HSE
Health & Safety Executive

Manual handling in food/drink industries

Injury rate *v* weight of unit loads lifted

Prepared by **System Concepts**
for the Health and Safety Executive 2002

RESEARCH REPORT 007

HSE
Health & Safety Executive

Manual handling in food/drink industries

Injury rate *v* weight of unit loads lifted

Sarah Durham & Tanya Heasman
System Concepts
2 Savoy Court
Strand
London
WC2R 0EZ
United Kingdom

An informal analysis of Health and Safety Executive (HSE) national injury statistics appeared to indicate that some foods sector industries which handled heavy loads (eg brewing/malting) had a higher manual handling injury rate than others (eg dairies and soft drinks). System Concepts was commissioned by HSE in May 2001 to try to verify this finding and to try to determine a statistical association between loads lifted (eg light and heavy sacks) and manual handling injury/absence from injury, based on data from a number of food/drink company sites. It was envisaged that any information arising from such a project could be used to help encourage food and drinks companies to reduce the weight of the heavier loads used in the sector.

This report and the work it describes were funded by the HSE. Its contents, including any opinions and/or conclusions expressed, are those of the authors alone and do not necessarily reflect HSE policy.

HSE BOOKS

First published 2002

ISBN 0 7176 2537 0

CONTENTS

1 Executive Summary

System Concepts was commissioned by the HSE to try to verify whether some food sector companies (which handled heavy loads) had a higher injury rate than others and to try to determine a statistical association between loads lifted and manual handling injury/absence from injury, from a number of food/drink company sites.

Firstly we undertook a review of HSE to examine statistics on manual handling-related reportable injuries and accidents, and a review of data from previous HSE projects to identify companies who used different weights of certain containers. We also conducted a literature review of publications referring to injury rate *v* weight of unit loads lifted.

Secondly we contacted the companies identified from previous projects and our own contacts within the industry to identify typical organisations who would give us access to their accident and injury statistics. We identified five organisations who kept accident and injury statistics and were willing to release this information to us.

We attempted to use the data collected from the participating organisations to try to identify any indicative differences in injury and accident statistics. Unfortunately the data we received from these organisations was unsatisfactory, for a number of reasons, and did not allow us to perform rigorous statistical analysis. Due to this unsatisfactory and non-comparable accident data we could not say definitively that the injury rate for handling heavier loads was higher than for lighter loads.

However, using the information we obtained from the literature review and from previous work, we can conclude that:

a) Reducing the weight of loads reduces the risk of injury and increases efficiency.
b) In one case study (at a large site), reducing sack weights from 50kg to 25kg reduced injuries by 30%.

And, from this study, we can conclude that:

c) Most lifting injuries involved lifting sacks and ‘outers’ (boxes containing smaller boxes) and most push/pull injuries involved trolleys.
d) For three weight ranges between 1-30kg (i.e. where we have sufficient data) injuries numbers increased with weight, although corresponding injury rates are not known.
e) Methods of recording accident and injury data (e.g. cause of injury, weight being lifted etc) varied remarkably from company to company making comparisons very difficult.

2 Introduction

An informal analysis of HSE national injury statistics appeared to indicate that some foods sector industries which handled heavy loads (e.g. brewing/malting) had a higher manual handling injury rate than others (e.g. dairies and soft drinks). System Concepts was commissioned by HSE in May 2001 to try to verify this finding and to try to determine a statistical association between loads lifted (e.g. light and heavy sacks) and manual handling injury/absence from injury, based on data from a number of food/drink company sites. It was envisaged that any information arising from such a project could be used to help encourage food and drinks companies to reduce the weight of the heavier loads which still are commonly used in the sector.

2.1 Objectives

Thus the main objective of this assignment was:

- To attempt to identify a number of sites where differences in injury statistics showed that, for example, lifting 50kg loads/sacks caused x% more injuries than lifting 25kg loads/sacks, and 75kg loads (eg malt sacks) caused y% more injuries than 50kg.

2.2 Methods

The following activities were carried out as part of the research:

2.2.1 Reviewing HSE and other sources of information

- We met with an HSE Foods Sector representative to discuss our approach; to make use of any existing information and knowledge of the industry, and to identify the type of companies to involve in later steps.

- We conducted a review of data from previous HSE projects to identify companies who used different weights of certain containers.

- We conducted a review of HSE databases to examine statistics on manual handling-related reportable injuries and accidents.

2.2.2 Contacting organisations within the UK Food and Drinks Industry

We sent a mailshot to the companies identified in 2.2.1, and to our own contacts within the industry, which was followed up by a telephone interview, to identify typical organisations that could give us access to their accident and injury statistics.

2.2.3 Collecting and reviewing health and safety statistics and working practices within participating companies.

We identified five organisations who kept accident and injury statistics (including weight and container type) and were willing to release this information to us. We also gathered information, wherever possible, on the working practices associated with the handlers' tasks, for example shift patterns, break patterns, training practices, and equipment used, so that the accident and injury statistics could be put within an appropriate context.

2.2.4 Analysing and comparing health and safety statistics, and working practices within participating companies.

We used the data collected from the participating organisations to try to identify any indicative differences in injury and accident statistics.

In the following sections we report our findings from the different sources of information analysed during this research.

3 Results of findings from literature review

We conducted a literature review of publications referring to injury rate *v* weight of unit loads lifted. The bullet points below describe the related information derived from these publications (bullet points in quote marks refer to direct quotations, other bullet points are our observations).

Balance of risk between weight of load and frequency of lift: a study of the psychophysical and biomechanical parameters of repetitive handling - M G Boocock, S Monnington and A D J Pinder (EWP/98/01) Health & Safety Laboratory (1998)

- It was better to handle lighter loads more frequently than heavy loads less frequently.
- The physical characteristics of the containers may have had a significant effect on the efficiency and / or ease of the lift.
- "The effects of container shape on the acceptable weight of lift were considerably less than the effects stemming from the frequency of the task repetition"
- "Providing a definitive answer to the question is, without doubt, unwise as every handling situation possesses unique risk factors which often sets it apart from others"
- "The lifter's body weight may influence the physiological costs of the handling task more than the weight of the load as the frequency of the handling increases".

The Effects of Expectation on Trunk Loading – W S Marras, S A Lavender, S L Rangarajulu (A Cradle for Human Factors. Proceedings of the Human Factors Society 30th Annual Meeting, Dayton, Ohio, September 29-October 3, 1986. The Human Factors Society, Santa Monica, California, Volume 1. 1986)

"It was hypothesized that sudden unexpected loads would create excessive forces upon the trunk due to the overcompensation of the trunk muscles".

- The study found that during sudden unexpected loading the trunk response resembled an expected loading of twice the weight value.

An Ergonomic Study of Notified Cases of Occupational Musculoskeletal Disease – A Kilbom, M Liew, E Lagerlof, E Broberg (National Board of Occupational Safety and Health (Arbetarskyddsstyrelsen), Solna, Sweden, Arbete och Halsa No. 1984:45. 1984)

"Subjects with musculoskeletal diseases notified as occupational injuries were compared to matched reference subjects. "A questionnaire on occupational work load disclosed slight differences between the groups".

- Subjects in the injury group reported a heavy workload on their arms, and they handled weights heavier than 10 kg more often.

- The injured subjects were exposed to heavier postural, static workloads, such as work with their trunks leaning forward slightly and/or twisted.
- They lifted twice as much weight per hour and spent three times as much time per hour carrying, pulling and pushing objects than the reference subjects.
- Definite quantitative differences in workload were found between the groups.

Unexpected Lifting of a Light Load: Risk of Falling and Back Injury – M N Faber, Y m Michies, H M Toussaint (Tijdschrift voor Ergonomie. 1995)

"During voluntary whole body movements balance must be controlled and the goal of the movement must be achieved. Movements are programmed in a feed-forward manner. To start a lifting movement, the expected weight of the load is derived from visual information about the size of the box and from memory. However, when this feed-forward programming is inadequate to correct for perturbations due to the voluntary movement, disturbance of balance may occur".

"In this present study male subjects lifted boxes of weights between 6 and 16 kg, as fast as possible. The boxes were presented in such an order that an expectation pattern was created".

- In 78% of the lifting movements in which the mass was unexpectedly less, subjects showed imbalance.
- Size-weight illusion was reported by 81% of the subjects.

Effects of Gender, Lift Height, Direction, and Load on the Ability to Estimate Weight – V J Rice, M A Sharp, T L Williamson, B C Nindl (Innovations for Interactions. Proceedings of the Human Factors Society 36th Annual Meeting, Atlanta, Georgia, October 12-16, 1992. The Human Factors Society, Santa Monica, California, Volume 1. 1992)

"The study evaluated the effects of gender, lift height, direction (lift/lower), and load on the ability to correctly estimate weight handled. Seven women and six men lifted and lowered boxes to and from knuckle, waist, and shoulder heights. Subjects were asked to estimate weights corresponding to 50, 40, 30, and 20% of gender specific lifting strength to 152 cm".

- The difference between the actual and estimated weight was 100% greater for men than for women, i.e. men over-estimated more than women over-estimated.
- The least accurate estimates occurred when lowering a weight from knuckle height.
- The majority of subjects underestimated the weight.
- Men underestimated more frequently than women.
- Subjects over-estimated the weight more often at higher weights.

Unexpected Load - Risk Factor in the Workplace – M L Magnusson, D G Wilder, M H Pope (Contemporary Ergonomics 1999, Edited by M.A. Hanson, E.J. Lovesey and S.A. Robertson. Taylor & Francis, London. 1999)

"Unexpected loads often occur in the working environment. This can lead to high forces in the spine and be a cause of low back injury. Muscle responses were affected by fatigue, posture, and expectation".

- The effect of sudden loads can be exacerbated if a worker is not standing on a flat surface or if the worker is fatigued.
- Chronic low back pain patients have less ability to protect themselves from sudden loads but they can be trained to improve their response.

Load Knowledge Affects Low-Back Loading and Control of Balance in Lifting Tasks – D A C M Commissaris, H M Toussaint (Ergonomics. 1997)

"This study investigated the effect of the presence or absence of load knowledge on the low-back loading and the control of balance in lifting tasks".

- Preserving balance seemed easier while picking up a load with a backlift than with a leglift.
- Despite a 10 kg difference in actual load mass, the net torque at the lumbo-sacral joint was not different between lifting 6 and 16 kg, until 150 ms after box lift-off.
- Lifting of the overestimated load mass caused a disturbance of balance in 92% of the trials.
- The postural reactions aimed at regaining balance were not accompanied by an increased low-back loading.
- The absence of load knowledge led to an increased mechanical load on the lumbar spine and to an increased risk of losing balance in lifting tasks. Both events may contribute to a higher risk of low-back injury in manual materials handling tasks.

Trunk Muscle Activation and Low Back Loading in Lifting in the Absence of Load Knowledge – M P De Looze, M C Boeken-Kruger, S Steenhuizen, C T M Baten, I Kingma, J H Van Dieen (Ergonomics. 2000)

"People who know the actual mass of an object to be lifted normally prepare themselves before attempting a lift to control the movement and to minimize low back loading".

In this study, the trunk muscular reactions and low back torque were investigated in the situation in which the individual did not know the actual mass but only had some idea of the range within which the mass lay.

- The risks of low back injury were increased in comparison with conditions where the actual weight of the lift was known in advance.

We also conducted a review of data from previous HSE projects.

In 1993-4 we prepared the majority of the manual handling good practice case studies which were subsequently published in the Health and Safety Executive (HSE) book '*A Pain in your workplace - Ergonomic problems and solutions'*. In 1996 we collected a set of manual handling case studies for the Offshore Safety Division of HSE. We identified and prepared 50 of these for publication in the practical guidance which was published as *'Well Handled: Offshore Manual Handling Solutions'*. In 2000-1 we prepared a set of 100 manual handling case studies which have since been published in the Health and Safety Executive book *'Moving food and drink'*. These case studies contained examples of solutions to upper limb and back problems caused by tasks in food and drink factories.

System Concepts also conducted research into sack handling techniques which was published in January 2002 as an HSE information sheet (Food Information Sheet No 31 – Reducing injuries caused by sack handling in the food and drink industries).

Some of the information contained in these publications provides information about the issue under investigation, as outlined below.

3.1.1 HSE A Pain in your Workplace – Ergonomic Problems & Solutions 1994

We identified a relevant case study in the above publication. A brief summary is provided below.

- Preparation, weighing and mixing of raw materials – 50 kg sacks were being handled manually in four stages to make up a mixture. Operators were suffering from back pain. As solutions, the load was spread over all three shifts rather than one shift, **some sacks were supplied as 25 kg instead of 50 kg**, a vacuum hoist was installed, and a floor level scale was introduced. Throughput was increased between 80 % and 100 % and **operators no longer complained of back pain**.

3.1.2 HSE Well Handled – Offshore Manual Handling Solutions 1997

We identified a relevant case study in the above publication. A brief summary is provided below.

- Underwater grit-blasting operation – The operators carried 50 kg sacks approximately 15 m from a pallet to a hopper (which was 2.2 m above the ground), slit the bag and poured the contents. The pallets were placed on a platform so that most lifting was from waist height, decreasing bending. An elevated walkway was constructed so that

sack pouring was at waist height rather than overhead and the **size of the sacks was reduced to 25 kg.** The benefits included a reduction in strain and fatigue, fewer eye injuries, and reports from staff that the task was easier to perform.

3.1.3 HSE Moving Food & Drink Case studies book 2001

We identified six relevant case studies in the above book. Brief summaries are provided below.

- Handling sacks of raw materials – 50 kg sacks were carried from pallets to hoppers and emptied. The company **put pressure on their suppliers to deliver in 25 kg sacks.** The weights handled decreased (although the number handled doubled). The **risk of injury and accidents decreased** and the **number of complaints from staff was reduced.**

- Tipping sack contents into sieves – Staff had to lift 50 kg sacks onto their shoulder and pour the contents into the hopper of a sieving unit. **Pressure was put on the manufacturers to deliver the raw materials in 25 kg sacks.** Two large scissor lifts, each with a rotating turntable on the top were purchased and a small shelf was placed in front of the sieve hopper, on which to rest the sack. The awkward postures associated with lifting the sack onto the shoulder were eliminated, and general housekeeping in the area was better as the process was less prone to spillage.

- Tipping tub contents into a hopper – 25 kg tubs were tipped into a hopper. The company **decided to use smaller tubs, weighing 15 kg.** There was a **reduction in hand injuries** and **all complaints ceased.**

- Lifting and carrying kegs to a pallet – 25 kg kegs were filled with finished product and then lifted and carried to a pallet. The company **encouraged customers to receive the product in 10 kg cardboard boxes** instead of the kegs**. All complaints associated with the task ceased.**

- Multiple picking operation – Loads up to 50 kg were picked from shelves and loaded onto trucks. **The maximum weight of loads was reduced to 25 kg. Accident rates decreased by 30%.**

- Lifting egg boxes – 25 kg boxes of eggs were lifted onto a trolley for transport to the shop floor. The company put **pressure on their supplier to deliver eggs in 13 kg boxes. No further complaints were made** regarding the task and there was a **decreased risk of likelihood of musculoskeletal injury and accidents.**

4 Results of findings from telephone work

We sent a mailshot to relevant health and safety personnel in approximately 100 food and drink companies. This mailshot was followed by a telephone interview, in which we identified:

- Approximately 25 companies who offered to send us accident data but did not keep records of weights lifted or containers used.
- Several companies who stated that they were in the process of setting up accident databases so could not help at this time.
- Two companies who were willing to help but were unable to access their databases – in one the database administrator had left the company and no-one else knew how to use it, and in the other the database administrator was on maternity leave.
- Several companies who were too busy to help at this time.
- Seven companies who were willing to send us data (which included weights and container types). We received usable data from 5 of these companies. The 2 remaining companies failed to send us data (despite numerous reminders).

4.1 Company Profiles

Table 1 below contains profiles of the five companies who supplied us with relevant data:

Table 1 – Company Profiles

Company	A	B	C	D	E
Business	Smoked salmon products	Sauces	Confectionery	Tinned foods	Distillers
No of Factory Operatives	440	150	1669	305	1100
No of Factory Operatives involved in Manual Handling Tasks	440	150	1669	305	1100
Shift Pattern	6am to 2.30pm (early shift) 8am to 4.30pm (days) 2.30pm to 11pm (backshift)	8 hours One week off in four	12 hours, 4 days on 4 days off, days & nights 2 'Standard Day' rooms – 8.1 hours Mon - Fri	Mon – Fri 6am – 2pm 2pm to 10pm 10pm to 6am	Day shifts Three shift cycle Double dayshift cycle Continental shift pattern Day shift
Work Breaks	Three breaks (around every two hours) 2 x 15 mins Lunch 30 mins	30 mins meal break Shorter rest/drink, smoke breaks	18 mins (am) 42 mins (midday) 18 mins (pm)	15 mins tea break 30 mins meal break	Bottling/Maturation/Drain & Fill – 55 mins (Monday – Thursday), 15 mins (Friday) Malt distilling – 30 mins lunch, 2 x 15 mins breaks
Manual Handling Training	Carried out on Induction – video & questionnaire Refresher Training	Formal training sessions Safe Behaviour discussions which include Manual Handling	Induction training by in-house operator trainers Annual on-the-job training by consultant specialists Regular manual handling briefings	Induction training On-the-job training – including location specific manual handling training	Manual Handling Course, Manual Handling Awareness, Kinetic Handling
Equipment Used	Scissor lift, forklift trucks, conveyors, reel lifting equipment	Powered pallet trucks Vacuum lifters Scissor lifts (for palletising)	Forklift trucks Pedestrian operated power trucks Hand trucks Lifting tables Hoists & Tackle Vacuum assisted lifting Robotic stackdown Conveyors	Pallet lifters Bag/box lifters Mobile pallet/dolav lifters Tippers Pump trucks Power workers Forklift trucks	Forklift trucks Autopackers Cask draining/filling equipment Chain blocks Slings Eyebolts Electric hoist
Dates of Data	December 2000 – December 2001	1992 – 2001 (inclusive)	2001	1999, 2000 and 2001	2000 and 2001

4.2 Data Received

We received data on a total of 272 accidents. Of these 272 accidents, 60 involved females and 212 involved males. The raw data is contained in Appendix I.

Our original remit was to look at lifting accidents of which there were 107, however, as pushing/pulling accounted for 86 accidents we analysed both. We excluded 79 accidents which did not describe the method of handling.

4.3 Confounding Factors

Unfortunately the data we received from these organisations was too inconsistent to allow us to perform rigorous statistical analysis. The confounding factors are described below:

- The date ranges for data were different for each company. The only year we received data from all five companies was 2001, but there was not enough data for this year to perform any significant statistical tests.

- We were unable to determine (and this information was not available from the companies) how many times people lifted without injury, therefore we cannot calculate the risk of injury for each weight.

- We were unable to determine (and this information was not available from the companies) the severity of injuries. Most of the injuries were classed as 'strains/sprains'. We were unable to determine the seriousness of each 'strain/sprain'.

- We were not provided with ages for all injured persons, therefore we could not produce any age comparisons.

- There were very few accidents which involved 'days off'. The number of 'days off' may have helped us to calculate the seriousness of each accident. We were unable to determine if this is because there were not many days off or whether the companies did not keep a record of how many days off.

- There was not enough data for each container type to produce container/load comparisons, eg 25kg sacks vs 50kg sacks.

- The data from Company E could not be compared with data from the other companies as the weights involved were well above the weights for other companies. This company provided data for accidents involving barrels with weights of 250kg.

4.4 Descriptive Graphs

Using the data we produced the following graphs:

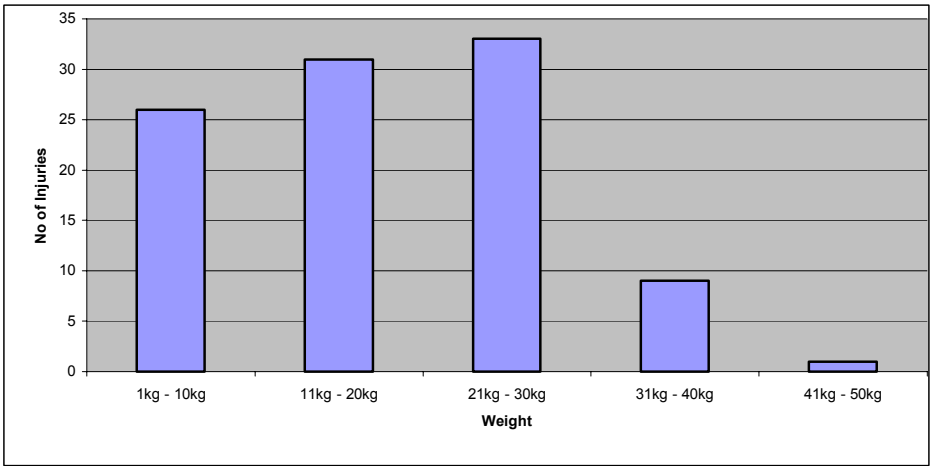

Figure 1. No of Lifting Injuries per weight range

Figure 1 shows the number of injuries, per weight range, which resulted from lifting tasks. We can see from this graph that the highest number of injuries caused by lifting were in the 21 – 30kg range. It also appears from the graph that the majority of injuries were caused by the lighter loads (injuries increasing in frequency with the increase in load, but showing a sharp decrease above 30kg). However, as there may have been many more lifts made at the lower weights, we cannot determine a 'rate' for each weight range and therefore cannot say for certain that handling lower weights causes more injuries.

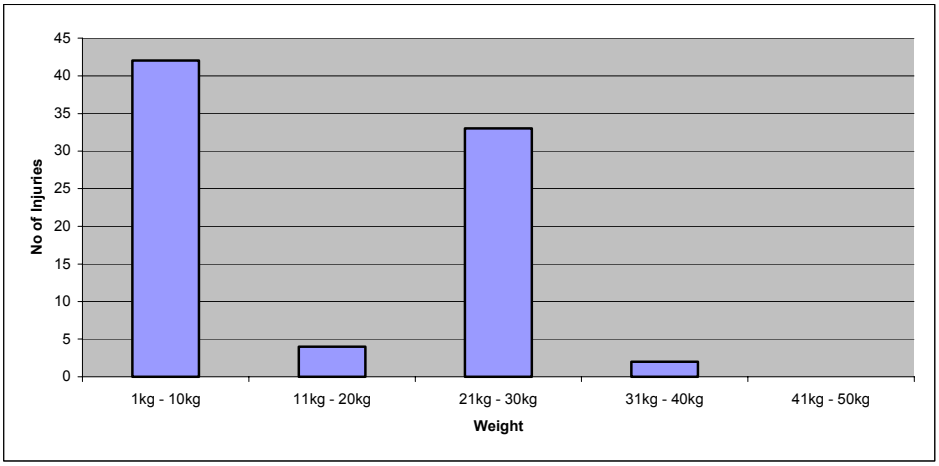

Figure 2. No of Push/Pull Injuries per weight range

Figure 2 shows the number of injuries, per weight range, which resulted from push/pull tasks. We can see from this graph that the highest number of injuries caused by pushing/pulling were in the 1 – 10kg range and the 21 – 30kg weight range. Relatively few injuries were sustained from loads of other weights. Again, accurate data was not available from the companies on the overall proportion of each type of tasks, so a rate could not be determined.

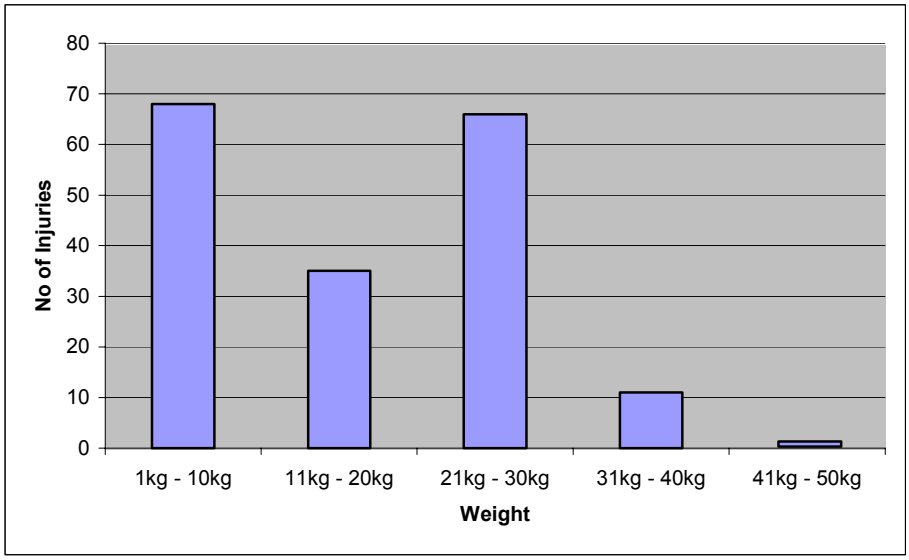

Figure 3. Overall injuries per weight range

Figure 3 is a combination of Figures 1 and 2 and shows the number of injuries per weight range. We can see from this graph that the highest number of injuries overall were in the 1 – 10kg and 21-30kg ranges. It also highlights that the majority of injuries were sustained moving loads less than 30kg. However, it is likely that most of the lifts made were within this range, but again, accurate and consistent data was not available from the companies on the proportion of time and the number of people carrying out different manual handling tasks.

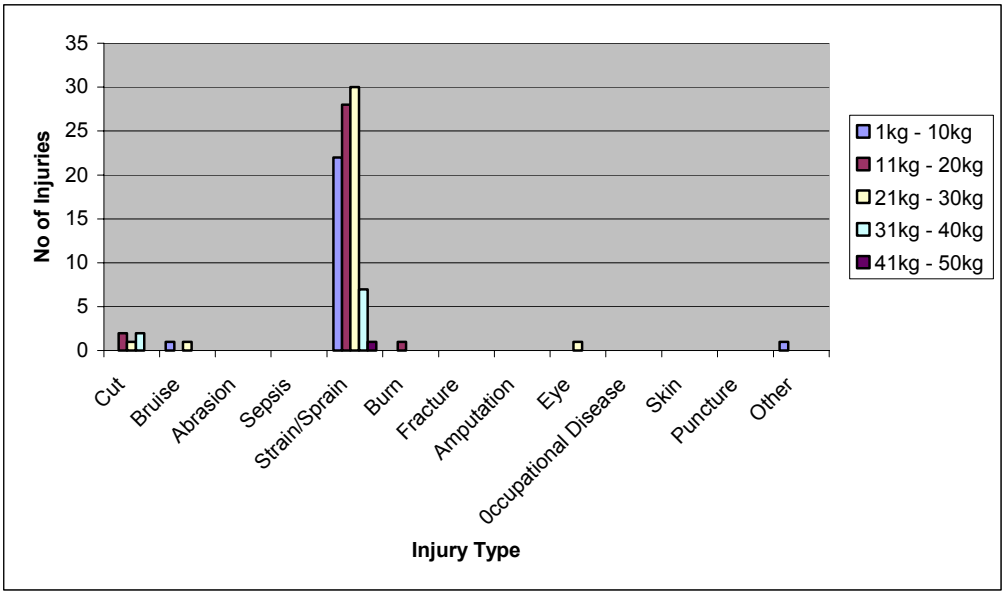

Figure 4. Lifting injuries

Figure 4 is a breakdown of Figure 1 and shows the number of each type of injury, per weight range, caused by lifting tasks. We can see from this graph that most injuries caused by lifting were strains/sprains and that the highest number of strains/sprains were in the 21 – 30kg range. There were very few other types of injuries, but of these, the majority appeared to be cuts and bruises.

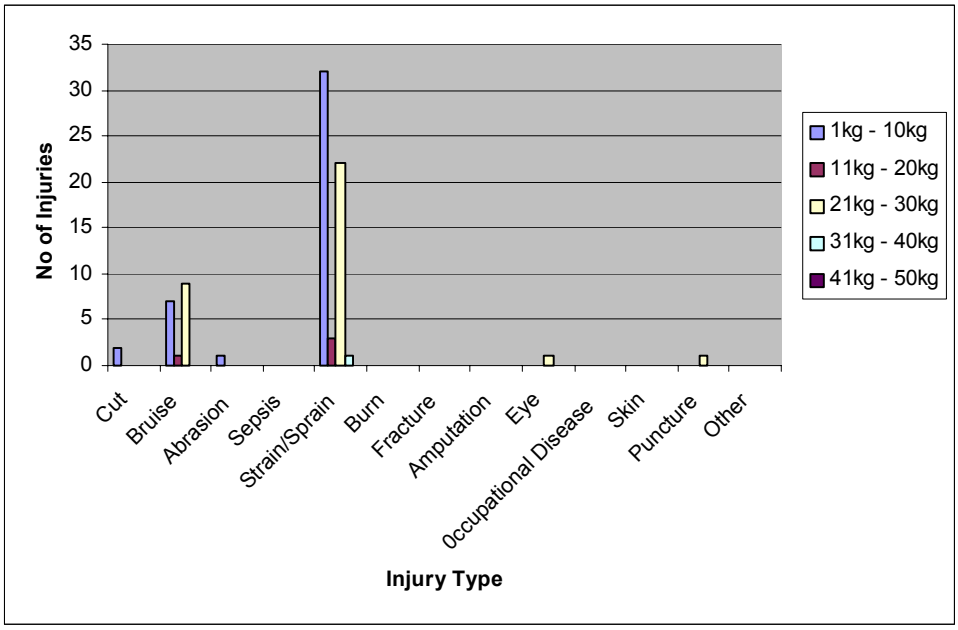

Figure 5. Push/Pull injuries

Figure 5 is a breakdown of Figure 2 and shows the number of each type of injury, per weight range, caused by push/pull tasks. We can see from this graph that most injuries caused by pushing/pulling were strains/sprains (with bruises accounting for a significant minority) and that the highest number of strains/sprains were in the 1 – 10kg range.

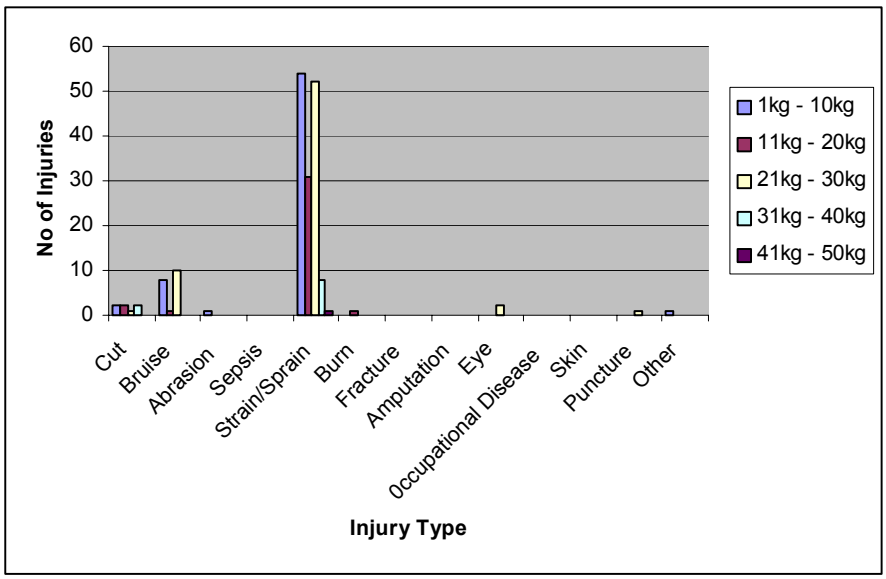

Figure 6. Overall injury type

Figure 6 is a breakdown of Figure 4 and 5 and shows the overall number of each type of injury, per weight range. We can see from this graph that overall most injuries were strains/sprains and that the highest number of strains/sprains were in the 1 – 10kg range. However, the majority of injuries were strains/sprains throughout the entire weight range. Other types of injuries occurring much less often were bruises, which appear to occur most frequently within the 1 – 10kg and 21 – 30kg ranges, and cuts which occur periodically. Other types of injuries seem to happen infrequently.

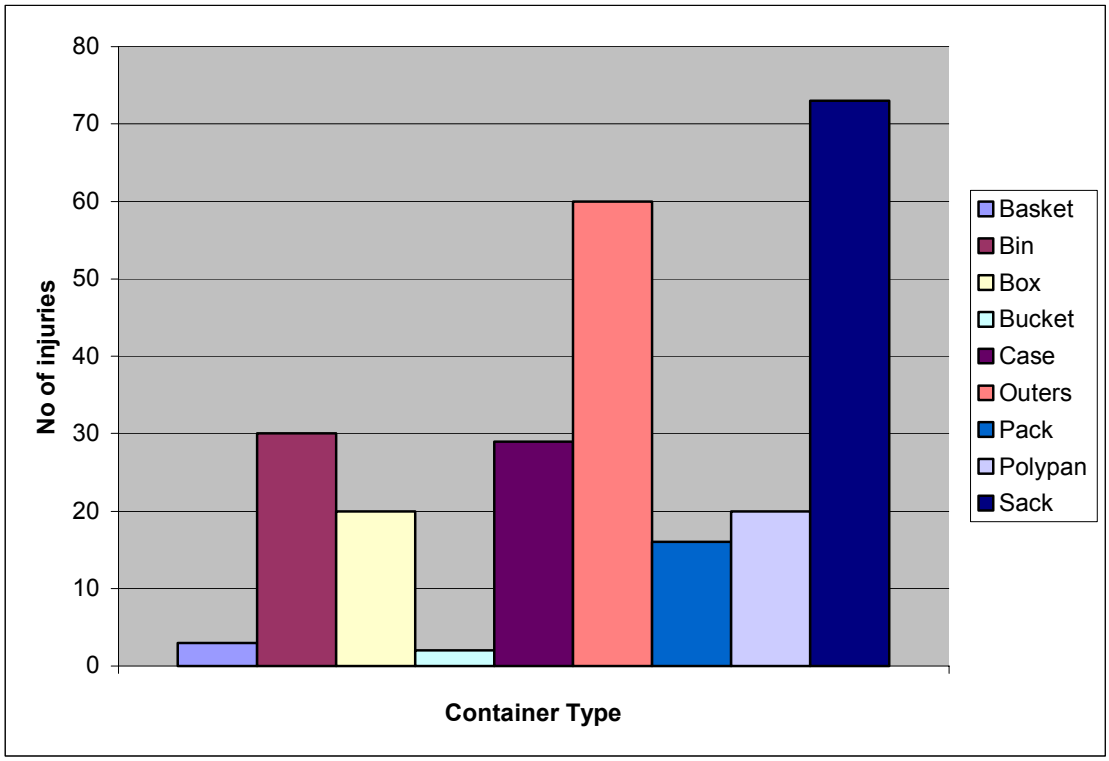

Figure 7. No of Lifting injuries per container type

Figure 7 shows the number of injuries for each container type caused by lifting tasks. We can see from this graph that most injuries caused by lifting involved sacks. However, a significant number of injuries were sustained from lifting outers (boxes containing multiple smaller boxes/packs of finished product). It can also be seen that relatively few injuries were caused by lifting baskets and buckets.

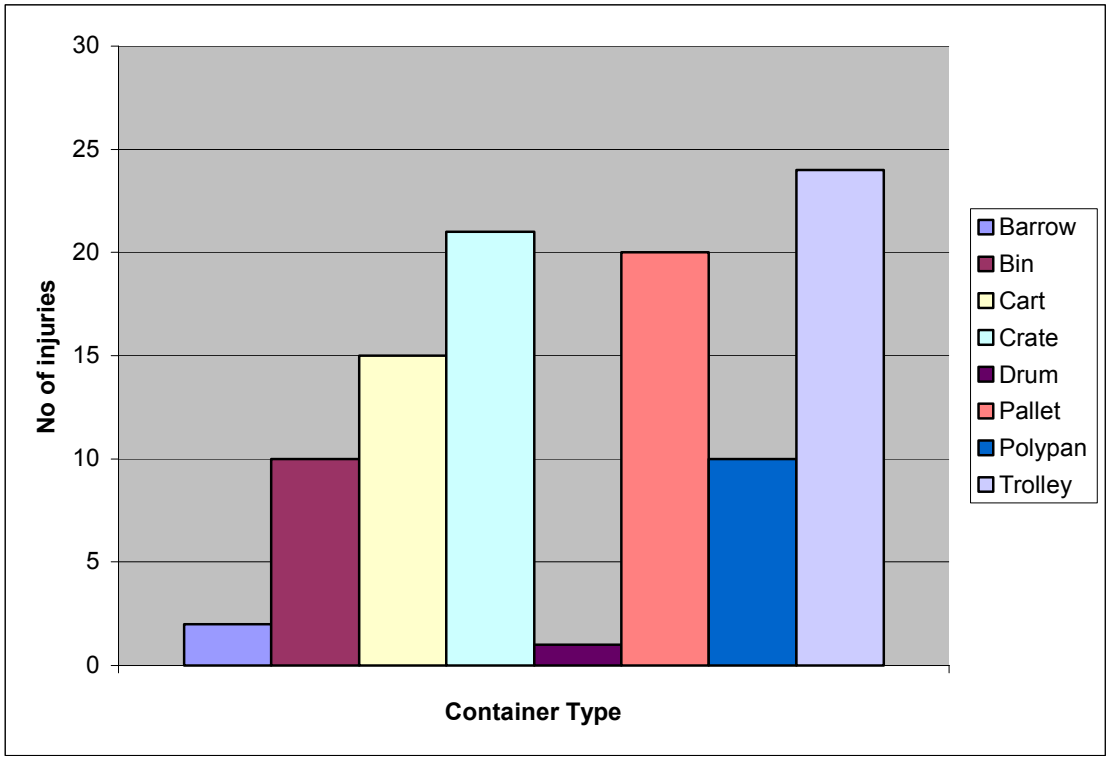

Figure 8. No of push/pull injuries per container type

Figure 8 shows the number of injuries for each container type caused by push/pull tasks. We can see from this graph that most injuries caused by pushing/pulling involved trolleys. However, a significant number of injuries were sustained from pushing/pulling crates and pallets. It can also be seen that relatively few injuries were caused by pushing/pulling barrows and drums.

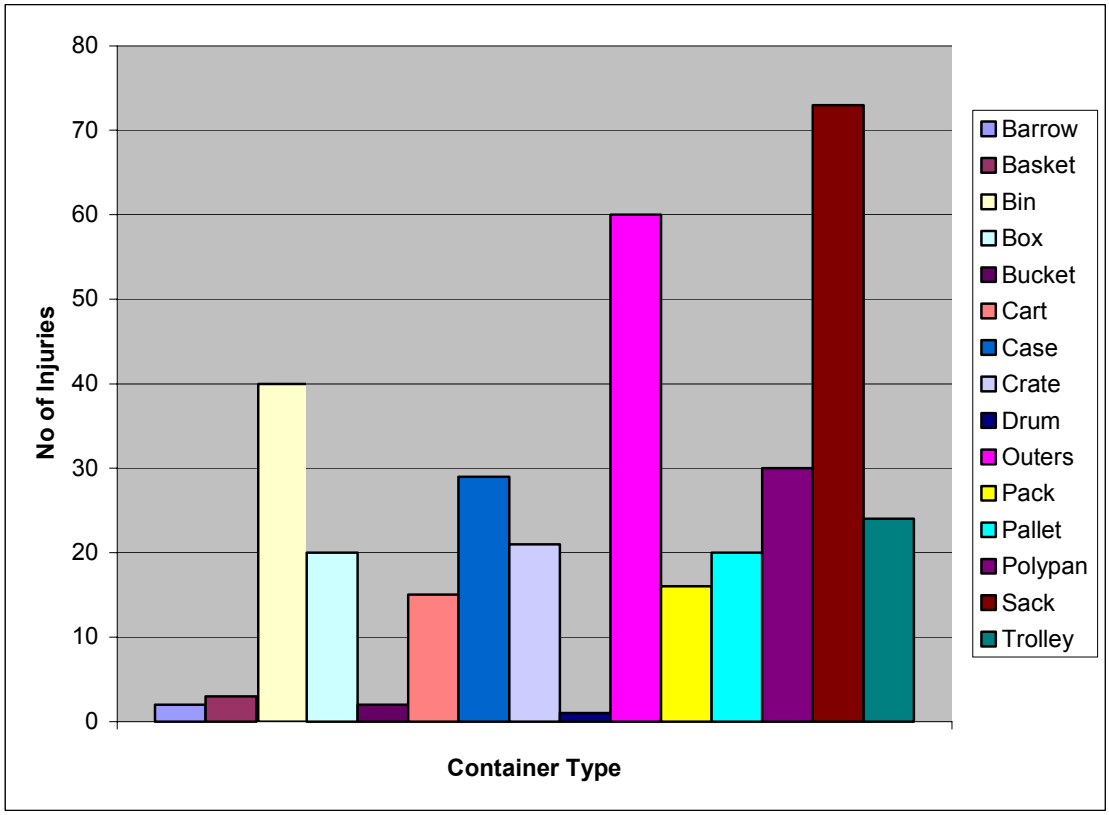

Figure 9. Overall no of injuries per container type

Figure 9 is a combination of Figure 7 and 8 and shows the overall number of injuries for each container type. We can see from this graph that overall most injuries involved sacks. However, a number of injuries were also sustained from handling bins and outers. It can also be seen that relatively few injuries were caused by handling barrows, baskets, buckets and drums.

5 Conclusions

The objective of this study was to address the following issue.

- To identify a number of sites where differences in injury statistics show that, for example, lifting 50kg loads/sacks causes x% more injuries than lifting 25kg loads/sacks, and 75kg loads (eg malt sacks) causes y% more injuries than 50kg.

Due to the multiple confounding factors associated with the data sets with which the companies provided us (described in 4.2) we were unable to answer this question definitively.

However, the following sections describe our main results and our conclusions as to why these were obtained.

5.1 Telephone Work

The main results from our study were:

Most injuries occurred in the 1 – 10kg weight range.

The majority of injuries are sustained moving loads less than 30kg.

Lifting - the highest number of injuries were in the 21 – 30kg range. The majority of injuries were caused by the lighter loads (injuries increasing in frequency with the increase in load, but showing a sharp decrease above 30kg).

Pushing/Pulling - the highest number of injuries were in the 1 – 10kg range. The 21 – 30kg weight range was also responsible for a large number of injuries. Relatively few injuries were sustained from loads of other weights.

Although we cannot conclude from these results that heavier loads cause more injuries than lighter loads, because data was not available on what proportion of the time was spent lifting different types of loads, we can make some conclusions as to why these results occurred.

Most injuries occurring in the 1 – 10kg weight range may be due to the fact that manual handling equipment is often used to handle heavier loads, therefore lighter loads are handled manually more often. Smaller/lighter containers are generally handled without assistive devices, and furthermore workers may be more careful when handling larger/heavier containers. Larger containers may be perceived to be heavy, when in fact they are light, and this may cause imbalance. Finally, the companies involved may have reduced the weights received from suppliers, thus using mostly containers under 30kg.

Most injuries were classed as strains/sprains.

The highest number of strains/sprains were in the 1 – 10kg range. The majority of injuries were strains/sprains throughout the entire weight range. Other types of injuries occurring much less often are bruises, which occur most frequently within the 1 – 10kg and 21 – 30kg ranges, and cuts which occur periodically.

Lifting - most injuries were strains/sprains and that the highest number of strains/sprains were in the 21 – 30kg range. There were very few other types of injuries, the majority of which were cuts and bruises.

Pushing/pulling - most injuries were strains/sprains (with bruises accounting for a minority) and the highest number of strains/sprains were in the 1 – 10kg range.

Although these findings do not address the main objective of this study, these results would be expected given that, due to the very nature of manual handling, the majority of injuries tend to be strains/sprains.

Most injuries involved the lifting and pushing/pulling of sacks.

Lifting - most injuries involved sacks. A number of injuries were sustained from lifting outers. Relatively very few injuries involved baskets and buckets.

Pushing/pulling - most injuries involved trolleys. A number of injuries involved crates and pallets. Relatively few injuries were caused by lifting barrows and drums.

Again, although these findings do not address the main objective of this study, it comes as no surprise that most injuries involved sacks. Sack handling has been previously identified as a particular problem area within the food and drink industries. Sacks have been shown to be difficult to handle, and this can be partly attributed to the nature of the load (the contents are usually loosely packed which can give rise to an unstable load) and the material from which the sacks are constructed (easily damaged and difficult to grasp).

5.2 Literature Review

The literature search revealed that if a worker has no knowledge of load weight there may be an increased risk of injury. This could be due to unexpected loads leading to high forces in the spine causing low back injury, which can be exacerbated if a worker is not standing on a flat surface or if the worker is fatigued. This could also be due to unexpected lifting of a light load resulting in imbalance and the risk of falling over.

Although these results do not address the main objective of this study, we can conclude that more accidents and injuries may occur when the worker has no knowledge of the load to be lifted.

5.3 Previous Work

Case studies from previous work have shown that reducing load weights can reduce the risk of injury. Where load weights could not be reduced, the introduction of manual handling equipment and mechanisation reduced the risk of accidents and injury.

These results show that reducing weights and utilising manual handling aids can reduce injury.

6 Further Work

One of the main findings from this study was the remarkably variable methods of recording accident and injury data from company to company. The lack of contextual information associated with the data made it impossible to determine 'rates' for different types of injury and to compare them in a statistically meaningful way. Data collection regarding ill health and accidents/injuries at work should help organisations to identify areas of risk within their operations and to minimise or eliminate the risks. In our opinion, these organisations would benefit from an improved structure to help them collect, classify and record such data in a way that enables them to identify areas of risk in a methodologically sound way.

We are aware that there are existing concerns within HSE regarding the recording and monitoring of information on sickness absence including the work-relatedness of such absence. We have recently been invited to tender for a research project (RSU REF 4379/R68.076, deadline May 10 2002) to develop tools to manage sickness absence. In our opinion the development and use of such tools would be of considerable use to all the companies approached during the project reported here. Informal discussions with certain of these companies has indicated that they would be prepared to act as test-beds for the pilot tools, if we are successful in our tender.

APPENDIX I – Raw Data

GENDER	AGE	CONTAINER	WEIGHT (Kg)	INJURY	DAYS OFF	NOTES
						COMPANY A
M	44	Bin	10	Torn fibres in elbow joint / ligament damage	47	Moving bin onto wheels, wheels moved
F	42	Tray	10	Swelling to left hand		Trapped hand under tray
M	22	Basket	20	Muscle spasm in left side of back		Lifting baskets of product on top of one another
M	20	Basket	20	Muscle spasm in left side of back	1	Lifting baskets of product from belt to pallet
M	65	Bin	25	Strained back	5	Lifting bin filled with moulds
F	37	Bin	150	Strained back	14	Lifting stack of 5/6 bins from pallet onto wheels - more sliding than lifting
F	32	Bin	25	Muscle spasm in left hand	4	Lifting bins of product onto wheels from pallet
M	42	Bin	10	Twisted back	2	Taking off product bins at packing bay hatch and stacking 10 high onto pallets
F	27	Table	50	Pulled muscles in back of right hand, neck & shoulder		Moving tables on line
F	37	Bin	15	Injured muscles in lower back	5	Lifting bin of flesh
						COMPANY B
M		Sack	20	Back pain	2	Loading cleaner
M	38	Sack	45	Back pain	4	Palletising
M	32	Sack	25	Back pain	11	Restacking different size sacks
M	35	Pack	2	Back pain	13	Palletising
M		Pack	15	Wrist pain	3	Lifting load of sachets with second person
M	29	Sack	20	Back pain	1	Lifting sacks of raw material
M	19	Case	1	Neck pain	1	Stacking 6 cases onto pallet together
F	29	Pack	1	Finger pain		Packing product
M		Sack	50	Arm pain		
M	34	Pack	4	Side pain		Filling 2kg tins
M		Box	5	Groin pain		
M		Sack	25	Back pain		
M		Sack	25	Back pain		
M	29	Tray	5	Groin pain		Rectifying badly labelled jars
M		Pack	5	Back pain		Packing & palletising
M		Pack	5	Back pain		Packing
M		Box	10	Chest pain		Lifting 2 boxes of jellies
M	39	Box	10	Shoulder pain		
M		Pallet	1	Wrist pain		Using pallet truck to move pallet load
M		Pack	25	Back pain		Loading bottom layer of pallet
M		Sack	20	Back pain		
M		Tin	2	Wrist pain		Hand packing 1lb tins
M		Box	25	Back pain		Manouevring boxes into car
M	31	Sack	20	Shoulder pain		Apple tipping
M	48	Sack	25	Back pain		Pulling sack
F	36	Bin	40	Back pain		Emptying bin
M	38	Box	20	Back pain		Lifting boxes off pallet
M	46	Pack	5	Back pain		Helping with lifting for analysis work

M		Pallet	25	Back pain		Picking up pallet
M		Pallet	25	Back pain		Lifting pallet from floor
M		Pallet	25	Arm pain		Lifting a pallet
						COMPANY C
F	42	Outers	3	Injured finger		Lifting outers onto pallet
M	44	Box	1	Wrist pain		Assembling boxes
F	45	Pallet	25	Left knee pain		Lifting wooden pallet
F	50	Polypan	17	Lower back pain	10	Pushing polypan
M	48	Box	2	Wrist pain		Assembling boxes
F	58	Box	7	Wrist pain		Tumble while filling boxes
M	52	Box	4	Wrist pain		Stacking boxes
F	59	Polypan	17	Injured toe		Moving stack of polypans with foot
M	39	Pallet	25	Splinter		
M	57	Pallet	25	Splinter		Handling wooden pallet
M	47	Pallet	25	Bruised finger		De-stacking pallets from 9 to 8 high
M	36	Outers	4	Hand & rib pain		Lifting outers
F	57	Pallet	25	Injured back	20	Pushing pallet into position
M	22	Polypan	13	Groin pain		Lifting polypan of by-product
F	40	Polypan	50	Bent finger back		Moving 11 full polybins on pallet
F	55	Pallet	25	Strained shoulder		Handling wooden pallet
F	47	Tray	9	Back pain		Lifting 2 trays onto a pallet
M	36	Polypan	5	Lower back pain		Tipping polypan into box
M	37	Pallet	25	Injured foot		Pallet slipped out of hand & onto foot
M	45	Polypan	5	Banged arm & hand		Banged arm on conveyor & hand on polypan when trying to lift it
F	60	Outers	8	Lower back pain	60	Lifting outers
F	51	Pallet	25	Splinter		Placing wooden pallet on floor
M	48	Polypan	13	Sharp pain in back	20	Lifting polypan full of waste
F	58	Box	8	Pull in back		Dragging box of units
F	53	Box	15	Back pain	20	Lifting boxes
M	45	Pallet	25	Splinter		
F	55	Pallet	25	Splinter		Handling wooden pallet
F	47	Outers	8	Lower back pain		Moving a load of outers
F	47	Box	8	Strained back		Carrying box
M	47	Pallet	25	Splinter		Moving wooden pallet
M	23	Tray	2	Lower back pain		Repetitive lifting of trays from belt
F	35	Pallet	25	Swelling of left foot		Moving a pallet and dropped on foot
F	50	Tray	1	Right elbow pain		Placing PVC trays on belt
M	47	Pallet	25	Splinter		Handling wooden pallet
F	42	Box	8	Upper limb pain		Repetitive lifting of boxes
M	19	Case	8	Injury to back of right hand	5	Case of drinks falling onto hand when opened
M	56	Pallet	25	Lower back pain		Lifting wooden pallet
						COMPANY D
M	29	Eurocart	8	Cut		Pushing eurocart

M	43	Meat blocks	20	Bruise		Pushing meat blocks
M	23	Barrow	10	Bruise		Pushing barrow
M	25	Eurocart	10	Bruise		Pushing eurocart
M	25	Barrow	10	Bruise	2	Pushing barrow
F	34	Cart	25	Bruise		Pushing veg cart
M	30	Cart	25	Strain/sprain	14	Pushing veg cart
M	35	Bin	200	Strain/sprain		Moving full bins
M	26	Bin	25	Strain/sprain		Pushing bin to kettle
M	40	Crate	20	Strain/sprain	21	Pushing rotomat crates
F	31	Eurocart	10	Strain/sprain		Pushing eurocart
F	31	Bin	25	Strain/sprain		Pushing/pulling bins
M	20	Cart	25	Strain/sprain		Pushing veg cart
M	46	Bin	10	Strain/sprain		Pushing full wastebin
M	25	Bin	25	Strain/sprain		Pushing bins
F	33	Bin	10	Strain/sprain		Pushing full bin
M	28	Bin	200	Strain/sprain	7	Pushing veg bin
M	20	Drum	10	Cut		Moving drum
M	22	Basket	5	Strain/sprain		Pushing/pulling basket
M	34	Drum	200	Strain/sprain		Moving paste drums
M	43	Pallet	15	Strain/sprain		Pulling pallet & slipped
M	52	Bin	200	Strain/sprain	1	Pulling heavy bin
M	18	Barrow	10	Strain/sprain		Dragging barrow
M	20	Bin	25	Strain/sprain		Pulling bins
M	54	Bin	90	Strain/sprain		Pulling carrot bin
M	47	Eurocart	10	Strain/sprain		Pulling eurocart
M	26	Trolley	10	Strain/sprain	24	Pulling loaded trolley
M	25	Bin	25	Strain/sprain		Pulling potato bins
M	36	Basket	225	Strain/sprain		Pulling rotomat basket
M	36	Basket	225	Strain/sprain		Pulling rotomat basket
M	43	Bin	40	Strain/sprain		Pushing bin onto rollers
M	31	Eurocart	10	Strain/sprain		Pulling eurocarts
M	52	Bin	25	Puncture		Pulling metal bins
M	47	Bin	25	Cut		Moving bins off scale
M	22	Bin	200	Bruise		Trapped hand between bins
F	39	Bin	15	Abrasion		Putting bin on top of bin
M	57	Meat packs	20	Strain/sprain		Lifing meat packs
M	19	Box	18	Strain/sprain		Lifting pineapple box
M	43	Bin	36	Strain/sprain		Loading bins to binwash
M	19	Sack	30	Strain/sprain	14	Lifing sacks
M	64	Drum	36	Strain/sprain		Lifting drums
M	30	Drum	30	Strain/sprain		Picking up start drum
M	19	Bin	200	Strain/sprain		Loading bins to barrow
M	40	Pallet	15	Strain/sprain		Lifting pallet
M	41	Sack	25	Strain/sprain		Lifting bag of flour
F	35	Sack	20	Strain/sprain		Lifting onions
M	61	Pallet	15	Strain/sprain		Lifting empty pallet

M	31	Sack	40	Strain/sprain	12	Moving barley sacks
M	29	Tray	10	Strain/sprain		Lifting trays
M	23	Sack	25	Strain/sprain		Lifting onion sacks
F	20	Sack	25	Strain/sprain		Lifting sack of onions
M	38	Sack	25	Strain/sprain		Lifting bags of sugar
M	30	Bin	30	Strain/sprain		Tipping bin into bowl
M	51	Bucket	15	Strain/sprain		Filling & tipping buckets
F	37	Basket	15	Strain/sprain	2	Lifting full basket
M	30	Sack	20	Strain/sprain	14	Lifting onion sacks
F	33	Bin	220	Strain/sprain		Lifting tote bin
F	33	Sack	35	Strain/sprain	28	Lifting starch sack
M	20	Pallet	15	Strain/sprain		Lifting empty pallets
F	26	Sack	20	Strain/sprain	1	Lifting onion sacks
M	50	Tray	2	Strain/sprain		Picking up tray
M	36	Box	25	Strain/sprain		Moving box
M	26	Bin	37	Bruise		Moving empty bins
M	20	Bin	10	Strain/sprain		Moving flour bins
F	40	Pallet	15	Strain/sprain		Turning pallet around
M		Meat blocks	25	Strain/sprain		Loading meat blocks
M	22	Bin	37	Strain/sprain		Moving steel bin
M	47	Pallet	15	Puncture		Moving wooden pallet
F	42	Pallet	15	Other		Moving empty pallet
M	35	Bin	200	Puncture		Moving bin
M	26	Bin	10	Bruise		Pushing full bins together
F	36	Basket	5	Bruise		Pushing basket back to fray line
M	20	Drum	25	Strain/sprain		Filling & moving drums
M	20	Eurocart	10	Strain/sprain		Pushing eurocart
M	22	Bin	10	Strain/sprain		Moving bins
M	32	Bin	25	Bruise		Offloading bins
M	20	Drum	5	Strain/sprain		Moving drums on kettle rollers
M	19	Barrow	10	Strain/sprain		Pushing barrow
M	30	Eurocart	10	Strain/sprain		Pushing meat eurocarts
M	23	Bin	25	Bruise		Moving bins
M	35	Trolley	10	Strain/sprain		Pulling trolley
M	26	Bin	25	Strain/sprain		Pulling bin
M	47	Pallet	10	Strain/sprain		Sorting pallets by hand
M	24	Basket	25	Strain/sprain		Pulling full basket away from line
M	43	Basket	5	Strain/sprain		Pulling basket to retort
M	25	Bin	25	Eye		Pulling bins
F	24	Basket	5	Strain/sprain		Pulling basket from end of row
M	50	Bin	10	Strain/sprain		Pulling bin
M	50	Eurocart	10	Strain/sprain		Pushing/pulling eurocart
M	25	Bin	30	Strain/sprain		Tipping spice bin
M	29	Basket	25	Strain/sprain		Pulling baskets
M	21	Bin	25	Bruise		Pulling bin off trolley onto rollers
F	21	Bin	25	Bruise		Pulling bin onto barrow

M	49	Bin	25	Strain/sprain		Pulling bin on rollers
M	25	Basket	25	Strain/sprain		Pulling rotomat basket
M	19	Bin	25	Abrasion		Moving bins & slipped
M	37	Bin	25	Bruise		Pulling spice bin
M	46	Bin	25	Strain/sprain		Moving full bin from scales
M	39	Bin	25	Strain/sprain		Pulling bins
M	30	Bin	25	Bruise		Pulling bin of potatoes
M	52	Bin	25	Bruise		Pulling ingredient bins over rollers
M	20	Cart	25	Bruise		Pulling veg cart
M	26	Bin	25	Strain/sprain		Moving bins from truck to rollers
M	19	Bin	25	Bruise		Moving bin of carrots
M	33	Bin	25	Bruise		Moving empty bin to trolley
M	33	Trolley	10	Abrasion		Pulling trolley of empty bins
M	33	Trolley	10	Strain/sprain		Pulling trolley
M	33	Bin	25	Strain/sprain		Pulling empty bin off trolley
M	30	Basket	5	Strain/sprain		Pulling baskets
M	31	Cart	30	Strain/sprain		Pulling soup cart
M		Bin	25	Bruise		Pulling bin off scales
F	30	Bin	10	Strain/sprain		Pulling bin full with carrots
M	31	Bin	25	Strain/sprain		Pull/push full bin
M	35	Bin	25	Strain/sprain		Lifting bins onto rollers
M	19	Bin	37	Cut		Picking up bin
M	22	Bin	30	Strain/sprain		Lifting starch bin off scales
F	24	Pack	5	Bruise		Lifting packs off line
M	27	Bucket	30	Strain/sprain		Carrying buckets
M	28	Meat blocks	20	Strain/sprain		Lifting blocks of meat
M	36	Tin	25	Strain/sprain		Lifting tins out of kettle
M	31	Bin	37	Strain/sprain		Lifting bin to put on wash platform
F	19	Sack	25	Strain/sprain		Lifting pea bags
M	38	Bin	37	Cut		Taking bin off line, bin fell on leg
M	20	Sack	25	Strain/sprain		Lifting sacks
M	21	Bin	25	Bruise		Moving bin of sweetcorn
M	49	Bin	25	Cut		Lifting bin onto barrow
M		Bin	37	Strain/sprain		Loading bins in washer
M	32	Drum	25	Strain/sprain		Lifting drum
M	25	Tray	10	Strain/sprain		Lifting pastry trays
F	57	Tray	15	Strain/sprain		Lifting pudding trays onto line
M	31	Tray	15	Strain/sprain		Lifting full pastry trays onto roller
M	26	Butter blocks	10	Strain/sprain		Loading butter blocks
M	39	Barrel	10	Other		Picking up barrels
M	21	Bin	25	Strain/sprain		Removing bin from scales
F	22	Box	10	Strain/sprain		Lifting boxes of caps
M	25	Cart	25	Bruise	4	Removing cart from grind machine
M	36	Drum	15	Cut		Picking up tomato paste drums
M	27	Sack	25	Eye		Emptying spice into bucket
M	27	Bin	10	Strain/sprain		Pushing two starch bins

M		Bin	5	Bruise		Pushing bin off product lift
M	44	Bin	10	Strain/sprain	2	Pushing bin off scales
M		Bin	25	Cut		Moving bin of carrots onto platform
M	18	Cart	25	Strain/sprain	1	Pushing full veg cart
M	18	Eurocart	10	Bruise		Pushing full eurocarts
M		Cart	10	Cut		Pushing meat cart on wet floor
F	21	Basket	5	Strain/sprain		Pushing baskets
M		Bin	10	Strain/sprain		Pushing bin into hoist
M		Eurocart	10	Strain/sprain		Pushing eurocart around corner
M	27	Cart	25	Bruise		Pushing veg cart into lift
M	28	Bin	10	Strain/sprain		Moving bins of sugar
M		Cart	10	Strain/sprain		Pushing veg carts
M	37	Basket	5	Strain/sprain		Pulling full basket from load area
F		Basket	5	Strain/sprain		Pulling basket
M	37	Bin	10	Strain/sprain		Moving bin into extractor
M	21	Bin	10	Strain/sprain		Moving full bin off scales
F	57	Pallet	10	Strain/sprain		Pulling pallet from magazine
F	22	Trolley	10	Strain/sprain		Pulling loaded trolley
M	31	Basket	5	Strain/sprain		Pulling baskets
M	24	Drum	25	Strain/sprain	1	Pulling drum onto rollers
M		Bin	25	Strain/sprain		Moving full bin of carrots
M	38	Bin	25	Strain/sprain		Putting bin on barrow
M	24	Bin	25	Strain/sprain		Pulling full bin across roller
F	51	Box	12	Strain/sprain		Lifting/collecting jars in box
M	53	Box	12	Strain/sprain		Lifting boxes of caps into hopper
M	37	Bucket	25	Strain/sprain	2	Lifting full bucket onto trolley
F	20	Pallet	12	Cut		Lifting pallet up to remove
M		Box	25	Strain/sprain		Lifting box
M		Box	15	Strain/sprain		Moving boxes from pallet
F		Tray	10	Strain/sprain		Lifting full pastry tray
M	32	Bin	30	Strain/sprain		Emptying bin of trimming to kettle
M	32	Tray	10	Strain/sprain		Lifting emply trays on pallet
M	30	Tray	10	Strain/sprain		Lifting trays of pie lids up to line
M	22	Sack	25	Strain/sprain		Lifting sacks into mixer
M	44	Bin	37	Strain/sprain		Removing bins from bin wash
M	28	Bucket	15	Burn		Carrying acid bucket
						COMPANY E
M	44	Case	14	Shoulder strain		Handling cases
M	55	Case	14	Neck & shoulder pain		Packing bottles in cases
M	51	Case	14	Back pain	14	Lifting cases
F	37	Case	14	Neck pain		Lifting cases
M	43	Case	14	Groin strain	4	Catching falling case
F	59	Case	14	Back strain		Lifting cases
M	50	Barrel	250	Back strain	3	Moving barrel
F	40	Case	14	Shoulder & arm strain		Moving cases

M	43	Case	14	Wrist strain		Hand bailing cases
M		Case	14	Arm strain		Freeing case
M	42	Barrel	250	Back strain	22	Moving barrel inside van
M	58	Barrel	150	Back pain		Using metal bar in roller van to move barrels
F	39	Case	14	Back strain		Moving barrels
F	41	Barrel	250	Knee strain		Moving barrels
M	46	Barrel	250	Back & knee strain		Moving barrels
M	50	Barrel	250	Back strain		Moving barrel
F	41	Case	14	Back strain		Moving cases
M	50	Barrel	250	Back strain		Unloading lorry
M	41	Barrel	250	Back pain		Unloading container

Printed and published by the Health and Safety Executive
C1.25 8/02

MAIL ORDER
HSE priced and free
publications are
available from:
HSE Books
PO Box 1999
Sudbury
Suffolk CO10 2WA
Tel: 01787 881165
Fax: 01787 313995
Website: www.hsebooks.co.uk

RETAIL
HSE priced publications
are available from booksellers

HEALTH AND SAFETY INFORMATION
HSE InfoLine
Tel: 08701 545500
Fax: 02920 859260
e-mail: hseinformationservices@natbrit.com
or write to:
HSE Information Services
Caerphilly Business Park
Caerphilly CF83 3GG

HSE website: www.hse.gov.uk

RR 007

£15.00

ISBN 0-7176-2537-0