Height adjustable pallet stacks
 Helmet
 Safety glasses
 Hearing protection



Risk Factors to Consider/ Environmental Conditions

Musculoskeletal injury
Slips, trips, falls
Pinch point injury

Recommendations Made:

Yes - see addendum

Life Ready

Biosymm

Manual Task Risk Screen - Addendum

Risk / Considerations:

*<10% of the healthy working female and male population are able perform a floor to waist, waist to shoulder lift and carry of up to 28kg on a constant basis with an acceptable risk of injury (Blankenship).

*25-35% of the healthy working female population are able perform a overhead lift A25of up to 15kg on a occasional basis with an acceptable risk of injury (Blankenship).

*Rapid Entire Body Assessment (REBA) score of 14 = very high risk, investigate and implement change.

*The average cost of a Workers Compensation injury in the food manufacturing industry is \$47,708.00 (WorkCover WA).

Recommendations:

- 1) Consider implementation of automated packing machine.
- 2) Consider implementation of the v2 backX-S suitX device to support the below waist lifting.
- 3) Consider implementation of the v3 shoulderX-S suitX device to support the lifting overhead and between waist and shoulder level.
- 4) Consider implementation of a height adjustable pallet stack for all pallets to reduce frequency of below waist lifting.
- 5) Consider implementation of automatic lifting device for example Maverick Australian Built as below) to eliminate waist to shoulder and above shoulder lifting
- 6) Consider task specific manual handling training, including task normalisation education.

Action Plan:

Meeting date:

Attendees:

Outcome:

Summary:

This assessment was completed by Life Ready Biosymm whilst investigating the use of exoskeletons in the meat industry. The forceful exertion and repetitive nature of this task exposes workers to a moderate risk of musculoskeletal injury. A risk screen has identified the task as potentially hazardous with a risk matrix score of intermediate (12). The recommendations listed need to be reviewed and discussed with all key stakeholders, from which more recommendations may result.

Life Ready
Biosymm

v3 shoulderX-S



v2 backX-S



Recommendations

Risk Rating Matrix

		Risk Rating Matrix				
		Trivial (1) Injury resulting in a First Aid Environmental: No effect of issue on-site effects that are rectified rapidly with an negligible residual effect. Minor Leak that does not lead to contamination.	Minor (2) Injury resulting in an SRTI Environmental: Localised with very short-term (weekend) effects. Easily rectified. Minor impact on raw and endangered flora/fauna. On-site chemical release, which is contained without outside assistance.	Severe (3) Injury resulting in LTA or multiple RTIs Environmental: Localised with short term effects (< 2 yrs); easily rectified. Moderate impact upon cultural & heritage sites or vulnerable/aged flora/fauna. Chemical release combined with outside assistance.	Major (4) Up to 2 fatalities or up to 4 individuals with life threatening injuries / permanent disabilities or multiple LTA Environmental: Major off-site impact. Long term (> 2 yrs); severe effects. Rectification difficult. Major impact on an area of high conservation value or significance.	Catastrophic (5) More than 2 fatalities or more than 4 individuals with life threatening injuries / permanent disabilities Environmental: Effects widespread, viability of threatened eco-systems or species affected or permanent major changes.
Likelihood ↓	Prepared (5) This event is expected to occur once a year or more	Low 5	Intermediate 10	High 15	Extreme 20	Extreme 25
	Occasional (4) This event may occur occasionally in the life of the asset	Low 4	Low 8	Intermediate 12	High 16	Extreme 20
	Unlikely (3) This event is unlikely to occur in the life of the asset, but it is possible	Negligible 3	Low 6	Intermediate 9	High 12	High 15
	Rare (2) This event is not anticipated to occur for the asset at this location	Negligible 2	Negligible 4	Low 6	Intermediate 8	High 10
	Hyphenated (1) This event is theoretically possible but has never occurred on a similar point	Negligible 1	Negligible 2	Negligible 3	Low 4	Intermediate 5
Hierarchy or Preferred Order of Controls (1) being the most effective control						
(1) Eliminate the hazard, remove the hazard or prevent from the workplace	(2) Isolate the hazard, i.e. installing screens or barriers, marking off hazardous areas.	(3) Administrative control, introducing work practices that reduce the risk, i.e. limiting the amount of time a person is exposed to a particular hazard	(4) Engineer the hazard out i.e. modifications to tools or equipment, guarding to machinery	(5) Personal protective equipment should be considered only when other control measures are not practicable or to increase protection		
(3) Substitute or replace the hazard or hazardous work practice with a less hazardous one.	(4) Engineer the hazard out i.e. modifications to tools or equipment, guarding to machinery					

Maverick Australian Built



REBA Scoring

Score	Level of MSD Risk
1-2	negligible risk, no action required
2-3	low risk, change may be needed
4-7	medium risk, further investigation and change soon
8-10	high risk, investigate and implement change
11+	very high risk, implement change

7.6.2 Appendix B – Cold Store

Life Ready
Biosymm

Manual Task Risk Screen

Task Name:	Packing	Date:	4/02/2022
Client/ Site:	JBS - Brooklyn	Assessor:	James Ryan
Work Area:	Cold store	Review Date:	4/02/2022

Task Description:

Workers in the cold store will manually load pallets with boxes of meat (up to 28kg). A conveyor transports the meat to the packing room. Workers will lift and carry boxes from the conveyor to the pallets. This task is performed by workers for the duration of their shift. Workers will lift >1000 boxes per shift. Workers are also required to wrap pallets manually (pallet wrap up to 2kg) and scan each box (scanner up to 1kg).

Critical Physical Demands

Constant floor to waist, waist to shoulder lift and carry of up to 28kg
 Constant forward reach, bending, squatting and trunk rotation
 Frequent standing and walking
 Mass grasp
 Critical balance

List of Tools & Materials

High vis
 Steel cap boots
 Pallets
 Height adjustable pallet stacks
 Helmet
 Safety glasses

Risk Factors to Consider/ Environmental Conditions

Musculoskeletal injury
 Slips, trips, falls
 Pinch point injury



Recommendations Made:

Yes - see addendum

Life Ready



Manual Task Risk Screen - Addendum

Risk / Considerations:

*<10% of the healthy working female and male population are able perform a floor to waist, waist to shoulder lift and carry of up to 28kg on a constant basis with an acceptable risk of injury (Blankenship).

*Rapid Entire Body Assessment (REBA) score of 13 = very high risk, investigate and implement change.

*The average cost of a Workers Compensation injury in the food production industry is \$47,708.00 (WorkCover WA).

Recommendations:

- 1) Consider implementation of automated packing machine.
- 2) Consider implementation of the v2 backX-S suitX device to support the below waist lifting.
- 3) Consider implementation of a height adjustable pallet stack for all pallets to reduce frequency of below waist lifting.
- 4) Consider task specific manual handling training, including task normalisation education.

Action Plan:

Meeting date:

Attendees:

Outcome:

Summary:

This assessment was completed by Life Ready Biosymm whilst investigating the use of exoskeletons in the meat industry. The forceful exertion and repetitive nature of this task exposes workers to a moderate risk of musculoskeletal injury. A risk screen has identified the task as potentially hazardous with a risk matrix score of intermediate (12). The recommendations listed need to be reviewed and discussed with all key stakeholders, from which more recommendations may result.

Life Ready
Biosymm

v2 backX-5



REBA Scoring

Score	Level of MSO Risk
1-2	negligible risk, no action required
2-3	low risk, change may be needed
4-7	medium risk, further investigation and change soon
8-9	high risk, investigate, implement change
10-11	very high risk, implement change

Recommendations

Height adjustable pallet stack



Risk Rating Matrix

Consequence	Risk Rating Matrix				
	Minor (1)	Minor (2)	Major (3)	Major (4)	Catastrophic (5)
Frequency (F) This event is expected to occur once in a year or more.	Low 1	Intermediate 10	High 18	Catastrophic 30	Catastrophic 45
Occasional (O) This event may occur occasionally in the life of the asset.	Low 6	Low 6	Intermediate 12	High 18	Catastrophic 30
Infrequent (I) This event is unlikely to occur in the life of the asset, but it is possible.	Negligible 3	Low 6	Intermediate 9	High 12	High 15
Rare (R) The event is not anticipated to occur in the asset's life span.	Negligible 2	Negligible 3	Low 6	Intermediate 9	High 12
Unlikely (U) This event is theoretically possible, but has never occurred in a similar asset.	Negligible 1	Negligible 2	Negligible 3	Low 6	Intermediate 9

Severity Descriptions:
 Minor (1): Injury resulting in a First Aid.
 Minor (2): Common injury localized with very short-term (weeks) effects. Easily treated. Minor impact on work and development. Resilience. Consider chemical releases which do not lead to contamination.
 Major (3): Injury resulting in 1-3 or multiple RPs. Common injury localized with short-term effects (1-2) and easily treated. Moderate impact on work and development. Resilience. Consider chemical releases. Chemical releases contained with active isolation.
 Major (4): Up to 2 injuries or up to 4 RPs with the following: Injury contained localized or multiple LRs. Environmental. Major off-site impact. Long term (1-2 yrs) adverse effects. Resultation of high temperature release or off-site release or release of hazardous materials.
 Catastrophic (5): More than 2 injuries or more than 4 RPs with the following: Injuries localized, environmental. Effects widespread. Ability of contained systems to contain major changes.

Priority or Preferred Order of Control:
 (1) Eliminate the hazard, wherever feasible or process from the workplace.
 (2) Substitute or replace the hazard or hazardous work practice with a less hazardous one.
 (3) Engineer the hazard out or modifications to tools or equipment, guarding or machinery.
 (4) Administrative controls, including work practices that reduce the risk, i.e. limiting the amount of time a person is exposed to a particular hazard.
 (5) Personal protective equipment should be considered only when other control measures are not practicable or to increase protection.

7.6.3 Appendix C – Sheep Skins



Manual Task Risk Screen

Task Name:	Stacking sheep skins	Date:	4/02/2022
Client/ Site:	JBS - Brooklyn	Assessor:	James Ryan
Work Area:	Sheep skins	Review Date:	4/02/2022

Task Description:

Sheep skins are transport to the work area via forklift. Workers will lift wet sheep skins (up to 5kg) into the cells. Workers will also lift salt bags (25kg) and pour them into the cell. The cell rotates automatically for approximately 30 minutes. Then the workers will left sheep skins from the cell onto the floor and then a pallet. Workers are also required to clean the salt from the floor beneath the cells with a sloop. Workers will lift more than 1000 sheep skins per shift.

Critical Physical Demands

- Constant floor to waist, waist to shoulder lift and carry of up to 5kg
- Constant forward and overhead reach, bending, squatting and trunk rotation
- Frequent above shoulder lift of up to 5kg
- Frequent standing, walking and stair climbing
- Occasional floor to waist and waist to shoulder lift of up to 25kg

Mass grasp

Critical balance

List of Tools & Materials

- High vis
- Steel cap boots
- Pallets
- Height adjustable pallet stacks
- Helmet
- Safety glasses
- Hearing protection
- Hood



Risk Factors to Consider/ Environmental Conditions

- Musculoskeletal injury
- Slips, trips, falls
- Pinch point injury

Recommendations Made:

Yes - see addendum



Manual Task Risk Screen - Addendum

Risk / Considerations:

*60-65% of the healthy working male population (10-15% female) are able to perform a waist to shoulder lift of up to 5kg on a constant basis with an acceptable risk of injury (Blankenship).

*70-75% of the healthy working male population (15-20% female) are able to perform a carry of up to 5kg on a constant basis with an acceptable risk of injury (Blankenship).

*30-35% of the healthy working female population are able to perform a floor to waist lift of up to 25kg on an occasional basis with an acceptable risk of injury (Blankenship).

*70-75% of the healthy working female population are able to perform an above shoulder lift of up to 5kg on a frequent basis with an acceptable risk of injury (Blankenship).

*60-65% of the healthy working male population (10-15% female) are able to perform a waist to shoulder lift of up to 25kg on an occasional basis with an acceptable risk of injury.

*Rapid Entire Body Assessment (REBA) score of 12 = high risk, investigate and implement change.

Recommendations:

1) Consider implementation of the v2 backX-S suitX device to support the below waist lifting.

2) Consider implementation of the v3 shoulderX-S suitX device to support the lifting overhead and between waist and shoulder level.

3) Consider implementation of a height adjustable pallet stack for all pallets to reduce frequency of below waist lifting.

4) Consider task specific manual handling training, including task normalisation education.

Action Plan:

Meeting date:

Attendees:

Outcome:

Summary:

This assessment was completed by Life Ready Biosymm whilst investigating the use of exoskeletons in the meat industry. The forceful exertions and repetitive nature of this task exposes workers to a moderate risk of musculoskeletal injury. A risk screen has identified the task as potentially hazardous with a risk matrix score of intermediate (12). The recommendations listed need to be reviewed and discussed with all key stakeholders, from which more recommendations may result.

Life Ready
Biosymm

Recommendations

v2 backX-5



v3 shoulderX-5



Risk Rating Matrix

Consequence	Risk Rating Matrix				
	Trivial (1) Injuries resulting in a First Aid Environmental: No effect of minor or no other effects that are verified rapidly with an negligible residual effect. Minor Lead that does not lead to contamination.	Minor (2) Injuries resulting in an LPT Environmental: Localised with very short-term (weeks) effects. Easily verified. Minor impact or rare and undamaged. Residuals: Cracks, Chemical release, which is contained without outside assistance.	Severe (3) Injuries resulting in LPT or multiple RTTs Environmental: Localised with short term effects (1-2 yrs) easily verified. Moderate impact upon cultural & heritage sites or endangered flora/fauna. Chemical release contained with outside assistance.	Major (4) Up to 3 fatalities or up to 4 individuals with life threatening injuries or permanent disabilities or multiple LPTs Environmental: Major off-site impact. Long term (>2 yrs) severe effects. Identification difficult. Major impact in an area of high conservation value or significance.	Catastrophic (5) More than 3 fatalities or more than 4 individuals with life threatening injuries / permanent disabilities Environmental: Effects widespread, stability of threatened eco-systems or species affected or permanent major changes.
Likelihood					
Frequent (6) This event is expected to occur once a year or more	Low 5	Intermediate 10	High 15	Extreme 20	Extreme 25
Occasional (4) This event may occur occasionally in the life of the asset	Low 4	Low 8	Intermediate 12	High 16	Extreme 20
Rarity (3) This event is unlikely to occur in the life of the asset, but it is possible	Negligible 3	Low 6	Intermediate 9	High 12	High 15
Rare (2) This event is not anticipated to occur for the asset at this location	Negligible 2	Negligible 4	Low 6	Intermediate 8	High 10
Hypothetical (1) This event is theoretically possible, but has never occurred on a similar asset	Negligible 1	Negligible 2	Negligible 3	Low 4	Intermediate 6
Severity or Preferred Order of Control (1) Being the most effective control					
(1) Eliminate the hazard, remove the hazard or process from the workplace	(2) Reduce the hazard, i.e. installing screens or barriers, marking off hazardous areas		(3) Administrative control, introducing work practices that reduce the risk, i.e. limiting the amount of time a person is exposed to a particular hazard		
(2) Substitute or repair the hazard or hazardous work practice with a less hazardous one	(4) Engineer the hazard out, i.e. modifications to tools or equipment, guarding to machinery		(5) Personal protective equipment should be considered only when other control measures are not practicable or to increase protection.		

REBA Scoring

Score	Level of MSD Risk
1-2	negligible risk, no action required
2-3	low risk, change may be needed
4-7	medium risk, further investigation and change soon
8-10	high risk, investigate and implement change
11+	very high risk, implement change

7.7 Risk Assessments – Coles Retail Ready Operations

7.7.1 Appendix A – De-cartoning

Biosymm

Manual Task Risk Screen

Task Name:	Decartoning	Date:	24/03/2022
Client/ Site:	Decartoning	Assessor:	Natasha Le
Work Area:	Red Meat Production	Review Date:	

Task Description:

Workers in the Red Meat Production will manually unload boxes of meat (up to 17.5kg each box) from the pallets onto the conveyor belt for scanning and weighing. The workers will lift and carry boxes from the height adjustable rotatable pallet stand to the conveyor. The workers work for 10 hours per shift, 4 days per week. This task is performed by workers for the duration of their shift. Workers will lift up to 500 boxes per shift. At waist level, workers are required to tip the meat products out of the carton on to the conveyor belt. At an overhead level, workers are required to lift the empty carton above their head onto another conveyor belt.

Critical Physical Demands

Frequent waist to shoulder lift, bilateral carry and pulling of up to 17.5kg
 Frequent standing, walking, stair climbing, forward reach, overhead reaching and trunk rotation.
 Mass grasp
 Critical balance

List of Tools & Materials

White lab coat
 Hearing protection
 Safety boots
 Hair net
 Beard net if required
 Gloves
 Height adjustable pallet stand



Risk Factors to Consider/ Environmental Conditions

Musculoskeletal injury - due to highly repetitive lifting
 Slips, trips, falls - due to stair climbing
 Environmental conditions: cold conditions.

Biosymm Manual Task Risk Screen - Addendum

Risk / Considerations:

Risk of musculoskeletal injury: Possible likelihood and Minor consequence. (Risk Matrix score of Medium rating). This is due to

- * Blankenship data: Less than 30% of the healthy, working, male population (<10% for females) can perform a waist to shoulder lift and carry of up to 17.5kg on a frequent basis with an acceptable risk of injury.
- * PErforM Risk Assessment - Total Risk Score of High for upper back, low back, shoulder and elbow. Moderate for neck.

Recommendations:

- 1) Consider implementation of the V3 BackX SuitX device to support the forward reaching/lifting
- 2) Consider implementation of a roller conveyor
- 3) Consider task specific manual handling training, including task normalisation education.

Action Plan:

+

Meeting date:

Attendees:

Outcome:

Summary:

This assessment was completed at the request of Biosymm whilst investigating the use of exoskeletons in the meat industry. The forceful exertion and repetitive nature of the task exposes workers to a high risk of musculoskeletal injury for the upper back, low back, shoulder and elbow and moderate risk for the neck with the PErforM assessment tool. The MLA Risk Matrix assessment returns a medium risk rating. The recommendations listed need to be reviewed and discussed with all key stakeholders, from which more recommendations may result.

Biosymm

Recommendations

v3 backX-S

Conveyor system



PERFORM Risk Screen

Exertion	How much force is the person using?				
1	2	3	4	5	
No effort	Low force & speed (0-9kg)	Moderate force & speed (10-22kg)	High force & speed (23-45kg)	Maximum force & speed (>45kg)	
Award Posture	How awkward is the person's posture?				
1	2	3	4	5	
All postures neutral	Mildly uncomfortable	Moderately uncomfortable	Very uncomfortable	Extremely uncomfortable	
Vibration	How much are the whole body or hand(s) being vibrated?				
1	2	3	4	5	
None	Low	Moderate	High	Very high	
Duration	How long is the action performed for?				
1	2	3	4	5	
Less than 10 minutes	10 - 30 min	30 min - 1 hour	1 - 2 hours	More than 2 hours	
Repetition	How often are similar actions done?				
1	2	3	4	5	
No repetition	Cycle time >90 secs	Cycle time 30-90 secs	Cycle time 10-30 secs	Cycle time <10s	

Body Part	Exertion	Award Posture	Vibration	Duration	Repetition	Exertion + Posture	Total Risk Score
Neck	Low	Mildly Uncomfortable	None	>2 hours	Cycle time 10-30 secs	4	34
Upper back	Moderate	Mildly Uncomfortable	None	>2 hours	Cycle time 10-30 secs	5	35
Low back	Moderate	Moderately Uncomfortable	None	>2 hours	Cycle time 10-30 secs	6	36
Shoulder	Moderate	Moderately Uncomfortable	None	>2 hours	Cycle time 10-30 secs	6	36
Elbow	Moderate	Mildly Uncomfortable	None	>2 hours	Cycle time 10-30 secs	5	35

* Note: Exertion + Posture 10 = High
 Total Risk Score: 35 = Low, 30-34 = Moderate, 25-29 = High



Likelihood	Consequence				
	Catastrophic	Major	Moderate	Minor	Insignificant
Almost Certain	H	H	H	H	H
Likely	H	H	H	M	M
Possible	H	M	M	M	L
Unlikely	M	M	M	L	L
Rare	M	L	L	L	L

Hierarchy of Control	
Eliminate	Totally remove the hazard.
Substitute	Replace the hazard with something less hazardous.
Isolate / Separate	Reduce the amount of hazard.
Engineering	Apply to the hazard via physical means to reduce the exposure to the hazard or to reduce the severity of the hazard.
Administrative	Apply to the hazard via procedural means, such as training, signage, PPE, etc.
Personal Protective Equipment	Apply to the hazard via personal protective equipment, such as PPE, safety harness, etc.

Risk Treatment Action Plan	
Current Risk Rating	Action
Very High	Review Work Feasibility, identify critical tasks, identify tasks that can be automated or supported by the exosuit, identify tasks that can be supported by the exosuit, identify tasks that can be supported by the exosuit, identify tasks that can be supported by the exosuit, identify tasks that can be supported by the exosuit.
High	Review Work Feasibility, identify critical tasks, identify tasks that can be automated or supported by the exosuit, identify tasks that can be supported by the exosuit, identify tasks that can be supported by the exosuit, identify tasks that can be supported by the exosuit, identify tasks that can be supported by the exosuit.
Medium	Review Work Feasibility, identify critical tasks, identify tasks that can be automated or supported by the exosuit, identify tasks that can be supported by the exosuit, identify tasks that can be supported by the exosuit, identify tasks that can be supported by the exosuit, identify tasks that can be supported by the exosuit.
Low	Review Work Feasibility, identify critical tasks, identify tasks that can be automated or supported by the exosuit, identify tasks that can be supported by the exosuit, identify tasks that can be supported by the exosuit, identify tasks that can be supported by the exosuit, identify tasks that can be supported by the exosuit.

Note: Colors have been declared that a Treated Risk of Very High is not acceptable, which means risk score must be reduced and treated within the annotated timeframe. Any deviation must be approved by the Accountable and Responsible persons.

