OH&S in Small Business: Influencing the Decision Makers

The application of a social marketing model to increase the uptake of OHS risk control measures by small business

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Abstract

Losses resulting from traumatic injuries and occupational disease are prevalent in the small business sector of Australian industry. Although the true size of the problem is unclear, it is estimated that the losses amount to more than $8 billion annually. The hazard control measures to counter these losses are largely known and are available to small businesses but they are not widely adopted. Regulators and other bodies have employed a range of intervention strategies to influence decision-makers in small businesses but most have focussed on the dissemination of printed materials or broad-based advertising campaigns with limited success.

In the public health discipline, behaviour change models and their underpinning theories are widely applied to influence the health behaviours of groups of people. Social marketing is one framework used that draws together various theories of behaviour change, including the Transtheoretical Model of health behaviour change (TTM) and Rogers' diffusion theory. It is proposed that the social marketing framework may be adapted and transferred to the OHS discipline for the purposes of overcoming some of the shortcomings of the strategies currently used in the occupational health and safety (OHS) discipline to influence the behaviour of decision-makers in small businesses who decide whether or not to adopt an OHS risk control measure.

An exploratory study using three case studies tested the research hypothesis that the social marketing model, currently used in other disciplines, is transferable to the OHS discipline for the purposes of increasing the rate of adoption of OHS risk controls within small businesses. The aim of the research was to apply relevant elements of a social marketing model to the case study groups of small business operators to evaluate its usefulness to the OHS discipline in increasing the rate of adoption of OHS risk control measures. The case studies were conducted within groups of small businesses in the commercial fishing industry, the plastering sector of the construction industry and the motor vehicle repair industry in Victoria.

The research concludes that the listening processes at the heart of social marketing add to the methods already used in the OHS discipline by forcing the marketer to listen to the subjective assessment of risk as perceived by targets as well as to question the evidence

base that supports the legitimacy and efficacy of the proposed intervention. The TTM was found to be a useful means of categorising small business decision-maker behaviour and assessing the readiness for change of individuals and therefore the messages that are needed to unfreeze behaviour. The TTM also provides a tool for evaluation of the impact of an intervention.

As a result of this research it is suggested that opinion leaders, who are employed within a social marketing model to diffuse information, multiply the effort of those wishing to increase the adoption of an innovation. Thus engagement of opinion leaders by an OHS authority for the communication of risk control messages may be more cost-effective than attempting to visit every workplace within an industry group.

Thus, although social marketing is not in the general repertoire of OHS interventions, it appears to be extremely useful as a framework for interventions and, when used in concert with a stages of change model, provides natural lead indicators for evaluating the impact of OHS interventions. Application of social marketing to people who have the responsibility for the health and safety of others was unique.

Statement of authorship

Except where explicit reference is made in the text of the thesis, this thesis contains no material published elsewhere or extracted in whole or in part from a thesis by which I have qualified for or been awarded another degree or diploma. No other person's work has been relied upon or used without due acknowledgement in the main text and bibliography of the thesis.

Signed:	Signed:
Applicant	Supervisor
Date:	Date:

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The support of WorkSafe Victoria in accessing case study groups is gratefully acknowledged.

Statement of Ethics Approval

Human Research Ethics Committee

Outcome of Meeting No ***4/03*** ***Held on*** ***Thursday, 29 May 2003***

Ethics clearance for the recently submitted application is as follows:

Project No:	65
Project Type	A - Category A: Research Project
Title	Prevention of occupational asthma among automotive body repairers in Victoria.
Associate Researcher(s)	
Principal Researcher(s)	S Cowley
School	Science & Engineering
HREC Decision	**With Provisions, Approved**
HREC Comment	**Approved with the following provisions:** *** The employer cannot nominate participants.** *** Does VACC approve the release of this data?** *** It would be helpful to refer to attachment by numver.** *** Why is the Principal Researcher, D Else, not mentioned in the application?** **BEFORE BEGINNING THIS PROJECT, please provide the Executive Officer with details of how the above issues have been addressed.**
Resub Comment	
Project Start	02/06/2003
Project End	03/09/1931
Final Project Report	**Please return completed Final Project Report form to the Executive Officer at the completion of this project.** **This form is available at:** **http://www.ballarat.edu.au/research/ethics/hrec.shtml**

Yours sincerely

S. O. Boyle

SALLY BOYLE
Executive Officer
Human Research Ethics Committee

Tuesday, 3 June 2003 *Individual Project REPORT (notification of decisions)*

University of Ballarat
Human Research Ethics Committee (HREC)

HUMAN RESEARCH ETHICS APPROVAL FORM

Principal Researcher / Supervisor: D Else

Associate Researcher/s / Student Researcher/s: S Leggett/S Cowley

School: Science & Engineering

Ethics approval has been granted for the following project:

Project Number: 04/49

Project Title: Prevention of falls and manual handling injuries in the Wall and Ceiling Industry

for the period: 28/05/2004 **to** 30/04/2005

Approval Date: 28/05/04

Within one month of the conclusion of the project, researchers are required to complete a Final Report Form and submit it to the HREC Executive Officer.

If the project continues for more than one year, researchers are required to complete an Annual Progress Report Form and submit it to the HREC Executive Officer within one month of the anniversary date of the ethics approval.

Signed: S. O. Boyle .... Date: 23/06/04
[Executive Officer, HREC]

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Human Research Ethics Committee (HREC)

HUMAN RESEARCH ETHICS AMENDMENT APPROVAL FORM

Principal Researcher / Supervisor: D Else

Associate Researcher/s / Student Researcher/s: S Leggett/S Cowley

School: Science & Engineering

Ethics approval has been granted for the following project:

Project Number: 04/49

Project Title: Prevention of falls and manual handling injuries in the Wall and Ceiling Industry

for the period: 28/05/2004 **to** 30/04/2005

AMENDMENT APPROVAL: 25/08/04 – Minor amendment to recruitment process and minor changes to questionnaire and documentation

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Signed: RBennett ....
[Executive Officer, HREC]

Date: 25/08/04 ......

University of Ballarat
Human Research Ethics Committee (HREC)

HUMAN RESEARCH ETHICS APPROVAL FORM

Principal Researcher / Supervisor: S Leggett

Associate Researcher/s / Student Researcher/s: S Cowley

School: Science and Engineering

Ethics approval has been granted for the following project:

Project Number: 03 / 64

Project Title: Prevention of falls and manual handling injuries in the wall and ceiling industries

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Acting:
Signed:.. Date: 25/07/2003
[Executive Officer, HREC]

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List of Abbreviations

AWCIV: Association of Wall and Ceiling Industries, Victoria, Inc.

HSE: Health & Safety Executive (UK)

KABP: Knowledge, attitudes, beliefs and practices

MOA: Motivation, opportunity, ability

MSDS: Material Safety Data Sheet

MSD: Musculo-skeletal disorder

MVR: Motor vehicle repair

NIOSH: National Institute for Occupational Safety and Health (USA)

NOA: New Onset Asthma

NOHSC: National Occupational Health and Safety Commission (now the Australian Safety & Compensation Council)

OHS: Occupational health and safety

OPRA: The Occupational Physicians Reporting Activity

PFD: Personal flotation device

SENSOR: US Sentinel Event Notification Systems for Occupational Risks

SME: Small to medium enterprise

SWORD: The Surveillance of Work-related and Occupational Respiratory Disease

RPE: Respiratory protective equipment

TTM: Transtheoretical model (TTM) of health behaviour change

WAA: Work Aggravated Asthma

WRA: Work-related asthma

1. Introduction

Occupational injuries and disease impose a considerable burden on our community, affecting people in the most productive years of their lives. Globally, approximately 1,000 workers are killed by injuries every day and a further six of every 1,000 workers will be fatally injured at work during a 40 year life span (Smith, 2001). Feyer et al. (2001) compared work-related fatal injury rates in Australia, New Zealand and the United Sates and found that in period 1989 to 1992 the annual fatality rate in Australia was 3.8 per 100,000 workers. During the same period the annual fatality rate in the United States was 3.2 per 100,000 and in New Zealand in the period 1985-1994 the annual fatality rate was 4.9 per 100,000. In each country, male workers, older workers and those working in agriculture, forestry and fishing, mining and construction were at highest risk. Smith (2001), in his review of public health approaches to injury prevention suggests that non-fatal injuries are a more pervasive problem.

In 1996, The National Occupational Health and Safety Commission (NOHSC) published a review of the incidence of occupational mortality in Australia (Kerr et al., 1996) which concluded that previous estimates of annual occupational mortality in Australia (500) were clearly underestimates, having not included the 2,200 deaths related to disease.

More recently Mathers et al. (2001) have reported that occupational exposures to toxic chemicals and injury risks were responsible for an estimated 2,005 deaths in Australia in 1996, or 1.6% of all deaths (p.1081). They report that the attributable burden of occupational exposure was 1.7% of the total burden of disease and injury in 1996; cancers were responsible for 41% of this attributable burden, followed by injuries (33%) and other chronic diseases (25%).

While precision was not offered in the Kerr report and other estimates of the size of the occupational disease problem are different, we can at least be confident that the problem is significant. We know just in relation to asbestos exposure that there are some 500 cases of mesothelioma each year and a further 10,000 cases are predicted by 2010 (National Occupational Health and Safety Commission, 2001b). Diseases such as respiratory tract disorders including pneumoconiosis, asthma, silicosis and asbestosis, which may be non-fatal, remain unsolved problems and neurotoxic effects associated with organic solvents and metals are an unknown quantity (Sim, 1998).

Over 35,000 chemicals are used in tens of thousands of different products in Australia and the potential for occupational health impacts is great (Howell, Spickett, & Hudson, 1998). New information about the toxicological effects of chemicals is continually emerging, adding them to the lists of known and suspected carcinogens and designated hazardous substances. For example, crystalline silica was recently listed as a human carcinogen by the International Agency for Research on Cancer (IARC) (International Agency for Research on Cancer, 1997) and a range of commonly used agricultural chemicals are becoming known as endocrine system disrupters (Papas, 1999).

In addition, there is probably a severe under-reporting of occupational diseases for several reasons. These include non-diagnosis by medical practitioners owing to limited training in occupational medicine; the link with the causative agent in the workplace not being properly identified; and a patient having already left the employment that caused the health problem (Sim, 1998). The consequence of these shortcomings is a data set that is biased towards traumatic injury and inadequately considers disease, that offers limited information about severity and does not provide sufficient information for assessment of real costs of injury and disease (Sim, 1998).

Quinlan and Bohle (1997) point out that, despite the $10 billion cost to the community that results from failure to provide safe workplaces, OHS receives a level of attention that is not reflective of its economic impact on the community. Further, they suggest that in terms of increasing its profile, there is little integration of OHS education into mainstream management, engineering or other core discipline education.

The Australian Chamber of Commerce and Industries (2005) argue that there is a strong business case for safer workplaces and a reduction in workplace fatalities, injuries and disease. However, Australia continues to experience high rates of work-related fatal and non-fatal injury and disease and NOHSC (National Occupational Health & Safety Commission, 2002) note that while here have been significant improvements in OHS performance in recent years considerable scope exists for further progress. In the past interventions have been based on simplistic assumptions that changing people's awareness about the injury problem would change their behaviour (Gielen & Sleet, 2003). The intent of the OHS legislation in Australia is that organisations adopt an approach to risk control that will eliminate or minimise exposure to hazardous energies through engineering means (Culvenor, 1997). This approach is in preference to individual behaviour-centred approaches that are recognised as being less reliable. The former and preferred approach is referred to as a "safe-place" approach, while the latter is referred to as a "safe-person" approach (Culvenor, Cowley, & Harvey, 2003). Safe-place approaches are passive and rely on changing products, or environments to make them safe for all irrespective of the behaviour of individuals. Safe-person approaches are active and encourage or require individuals to take an active role in protecting themselves, despite hazards in their environments (Gielen & Sleet, 2003).

The safe-place, safe-person approach to risk control is represented by a hierarchy of controls (National Occupational Health & Safety Commission, 1990) which originated in Haddon's ten countermeasures to reduce risk of injury within the community in general (Haddon, 1973). This hierarchy proposes that eliminating the risk is the highest level of control and issuing personal protective equipment such as safety glasses results in a low level of control of the risk; once control options, other than elimination of the hazard, are adopted, reliability is reduced. Control of the hazards by measures, other than elimination, relies on human interaction in the form of such measures as maintenance, education and training and supervision. The extent of this human interaction increases as the hierarchy of control measures is descended. However, health and safety problems are rarely solved without drawing on a range of strategies. A hierarchy may be conceptualised as a smorgasbord from which a number of food items that satisfy our hunger are selected. The predominant flavour is, however, safe-place (Cowley, 2004). Gielen and Sleet (op. cit) discuss approaches to injury prevention in regard to the application of behaviour change theories to injury prevention in the community at large and suggest that both passive and active approaches need to be integrated. They offer road safety campaigns that encourage parents to place their children in the rear seats of cars or encourage people to wear seat belts as examples of *active approaches to passive protection*. In regard to workplace safety, this may be paralleled by applying strategies that influence the behaviour of employers such that they implement passive risk controls for their employees.

There is evidence to suggest that the safe-person paradigm persists within our community (National Occupational Health and Safety Commission, 1999) and within workplaces today (Culvenor et al., 2003) and with the problem of occupational disease being largely hidden, control of disease risk in particular has been underemphasised. Although the risk control measures that industry may adopt are largely known and available and attendant increases in productivity through their application are demonstrable, their application is limited (Hudspith & Hay, 1998; Industry Commission, 1995; Topping, Williams, & Devine, 1998).

Improvement has been attempted through regulation that encourages the adoption of a comprehensive and formal approach to the management of exposure to hazardous substances. As such, the National Health and Safety Commission's Hazardous Substance Regulatory Package (National Occupational Health and Safety Commission, 1994) has recently been adopted by all Australian jurisdictions.

Similar regulations, known as The Control of Substances Hazardous to Health (COSHH) Regulations (*The Control of Substances Hazardous to Health Regulations 1999 (UK)*, 1999) have been in place in the UK since 1985 and have recently been reviewed (Health and Safety Executive, 1999). As a part of this review, Topping et al. (1998) undertook a survey of small business in the UK that used chemicals. Despite the widespread dissemination of information over more than 10 years, it was found that only 65% of respondents were aware of hazardous substance regulation.

Small businesses are of particular interest in this context given that the owners are often unaware of the hazards associated with their operations and that we have traditionally focused efforts to improve workplace safety on large industrial manufacturers (Eakin, 1992; Jones, 1999). Further, small businesses are a major entry point to the labour market and employ many young and inexperienced workers who are at relatively high risk of injury; have limited knowledge of hazards and are unaware of workplace OHS legal rights and obligations (Eakin, 1992).

Smith (2001) argues that prevention has previously focussed on individual workplaces that employ many workers and tended to ignore small workplaces, despite the fact that they often have the highest injury rates. Further, he argues that there is much we already know in regard to prevention, but it is not being applied.

Risk control in workplaces is underemphasised and there is often a focus instead on the measurement of risk (Cowley, 1990). Roelofs et al. (2003) undertook a critical review of industrial hygiene literature in regard to prevention strategies. They reported that little is known about the extent of use of prevention and control strategies in workplaces although the scant research available suggest that employers are most likely to implement administrative strategies and personal protective equipment.

In 1980 Hammond, an Environmental Control Engineer in the United Kingdom, undertook an analysis of the contents of papers published in the Annals of Occupational Hygiene between August 1975 and December 1978 (Hammond, 1980). The Annals of Occupational Hygiene is an international journal published for the British Occupational Hygiene Society and widely read by the profession in Australia. Hammond found that significantly more attention was paid to monitoring of conditions than to the control of hazards and prevention Hammond expressed a desire to look back in 10 to 20 years time and find the monitoring and environmental control ranking reversed. Ten years later Cowley (1990) undertook a similar review of the papers published over the period February 1987 – June 1990 reveals little change to the status quo. Twenty years later, Roelefs et al. (2003) undertook a similar analysis of the hygiene literature in general and comment, “Unfortunately, 20 years on, Hammond’s hope for a greater proportion of articles reviewing control and prevention strategies has not come to pass. The overwhelming majority of articles published in the occupational hygiene literature during the period under review concerned some aspect of exposure assessment.” (p.65)

While a safe-person paradigm predominates within workplaces and the OHS discipline continues to emphasise the measurement of risk at the expense of risk control major advances in reducing the burden of injury and disease are unlikely to be achieved. In small workplaces where access to human, economic and technological resources that can assist with risk reduction is limited (Champoux & Brun, 2003) the opportunities for control of risk are further limited. ACCI note (Australian Chamber of Commerce and Industries, 2005), “SME’s [small to medium sized enterprises] operate the majority of workplaces in Australia and employ around half of all employees. Small businesses must be recognised by all stakeholders as having a different range of needs to other stakeholders".

This document outlines the problems that small business operators face in dealing with OHS issues. It discusses the strategies that have been and may be used to help those operators overcome those problems and thus improve the health and safety of their employees. A hypothesis is developed in regard to the strategies that may be used to influence small business decision-maker behaviour when they apply risk controls. Three cases studies are described, each detailing an OHS problem and the application of elements of a social marketing model to increase the adoption of risk controls. The case studies address drowning within the commercial fishing sector; musculoskeletal injuries and falls injuries among plasterers in the construction sector; and asthma among spray painters in the vehicle body repair sector.

2. Literature Review

2.1. OHS & Small Businesses

The size of the OHS problem within the small business sector relative that among larger businesses is debatable. However, it is not disputed that small business operators and those wishing to influence their behaviour in regard to decisions about OHS face challenges specific to the sector.

Within this section, the characteristics that define small businesses and the nature of the OHS issues that have been found to set them apart are described. Within this context, some approaches that have been employed to reach small business operators and influence their behaviour are reviewed.

2.1.1. Characteristics of Small Businesses

The definitions of "Small Business" differ from one country to another. Small and medium sized enterprises (SME's) have been defined against various criteria such as the number of workers employed, the volume of output or sales, the value of assets employed, and the use of energy. Other definitions are based on whether the owner of the enterprise works alongside the workers; the degree of sophistication in management; and whether or not an enterprise lies in the "formal" sector (Watfa, Awan, & Goodson, 1998). Walters (2001), in his discussion of strategies for improving OHS in small businesses in Europe, suggests that finding an appropriate definition is problematic. In illustrating this point he reports the European Commission definition that is based on not only size but also financial turnover, balance sheet total and independence of the business. However, it appears that the definition varies widely throughout the European Economic Community (EEC). The workforce size component of the European Commission definition classifies businesses (Walters, 2001 p.34) as:

1. Micro-enterprises (employing less that 10 people)
2. Small enterprises (employing less than 50 people)
3. Medium-sized enterprises (employing less than 250 people)

In Australia, the NOHSC defines "small business" as those having less than 20 employees (NOHSC, 2001c). However, Lamm (1999), in her study of small business for the NOHSC, points out that NOHSC itself operates two definitions of "small business" with the second (less than 200 employees) being used for its injury and disease recording standard and incorporating medium-sized businesses. Lamb employs the Australian Bureau of Statistics (ABS) classification that defines small businesses as "those employing less than 20 people" (Australian Bureau of Statistics, 2001). The Victorian WorkCover Authority also defines small businesses as those having less than 20 employees (Victorian Government, 2002) and, given the widespread use of this definition in Australia, it will be used in this research.

Small businesses as defined, represent 44.5% of the Australian workforce (NOHSC, 2001c) and in Australia are spread over an estimated 1,162,000 separate business premises operated by 1,597,200 business operators (Australian Bureau of Statistics, 2001). The small business sector represents approximately 90% of all businesses (Lamm, 1999). Wight (2001a), in her development of strategies for improving OHS in small businesses in South Australia, notes that they typically have the following management and organisational characteristics, "They are independently owned and operated; they are closely controlled by owners/managers who also contribute most, if not all of the operating capital; and the principle [sic] decision making function rests with the owners/managers." (Wight, 2001a p.2)

The ABS report (Australian Bureau of Statistics, 2001) that of the 1,162,000 small businesses operating in Australia at June 2001, 14% had been in operation for less than 1 year; 35% had been in operation for 1 year but less than 5 years; 19% had been in operation for 5 years but less than 10 years; and 32% had been in operation for 10 or more years. The length of operation refers to the length of time the business has been operated by the current owner only.

Of the 1,597,200 small business operators, 67% were male. Most small business operators (59%) were aged between 30 and 50 years (11% were less than 30 years old; 59% were aged between 30 and 50 years; and 31% were aged greater than 50 years). A strong growth in the number of business operators aged less than 30 years old is reported (ibid.).

The highest educational attainment most commonly held by small business operators was school education accounting for 41% of the total. Small business operators with non-school qualifications at the certificate level were next, recording 38%, with non-school qualifications of advanced diploma or above accounting for 21% of the total (ibid.).

In June 2001 some 773,600 (67%) of the 1,162,000 small businesses reported they were using computers in their business operations. As the size of the business increases, so to the likelihood that a business would have a computer, with 89% of businesses with 5-19 employees having a computer, compared to 56% of non-employing businesses (ibid.).

Only 609,900 (53%) businesses had access to the Internet. Again, the use of the Internet was more common in the larger businesses; 43% of non-employing businesses had access to the Internet, (up from 27% in November 1999); 62% of businesses employing 1-4 people had access to the Internet, (up from 42% in November 1999); and 73% of businesses employing 5-19 people had access to the Internet, (up from 56% in November 1999) (ibid.).

The most common usage of the Internet was for email (44% of small businesses, or 83% of businesses with the Internet) and research (42% of small businesses, or 79% of those with the Internet). Vickers et al. (2003) found in the UK that internet access was a good indicator of small businesses with a more active and systematic approach to management and it also is related to a greater awareness of OHS legislation (ibid.).

2.1.2. The OHS Problem in Small Businesses

NOHSC reports that the sector does not appear to have an injury incidence rate that is higher than the all industry average. However, the cost of each injury occurrence is greater and associated losses pose a significant threat to business viability. The total cost of losses across the sector is $8.3 billion annually (NOHSC, 2001c).

A different view emerges from Europe where analysis of serious injury and fatality data, backed by similar findings from other industrialised economies, supports the conclusion that the risks of work in small business are greater than in larger businesses (Walters, 2001). Walters (2001 p.268) refers to “additional sources of data on work-related ill health and the work environment that adds further weight to the description of the challenge to health and safety management. Moreover, such data probably underestimate the true extent of the problem since it is widely accepted that it is under reported”. Walters and Lamm (2003), in a more recent review of the options for improving OHS in small business, suggest that work in small business is more dangerous than in larger business but this is primarily because the arrangements for prevention if ill health and injury in the former are unsatisfactory.

Vickers et al. (2003), in their extensive review of cultural influences in health and safety in small business in the UK, confirm that people in small businesses do face proportionately greater physical risks than workers in larger businesses and support Walters and Lamm (op. cit) with the view of that the poor safety performance in the sector may be “more related to the poor management of risk than the absolute seriousness of the hazards faced.” (Vickers et al., 2003 p.1)

Research shows that small businesses have greater difficulty meeting OHS requirements than do larger businesses (Jones, 1997; Lamm, 1999). In her review of the literature relating to small businesses Lamm (1999) found that they cannot match the resources that larger businesses have at their disposal and that conforming with regulations often places greater financial obligation on them as they are unable to spread their compliance costs over a range of products, markets or plants. Fairman and Yapp (2005) explored the impact of interventions on compliance with OHS law within 41 small hairdressing businesses in the UK and report that small businesses tend to display a lack of expertise and ability to identify risks associated with activities, as well as being unable to afford the necessary safety specialists. They cite research that suggests the average cost of compliance with regulations in the UK is 4-6% of small businesses' turnover (Institute of Chartered Accountants of England and Wales in Fairman & Yapp, 2005 p.8), which places them at a commercial disadvantage compared with larger businesses.

James Jones who leads the US National Institute of Occupational Safety and Health (NIOSH) small business program suggests that, because of economic pressures, provisions for safety equipment and updating of process equipment may be a low priority. He also suggests that many engineering solutions devised for large industrial concerns are not economically feasible, nor practical, for small business (Jones, 1997).

While acknowledging the difficulties that generalisations may present, Walters (2001) proposes that typically small businesses have limited development of safety management resources; limited access to external health and safety services; limited experience on the part of both workers and employers given the short life of many enterprises; infrequent inspection; and workers have restricted access to autonomous representation of their interests (i.e. trade unions). Champoux and Brun (2003) interviewed managers of small manufacturing enterprises in Quebec and found that small business owners are generally isolated, overworked and do not use the services offered by OHS sector associations and generally do not belong to business groups.

Walters and Lamm (2003 p.4) have subsequently expressed these generalisations differently, in terms of "key factors" affecting OHS in small business that may be grouped under the following headings:

- Low management and training skills;
- Lack of resources;
- Burden of compliance;
- Relationship with regulatory agencies and the use of consultants;
- Dependent relationship with large businesses; and
- Employment and OHS practices.

They argue that small businesses differ from larger ones in that they have shorter lines of communication; simpler structures and that economic pressure is felt more keenly and immediately. Small businesses lack the resources of larger ones in terms of time, good staff and finance and are unable to keep abreast of changes to OHS legislation. They suggest that small businesses often have a hostile relationship with regulatory agencies and avoid contact with government staff for fear of prosecution. However, while they may resent the attention given by government to larger businesses, many small businesses operate in close relationships with larger businesses. Finally it is suggested that small businesses are less likely to adopt formalised employment or OHS procedures and they report on research that found a large proportion of employees interviewed in small businesses were dissatisfied with their level of OHS conditions.

Vickers et al. (2003) adds to the list of generalisations, which they term as “features that give rise to structures of vulnerability” (p.2) with the suggestion that the low profile of a small business leads to there being little fear of loss of business resulting from adverse publicity and regulatory attention.

Walters (2001) suggests that micro-enterprises (less than 10 employees) are particularly vulnerable. While they are particularly entrepreneurial they have little organisational structure and no human resources function and very low trade union membership. Conditions in small businesses generally are aggravated by job insecurity that in turn leads to psychological insecurity and economic vulnerability. Further, the considerable illegal and therefore unregulated work and workers and the disproportionate representation of disadvantaged groups engaged in such activities add further to the likely absence of a culture of risk awareness and concern for health and safety. Fairman and Yapp (2005) list barriers that may affect compliance as lack of knowledge; lack of interest; lack of skill; lack of money and lack of time.

It is possible that a factor that influences compliance is the lack of recognition of the problem within the sector and the nature of the risks that individual businesses face is misunderstood. Elliott and Shanahan (1995) undertook an investigation of current attitudes and information needs of small business in order to plan a community education media campaign and reported that there is a widespread belief among small business operators that only some larger industries are dangerous. Vickers et al. (2003) report that many small businesses in the UK remain unpersuaded by the business case for health and safety related investment. They note “the lack of positive evidence to help demonstrate to owners/managers the existence of such a link in the context of their own or similar business.” (op. cit. p.82)

Lamm (1999) also found that small business employers generally perceive their workplace as being low risk and “are only aware of the risks involved if a key employee suffers a work-related injury or illness, or if they incur a fine for violating the regulations. Moreover, when employers are aware of unsafe work practices by their employees, they are, on the whole reluctant to intervene” (p3). It is suggested that a low level of awareness of OHS regulations was a key determinant of employers’ lack of interest in OHS in general. Champoux and Brun (2003) interviewed managers of small manufacturing enterprises in Quebec province, Canada and report that accidents may be relatively rare in small firms due to their smaller workforce and this may be a factor in the lack of attention given to the subject.

Eakin (1992) interviewed 53 small business owners in Calgary. She found that in general, owners understood the concept of workplace health primarily in terms of personal behaviour of employees and referred to worker carelessness and use of personal protective equipment when asked about OHS and risk control. These safe-person beliefs about accident causation and risk control disagree with contemporary occupational health and safety theory and practice (see for example Viner, 1996). Champoux and Brun (2003) concluded that the small business operators they interviewed tended towards blaming accidents on employees or denying the existence of safety problems. They also avoided questioning the firm’s management and organisation of work.

Significantly, Eakin was able to categorise subjects’ perspectives on roles and responsibilities with respect to health-related behaviour of employees. These perspectives ranged on a continuum from “coming down hard” to “leaving it up to the workers”. The “coming down hard” position included owners who made explicit concerted efforts to manage the OHS behaviour of employees. Those categorised as “leaving it up to the workers” indicated that they left OHS matters up to their employees and, in the extreme, some workers were even expected to provide their own personal protective equipment if they wanted it.

The “leaving it up to the workers” posture was the most common perspective with over two thirds of the sample responding in this way. The author concluded that this posture related to their:

a) Assessment of the significance of health and safety issues within the business,

b) Social relationships with employees and

c) Understanding of the nature of their responsibility for OHS.

Fairman and Yapp (2005) found that more than 50% of hairdressing salons had employed staff suffering dermatitis but control measures were not enforced. All the operators interviewed provided gloves for staff but only 10% required them to be used during colouring treatments. Barrier creams were provided for staff use “but it was usually left to the staff to decide whether and how to use these measures” (Fairman & Yapp, 2005 p.74).

With regard to the owner’s assessment of the significance of health and safety issues within their business, Eakin (1992) reports that many did not believe their workplaces to be hazardous or if they did, the hazards were considered acceptable, despite the sample including relatively high-risk industries. Also, owners who did not have personal experience of OHS problems took the matter much less seriously than those that did have experience. Despite the prevalence of injuries and ill-health in the sector as a whole, events at individual worksites are rare and this was identified as a factor in reducing the perception that there could be a negative event. This in turn reduced the likelihood of preventive action. It was also found that owners were too preoccupied with the myriad of immediate day-to-day demands associated with running a small business to consider OHS a significant issue. One business owner reported that, “Health and Safety is a very minor thing, very minor. Compared to problems of getting business, and collecting money, and dealing with bankers, and things like that. Oh yes, it’s way down the line”. (Eakin, 1992 p.694)

Regarding social relationships with employees, many employers who took the “leave it up to the workers” posture, believed that they did not have control nor legitimate authority over the health and safety behaviours of their employees. In some cases this was because the employer down played status distinctions between them and their employees; in other cases it was because they were concerned about retaining good employees and did not wish to exert authority. Some employers referred to the value of personal autonomy as important to them in operating their own business and expressed the same need or desire for independence in their employees. Some employers were unwilling to intervene in the health practices of employees for fear of being seen as inappropriately paternalistic.

Regarding their responsibility for OHS, two contrasting perspectives emerged. The first, "personal responsibility", was characterised by employers who saw intervention as a personal rather than managerial action. These employers believed that there might be a negative perception as a result of intervention. Also, some employers saw their business as an extension of themselves and therefore had difficulty acknowledging health issues, i.e. if the work was harmful, then the owners themselves must be harmful. The second, "bureaucratic responsibility", was found among employers who were less likely to adopt the "leave it up to the workers" posture and saw OHS intervention as a normal management function. Eakin (1992) concludes that lack of awareness among small business operators is a significant problem and that a key strategy for increasing awareness is information transfer.

Vickers et al. (2003) and Walters and Lamm (2003) comment of the relationships that small business operators have with their employees and support Eakin's "leave it up to the workers" posture in reporting that health and safety issues are often treated as an individual rather than corporate responsibility. They also support the findings that small business operators have a preference for autonomy, have more informal approaches to management than larger businesses and have an antipathy to government intervention, particularly in regard to regulation. Curran et al. (cited in Vickers et al., 2003 p.5) coined the term "fortress enterprise" in regard to the mentality that tends to make small business operators suspicious of external agencies.

In contrast to the "leave it up to the workers" posture adopted in regard to OHS, Vickers et al. (op. cit.) point out that employees in small businesses were less likely to be involved in decision making than employees in large workplaces, "…with small business owners/managers generally seeing themselves as best placed to make decisions about the workplace." (p.6)

However, in small business the close nature of the relationships can be a positive attribute with respect to the business operator wishing to protect their employees. Paternalistic concern for the workforce maybe reinforced by family involvement in the business (Vickers et al., 2003). Conversely, Vickers et al. (op. cit. p.102) point out

> "…difficulties can still arise with respect to persuading employees to observe good health and safety practice. It may be harder for managers in small businesses to discipline or sack staff if they choose to regularly disregard safe practice, because of the close relationship between the owner/manager and his/her core staff, at least. A further factor may be the difficulty and expense of recruiting replacement staff in some sectors and locations."

Walters and Lamm (2003 p.6) comment on this from the perspective of the employees and suggest "…relationships within small workplaces occur on a more personal basis, making employee dissention over OHS matters more difficult…"

More than half (53%) of the respondents to Vickers et al. (op. cit.) survey indicated that their motivation for adopting improvement measures had been a desire by management to protect their workforce and/or reduce risk. Only 30% of respondents indicated that improvements had been initiated by a desire to comply with legislation. However, in the same survey, 63% of respondents were unable to identify any health and safety legislation affecting their business. Fairman and Yapp (2005) found that 46% of their sample population of small business operators did not comply with risk assessment requirements. Of the 22 of operators that expressed a belief that they "definitely complied" with legislation 45% (n=10) were unaware of risk assessment requirements.

2.1.3. Reaching Decision-makers in Small Businesses

Given the lack of awareness and the lack of understanding of OHS legislation (NOHSC, 2001b), the transmission of occupational health and safety (OHS) information to small business has received increasing amounts of attention. NOHSC commissioned Elliott and Shanahan (1995) to investigate current attitudes and information needs of small business and they conducted interviews and group discussions nationally. They concluded that small business operators are more inclined to take risks due to tighter economic pressures, that there is widespread belief that only some (larger) industries are dangerous, are reluctant or do not know how to access appropriate advice and they work in an “information vacuum”.

In another project commissioned by NOHSC, David Caple and Associates (1996) surveyed the utilisation of health and safety information and found that, in regard to control of risk, many small businesses act on the basis of personal experience and information obtained through personal contacts, many of whom do not have credible OHS knowledge. Goldenhar et al. (1999) undertook a small in-depth study of dry-cleaning business operators in the USA. Focus groups comprising business owners and workers revealed that there was a belief that solvent manufacturers would “sell them only safe chemicals” (p116), when in fact perchloroethylene (among other things a probable human carcinogen) is in widespread use. Cox et al. (2003) developed a methodology for risk communication and commented, “…extensive detail and technical jargon contained in MSDSs[1] appear to render much of the information inaccessible to many chemical users in the workplace.”

Briggs and Crumbie (2000) interviewed 521 people in 305 small businesses in the UK to identify characteristics of people who work with chemicals. They found that, despite respondents working with chemicals that all had well documented detrimental effects (e.g. cadmium solution and perchloroethylene), about two thirds (64%) of users thought that the chemicals they used posed little or no risk and only 8% admitted that there was a high risk. About one third of judgements about the short-term effects of the main chemical that respondents used was either incorrect or the effects of the chemical were unknown. For long-term effects the number of incorrect judgements rose to about one half. While container labels and data sheets were cited as the main source of information about chemicals, suppliers and sales representatives were chosen as the preferred source of further information, there being a high level of respect for them. Sadhra et al. (2002) interviewed 21 chromium platers and administered a further 84 questionnaires regarding the health effects of the chemicals they worked with and report that acute effects were often first to be mentioned and long-term effects were rarely mentioned. When the long-term effects were mentioned there was rarely knowledge of what those effects were.

[1] Material safety data sheets

Health effects were often discussed only after prompting and protective clothing was sometimes the only control measure mentioned.

It is interesting to note that the Briggs and Crumbie work found that knowledge on chemical symbols was low and only about one third of respondents knew the meaning of the term “carcinogenic”. The results here correlated closely with reading age. They found that 63% of respondents had a reading age less than 12 years 4 months.

Howell et al. (1998) visited 50 small businesses in Western Australia and found similar results with formal systems of management uniformly absent and only rudimentary management evidenced by several firms’ attempts to collect material safety data sheets and to communicate with employees. They reported “An understanding of the hazards presented by various substances tended to be low, although proprietors were positive about the manner in which they managed hazards.” They also found, in support of Eakin (1992), Jones (1999), Vickers et al. (2003) and others that firms were preoccupied with economic survival rather than OHS and that managers tended to downplay hazards and to emphasise worker responsibility. Walters and Lamm (2003 p.4) proposed “The application of the most elementary OHS remedies in a small business have to be considered alongside the weekly cash flow.”

Lack of information not only influences the likelihood that an employer will control risk, but it also influences the *level* of control that will be applied. Topping et al. (1998), undertook a nation-wide review of perceptions of occupational exposure limits in industry in the UK. They found that small business employers that acted on printed information received from suppliers placed heavy reliance on use of personal protective equipment rather than the preferred higher order controls. Jones (1997) identified that the information about cost-effective control strategies is generally unavailable to small businesses in the USA and that they only have a vague knowledge about where to find OHS and technical assistance.

Risk perception is influenced by the availability of information and this in turn influences the motivation for small business to adopt OHS management strategies. Jones (1997), through his 10 years of management of small business OHS for NIOSH, has identified several reasons why small business employees in the USA may be at greater risk than employees in larger companies:

> "The first is that the seriousness of high-injury rates for small businesses is unlikely to be perceived because serious injuries occur infrequently at any single enterprise with few employees. Another factor is financial incentives, such as reduced workers compensation costs, that are less likely for small businesses. The injury "experience rating", which determines an employer's insurance premium, is also not generally calculated for individual small employers that do not pay a certain amount in premiums.
>
> Many small businesses do not have health care plans or preventive medicine programs, so workers who become sick from occupational exposures may quit. Therefore owners and workers are less likely to identify job-related health effects...Also unions are rare, training programs may be haphazard or absent, and there may be no advocates for worker health and safety." (p11)

Mayhew (1997c) undertook a number of projects in the small business sector in Australia and found similar factors influencing management of OHS:

> "First, small businesses do not usually have the OHS expertise available to them that larger firms enjoy…second, census data indicate that the self-employed work longer hours than employees do. As result there is less time and energy for what are perceived to be "optional extras". Third, small business owners and the self-employed are typically from trades or "hands-on" skills backgrounds…However few have management skills, and indeed do not necessarily even recognise these are important."(p363)

Mayhew (1997c) reports that people in small businesses often lack knowledge of hazard identification and control, are unaware of legal rights and lack financial resources required for higher order controls. In regard to incentive, she proposes that insurance leverage is limited as the self-employed are generally not covered by workers' compensation schemes and rebate schemes offer little to small business where claims are relatively infrequent and the relative time and financial costs of implementing OHS programs are unlikely to be rewarded. Vickers (2003 p.82) endorses these sentiments and identifies the "lack of incentive stemming from the fact that insurance premiums are insufficiently linked to good health and safety practice."

The infrequency of injuries and illnesses that a small business may experience, as a factor in risk perception, is supported by the work of Eakin (1992). The “healthy worker effect” is widely recognised by epidemiologists and has been cited by Redlich et al. (2001) who examined 75 isocyanate (HDI) exposed auto body repair shop workers and raise the possibility that the true prevalence of asthma is underestimated because the sensitised workers have left the industry (i.e. the healthy worker effect). Further to this, Ashford and Zwetsloot (2000) suggest that in any enterprises acute chemical accidents are rare and therefore, even where controls have been implemented, there may be no positive feedback and therefore no reward for the effort.

Mayhew and Gibson (1996) interviewed 500 builders across Queensland and found that the perception of hazard exposures and illness and injury patterns were mismatched. In particular chronic back injuries were common, but manual handling tasks were rarely identified as hazards or risks. Research by Holmes, Gilford, and Triggs (1998) has revealed that employers’ and employees’ perceptions of risks differ in the small business sector and that perceptions of acute versus chronic risk influence attitudes towards the adoption of appropriate control strategies.

These various findings are supported in the literature regarding the adoption of protective activities. Kunreuther, Sanderson, and Vetschera (1985), for example, identify that people are often willing to protect themselves against risks which will have a moderate frequency of occurrence even though the potential loss is small. On the other hand, they are often reluctant to protect themselves against low probability events with high losses. To illustrate the matter, they cite research in the areas of seat belt usage, which is high relative to purchase of flood insurance, which is low.

Fairman and Yapp (2005) report that small hairdressing business operators interviewed recognised the existence of dermatitis and back pain as important issues but demonstrated some fatalism toward these conditions in as much as they are part of the job and not much can be done to prevent them. It was also recognised that in some cases these conditions would be so severe that the sufferer would have to leave their job. In this population there was disparity between the perception of safety problems and health problems. For example 54% of the sample noted that slips, trips and falls were a major concern even though only 2% had experienced a client slipping while one operator identified dermatitis as a major hazard even though more than 50% had employed staff with the condition.

To address concerns over these issues, a number of initiatives to raise awareness of OHS within small businesses in Australia have been led by State authorities (see for example the Small Business Program in South Australia (Wight, 2001a, 2001b) and the Small Business safety program in Victoria (Victorian Government, 2002)), the National Occupational Health and Safety Commission and by industry associations (see for example Australian Chamber of Commerce and Industry, Victorian Employers Chamber of Commerce and Industry, Australian Industry Group). With few exceptions such as the trial delivery of information via presentations at Rotary Club meetings (NOHSC, 2001a), most of these programs have used traditional strategies for the broadcast of general information via either mass media or direct non-specifically targeted mail. In South Australia the principles of social marketing were used to underpin the development of written materials and media promotions (Wight, 2001a).

However, Fairman and Yapp (2005) report that mail shots and leaflets have not been shown to be effective interventions within small business. They found (p.81):

> "In the face of too much information or complexity, business owners filter the information they have. They neglect large parts of it, especially any areas not familiar or understandable. In the face of increasing complexity, more information gets neglected. The SME's concentrate on the parts that appear familiar and relevant to their own businesses. Therefore if they have limited knowledge in the first place, written information will be largely ignored as they will filter out the complex and unfamiliar and concentrate on the areas that seem simple and manageable and those within their existing knowledge boundaries."

Fairman and Yapp (op. cit.) report that this was seen in small businesses that had received general leaflets about risk assessment requirements that had been dismissed as being irrelevant to their own business. Leaflets presenting information about risk presented the business operator with an opportunity to ignore the information because it was such an alien concept and therefore it could not apply to the businesses they operated. They report that even if leaflets were read and understood, they generally did not improve knowledge or motivation in businesses.

Walters (2001) comments on strategies employed in Europe that have paid considerable attention to contact techniques, including the use of electronic media, radio and television as well as mail shots and leaflet campaigns. Walters (p.371) describes these as "arms-length tools" and concludes that most successful interventions are associated with face-to-face contact between the small business owner/manager (as well as their workers) and OHS agents. Walters and Lamm (2003 p.26) acknowledge that the problem is that such agents are in short supply and cannot reach anything like the number of businesses that would benefit from such contact. This author further contends that opportunities for face-to-face contact are limited in Australia given the costs and practicalities associated with reaching geographically widespread small businesses.

Vickers et al. (2003) reported on a variety of mechanisms for reaching small business, one being the potential use of banks and accountants, which they report was disappointing. Briggs and Crumbie (2000) found that a verbal rather than written culture predominates in small business. Vickers et al. (op. cit.) link this to the lower percentage of small businesses that take action on OHS as a result of mail shots (9%) than for face-to-face contact such as seminars (47%) and inspections (43%). Notwithstanding this, Wight (2001a) reports a campaign involving direct mail to small business operators regarding the availability of OHS starter kits that attracted a 50% response rate. As a consequence of this campaign it was concluded that small business initiatives needed to be flexible and include consultation and testing

Although references to OHS intervention strategies within the literature are increasing in number, there are few reports of efforts specifically targeted to address the uptake of individual risk control measures using strategies other than the broadcast of general information via either mass media or direct non-specifically targeted mail.

2.1.4. Summary

There is a lack of recognition of the OHS problem within the small business sector. Many business owners are too preoccupied with economic survival to consider OHS a significant issue and are inclined to take risks due to tighter economic pressures.

Small businesses have limited development of safety management resources and greater difficulty meeting OHS requirements than do larger businesses. They have limited access to external health and safety resources and are inspected infrequently.

A number of studies have found that small business owners adopt a safe person approach to OHS and risk control and misunderstand the nature of their responsibility for OHS and it is often a matter left up to individual workers to deal with. Many engineering and OHS management solutions devised for large industrial concerns are not economically feasible, nor practical, for small business.

Small business operators work in an "information vacuum" and many small businesses act on the basis of personal experience and information obtained through personal contacts. Lack of information not only influences the likelihood that an employer will control risk, but it also influences the *level* of control that will be applied.

To address concerns over these issues there have been a number of initiatives to raise awareness of OHS within small businesses in Australia. With few exceptions most of these programs have used traditional strategies for the broadcast of general information via either mass media or direct non-specifically targeted mail. There are few reports of efforts specifically targeted to address the uptake of individual risk control measures using strategies other than the broadcast of general information via either mass media or direct non-specifically targeted mail.

2.2. Intervention Strategies

2.2.1. Regulation versus Voluntarism

Workplace health and safety intervention has traditionally been seen as the role of the regulator and intervention strategies have drawn heavily upon the enforcement of legislation.

The Australian legislative framework was built around the principles of the British Robens Report of 1972 (Committee on Health & Safety at Work, 1972), resulting in a dramatic change from the traditional "command and control" (Gunningham & Johnstone, 1999) model, that imposed detailed obligations on businesses enforced by an inspectorate to a more self-regulatory regime. Gunningham and Johnstone (1999) believe that at the time the legislation was introduced (1985 in Victoria and similar in other Australian jurisdictions), it represented a major advance on the antiquated system it replaced. However, they believe that the legislation is now approaching the limits of its efficiency to address traditional problems, which to date have been inadequate. Citing a European survey of working conditions, they report that a quarter of the workforce still complains of high noise levels and air pollution, a third experience extremes of temperature and heavy loads and nearly a half complain of painful postures induced by poor design of workstations. Perhaps more importantly, Gunningham and Johnstone believe that the legislation, designed in the 1970's and early 1980's to address OHS issues of that era, is also becoming ill suited to accommodate trends in the economy and in the nature of employment. They contend that the model for the legislation was implicitly the manufacturing sector and, to a limited extent, construction and was primarily directed towards physical hazards and workers in medium to large enterprises. In more recent times however, the picture has changed with manufacturing diminishing as part of the economy and there has been a very substantial increase in the proportion of small businesses, where very different regulatory strategies are required.

Ellis (2001) concurs, saying that the concept of self regulation was naïve and is even more problematic in an environment with declining union membership; greater small business and self employment; increased establishment of autonomous business units in organisations; and increased outsourcing. She further contends that there is a lack of provision for access to appropriate OHS expertise; that the Robens-style legislation is too general in its statement of responsibilities and provides little guidance on what to do to meet it. Ellis (op. cit.) contends that, in Australia, there is too much legislation, despite the intent that Robens-style legislation would reduce the burden and there is duplication and inconsistencies at different levels and between the jurisdictions.

Walters and Lamm (2003) say of the move to self-regulation:

> "The tradition of protecting workers through setting substantive requirements in which health and safety standards are prescribed, has therefore given way to an approach in which the compliance of duty holders is sought in terms of their management of the processes necessary to achieve improved health and safety outcomes."

They suggest that the various factors that influence and impede the management and enforcement of OHS in small business make the return to the old-fashioned prescriptive standards attractive. In support of this they cite surveys of small business in which the majority of respondents claim that they want to be told precisely what they need to do in order to comply with OHS standards (op. cit. p.14). However, they recognise that a return to prescription is unlikely to occur because of the "…desire on the part of the state to withdraw from its central role in regulation and to create self regulatory approaches to help offset the burgeoning costs associated with state intervention". In this context, the support of large-scale inspection that will be necessary to achieve enforcement in small business is unlikely to occur.

Fairman and Yapp (2005) explored the impact of interventions on compliance with OHS law within six or seven small hairdressing businesses within six local authority-defined areas in the UK and concluded that compliance was not interpreted as complying with the requirements of the law; it was doing what they had been told to do after an inspection or other intervention. Even though there were few interventions, it was the operators' belief that they would be told by someone if they did not comply. Compliance was considered to be a reactive process. Compliance was not found to be part of the decision making processes of business operators. Instead it was a process of making sense of what had to be done; business operators received written materials and guidance but did not necessarily recognise that the information applied to them and there was a general belief that they complied with legislation and no action was required. The main motivators for compliance were identified as; fear of enforcement after non-compliance has been identified; threat of litigation by salon clients; and the threat of withdrawal of trainees by the hairdressing college if non-compliance was not remedied.

Gunningham and Johnstone (1999 p.4) cite organisational ignorance as a major impediment to the success of OHS regulation. They point out that the problem is particularly acute for small businesses that are "…faced with a plethora of regulatory requirements including taxation, superannuation, workers' compensation, consumer and environmental protection as well as OHS. Individuals operating small businesses often express bewilderment at the demands that these regulatory requirements impose upon their time." Fairman and Yapp (2005) concur and suggest that bombardment of businesses with more written information as a reaction to the knowledge that small business operators are ignorant of OHS requirements could simply worsen the situation.

As reported above, Topping et al. (1998) undertook a survey of small business in the UK that used chemicals. It was found that only 65% of respondents were aware of hazardous substance regulation, despite there being more than ten years since implementation. More recently, Addison and Burgess (2002) undertook a survey of small businesses in the UK and found that more than five years after the implementation of the UK Manual Handling Operation Regulations, 38% of businesses had never heard of the regulations and 46% had not performed an assessment as required. Vickers et al. (2003)surveyed small business in the UK and found that 63% of respondents were unable to identify any health and safety legislation affecting their business.

Gunningham and Johnstone (1999) identify economic pressures as another factor that may limit the ability of small business operators to allocate resources to OHS and report that they are often forced to choose between OHS and short term survival. Gunningham (1984), in his examination of the role of OHS law, goes further and points out that there was a fundamental misconception at the core of the Robens philosophy, and that was that employers will have an interest in minimising work hazards. He contends that often employers do not have an interest because the costs of accidents and disease are, in many situations, less than the costs of preventing them.

Hopkins (1995) explains that deregulation is part of the broader paradigm of neo-classical economics (referred to as economic rationalism in Australia), an element of which is give market forces as free a reign as possible. He suggests that an extreme version of economic rationalism applied to OHS holds that workers can be assumed to take account of the risks inherent in the jobs they accept or decline. If employers have difficulty recruiting workers to dangerous jobs they may have to increase the wages and thus those who need the money most or care least about the risks will gain employment. The system does offer incentives to employers who may find it advantageous to invest in safety rather than pay higher wages. However, Hopkins (op. cit.) identifies that in practice workers do not have a means to satisfactorily assess risk, make cost-benefit calculations or shop around for work. In addition the most dangerous jobs in reality are often the worst paid and when the threat to the worker is chronic (i.e. an industrial disease, the effects of which manifest themselves some time after exposure) the costs are borne by the family and broader community, which had no part in the decision to accept the risk. Thus Hopkins (op. cit) concludes that OHS cannot be left to the unfettered operation of the market.

Gunningham explains that in competitive industries at least, management must place profit and productivity above other considerations and, in the event of conflict between these factors and safety, the latter will come a poor second. Further, he suggests that the conflict is even more apparent in the case of health hazards. Unlike traumatic injuries that are visible and involve immediate and substantial costs, the relationship between cause and effect in occupational disease is harder to establish and the delayed on-set of ill health is likely to make the possibility of financial cost seem remote.

In adding weight to their argument that legislative reform is required, Gunningham and Johnstone (1984) point out that the two institutions most capable of combating the problems of legislative compliance, the trade unions and the state regulators, are both confronting increased pressures and difficulties in fulfilling this role. Walters and Lamm (2003 p.7) argue that the absence of any meaningful trade union presence in the small business sector has a bearing on illness and injury rates. They identify “Unionised workers are more likely to exercise their rights to a safe workplace than their non-union counterparts”.

Union membership is much lower among small businesses than among larger ones (Walters & Lamm, 2003) and in general trade unions are facing declining membership for a range of reasons, not least of which is the changing size of firms, mass redundancies and decentralisation of industrial relations (Gunningham, 1984). In regard to Australia, Walters and Lamm (2003 p.17) point out that a size threshold places employers under little obligation to either recognise or facilitate workers' representation on OHS. They support the view that trade union involvement may be fundamental to increasing worker involvement in OHS in small business by citing a range of research on the effectiveness health and safety representatives in larger businesses. However, in arguing that worker involvement will in turn lead to improvements in OHS, they stress the lack of evidence from evaluative research to support this contention.

The second of Gunningham and Johnstone's institutions, the regulators, are receiving fewer resources as a results of trends towards smaller government and fiscal restraint. Regardless of this, Walters (2001) suggests that the sheer numbers of small businesses makes inspection and follow up a very daunting task. Gunningham and Johnstone (1999) report that in the UK in 1991 about half the worksites had not been inspected for three years and nearly 70,000 had not been inspected for eleven years. They report that, in Australia, there is a 22% chance of a workplace being visited by an OHS inspector in any one year. When visiting, the amount of time that may be available for prevention-related activity may be limited given the proportion of inspectors' time that is necessarily taken up by reactive tasks (e.g. accident investigation). Leviton and Sheehy (1996) state that in the USA, regulation, inspection, and enforcement are not currently sufficient to assure that workers are adequately protected under existing standards. Historically, the Occupational Safety and Health Administration (OSHA) has been able to inspect only a minute proportion of all small business. They go on to state that only 0.02% of small businesses in Minnesota undergo OSHA inspections in any one year (Leviton & Sheehy, 1996 p.409).

Hopkins (cited in Gunningham & Johnstone, 1999 p.104) believes that "A visit by an inspector is almost the only way to get to small employers. Moreover, such a visit is likely to be relatively effective since small employers are more impressed than are larger employers by the authority wielded by government inspectors". Conversely, Vickers et al. (2003) found that, when businesses employing less than five people were excluded from the analysis of their survey results, inspected businesses were no more likely to have written health and safety policies, nor were they more likely to be able to identify relevant health and safety legislation than non-inspected businesses.

While Gunningham and Johnstone argue that Hopkins' view is too pessimistic, they agree that the range of tools capable of dealing with small businesses is very limited. In a discussion about strategies that may be used to increase the adoption of safety management systems in the face of the problems associated with current legislative approaches, Gunningham and Johnstone (1984 p.69) propose three options:

1. Leave it to the market (i.e. rely on enlightened self-interest of enterprises in voluntarily implementing management systems) i.e. voluntarism.
2. Require by law that all or some enterprises implement safety management systems, i.e. legislation; or
3. Provide incentives (including subsidies) to enterprises to implement safety management systems, but with no element of compulsion.

Voluntarism relies upon businesses having self-interest in improving OHS, i.e. recognising that OHS is good for business (Gunningham & Johnstone, 1999). However, as discussed above, there is not always a clear relationship between profit and OHS investment and there are situations where OHS and profit do not coincide. Even large businesses sometimes find it difficult to justify expenditure on OHS. Gunningham and Johnstone (p.69) report a survey of a large group of Chief Executive Officers in the USA who were asked what prevents their companies doing a better job on health, safety and environment issues. Over 50% cited the pressure to achieve short-term profits as the main reason. Further, some businesses simply may not realise the benefits to be gained from improved OHS, while others may be incompetent or irrational. In conclusion, Gunningham and Johnstone (op. cit.) believe that voluntarism alone is unlikely to be enough to change industry behaviour substantially.

Given the weaknesses of voluntarism, Gunningham and Johnstone (op. cit.) suggest that, provided the benefits exceed the costs, there is a role for government intervention. They then raise the question of whether the intervention should be by means of regulation or incentive. In regard to the former they point out that enterprises *do* respond positively to the dictates of government, in circumstances where they are most reticent to make changes voluntarily. However, there are obstacles to the successful implementation of effective legislation. Gunningham and Johnstone cite an example of businesses complying with the letter of the law rather than the spirit when writing OHS management systems that remain nothing more than systems on paper. Small business operators in Victoria have been found to purchase expensive respiratory protection simply to show a factory inspector should they be inspected, meanwhile the respiratory protection remains unused (Cowley & Else, 2002).

Given the weaknesses of a direct intervention approach, Gunningham and Johnstone (op. cit.) provide a limited discussion of a mid-way approach between voluntarism and mandate and cite the use of codes of practice as an example. However, they again find weakness and do not claim that it alone will be sufficient to bring about substantial change because, in general, codes provide insufficient detail of to enable employers to meet requirements.

Gunningham and Johnstone (op. cit.) do describe incentive-based approaches as a potentially effective and attractive because; they can influence behaviour without direct intervention in the affairs of enterprises; they encourage them to seek out the most cost-effective solutions to problems; they decentralise decision making to enterprises who often have better information on how to solve a problem than government; and they reduce government enforcement costs. They point out that the effectiveness will, however, depend upon the design and appropriateness of the particular mechanisms adopted. The options that Gunningham and Johnstone list (1999 p.79) are:

- Offering administrative benefits, e.g. easing off on regular inspections
- Supplying a logo or other positive publicity to enterprises
- Making OHS performance a pre-condition for gaining self-insurer status (this will be limited to larger enterprises)
- Giving "up-front" bonuses under the workers compensation system
- Making OHS systems a condition for tendering for major government contracts
- Using subsidies to help businesses commence work on OHS improvements
- Reducing penalties if prosecution takes place
- Using a court order to implement a safety management system.

The main advantages of an incentive based approach that Gunningham and Johnstone report (op. cit.) are that they encourage firms to exceed the bare minimum required by law, and that some firms which would not otherwise participate in a voluntary scheme are persuaded to do so. They do not however, overcome the problem of firms doing the bare minimum to receive the reward while not actually being committed to the OHS measure.

In addition, incentive schemes must not only be carefully designed to ensure that they are attractive to the employer; they must also target particular enterprises. This in turn requires accurate information about the enterprises of interest and this is largely unavailable in regard to small businesses.

As a partial solution to these problems, Gunningham and Johnstone (op. cit.) suggest that one could potentially distinguish between; volunteers (those who recognise the benefits of health and safety measures and embraces the appropriate strategies willingly); recalcitrants (those who do see costs rather than benefits and adopt only as a matter of expediency if the incentives offered are sufficiently powerful; and incompetents (those who could benefit from improved OHS but fail to take the initiative to achieve such improvements through ignorance, lack of in-house competence or organisational capability to understand or implement such improvements). They suggest that having distinguished between employer types, appropriate alternative strategies may be employed.

For example (Gunningham & Johnstone, 1999), volunteers offer a great potential for adoption given their commitment and are likely to adopt even in the absence of incentives. However, incentives may tip the balance. Recalcitrants/the wilfully disobedient are most likely to do the least possible to meet the regulators requirements in order to receive the incentives and without sophisticated measures of true safety performance improvement rather than apparent adoption, little OHS improvement is likely. Incompetents, however, may achieve much better results under an incentives based approach if they can be persuaded of the benefit. This may involve:

1. Enforcement (providing incentives)
2. Reducing resistance
3. Increasing motivation

While these approaches have not been tested and Gunningham and Johnstone recommend experimentation on a limited basis, there are a number of parallels with the approaches used in the application of the theories of diffusion (Rogers, 1995) and individual behaviour change and social marketing (Andreasen, 1995; Kotler, Roberto, & Lee, 2002; Weinreich, 1999a), which are discussed in more detail below.

Walters (2001 p.367) also advocates intervention strategies that "…address the weaknesses of will and capacity, on the part of the owners/managers, to manage health and safety…". He also acknowledges the limited resources of change agents in health and safety and suggests the use of intermediary agencies and processes to mediate, amplify ensure and support the implementation of messages, although the research base for these is seen as being in need of strengthening.

Gunningham and Johnstone's (op. cit.) proposals largely focus on the adoption of safety management systems by businesses of all sizes. Walters (2001) points out that attention to safety management is characteristic of current regulatory strategies, although the term "safety management" has connotations that hardly apply in small businesses, i.e. the practices that are embraced by the term "management" in small business may be quite different from those in larger organisations. The characteristics of small business such as informal structures and relations, an absence of bureaucratic processes and the concentration of authority in the hands of the owner/manager, for example, does not imply that health and safety is not managed, rather that it is managed differently. These differences in approaches to management need to be considered at the design stage of interventions that aim to improve OHS.

In addition Walters (op. cit.) suggests that OHS improvements cannot be tackled in small businesses in the same way as they are in large businesses. However, the assumptions behind the broad legislative strategies on health and safety, in the EU at least, continue to be most influenced by experience of large and stable organisations. Specifically, Walters argues that self-regulation is based on experience of what seems to work best in relation to large organisations with the will and capacity to appreciate the business advantages of health and safety management.

Walters (op. cit.) draws similar conclusions to those of Gunningham and Johnstone (op. cit.) in regard to the efficacy of self-regulatory approaches. Specifically in relation to small businesses he identifies the challenges associated with finding a balance between the provision of operational advice and enforcement and the contradictions that may be associated with the dual role of enforcement agents. It is argued that advice and support should be tailored to the needs of small enterprises and within that sector to the needs of specific groups.

Again in agreement with Gunningham and Johnstone (op. cit.), Walters (op. cit.) identifies the role that trade unions may play in transferring information to the workplace, even though they are weakly organised in small enterprises. Further, he identifies other potential intermediaries such as larger organisations, public sector agencies and local authorities, information agencies, training agencies, business advisors, general and community health care providers, business suppliers and clients and customers. However, Walters concludes that that there has been little serious research undertaken to measure the outcomes of the strategies reviewed.

In the broader area of public health management, Rothschild (1999) presents a framework that uses education, marketing and law as its three classes of strategic tools. He argues that current public health behaviour management relies heavily on education and law while neglecting the underlying philosophy of marketing and exchange. Specifically the framework proposed is for use with targets that may or may not have any motivation, opportunity or ability to cooperate.

Rothschild (op. cit. p.25) defines education as:

> "messages of any type that attempt to inform and/or persuade a target to behave voluntarily in a particular manner but do not provide, on their own, direct and/or immediate reward or punishment…education can teach and create awareness about existing benefits but cannot deliver them…Education (alone) requires the target to initiate the quest for the benefit and/or solicits voluntary compliance."

In summary, Rasmuson's (cited in Rothschild, 1999) definition of health communication is used as: "the development and diffusion of messages to specific audiences in order to influence their knowledge, attitudes, and beliefs in favor of healthy behavioral choice." Similar messages are often used to aid the marketing of a product or service but are not included in Rothschild definition of education. Messages that are used in marketing are different to messages that stand in isolation and are considered to be education.

Rothschild (op. cit. p.25) defines marketing as:

> "…attempts to manage behavior by offering reinforcing incentives and/or consequences in an environment that invites voluntary exchange. The environment is made favourable through the development of choices with comparative advantage (products and services), favorable cost-benefit relationships (pricing), and time and place utility enhancement (channels of distribution). Positive reinforcement is provided when a transaction is completed."

These principles are developed in the discipline of social marketing that are discussed in depth in Section 2.2.4.3 below.

Rothschild (op. cit. p.25) explains that law "…involves the use of coercion to achieve behavior in a nonvoluntary manner…or to threaten with punishment for noncompliance or inappropriate behavior." He distinguishes between law and marketing by explaining that "marketing works through self-monitoring and self-sanctioning after negotiating, whereas law is used as external monitoring and sanctioning when the transaction costs of marketing are too high and the community is not strong enough to reduce these costs on its own." (op. cit. p.25) i.e. law and marketing both offer environmental opportunities and reinforcement of behaviour, but in marketing the behaviour is voluntary and in law it is coerced.

In differentiating between education and marketing, Rothschild (op. cit. p.26) explains that:

> "Education and marketing are similar in that both propose uncoerced, free-choice behavior. In addition, marketing offers a specific timely and explicit payback, whereas education can offer only a promise of future potential payback and is unable to reinforce directly. Whereas marketing offers an explicit exchange and brings it to the target, education implies that an exchange might exist but the target must search for it. Marketing adds choices to the environment, whereas education informs and persuades within the set of choices that

> already exist. Law is similar to marketing in that both offer exchanges in the target's environment; marketing's offerings, though, are presented with free choice that is rewarded, whereas the force of law generally imposes sanctions for noncompliance with the proffered choice. In general, the presence of a reinforcer is incentive (marketing), whereas the withholding of a reinforcer or the onset of a punishment is coercive (backed by the force of law).

In the same way that Gunningham and Johnstone (1999) and Walters (2001) recognised the importance of self-interest in achieving behaviour change among employers, Rothschild (op. cit.) identifies the importance in marketing healthy behaviours. However, the strategies used in commercial marketing assume a level of self-interest in adoption of the product or service being marketed, whereas there is often no apparent self-interest in adopting health related behaviours. This issue is given greater consideration in subsequent sections of this paper; suffice to say at this stage, education and law play on self-interest in quite different ways. Education sometimes recommends and encourages behaviours by promising a self-interested future return (e.g. "if you use a condom you will be less likely to contract a sexually transmitted disease"). Sometimes a societal benefit is offered, (e.g. "drive at a lower speed and fuel will be preserved") and sometimes neither individual nor societal benefits are offered (e.g. 'just say no"). Law demands non-voluntary behaviour and offers a self-interested return by promising not to punish those who behave correctly or cease behaving incorrectly. Rothschild (op. cit.) argues that in both education and law, the self-interest of the society and its managers is pursued, but it is not always clear to the target that its self-interest is being considered.

In marketing an exchange takes place. Explicit payback that is contemporaneous, offers an immediate reward and therefore there is a positive reinforcement for the behaviour. In education the reinforcement is weak because the exchanges are generally later and the payback is not explicit. In law the payback is often contemporaneous and explicit but being based on coercion, is often negative.

In parallel with the strategies of voluntarism or self-regulation and enforcement proposed by Gunningham and Johnstone (1999), Rothschild (op. cit.) considers "paternalism" and "libertarianism" (p.29). Paternalism is where there is a view that the state knows what is best for the individual. Paternalism is described as "…actions by society for the benefit of the individual without the consent of, or contrary to the wishes of, the individual".

Alternatively libertarianism operates from the view that the individual knows what is best and should be left alone to make choices freely. Rothschild (op cit p.30) maps the three strategic tools on to these as follows:

> "Education clearly offers free choice when it is used to inform and/or persuade, but also can lead to greater externalities when citizens choose not to act as mangers wish. If a libertarian were to allow any form of governmental intervention, it would be through informative education. Education suggests society's view of the individual's self-interest to the individual. Law is clearly coercive; even *if* it is used with the best *of* intentions, it would be a tool of a paternalistic government and would limit free choice to control externalities. Law imposes society's view of the individual's self-interest on the individual."

Marketing is thus defined, one interpretation being that it "…assesses the individual's self-interest and makes behavioural opportunities available that satisfy that self-interest; in the resulting exchange, the individual gives up a behavior that leads to the externalities and receives satisfaction of self-interested needs." (Rothschild, 1999 p.30)

In summary, Rothschild (1999 p.30) suggests that:

> "Education assesses and discusses needs but urges the targets to figure out how to meet their own needs. …Education is used to assist targets by helping them realize their needs and be motivated to pursue them, but it cannot be used to satisfy needs because it offers no direct rewards. …Education will be an appropriate tool when individual self-interest is strong and consistent with societal goals but the target merely is uninformed; in such cases, no additional reinforcement is necessary. …Marketing will be appropriate when the level of self-interest is insufficiently consistent with societal goals to elicit behavior. …Law will be appropriate when the pre-existing self-interest of the target cannot be overcome with additional rewards through exchange, when rewarding is inconsistent with societal goals, or when the rights of the target are believed to be irrelevant."

Rothschild proposes that a target of a social intervention may be prone, resistant or unable to adopt the desired behaviour. In commercial marketing this has been described in terms of "motivation, opportunity and ability" (MOA). This is presented in Table 1. Based on this matrix, Rothschild argues that when MOA are all present (cell 1 in Table 1), education is sufficient to manage behaviour. When opportunity is lacking but the target is motivated and able to adopt the desired behaviour, marketing may be sufficient to introduce a product or service that will enable to target adopt the behaviour. Similarly, if only ability is missing (cell 5 in Table 1), education and/or marketing may be sufficient. If there is ability and opportunity but motivation is lacking then law is proposed for consideration. When opportunity is also missing, (cell 4), marketing is suggested. If ability and motivation are lacking (cell 7) education and marketing are suggested. However, it is suggested that law should not be the first recourse in the cells where this is identified as an option given that motivation will often follow once ability and opportunity are addressed. The author (op. cit.) subsequently hypothesises that the cells in which motivation is lacking maybe dominated by lack of awareness and that by using education to raise awareness, motivation may follow. Rothschild (op. cit.) suggests that Table 1 may be used for the purposes of market segmentation.

In accord with the recommendation that social intervention managers use the principles in Table 1, Rothschild (op. cit. p.34) argues that there is a re-emergence of marketing philosophy in behaviour management and it should be used appropriately in concert with the complementary strategies of education and law. However he cites Weibe who wrote that:

> "…it is difficult to sell brotherhood like soap. When marketers sell soap, they have a product that has certain benefits; when they advertise, they can refer buyers to these benefits. Too often, managers of public health behaviors, in effect, tell the target to stop being dirty or threaten to fine the those who remain dirty, rather than offering the target a brand of soap and a rationale as to why the soap's benefits and rewards are superior to remaining dirty. To sell brotherhood like soap, there must be soap; however, in too many cases there is no immediately apparent soap, and as a consequence, it is difficult to show why behavior should occur."

Table 1 Application of Education, Marketing and Law (Rothschild, 1999)

Motivation	**Yes**		**No**	
Opportunity	**Yes**	**No**	**Yes**	**No**
Ability **Yes**	1 Prone to behave *education*	2 Unable to behave *marketing*	3 Resistant to behave *law*	4 Resistant to behave *marketing, law*
No	5 Unable to behave *education, marketing*	6 Unable to behave *education, marketing*	7 Resistant to behave *education, marketing, law*	8 Resistant to behave *education, marketing, law*

2.2.2. Summary

In considering the dilemma regarding traditional approaches to intervention and those that may be practical and appropriate in regard to small business decision-makers, there are possibly three approaches that have traditionally been used to ensure legislative compliance:

1. Leave it to the market i.e. voluntarism

   The neo-classical economic paradigm that underpins self-regulation assumes that employers will have an interest in minimising work hazards. However, organisational ignorance is a major impediment to its success and often employers do not have an interest because the costs of accidents and disease are, in many situations, less than preventing them.

2. Legislative prescription

   There is a role for government intervention but there are obstacles to the successful implementation of effective legislation, not least of which is the sheer numbers of small businesses.

3. Provide incentives with no element of compulsion

   Incentive-based approaches are a potentially effective approach and are attractive because they can influence behaviour without direct intervention in the affairs of enterprises. Important elements of this strategy are education and marketing which draw on the theories of diffusion and individual behaviour change and social marketing, which are discussed in detail below.

2.2.3. Public Health Intervention Models

There is increasingly discussion within the OHS literature regarding the application of successful workplace intervention strategies (a brief analysis of 31 key reports in the literature pertaining to OHS interventions, with particular reference to small business, spanning the decade 1992 to 2001, is provided in table 40 in Appendix 1). Goldenhar and Schulte (1996) reviewed the existing literature relating to OHS interventions and found "that many of the intervention studies conducted lacked a theoretical basis, used small samples, and tested interventions lacking the intensity to cause the desired change. Most studies were non-experimental or quasi-experimental." (p.289). Zwerling et al. (1997) reviewed the literature on the design, conduct and evaluation of occupational injury interventions and found that randomised controlled trials are rare and that non-experimental or quasi-experimental studies often use the weakest designs. Few reports of successful evaluated interventions are available to give guidance to researchers attempting to reach small business.

The public health discipline offers some guidance that may be adapted for use by the OHS discipline. Valente (2002) in his recent text guiding the evaluation of public health promotion programs, suggests that there are at least eight intervention strategies:

1. *Provider Training:* designed to improve the way providers (physicians, counsellors, nurses, etc) communicate with clients and patients and usually conducted within health care facilities, there is little direct relevance to OHS interventions in small business. Goldenhar, Avima et al. (1999) report that educational programs have attempted to reach small business operators but do not provide strong positive results.

2. *Community-based Distribution or Outreach*: Outreach workers convey information at targets' homes or in public locations. While the personal contact is very useful it is a costly strategy where target numbers are large and widely spread and is popular in developing countries where labour costs are low. The strategy is not applicable to small businesses in Australia, given the large numbers and wide geographic spread of the targets.

3. *Community Mobilisation*: Community leaders identify the community's needs and create programs to address them. Events such as fairs, street theatre and advocacy events may be used and are usually limited geographically and serve as pilot programs. There is little direct relevance to OHS interventions in small business.

4. *Entertainment-Education*: Entertainment is used to educate audiences about health issues. Programs may include drama, film, radio and television soap operas, music and variety shows, and talk shows with audience participation. The cost of such a broad strategy relative to the narrow segment of the community (small businesses) that it is desired to reach with regard to specific OHS control measures, makes this approach inappropriate in the current context.

5. *Interactive Health Communication*: In this strategy, computer and other telecommunication technologies are used to deliver health information. Valente (2002) identifies that because such communication is relatively new, evaluations of effectiveness are limited.

    The WorkCover Corporation of South Australia interviewed 400 small business operators by telephone between January and March 2001 and found that one third had access to email/internet at home only, one in six had access to internet/email at work only and a further one third had access at both home and work. Respondents expressed a preference for on-going communication with WorkCover through direct mail. An email survey of 3391 small businesses that elicited responses from 1742 (51%) found that 72% preferred to receive communication via email (Wight, 2001b). The latter survey is clearly biased by those who were comfortable with email and therefore more likely to respond and express a preference for that form of communication.

6. *Multimedia or Community-wide Programs*: This strategy uses a variety of media, enlists community support through opinion leaders and trains provider personnel (Valente, 2002). The programs are comprehensive, attempting to change community norms regarding health and the system that provides it. It is accepted that the best approach to behaviour change is a multimedia approach that reaches the largest possible audience through as many different channels as possible. In this sense, the opportunities for targeting as required when dealing with small business are limited. In addition, Valente (2002) reports that, although a range of multimedia programs have been effective, the gains in intervention communities were soon matched by those in comparison ones.

7. *Mass Media Advertising*: Television, radio and print are used to disseminate information through advertisements. Valente (2002 p.23) suggests that:

> "Advertising campaigns create brand identification and attempt to link specific images to specific products. Although they are not expected to change the behaviour of many people, they are important for a variety of reasons. First they raise awareness of the product or idea, making it widely known. Second, they can establish a positive image for the behaviour making it desirable. Third they can generate interpersonal communication about the behaviour, leading to subsequent behaviour change. Thus, although mass media advertising may not be sufficient for behaviour change, it is often necessary."

Mass media advertising has been widely used by the occupational health and safety authorities in Australia and elsewhere to raise awareness of OHS legislation, legislative change, company and personal obligations and, in a limited number of cases, to increase the adoption of specific OHS risk control measures (Larsson, Rechnitzer, & Lee, 1997). However, both in Australia and overseas, awareness of OHS legislation and obligations remains low and adoption of OHS risk controls is not as widespread as desired (Briggs & Crumbie, 2000; Ellenbecker, 1996; Holmes, Lingard, Yesilyurt, & De Munk, 1999; Holmes, Triggs, Gifford, & Dawkins, 1997; Howell et al., 1998; Jones, 1997; Lamm, 1999; Leviton & Sheehy, 1996; Mayhew, 1997a, 1997b, 1997c; Mayhew & Gibson, 1996; NOHSC, 2001a; Spickett & Howell, 1992; Topping et al., 1998).

Mayhew (1999) reports that many OHS authorities use broadcast mail to reach small business but the success of such campaigns is uncertain. Mayhew subjected 75 cabinetmakers to a mail-based information campaign and concluded that the overall impact was minimal.

Caple et al. (1997) surveyed 400 small business employers in Australia to identify how they receive OHS information. They concluded that much of the OHS information produced and circulated is targeted towards committed employers and OHS practitioners. Further, much of the information is duplicated by the various agencies and the small business employers tend to scan and disregard the majority of this information. The authors suggest that:

> "…future funding relating to OHS information for small business should be targeted towards understanding the methods of networking used successfully by small business to identify trusted sources of information when it is required. The mass production and circulation of generic OHS information is no longer a viable method for penetrating into Australia's small business communities." (p.159)

8. *Social Marketing*: Valente (2002) suggests that the term social marketing is used by some people to describe any promotion of health and social behaviours. Andreasen (1995 p.3) defines social marketing as:

> "…the application of commercial marketing technologies to the analysis, planning, execution, and evaluation of programs designed to influence the voluntary behaviour of target audiences in order to improve personal welfare and that of their society".

Social marketing may be applied to improve OHS in small business and could target employee or employer behaviour to, for example, increase usage of personal protective equipment or other protective behaviour (see for example Brosseau, Parker, Lazovich, Milton, & Dugan, 2002; Kerr, Lusk, & Ronis, 2002; Lazovich et al., 2002; Lusk, L., Ronis, & Hogan, 1997; Lusk, Ronis, Kerr, & Atwood, 1994) application of higher order control measures in response to a specific hazard or risk.

Social marketing as applied to small business decision-maker behaviour is a central focus within this thesis and, as such, the discipline is discussed in detail later in this document.

2.2.4. Behaviour Change Models

In this context the interest lies in the change of the behaviour of the small business operator who makes the decision whether or not to adopt an OHS risk control measure. The application of behaviour change models in this context has not previously been given consideration in the literature. This section therefore reviews a number of the models drawn from the health promotion literature with regard to their application to the small business sector.

Valente (2002) suggests that theory-based evaluation is used to explain how an intervention is expected to change outcomes and offers seven theories that may be chosen from. The choice of theory, he explains, is based on the appropriateness of the theory to answer the research question that is posed. The theories may be categorised in accord with their application to individual behaviour change or changes within a population and are discussed below.

2.2.4.1. Individual Behaviour Change

Gielen and Sleet (2003) reviewed the application of behaviour change theories to injury prevention and suggested that the complexity of injury problems demands complementary and multi-disciplinary approaches to intervention. They argue that such approaches will help researchers avoid the false dichotomy between active and passive approaches and the tendency to choose one over the other (see discussion of safe-place versus safe person in

Section 1.Introduction). Trifiletti et al. (2005) reviewed the use of behavioural and social sciences theories and models in injury prevention research and suggested, “Theories and models help specialists focus on what is changeable and the most suitable areas or targets for change.” and “Theories and models can be useful in planning, implementing and evaluating interventions.” (p.2) They found, however, that of 453 articles identified in PubMed in a search for the Health Belief Model, only 8 (1.8%) addressed injury prevention. In regard to the limited success of interventions that have focussed on injury-related behaviour change, they suggest that there has been a failure to understand the determinants of behaviours and a failure to properly apply health behaviour theory to the development and implementation of interventions.

To explain and predict behaviour change within a target population, various stages of change models have been proposed. Valente (2002 p.41) identifies that “Change takes time and it is wise to classify this process in terms of stages both for individuals and communities.” Weinstein (1988) reviewed various behaviour and stages of change models and pointed out that each is dominated by a cost-benefit, decision-making perspective. The theories assume that people weigh the expected benefits of a precaution against its costs and adopt the precaution if the balance appears favourable. The various theories differ mainly in the range of cost benefits that are considered. Weinstein refers particularly to the Theory of Reasoned Action, the Health Belief Model, the subjective expected utility theory and Roger’s protection motivation theory but broadly encompasses other models discussed by Valente (2002) in his review.

Weinstein proposes an argument that earlier models of preventive behaviour focus narrowly on the perception of the threat and the perception of the precaution under consideration. The principal variables are therefore perceived susceptibility (likelihood of being harmed if the precaution is not adopted), perceived severity (amount of harm that may occur), perceived effectiveness of the precaution and perceived costs (time, energy, money). Weinstein argues that consideration of these variables in a linear and algebraic fashion implies that nothing changes during the entire precaution-adoption process except the value of the variables in the equation. A further limitation of the earlier models is that they focus on a single threat and a single preventive response. Weinstein (1988 p.358) therefore proposes a staged approached that suggests:

> "…that people at different points in the precaution adoption process behave in qualitatively different ways and (b) that the kinds of interventions and information needed to move closer to action will vary from stage to stage. In fact it can be difficult to get people to move from one stage to the next, transitions between stages can be viewed as barriers that must be overcome before action is taken."

Arguing in favour of his staged model, Weinstein suggests that earlier propositions that beliefs about susceptibility might be indicated on a rating scale and therefore a continuum are inappropriate. For example, studies that have focussed on belief about susceptibility to familiar hazards may overlook the important period of time when people have no opinions about a hazard because they have not heard of it. Weinstein states that stages in his model "are dichotomous variables; a person has either reached a stage or has not." (Weinstein, 1988 p.359) At the same time, he points out that the criteria that define the respective stages are not limited to two levels because people do distinguish among the risks to which they are vulnerable. However, he suggests that the staged model does imply that a qualitative change occurs in behaviour and thought when each of these beliefs passes a threshold. As an individual is exposed to new information and experiences, movement between stages may be backward as well as forward. Weinstein's staged model is illustrated in Figure 1.

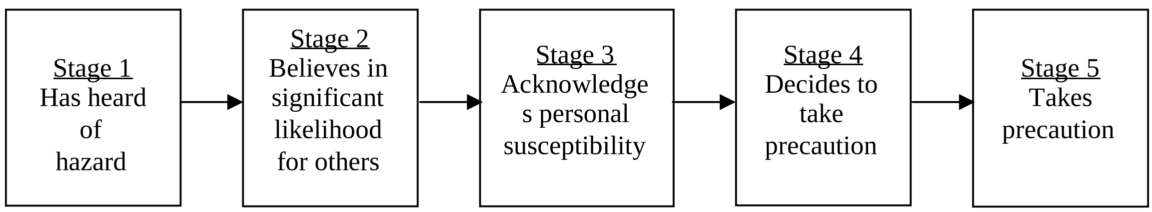

Figure 1 Weinstein's (1988) stages of belief, decision and action

In stage 1 of Weinstein's model, communications are emphasised, as people must first learn that a hazard exists. There is a qualitative difference between a person who has not heard of a hazard and a person who has heard about the hazard, thought about the issue and concluded that there is no risk. The first person will be open minded but not actively seek information. The second person will selectively attend to messages that support their position.

Weinstein refers to the significance of mass communication and suggests that this form of communication usually addresses the question of whether something is really hazardous and whether it is a hazard for many people, thus influencing movement to stage 2. But Weinstein points out that mass communications seldom establish clearly *who* is likely to be affected and it is therefore relatively easy for people to conclude that it is not their problem.

When communication does not provide certainty, optimistic bias can occur and become a barrier to the adoption of precautions (Weinstein, 1988). Optimistic bias is defined by Weinstein as an "erroneous belief that our own risk is less than that faced by others…" Weinstein reports research that has shown that hazards that are most likely to evoke optimistic bias are the ones we seldom encounter, that we think are preventable and that we encounter early in life. Seldom encountering ill-health in small business was discussed in Section 2.1 (Ashford & Zwetsloot, 2000; Eakin, 1992; Jones, 1999; Kunreuther et al., 1985) and optimistic bias is specifically mentioned by Goldenhar et al. (1999) in regard to the risk perceptions of dry cleaners working with perchloroethylene. Weinstein (op. cit.) suggests that both personal experience and information about the factors that determine susceptibility help reduce optimistic biases, as will information about the precautions that peers are taking. He comments that general facts about hazards are unlikely to move people beyond stage 2.

Which hazard severity, susceptibility or precaution effectiveness stage a person is at has implications for their open-mindedness and interest in further information. For example, little interest in precautions would be expected until the hazard is thought to present a significant personal threat. Weinstein proposes major determinants at each stage of his model that govern the progress of an individual to subsequent stages. These determinants are listed in Table 2.

Also important in determining preventive behaviour is the perceived cost. Cost as used in behaviour change models includes; the time and effort required to carry out the precaution; the expense; any undesirable side effects; the loss of pleasure from the behaviour that must change; the possibility that the precaution is unavailable to the individual; and similar obstacles (Weinstein, 1988). Because cost encompasses difficulty, it is possible that an individual may doubt their ability and therefore self-efficacy becomes a factor. The decision to act (i.e. adopt a precaution), therefore, requires an individual to believe that they are susceptible, that the hazard would have personally negative consequences and that the precaution would be personally effective.

Weinstein suggests that each variable would have to exceed some minimum value before an individual would decide to take a precaution. Therefore, the decision to act would also take in to account the extent to which the minimum values are exceeded and thus reflect the perceived *magnitude* of the severity and likelihood, the *degree* of effectiveness, and the *size* of the cost that would be incurred (Weinstein, 1988).

In OHS risk assessment an algebraic computation of risk is commonly used. Rowe (1988), for example, proposes that "risk estimation involves two basic parts: a probability determination and a consequence value determination…Risk, then, is a function of the probability of the consequence and the value of the consequence to the risk taker" (p.37). Other authors such as Petersen (1998) (see also Bamber, 1999) have offered a simplified risk score formula (Risk Score = Probability x Exposure x Consequence). A number of behaviour change models similarly determine perceived seriousness through the multiplication of perceived likelihood and perceived severity (Weinstein, 1988). Weinstein questions the rationale behind the algebraic approach given the inherent assumption about interaction between the variables and their independence. In answer he proposes a more complex decision rule that incorporates the notion of cut-offs, i.e. "people may regard a problem as undeserving of preventive action if *either* likelihood *or* severity is below a minimum level (in such a rule, the two variables are *not* independent), but once variables exceed cut-off, seriousness may be an additive (independent) function of the two factors" (Weinstein, 1988 p.367). In support of this view, Weinstein argues that even in laboratory studies it is clear that people often reach decisions without ever combining the expected outcomes into a single measure of value and questions the validity of models that assume they do.

Kunreuther et al. (1985) discussed the use of algebraic computations in risk assessment in the context of behaviour change models. They explain that according to the expected utility theory a risk-averse person increases demand for a protective activity if the probability of the event decreases and the negative outcome proportionately increases so that the expected loss remains constant. However, “individuals often violate the axioms on which the expected utility theory is grounded and make choices which are inconsistent with those predicted by the theory”. (Kunreuther et al., 1985 p.2)

Table 2 Major determinants in the stages of decision and action (Weinstein, 1988)

Stage of Change				
Stage 1 Has heard of hazard	Stage 2 Believes in significant likelihood for others	Stage 3 Acknowledges personal susceptibility	Stage 4 Decides to take precaution	Stage 5 Takes precaution
Major Determinants				
Communications about the hazards	Credibility and clarity of communications about prevalence	Risk factor information	Beliefs about seriousness of threat	Factors determining strength of intention to act (listed in stage 4)
Experience with the hazards	Experience with the hazard	Personalised risk information	Beliefs about personal susceptibility	Complexity of precaution
		Experience with the hazard	Beliefs about personal severity	Ease of obtaining information required to carry out precaution
		Information about peers’ status on risk factors	Behaviours of others and communications directly indicating threat seriousness	Time, effort and resources required by precaution
			Salience of short and long term threat	Time, effort and resources available considering competing life demands
			Beliefs about precaution effectiveness for oneself	Time until hazard appears
			Beliefs about barriers to adoption of precautions	Opportunities that decrease costs of acting
			Behaviour of others and communications directly indicating desirability of precaution	Reminders of threat
			Salience of short and long term costs	Reminders to take precaution
			Alternative precautions available	

Kunreuther et al. (1985) discuss the importance of interpersonal influence and past experience on the adoption of protective activities, using the examples of seat belt usage and purchase of flood damage insurance. They propose that individuals faced with the same objective risk will have differing perceptions of the expected loss owing to past experience and information that they have collected from publications and from friends, neighbours and acquaintances.

In the discussion of past experience Kunreuther et al. point out that protective activities differ from consumption goods because they are contingent claims. Rewards are received only when a particular state of nature occurs (e.g. an accident). Weinstein (1988) discusses this issue in the context of cost versus benefit of adoption of a precaution. He suggests that costs are usually certain whereas the benefits are more hypothetical, i.e. “An individual has no assurance that taking a precaution will make any difference in the long run because there is only a possibility that the hazard will ever appear” (p.368). This issue once again is supported by the anecdotal experience with small business of Jones (1997; 1999) and others discussed earlier.

Weinstein (1988) discusses a number of influences on the decision process. These include salience (the extent to which different aspects of the hazard hold our attention) and time dependency of costs and benefits. The latter is of particular interest to the present discussion given the long term and sometimes delayed effect of chemical exposure in the workplace. Weinstein suggests that even if people sometimes consider long-term effects, there is evidence that they weigh short-term consequences more heavily in making decisions.

In addition, hazard seriousness influences the decision to act and, in support of Kunreuther et al. (1985), Weinstein (1988) suggests that people often appear to acquire their notion of risk seriousness directly from acquaintances or from the media rather than deriving it from separate beliefs about susceptibility and severity. Another direct influence comes from others and sometimes the whole decision process is by-passed and people rely on the behaviour and opinions of others to guide their own actions. The direct influence of others, rather than a cost-benefit analysis, appears more likely when (a) issues are complex, (b) the requisite information is difficult to obtain, (c) the choices of others are apparent (d) experience with the hazard is limited, and (e) the cost of the action is relatively small (Weinstein, 1988 p.373).

Emotions will also influence the decision to act. Worry and fear can be used to focus an individual's attention and maintain awareness of a hazard. Hastings and Webb (2004) reviewed the literature addressing fear appeals in social marketing and found that laboratory-based research supported the use of fear in advertising, especially if the target has self-efficacy and can adopt a coping strategy. However, they question the relevance of this research to the real world communications environment. They found only a limited number of reports of intervention studies and among those the evidence suggested that fear campaigns raise awareness and change attitudes but do not change behaviour. They identified no research that dealt with the effect of fear in marketing communications on relationships with customers but they question the likelihood of building a lasting relationship with a customer that feels threatened. In regard to communications with stakeholders they point out that the emphasis is usually on shared objectives and mutual respect but they cite marketing campaigns by charities as anomalous given the need to portray the beneficiaries of the charity as at risk. Charities employing fear strategies are at risk of creating fear within the intended beneficiaries of the charity if they are exposed to the marketing communications. Thus fear appeals may have ethical issues associated with them and there is the potential for them to have a deleterious effect rather than a positive effect on the targets. Weinstein (1988) comments on fear and suggest that because the threat to the individual is often not immediate, it has limited use in the decision process. The commercial marketing literature also dismisses fear as a useful lever (Kotler, Brown, Adam, & Armstrong, 2001).

Deciding to act is not the same as acting and progression through the staged model should not be measured by an individual's statement of intention to act. Weinstein (op. cit. p.375) describes factors that may intervene in change the process including; there being a low need for action because the risk is low or has a low priority or because the precaution is risky or not very beneficial; the action required is unavailable or circumstances interfere with the action; the action proves difficult to initiate because of a lack of information or it is forgotten or it is not habitual; the action proves burdensome because it is unpleasant or uncomfortable or the present behaviour is enjoyable or hard to give up or the action is difficult or time consuming.

Further to these reasons for not acting are reasons for not maintaining a behaviour change. Often these are cited as being related to the absence of concrete rewards and the desire to protect oneself may be insufficient (Weinstein, 1988).

To simplify and refine many of the principles outlined above, Prochaska and colleagues (Prochaska & DiClemente, 1986; Prochaska & Velicer, 1997b) have proposed a Transtheoretical Model (TTM) of health behaviour change. The model aims to integrate processes and principles of change from different theories of intervention, hence the name "Transtheoretical". The model construes change as a process involving a series of six stages (Prochaska & Velicer, 1997b):

1. Precontemplation
2. Contemplation
3. Preparation
4. Action
5. Maintenance
6. Termination

Precontemplation is the stage in which people are not intending to take action in the foreseeable future, usually measured as the next six months. People may at this stage be uninformed or under-informed about the consequences of their behaviour and will avoid reading, thinking or talking about their behaviours.

Contemplation is the stage in which people are intending to change in the next six months. They are more aware of the pros of changing but are also acutely aware of the cons. The balance between the pros and cons can lead to ambivalence and Prochaska and Velicer (p.39) refer to a phenomenon known as "chronic contemplation or behavioural procrastination".

Preparation is the stage in which people are intending to take action in the immediate future, usually measured as the next month.

Action is the stage in which people have made specific and overt modifications in their lifestyles within the past six months. Action is an observable behavioural change and people have attained “a criterion that scientists and professionals agree is sufficient to reduce risks for disease” (p.39).

Maintenance is the stage in which people are working to prevent relapse.

Termination is the stage in which individuals have zero temptation and 100% self-efficacy.

In earlier versions of Prochaska’s TTM an individual’s movement through just four stages was proposed as shown in Figure 2.

Precontemplation → Contemplation → Action → Maintenance

Figure 2 Four-stage Stages of Change Model (Prochaska & DiClemente, 1986)

The development of the model to include six stages has been given some consideration by Prochaska (2002) in more recent writing and the inclusion of the “preparation” stage is useful. The relevance of a “termination” stage in treating the health related behaviours of individuals, particularly addictive behaviours, is self-evident. However, in the application of the TTM to the adoption of OHS controls, the termination stage is less relevant unless it could be argued in the context of a hierarchy of controls. For example, rather than adopting a risk control measure such as local exhaust ventilation or personal protective equipment that requires the on-going maintenance and reinforcement, the small business operator has adopted a risk control strategy from the top of a hierarchy i.e. “risk elimination”.

Prochaska and Velicer (1997b) describe ten “Processes of Change” that are the covert and overt activities that people use to progress through the stages of change. These are:

1. *Consciousness raising* that involves increased awareness about the causes, consequences and cures for a particular problem behaviour.

2. *Dramatic relief* initially produces increased emotional experiences followed by reduced affect if appropriate action is taken.
3. *Self-reevaluation* involves assessment of one's self-image with and without the unhealthy behaviour
4. *Environmental re-evaluation* combines both affective and cognitive assessments of how the presence or absence of the behaviour affects one's social environment (e.g. effect of smoking on others).
5. *Self-liberation* is both the belief that one can change and the commitment and recommitment to act on that belief.
6. *Social liberation* requires an increase in social opportunities or alternatives that will assist in the behaviour change.
7. *Counter conditioning* requires the learning of healthier behaviours that can substitute the unhealthy behaviours.
8. *Stimulus control* removes cues for unhealthy behaviour and prompts the preferred behaviour.
9. *Contingency management* provides consequences for taking steps in a particular direction (rewards in preference to punishments).
10. *Helping relationships* combine caring trust, openness and acceptance as well as support for the preferred behaviour.

The importance of self-efficacy (situation-specific confidence that a person has in their ability to cope with the behaviour change) and the individual's assessment of pros and cons of adopting the desired behaviour change are emphasised in both Weinstein's Precaution Adoption Process (Weinstein, 1988), and Prochaska's TTM (Prochaska & DiClemente, 1986; Prochaska & Velicer, 1997b). Prochaska et al. (Prochaska & Velicer, 1997b p.40) refer to the individual's assessment of pros and cons as "Decisional Balance". Their research shows that generally the cons of changing are higher than the pros for people in precontemplation and the pros increase between precontemplation and contemplation. Generally, from contemplation to action, cons of changing are lower in action than in contemplation. The pros of changing are higher than the cons for people in action. Prochaska and Velicer (1997b) believe that these research findings suggest principles for progressing through the stages:

> "To progress from precontemplation, the pros of changing must increase. To progress from contemplation to action, the cons of changing must decrease. So with people in precontemplation, we would target the pros for intervention and save the cons for after they progress to contemplation. Before progressing to action, we would want to see the pros and cons crossing over, with the pros higher than the cons as a sign of being well prepared for action." (p.41-42)

Prochaska and Velicer (1997b) have explored a mathematical relationship between pros and cons. They conclude that in moving from precontemplation to action the pros of changing must increase twice as much as the cons decrease. Therefore, twice as much emphasis should be placed on raising the benefits as on reducing the costs and barriers.

Collectively these models make a significant contribution to health behaviour modification theory. However, it should be noted that there has been some criticism of the term "stage theory" as applied by Prochaska and Velicer to the TTM. In his editorial in a special issue of the American Journal of Health Promotion, Albert Bandura (1997) suggested that the change continuum in the TTM is arbitrarily subdivided into stages and is simplistic. He argues that in a true stage theory, the stages constitute a fixed sequence of changes that everyone must pass through, and changes cannot be skipped along the way and are non-reversible (he cites an example of a butterfly developing through stages). In their defence, in the same edition, Prochaska and Velicer (1997a) argue that there is no universal definition of "stage theory" and that one should not become focussed on the theory so much as the application and thus what the models offer to disciplines such as social marketing. Notwithstanding the criticisms, the TTM is widely used.

While, Weinstein's Precaution Adoption Process (Weinstein, 1988), and Prochaska's (Prochaska & DiClemente, 1986; Prochaska & Velicer, 1997b) TTM may offer a valuable insight to behaviour change that may inform strategies for interventions in *individual* small businesses, the work of Everett Rogers should be considered because it has specifically defined the processes by which innovations are diffused among members of a social system and therefore may specifically inform the strategies used in *groups* of small businesses.

Leviton and Sheehy (1996), studied the adoption of airborne contaminant controls at vehicle radiator repair shops in the USA. These repair shops were predominantly small businesses and there was potential for exposure to lead fume during soldering and lead dust during cleaning. They discussed the failure of traditional approaches to increase the adoption of OHS controls by small business and conclude that Prochaska's (1997b) TTM and Rogers' (1995) Diffusion theory and the related social marketing seem relevant to the situation. In justifying this conclusion they proposed the categorisation of repair shop business operators against the respective stages of change. The hypothesis was not, however, tested.

2.2.4.2. Diffusion of Innovations

Diffusion is proposed by Rogers (1995) as "…the process by which an *innovation* is *communicated* through certain *channels* over *time* among members of a *social system.*" (p10). Weinreich (1999a), in her social marketing text, suggests, "Whereas the Transtheoretical Model follows an individual moving through time, the Diffusion of Innovations Model describes a particular innovation moving through a population over time."

Katz (1999) has traced diffusion theory back to the work of Gabriel Tarde, a jurist, criminologist, novelist, statistician, and psychologist who died in Paris in 1904. Katz (op. cit.) discusses Tarde's essay "L'opinion et la conversation" first published in 1898 and his "Laws of Imitation" published in 1903. Tarde believed that interconnected individuals (and groups and nations) copied each other (albeit not random others) in a semi-conscious way (Katz, 1999 p.148). He later made it clear in his writings that he believed that conversation was the key to imitation (i.e. influence). He proposed that an innovation spreads in concentric circles, flowing smoothly until it encounters a barrier. The flow therefore "…proceeds in stages, having a slow advance in the beginning, followed by rapid and uniformly accelerated progress that continues to slacken until it finally stops." (Katz, 1999 p.149) Thus interest in the flow of ideas through groups over time emerged. Rogers (1995) subsequently proposed that the four main elements of the diffusion process (innovation, communication channels, time and the social system) are identifiable in every diffusion program.

Rogers (1995 p10) defines an innovation as “an idea, practice, or object that is perceived as new by an individual or other unit of adoption”. In this sense diffusion theory may be very widely used and has in fact been incorporated as a core element of commercial marketing theory (see for example Kotler et al., 2001; McColl-Kennedy, Kiel, Lusch, & Lusch, 1994; Quester, Guiggan, McCarthy, & Perrealt, 2001).

In OHS and specifically industrial hygiene, an innovation may, for example, be a new process that no longer uses a potentially harmful chemical, a safer chemical substitute, a ventilation system, a mechanical lifting aid, an item of personal protective equipment or a safe work procedure.

Rogers uses diffusion theory to explain why some innovations are adopted more rapidly than others. Significant are the characteristics of the innovation (Rogers, 1995 p.15-16):

- The Relative advantage – the degree to which an innovation is perceived as better than the idea it supersedes. The degree of relative advantage may be measured in economic terms, but social prestige, convenience and satisfaction are also important factors. Rogers (1995) points out that the objective advantage is of less importance than the perceived advantage.

- Compatibility – the degree to which an innovation is perceived as being consistent with the existing values, past experiences and needs of the potential adopters.

- Complexity – the degree to which an innovation is perceived as being difficult to understand and use.

- Trialability – the degree to which an innovation may be experimented with on a limited basis. An innovation that is trialable represents less uncertainty.

- Observability – the degree to which the results of an innovation are visible to others i.e. the easier it is to see the results of an innovation, the more likely they are to adopt.

Therefore, innovations that are perceived as having greater relative advantage, compatibility, trialability and observability and less complexity will be adopted more rapidly than other innovations.

Rogers (1995) emphasises the importance of communication which he defines as (p17):

> "…the process by which participants create and share information with one another in order to reach a mutual understanding. Diffusion is a particular type of communication in which the message content that is exchanged is concerned with a new idea."

The information exchange process at its most elementary form involves:

> "(1) an innovation, (2) an individual or other unit of adoption that has knowledge of the innovation or experience with using it, (3) another individual or other unit that does not yet have experience with the innovation, and (4) a communication channel connecting the two units. A communication channel is the means by which messages get from one individual to another." (Rogers, 1995 p.18)

Rogers (1995) discusses the importance of mass media as an efficient and rapid means of communication but acknowledges that interpersonal channels are more effective at persuading an individual to accept a new idea.

Time, the third element of Roger's diffusion process, refers to the (1) innovation-decision process by which a person passes from first knowledge of an innovation through its adoption or rejection, (2) the innovativeness of the individual and (3) the rate of adoption of an innovation within a system.

Rogers (1995) proposes that during the innovation-decision process an individual passes from first knowledge of an innovation to forming an attitude toward the innovation, to a decision to adopt or reject, to implementation and use of the idea, and to confirmation of this decision. This is illustrated in Figure 3 and is clearly aligned with Weinstein's and Prochaska's models, discussed above.

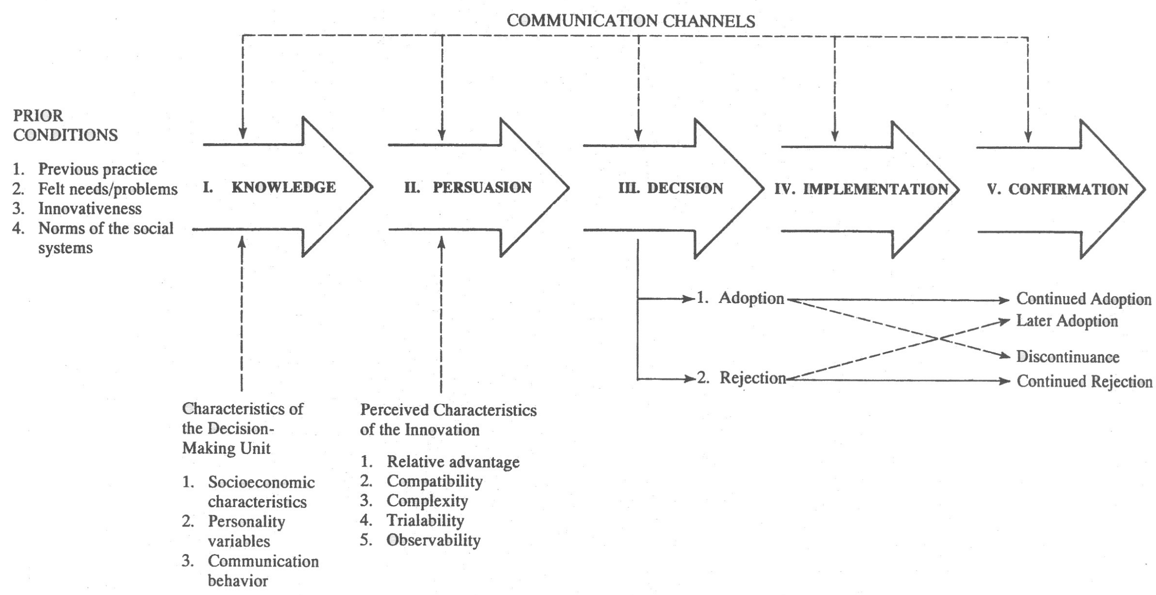

Figure 3 Rogers' Innovation-Decision Process (Rogers, 1995 p.163)

Figure 3 is explained by Rogers (1995 p.163) as follows:

1. "Knowledge occurs when an individual (or other decision-making unit) is exposed to an innovation's existence and gains some understanding of how it functions.

2. Persuasion occurs when an individual (or some other decision-making unit) forms a favourable or unfavourable attitude toward the innovation.

3. Decision occurs when an individual (or some other decision-making unit) engages in activities that lead to a choice to adopt or reject the innovation.

4. Implementation occurs when an individual (or other decision-making unit) puts an innovation into use.

5. Confirmation occurs when an individual (or some other decision making unit) seeks reinforcement of an innovation-decision already made, or reverses a previous decision to adopt or reject the innovation if exposed to conflicting messages about the innovation."

Clearly the links are strong with the various behaviour change models discussed above. In regard to this, Winett et al. (1995) reminds us that the process is not unidirectional, i.e. a person can move back and forth between stages (recycle). Further, people sometimes customise or modify an innovation to best suit them (reinvention). In some cases this may enhance the likelihood of adoption and maintenance; in others it may compromise effectiveness.

The model is useful in general in providing a perspective on the ways in which employers and employees may move from ignorance about a risk control through to deciding to implement and use a control. The importance of measuring usage rather than just, for example, purchase of a technical control or documentation of a new system of work that may not be used is highlighted by Fichman (1999).

Rogers (1995) refers to innovativeness to describe the degree to which an individual (or other unit) is relatively early in adopting new ideas. As such potential adopters of innovations can be categorised and, with knowledge of the constituents of the target population, strategies can be employed to increase the rate of adoption.

Rogers' argues that the time element of the diffusion process allows us to classify adopter categories and to draw diffusion curves. The adoption of an innovation usually follows a normal, bell-shaped curve when plotted on a frequency basis and if the cumulative number of adopters is plotted, an S-shaped curve as shown in Figure 4.

The S-shaped adopter curve rises slowly at first when there are few adopters and then accelerates to a maximum until half of the individuals in a system have adopted the innovation. The curve increases at a gradually slower rate as fewer and fewer individuals adopt. Rogers (1995 p.259) explains:

> "We expect a normal adopter distribution for an innovation because of the cumulatively increasing influences upon an individual to adopt or reject an innovation, resulting from the activation of peer networks about the innovation in a system. This influence results from information exchange through interpersonal networks. If the first adopter of an innovation discusses it with two other members of the system, and each of these two adopters passes the new idea along to two peers, and so forth…the process is similar to that of an unchecked infectious epidemic…The S-shaped diffusion curve begins to level off after half

of the individuals in a social system have adopted, because each new adopter finds it increasingly difficult to tell the new idea to a peer who has not yet adopted…”

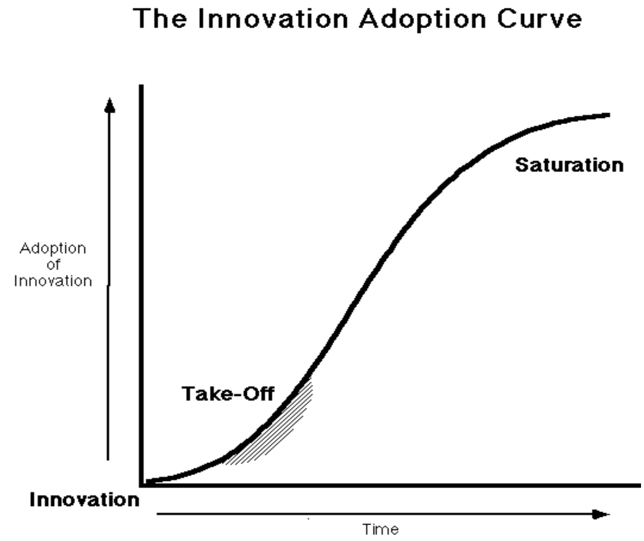

Figure 4 Cumulative Number of Adopters (after Rogers, 1995)

Rogers’ five adopter categories are based around the mean of the individuals in the system under observation. The mean and the standard deviation are used to divide a normal adopter distribution into categories as shown in Figure 5.

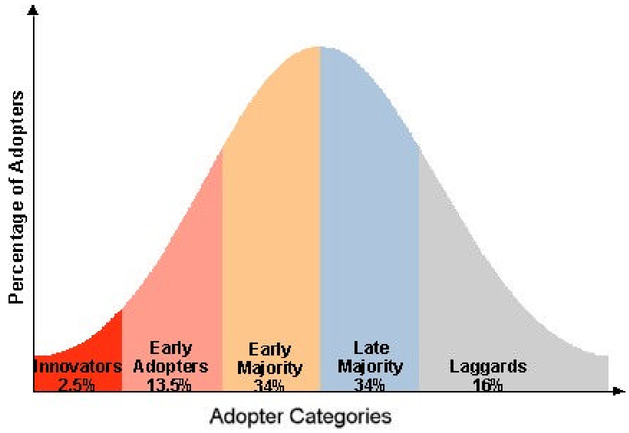

Figure 5 Adopter Categories (after Rogers, 1995)

Rogers (1995) describes the adopter categories as follows:

> *Innovators* are venturesome. The have an interest in new ideas that leads them out of a local circle of peer networks and into more cosmopolite social relationships. They have an ability to understand and apply complex technical knowledge and are able to cope with a high degree of uncertainty about an innovation at the time of adoption. The innovator is a gatekeeper in the flow of new ideas into a system.
>
> *Early adopters* are a more integrated part of the local system than are innovators. Rather than being cosmopolites they are localites. This category has the greatest degree of opinion leadership. Potential adopters look to early adopters for advice and information about the innovation (see below for greater consideration of opinion leadership). The early adopter is respected by peers and earns and maintains esteem by making judicious innovation related decisions. This category commands respect.
>
> *Early majority* are deliberate. They adopt new ideas just before the average member of a system. The early majority interact frequently with peers but seldom hold positions of opinion leadership. They make up one-third of the members of a system and provide interconnectedness in the systems interpersonal networks. They may deliberate for some time before adopting an innovation.
>
> *Late majority* are sceptical. Innovations are approached with scepticism and caution. They adopt new ideas just after the average member of the system. The weight of the system norms must favour an innovation before they are convinced. Adoption may be an economic necessity for the late majority and the result of increasing network pressures from peers. Relatively scarce resources mean that most uncertainty about an innovation must be removed before they feel it is safe to adopt.

Laggards are traditional and the last in the social system to adopt. Their decisions are largely based on what has been done in the past. They are suspicious of innovations and undergo a long innovation-decision process. They possess no opinion leadership and may be near-isolates in the social networks. They interact with people who have similar traditional values.

Rogers (1995) offers a number of generalisations about adopter categories under the headings of (1) socio-economic status, (2) personality values, and (3) communication behaviour.

1. Socio-economic status

Compared to later adopters, early adopters:

- Are not different in age
- Have more years of formal education
- Are more likely to be literate
- Have higher social status
- Have a greater degree of upward social mobility
- Have larger units (factories, farms, companies, etc)

2. Personality

Compared to later adopters, early adopters:

- Have greater empathy (ability to project oneself into the role of another person)
- Are less dogmatic
- Have a greater ability to deal with abstractions
- Have greater rationality
- Have greater intelligence
- Have a more favourable attitude towards change
- Are better able to cope with uncertainty

- Have a more favourable attitude toward science
- Are less fatalistic
- Have higher aspirations

3. Communication behaviour

Compared to later adopters, early adopters:

- Have more social participation
- Are more interconnected through interpersonal networks
- Are more cosmopolite
- Have more change agent contact
- Have greater exposure to mass media
- Have greater exposure to interpersonal communication channels
- More actively seek information about innovations
- Have greater knowledge of innovations
- Have a high degree of opinion leadership

The distinctive characteristics of the adopter categories mean that they may be used for audience segmentation (Rogers, 1995). As such, Rogers' work forms the basis of the most widely held theory of communication in marketing (Kotler & Andreasen, 1987; Kotler et al., 2001; McColl-Kennedy, Kiel, Lusch, & Lusch, 1992; McColl-Kennedy et al., 1994; Quester et al., 2001; Wright & Chariett, 1995). In the marketing discipline it is proposed that, once an overall target market for the innovation is selected, innovators and early adopters should specifically be targeted. As the product gains acceptance, the focus of attention should shift to the early and late majority.

Wright and Chariett (1995) have questioned the validity of Rogers' adopter categories in this context given that Rogers gives no method of predicting how profiles will vary across industries. They argue, "…consumers are innovators not because of some underlying general trait of "innovativeness", but merely because they are one of the first 2.5% of first purchasers, regardless of their demographic, socio-economic, or personality characteristics, and regardless of their behaviour in other circumstances." (p.34). In addition they point out that use of a distribution about a mean and calculation of standard deviations prevents the identification of adopter categories until the process of diffusion is complete.

Notwithstanding the arguments of Wright and Chariett, Rogers' model is probably one of the most widely used theories of behaviour change and has been useful for forecasting future levels of behaviour and providing insights to cultural change (Valente, 2002) and in concert with other models of behaviour change may offer opportunities to increase our understanding of the adoption of OHS controls by business.

Winett et al. (1995) in developing a conceptual and strategic framework for the application of diffusion theory, stress that diffusion research is descriptive and post hoc, with most research being conducted primarily after an innovation has been introduced. In many cases diffusion research is conducted years after the diffusion process in an attempt to track the diffusion through a population. However, they point out that the analyses have been important in the development and confirmation of the theory and now inform the experimental intervention trials being conducted in contemporary behavioural change research.

Rogers' models are significant not only in terms of categorisation of adopters but also in terms of the attributes of innovations that influence the rate of adoption and the role of opinion leaders. Social marketing draws together various behaviour change and intervention evaluation theories and is discussed in the next section.

2.2.4.3. Social Marketing

While there has been discussion in the literature of the principles of *commercial* marketing applied to OHS (Godkin, 1991; Hocking, 1991; Holmes, 1993; Tait & Walker, 2000), there is no reference in the literature and little other evidence of the application of *social marketing* principles to OHS. Where social marketing and health promotion models are referred to in the context of OHS, it is has been in regard to the adoption of personal protective behaviours or equipment by individual workers. For example Welbourne and Booth-Butterfield (2005) used the theory of planned behaviour (TPB) to evaluate a safety message for fire fighters in regarding to avoidance of structural collapse and found that the TPB variables did predict intentions. Lusk et al. (1997; 1994), Stephenson and Stephenson (Undated), and Melamed et al. (1996) applied the health promotion model to different groups of workers in the United States to encourage hearing protection use and report positive results; Guidotti et al.. specifically applied a social marketing model to the safety and health behaviours of oil sands workers at work and home in Fort McMurray (Guidotti, Ford, & Wheeler, 2000; Guidotti, Watson, Wheeler, & Jhangri, 1996; Guidotti, Watson, Wheeler, & Jhangri, 1997), focussing on protective behaviour in regard to solar radiation and use of eye and ear protection; the results beyond the baseline surveys have not, however, been reported. Lazovitch et al. successfully applied a stages of change model to small woodworking businesses in Minnesota, which included education about use of engineering controls such as local exhaust ventilation, although the emphasis was on modification of the behaviour of the individual workers in regard to minimising dust exposure (Brosseau et al., 2002; Lazovich et al., 2002).

Social marketing was first recognised during the 1960's (Andreasen, 2003; Elliott, Unsworth, Gomel, Saunders, & Mira, 1994) and draws together various behaviour change and intervention evaluation theories discussed above and is defined as:

> "…the application of commercial marketing technologies to the analysis, planning, execution, and evaluation of programs designed to influence the voluntary behaviour of target audiences in order to improve personal welfare and that of the society of which they are part" (Andreasen, 2003 p.296).

The parallels between social marketing and commercial sector marketing are very close. However, Elliot el at (1994) suggest that the distinguishing characteristics are the emphasis on the exchange of behaviours and ideas rather than goods. The American Marketing Association define commercial marketing as (American Marketing Association, 2004 p.17):

> "…an organizational function and a set of processes for creating, communicating and delivering value to customers and for managing customer relationships in ways that benefit the organization and its stakeholders".

Needs are related to Abraham Maslow's hierarchy of needs (Kotler et al., 2001) and are defined as a state of felt deprivation. Wants are objects that satisfy those needs. Kotler et al. (2001) proposes that those wants become demands when the consumer has buying power.

The objectives of social marketing set it apart from commercial marketing. For example, consumer marketing may aim to influence the brand choice of an individual (e.g. a brand of toothpaste) while social marketing aims to influence the behaviour of the individual in relation to oral hygiene (e.g. increase the frequency of teeth cleaning) (Kotler & Andreasen, 1987). Specifically Andreasen (1995) suggests that social marketing is set apart by the following points:

1. The ultimate objective of social marketing is to benefit target individuals or society and not the marketer.
2. The basic means of achieving improved welfare is through influencing behaviour, in most cases bringing about a change in behaviour.
3. The target audience has the primary role in the social marketing process.

Andreasen (op. cit.) suggests that the latter point is central to the success of social marketing and is a mind-set that the social marketer needs to adopt. As such, the social marketer must recognise that the target audience is in control of the marketing transaction and the marketing is therefore not organisation-centred. Organisation-centred social marketing results from a belief that the product (or desired behaviour) being marketed is superior or inherently good and therefore the targets will naturally wish to adopt. It also results from a belief that the targets are the problem and their failure to adopt the desired behaviour or product is a result of a character flaw. In relation to this, Andreasen (op. cit.) cites as an example, the early campaigns aimed at discouraging people from smoking in which zealous anti-smoking marketers simply assumed ignorance and promoted the damaging health effects of tobacco use. Their failure to make people quit smoking led them to believe smokers must have a character flaw.

Social marketing is a tool for social change. Therefore is not to be confused with social advertising that is sometimes seen in relation to OHS. Andreasen (op. cit.) suggests that social advertising is another symptom of organisation-centred social marketing where behaviour change is attempted through “slick television and radio commercials, clever product packaging, and a few glossy brochures or posters” (p.7). This approach relies on the belief that action takes place only if people are sufficiently motivated. It promotes causes and ideas, and Andreasen (1995) cites the example of the (US) “Just Say No” anti-drug campaign and numerous other examples are to be seen in the recent European publication “Health and Safety Campaigning” (European Agency for Safety and Health at Work, 2001). The limitation is that the approach attempts to get the consumer to adopt the persuader’s view of the world, i.e. the marketing is organisation-centred. By contrast the social marketer’s approach is to “adopt a customer-centred approach and recognise that change will only come about if one starts with the customer’s reality and adapts messages and other program elements to the customers’ perceptions, needs, and wants.” (Andreasen, 1995 p.11)

Another symptom of organisation-centred social marketing is a lack of market research and a tendency to treat the target audience as a mass, which results in a failure to recognise that within the target audience there are individuals at different stages of change. Further, competition is ignored.

Just like commercial sector marketing, social marketing uses a combination of influence factors to bring about change. These factors are analogous to the Four P’s of the commercial sector i.e. the “marketing mix” that refers to the conception of the (1) Product, (2) its Price, (3) its distribution (Place) and (4) Promotion (Kotler et al., 2001).

Weinreich (1999b) applies the 4 P’s to social marketing:

> **Product** may be physical (e.g. condoms to prevent sexually transmitted disease) or a practice (e.g. eating a healthy diet) or intangible (e.g. environmental protection).

> **Price** refers to what the customer must do in order to obtain the social marketing product. This could be monetary, time effort or even embarrassment or disapproval. Obviously the perceived benefits must outweigh the price.
>
> **Place** describes the way the product reaches the consumer. The place could be tangible in terms of a retail outlet or intangible in terms of information delivered through a communication channel.
>
> **Promotion** creates and sustains demand and may use a combination of advertising, public relations, promotions, media advocacy, personal selling, etc.

Elliott et al. (1994) reflected on the principles of social marketing while undertaking a campaign in Australia and distinguished between the Product of the traditional "4 P's" and referred to *social product*, consisting of ideas and behaviours that are regarded as socially desirable. They suggest the *place* is usually the point of consumption. Peattie and Peattie (2003) have mounted an argument that it is time to distance social marketing from commercial marketing principles and within this suggest that the price component of the "4 P's" is not appropriate to social marketing given the absence of a monetary price in most contexts and that costs vary between the stages of change. They suggest that although it is not as convenient for memory as the *price* term, "costs of involvement" may be a better term.

Applied to the prevention of occupational asthma among motor vehicle repair spray painters, for example, the product might be the increased use of air-line supplied respiratory protective equipment. Therefore, the product is a tangible item that the user will need to perceive as a solution to a problem. The price or costs of involvement will be the perceived discomfort and interference with vision and possibly the embarrassment of breaking with the norms of the peer group. The perceived benefits of the product (freedom from illness) must be greater than the price. The place is the repair shop where the respiratory protective device is used. The promotion is likely to rely on personal communication and supervisory intervention. However, this example focuses on *individual worker behaviour*. In regard to small business *decision-maker behaviour*, the product is the enforcement of the use of the air-line supplied respiratory protection i.e. a behaviour that the business operator must perceive as a solution to a problem. The price or cost of involvement will be the expense associated with the purchase (including the time associated with locating and taking delivery); on-going maintenance of the respiratory protective device and the air supply; the productivity costs associated with the time it takes to use and supervise; the negative impact on staff relations as results of enforcing; and the possible loss of the spray painter as a result of them moving to another operator's premises where the use of such devices is not enforced. The perceived benefits, which must be greater than the perceived costs, might include retention of a spray painter that might otherwise be lost as a result of asthma; freedom from a workers compensation claim, litigation and prosecution; and a sense of satisfaction resulting from the discharge of a moral obligation. The place is the repair shop where the decision maker exhibits the enforcement behaviour. The promotion is likely to rely on personal communication through the supply chain which is the main source of information for small business about chemicals and their control (Hudspith & Hay, 1998). Promotion could be at trade shows, through employers groups and personal contacts, as well as paint suppliers.

Andreasen (1995) suggests that social marketing is set apart by its special nature that requires it to often "sell" intangibles in environments where there is culture conflict, public scrutiny and limited funds. It often deals with sensitive issues, having invisible benefits and for which there is a negative demand.

Just like commercial sector marketing, social marketing requires demand for the product. Demand can be of one type in a range from full demand, through irregular demand, declining demand, latent demand and no demand to negative demand (Kotler et al., 2001). In OHS, small business often demonstrates no demand and negative demand. The former occurs when the consumer does not perceive there to be need for the product and is therefore uninterested or indifferent (this is described as precontemplation in Prochaska's TTM). The latter occurs when the product is disliked or even distasteful, an example from the social marketing area may be vaccinations or dental treatment (Kotler & Andreasen, 1987). Where the risk is chronic and the effects on the person and the organisation may be remote in time or intangible, creating demand is particularly difficult as the price is likely to appear high relative to perceived benefits (Elliott et al., 1994). Lombard, Neubauer et al. (1991 p.238) offer an example of unsafe outdoor behaviour when exposed to the sun.

The desired behaviours and product (sunscreen) are both seen as negative and involving high costs given the value of a tanned Caucasian skin in western countries where it is seen as a sign of health, beauty, status and athleticism. The problem of chronic risk is exacerbated by small business employers' mis-perception of risk and the focus on short term survival as discussed above.

In this context, Peattie and Peattie (2003) argue that social marketing differs from commercial marketing in regard to *exchange*; the former lacking a quid pro quo required to represent a genuine exchange. They suggest that in a genuine exchange, each party desires a set of attributes possessed by the other and attaches greater value to those attributes held by the other party than to those they hold. This makes each party willing to exchange. They suggest that social marketing is very different with the provision of attributes (e.g. promotional material or information) with the aim of changing behaviour; this is not done in exchange for *changed* behaviour. The marketer's contribution is made regardless of there being a change in behaviour. This becomes important when evaluating the success of a social marketing campaign. A social marketer can demonstrate success not in achieving a change in behaviour but by shifting the target audience within a stages of change model. Peattie and Peattie (op. cit. p.370) point out, "It is hard to imagine a commercial marketer attempting to persuade their superiors that their efforts have been successful because they have created an increased number of people who would consider becoming customers in the future."

Andreasen (2003) reflected on the life trajectory of social marketing and acknowledges that the origins of the discipline being within the commercial sector has hindered its development and led to confusion and rejection by some writers. The legitimacy of the discipline's name is, he suggests, in the fact that it deals with *transactions* and not just *market transactions*. He identifies that the discipline was probably not fully accepted until the 1990's and its true nature was recognised when scholars realised that it was not about changing *ideas* and was about changing *behaviours*.

2.2.4.3.1. The Social marketing Process

As previously explained, social marketing aims to bring about behaviour change, which is not new to OHS. Behaviour modification invokes learning theory, which argues that people do what they do because they (a) learn the techniques necessary for action and (b) find the outcomes rewarding. There is significant emphasis on rewarding the desired behaviour when it occurs. The nature of the behaviour modification approach, therefore, makes it most suitable for use at the individual level and in turn is very costly. Social marketing recognises this as a limitation and attempts to modify the behaviour of groups (Andreasen, 1995). For these reasons it is essential that the formative research obtains ethnographic information about the target population, the collective perceptions of (in the case of OHS) risk and the price of risk controls. Andreasen (op. cit) suggests the aim is to gain "a richer understanding of the customer" (p.139). In this regard he has coined the term "backward research" (Andreasen, 1985) that starts with the decisions to be made and makes certain that the research helps the social marketing program manager reach those decisions. In summary, the steps involved are (Andreasen, 1995 p.101):

1. Determine what key decisions are to be made using research results and who will make those decisions;
2. Determine what information will help management make the best decisions;
3. Prepare a prototype report and ask management if this is what will best help them make their decisions;
4. Determine the analysis that will be necessary to fill in the report;
5. Determine what questions must be asked to provide the data required by the analysis;
6. Ascertain whether the needed questions have already been asked;
7. Design sample;
8. Implement research design;
9. Analyse data;
10. Write report;
11. Implement the results.

Both qualitative and quantitative data are relatively cheaply obtained (Andreasen, 1995) by addressing the questions of:

Quantitative

- How many people are not doing the desired behaviour?
- What are the sub groups and which are most likely to respond?
- What are the characteristics of sub-groups?
- How much awareness is there and what are the feelings towards the new behaviour?
- What are the media habits of the target audiences?

Qualitative

- What is the extent of the problem?
- Who is most affected and where are they?
- How can the targets be reached?
- What are the beliefs about the benefits and costs of the desired behaviour?
- What are the perceptions of other people's desires?
- What is the level of self-efficacy?
- What is the competition?
- What will influence behaviour?

Commonly knowledge, attitude, practice and belief (KAPB) studies are undertaken in social marketing programs, especially in the area of health (Andreasen, 1995). Very importantly, the ways in which information is received by and flows within the target group must be established. Andreasen has found that the information gathered by formative research will provide a number of insights to the behaviour that is being influenced. These insights include information about the targets' stages of behaviour change; positive and negative consequences that targets perceive will follow their choices; tradeoffs against those consequences; the influence of other people and self-efficacy; grouping of targets (i.e. segmentation); and the targets' perceptions of competition, which are not always the same as the social marketer's perception (Andreasen, 1995 p.143).

Andreasen suggests that, as a part of the backward market research process (Andreasen, 1985), one can assess the targets' against a matrix as illustrated in Figure 6. Targets are more likely to adopt the desired behaviour if the perceived consequences of *not* adopting the behaviour are *important* and *likely* to be experienced. Therefore, the aim of the social marketing program is to change the profile of the target group so that a maximum number of members are in cell number one.

	High Likelihood	Low Likelihood
High Importance	1	2
Low Importance	3	4

Figure 6 Matrix for assessing likelihood and importance of a condition (Andreasen, 1995)

Social marketing draws extensively on the "Stages of Change" (Andreasen, 1995; Weinreich, 1995) models. In commercial marketing the stages of the adoption process are widely understood as awareness followed by interest, evaluation, trial, decision and confirmation (Quester et al., 2001) or awareness followed by interest, evaluation, trial and adoption (Kotler et al., 2001; McColl-Kennedy et al., 1994).

In social marketing the most useful stages of change model appears to be the TTM proposed by Prochaska and DiClemente (1986). Andreasen (1995) has refined the model and identifies the specific marketing tasks that are necessary at each stage as shown in Table 3. He therefore emphasises the importance of the formative research process in identifying where the target population is positioned within the model prior to embarking on the behaviour change process. The aim of the marketing process is to unfreeze behaviour and move the targets from their current respective positions in the model to the next stage.

Table 3 Stages in behaviour change (Andreasen, 1995)

Prochaska and DiClemente's stages	Marketing Tasks	Andreasen's Modified Stages
Precontemplation	Create awareness and interest	Precontemplation
	Change values	
Contemplation	Persuade; motivate	Contemplation
Preparation	Create action	Action
Action		
Confirmation	Maintain change	Maintenance

In the precontemplation stage Andreasen (op. cit.) contrasts educators with social marketers. The former will often inundate the target with information that the sources think is important. The latter will start by listening to targets and adjust messages to align with what is important to those targets, in a language that is appropriate, through vehicles that they will pay attention to. The social marketer typically measures success at this stage through assessment of knowledge, values and attitudes and resists the temptation to measure tangibles such as numbers of brochures distributed Andreasen (op. cit. p.150).

Central to moving targets through the contemplation stage is the recognition that individuals act on the basis of beliefs. The most important set of beliefs in this context are; beliefs about the positive consequences of the behaviour; about the negative consequences of the behaviour; about what others expect; and about the ability to carry out the action.

Beliefs about consequences

People make self-centred decisions based on how they think the behaviour will turn out. This is exemplified by the day-to-day decisions that people make (e.g. responding to an invitation to dinner) as well as complex behavioural decisions such as deciding to give up smoking, diet, etc. In each case, the factors considered (positive and negative) in the decision making process depend on the targets needs and wants (Andreasen, 1995).

Decisions about behaviour always have alternatives. In the commercial sector the alternatives – competition – come from other brands. In social marketing competition often comes from past habits or inertia (Andreasen, op. cit.). Andreasen cites, as an example, a social marketing program that aims to change drug-using behaviours among young people. The social marketer must recognise that the drugs *and* the attendant lifestyle are vigorous competitors for the proposed new lifestyle. Therefore, he suggests that marketing of a new behaviour involves "demarketing" of an old behaviour.

These marketing processes must address the positive and negative consequences that are perceived by the target. For behaviour change to occur the target needs to perceive that the benefits outweigh the costs of the new behaviour. In the commercial marketing sectors, bundles of costs are often exchanged for bundles of benefits and the *ratio* of benefits to costs is improved in the marketing process. Andreasen (op. cit. p.154) offers an example of a consumer contemplating going to a McDonald's hamburger restaurant instead of staying at home. The trade-offs being considered are listed in Table 4.

Table 4 An example of commercial marketing cot-benefit trade-offs (Andreasen, 1995)

Benefits	Costs
Getting good basic nutrition	Spending $x
Being served quickly	Having to drive for a long time
Experiencing good tastes	Feeling guilty about eating high fat food
Having a variety of options to choose from	Having to eat off paper with plastic utensils
Having a pleasant encounter with staff	Having to get dressed

Andreasen (op. cit. p.154) offers fours ways of modifying ratios and continues the hamburger example:

1. Increase the extent to which people believe they will get the benefits they want (e.g. increase the number of dessert options);
2. Decrease the extent to which people believe they will get the costs that they would like to avoid (e.g. decrease the price or fat content of the food);
3. Add new benefits (e.g. chance to win a prize);
4. Decrease the perceived benefits and increase the perceived costs of the likely alternative (e.g. eating at home or an unknown restaurant).

As discussed earlier, the importance of costs and benefits varies across the stages of change. For example, Prochaska and DiClemente (1986) found that moving targets from contemplation to action was largely a matter of reducing costs rather than promoting benefits. Andreasen (op. cit.) suggests, however, that it may be worth considering the contemplation stage in two sub-stages of early and late contemplation. While reducing costs at the later stage is appropriate it may be appropriate to emphasise benefits in the early stage. Reducing costs in the later stage may be necessary to overcome the final resistance to adoption of the behaviour i.e. action.

Andreasen (op. cit.) emphasises the role of what he calls "significant others" in exerting social pressure on individuals to adopt a behaviour (i.e. move from contemplation to action). He cites the work of Fishbien and Ajzen and proposes that "…in order to predict individuals' intentions to take a particular action, one must understand not only their perceptions of personal consequences but also their perception of what they think others want them to do and how likely they are to be influenced by these others." Clearly community norms will play an important role in influencing a target to adopt a behaviour and the discussion of social networks, above is of relevance here. Further insight is provided by the Theory of Reasoned Action (Ajzen, 1985) and the Precaution Adoption Process (Weinstein, 1988) each of which are incorporated in Andreasen's social marketing model and enable the understanding of the psychological processes engaged in moving through the model.

Moving from the belief that a behaviour is a good idea (contemplation) to action requires the target to have "perceived self-efficacy" (Bandura, 1977) or "perceived behavioural control" (Ajzen, 1991). Andreasen (op. cit) suggests that there are two parts to behavioural control; "internal efficacy" and "external efficacy". Internal efficacy refers to the individual's perception that they have the knowledge and skills to carry out the behaviour. External efficacy refers to the individual's perception that environmental factors will permit the behaviour to occur. Environmental factors that might interfere with behaviour might be related to the availability of necessary equipment or services or the willingness of another party to cooperate. Andreasen (op. cit.) subsequently introduces the notion of action efficacy, which is related to the target's estimate of whether the action will achieve the individual's behavioural goal. Action efficacy is therefore related to the perception of positive consequences of adopting the desired behaviour. The social marketer's task is therefore to increase the targets' internal, external and action efficacy.

Few social marketing programs are concerned with a single act (e.g. encouraging men to undergo vasectomy where birth control is the goal), and therefore maintenance is an important stage of change. Andreasen (op. cit) suggests that initial behaviours are often trials that are followed by repeats if the evaluation of the consequences is positive. To ensure that the behaviour is maintained, it is therefore, important to provide positive reinforcement. In the maintenance stage there are two constructs that need to be considered; "cognitive dissonance" and "behaviour modification". Cognitive dissonance occurs when a consumer has made a decision to act, having relatively recently found the choices to be very close at this point "…two cognitions that are in conflict produce a state of anxiety or dissonance" (Andreasen, op. cit. p.164). The consumer will consequently actively seek confirmation that the decision was the correct one. Andreasen cites the example of a person who makes a decision to purchase a new car and then starts to notice more of those models on the road, will read more adverts for that models and notice increasing numbers of positive features. The challenge for the social marketer is reduce cognitive dissonance resulting from the behaviour that has been adopted.

An often complementary approach is to use the principles of behaviour modification theory. This proposes that much behaviour is influenced by factors that precede, and factors that reinforce the behaviour. Preceding factors might be visual cues or opinion leaders, reinforcing factors might be rewards for adoption. Given that many social marketing behaviours are not intrinsically rewarding, extrinsic rewards may be particularly important. However, three conditions must be present (Andreasen, op. cit. p.166):

- The desired behaviour must be under the individual's control;
- A clear link must be established between the behaviour and the reinforcement;
- The reinforcer must constitute a meaningful reward to the individual.

With these understandings market segmentation (Andreasen, 1995; Kotler et al., 2001) can be used to target specific components of the population with relevant messages through pertinent media at applicable times via appropriate vehicles. In commercial marketing terms the "Four P's" are used to establish an extended marketing mix (Kotler et al., 2001). The marketing strategies are pre-tested before implementation and are then closely monitored. Monitoring provides feedback to the social marketer and identifies the necessity for adjustments to the strategy. The process is akin an to action-research cycle (Carr & Kemmis, 1986) and is presented by Andreasen (op. cit) as a strategic social marketing model as shown in Figure 7.

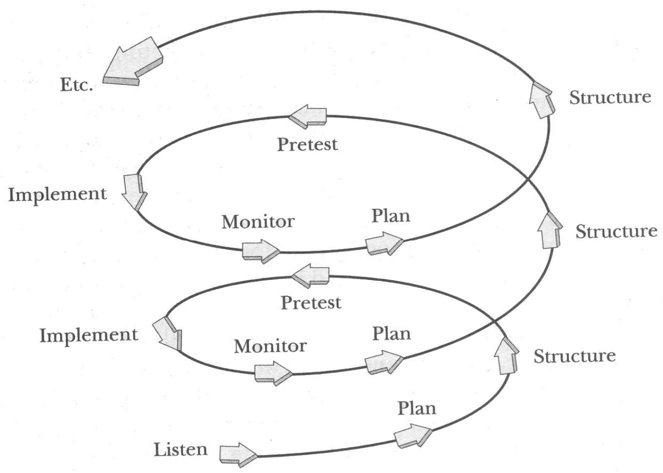

Figure 7 Strategic social marketing (Andreasen, 1995)

In summary, social marketing is "…the use of commercial marketing techniques to promote the adoption of a behaviour that will improve the health or well being of the target audience or society as a whole." (Weinreich, 1999a p.3) or, as alternatively defined by Kotler et al. (2002), "…the use of commercial marketing principles and techniques to influence a target audience target audience to voluntarily accept, reject, modify or abandon a behaviour for the benefit of individuals, groups, or society as a whole." The objectives of social marketing are different to those of commercial marketing and it seeks to influence social behaviours not for the benefit of the marketer but for the benefit of the target audience or society (Weinreich, 1999b).

Social marketing differs from traditional health education in that the former is consumer orientated at all levels of planning, development, implementation and evaluation stages, whereas the latter most often uses epidemiological data and demographics and then selects a target population for intervention, with minimal consumer input (Thackeray & Neiger, 2000). Social marketing draws from various disciplines including health education, marketing/advertising, anthropology and social psychology (Weinreich, 1999a) and specifically applies behaviour change models such that a number of major variables are integrated in to one campaign. These variables include (a) product – the idea or behaviour, and ideas and behaviours related to the product; (b) price – the monetary, effort, and social-psychological costs of adopting the behaviour or product; (c) promotion – the interpersonal and media-based approaches to informing target audiences about the product; (d) place – the distribution point of the product; and (e) positioning – the unique niche of the product (Winett et al., 1995). Central to the manipulation of the variables is diffusion theory and stages of change models.

Andreasen (1995) emphasises the importance of "significant others" in the social marketing framework and Valente (2002) emphasises the significance of Rogers' models not only in terms of categorisation of adopters but also in terms of the role of opinion leaders. The latter is subject to considerable discussion in the intervention literature and is discussed in the next section.

2.2.4.3.2. The Role of Opinion Leadership in Interventions

Rogers (1995 p.281) defines Opinion Leadership as, "…the degree to which an individual is able to informally influence other individuals' attitudes or overt behaviour in a desired way with relative frequency. Opinion leaders are individuals who lead in influencing others' opinions about innovations." and "…those that provide information and advice about innovations to many in the system." (op. cit. p.26) Burt (1999 p.46) defines opinion leaders as "people whose conversations make innovations contagious for the people with whom they speak."

Rogers states that the behaviour of opinion leaders is important in determining the rate of adoption of an innovation and that the S-shape of the diffusion curve (discussed in Section 2.2.4) occurs because once opinion leaders tell others about the innovation, the number of adopters per unit of time takes off. Opinion leadership is often used by commercial marketers who attempt to persuade them to buy their goods or services. However, Summers et al. (2003) that opinion leadership is casual, face to face phenomenon and is usually inconspicuous, thus location of opinion leaders can be challenging.

The concept of opinion leadership originated as part of a two-step flow model of mass communication. A model of mass communication that preceded the two-step flow model was the “hypodermic needle model” that postulated that the mass media had direct, immediate, and powerful effects on a mass audience. However, research in the 1960’s found that ideas often flow from radio and print to opinion leaders and from these to the less active sections of the population. The first step, from media sources to opinion leaders, is mainly transfer of information, whereas the second step, from opinion leaders to their followers, also involves the spread of interpersonal influence (Rogers, 1995). The model as it stands is limited in that different communication channels function at different stages in the innovation-decision process for both opinion leaders and followers. The model does, however, identify that mass media channels are important in creating knowledge and interpersonal networks are important in persuading individuals to adopt or reject.

Winett et al. (1995) question this view of communication based on what they refer to as “outdated” communication studies. A number of diffusion studies were undertaken in developing countries where mass media (particularly visual media such as television) was not widely available. They suggest that visual media may today play a greater role in diffusion given results of preliminary studies in developing countries where television is now widespread. As a result it is concluded that adoption of innovations may be instigated for many people by communication from either visual media or interpersonal sources or a combination of both. However, they go on to suggest that mass media may be appropriate to use to promote the adoption of a simple innovation having few constraints such as cost. Adoption of other innovations involving more complex behaviours often requires greater guidance and personal interactions. Further, Winett et al. (op. cit. p.237) point out that “…for individuals who are somewhat knowledgeable about the pros and cons of an issue or opposed to an issue or behaviour, a two-sided communication discussing costs and benefits is more persuasive and not easily dismissed out-of-hand.”

A fundamental principle of human communication is that the exchange of ideas occurs most frequently between individuals that are alike i.e. homophilous. Rogers (1995 p.286) defines homophily as “the degree to which a pair of individuals who communicate are similar.” The similarity may be in certain attributes as beliefs, social status, etc. Rogers suggests that communication is more likely to be effective when two individuals share common meanings, beliefs and mutual understandings. Heterophily is the degree to which pairs of individuals who interact are different in certain attributes, i.e. the opposite of homophily.

Homophily can present a barrier to diffusion when innovations spread horizontally rather than vertically. To overcome this problem Rogers suggests that change agents should work with different sets of opinion leaders in a system unless the networks are characterised by a high degree of heterophily. If the latter is the case, the change agents should concentrate on a few opinion leaders near the top in social status and innovativeness.

While Rogers (op. cit.) makes a generalisation that “interpersonal diffusion networks are mostly homphilous” and “individuals with high status in a system seldom interact with those of lower status.” and … “innovators seldom converse with laggards.” (p.288), he makes the point that this can be advantageous. For example in an agricultural community in the Netherlands it was found that only 3% of opinion leaders had farms smaller than 50 acres but 38% of farms were smaller than 50 acres. The wisest farm management decision for the larger farms was to purchase mechanised equipment while the wisest decision for smaller farmers was to ignore mechanisation and focus on labour-intensive horticultural practices. However, the smaller farmers followed the example of the larger farmers (opinion leaders). In this case a greater degree of homophily (small farmers interacting with opinion leaders who were also small farmers) would have been advantageous (Rogers, 1995). Within the OHS profession there has been considerable debate about the applicability to small business of OHS management systems designed for large organisations and many small businesses struggle to apply the Victorian WorkCover Authority’s “SafetyMAP” tool. Walters (2001 p.369) concluded that “The means by which good management practices may be achieved in large enterprises work only rarely in small enterprises and are even less likely to be relevant to micro-enterprises.” As previously discussed (Section 2.1) NIOSH acknowledges that many engineering OHS solutions devised for large industrial concerns are not economically feasible, nor practical, for small business (Jones, 1997).

Rogers offers a number of further generalisations (1995 p289) concerning interpersonal diffusion networks that are heterophilious. He suggests that followers seek opinion leaders of higher socio-economic status; with more formal education; with a greater degree of mass media exposure; who are more cosmopolite; with greater change agent contact; and who are more innovative. He subsequently makes some generalisations about opinion leaders that he suggests, when compared to their followers, have greater exposure to mass media; are more cosmopolite; have greater change agent contact; have greater social participation; have higher socio-economic status; and are more innovative.

Winett at al (1995) reports that extensive studies have been made of the characteristics of opinion leaders, and people in the various adopters categories and while generalisations are possible, there are shortcomings similar to those associated with other personality trait research. They explain that a person can be an innovator in one domain and a laggard in another. For example, a person may be an early adopter of electrical equipment but a laggard in adoption of new clothing styles. They do, however, believe that Rogers' generalisations are of value in designing interventions.

Given that it is likely that opinion leaders will possess many of the traits of innovators. However, the degree to which opinion leaders differ from their followers will influence the likelihood of acceptance or rejection of the opinion leaders' example, depending upon the norms of the social system. When a social system's norms favour change, opinion leaders are more innovative and when the social system's norms do not favour change opinion leaders are not especially innovative (Rogers, 1995 p295). Therefore, in systems with more traditional norms, the opinion leaders are usually a separate set of individuals from the innovators. The innovators are perceived with suspicion and disrespect and their judgement in adopting an innovation is questioned. The inverse is true in systems having less traditional norms. Rogers summarises this as:

> "Innovators are poor opinion leaders in systems with traditional norms: They are too elite and too change-oriented. The innovator serves as an unrealistic model for the average client, and he or she knows this. The norms of the system will determine which adopter category the opinion leaders in system belong to." (p295).

To support the use of opinion leadership, an understanding of the diffusion networks in systems is necessary. This is because the diffusion process relies upon imitation by potential adopters of their near-peers who have previously adopted a new idea.

Communication network analysis is described by Rogers (1995). He provides methodologies for assessing links and identifying opinion leaders. Andreasen (1995 p254) summarises three approaches in his text book on social marketing as follows:

> "The first and most expensive is to develop a sociometric diagram of the connections among the people in the social system. Sociometric studies may be feasible in small social systems like villages in developing countries and tightly knit neighbourhoods in larger cities. The ethnographic technique involves asking people such questions as:
>
> - To whom do you turn for advice with respect to the behaviour domain in question?
> - To whom do you give advice?
> - With whom do you talk about other subjects of importance to you?
> - To whom do you turn when you need help in the behavioural area?
> - With whom do you socialise?
>
> Where sociometry is not feasible, a second approach is simply to ask people to name those who they have the reputation for being influential in the behavioural subject area. Finally one can ask for self-reports wherein individuals indicate whether others turn to them for information or advice."

Andreasen (1995 p256) differentiates between opinion leaders and role models. The latter he suggests are "individuals who communicate to the target consumers not only what can and should be done but also how to do it. The latter is particularly important in helping consumers build self-efficacy." He cites an example of an elderly male village leader who may be very important in leading opinion about giving oral rehydration solution to children with diarrhoea but that person cannot serve as a role model for mothers as to when and how to carry out the behaviour. In summary he suggests that a role model must be someone who the target audience can identify with and look up to, someone who is respected and someone who is in similar circumstances to the target audience.

The work of Rogers receives considerable discussion in articles contained in a November 1999 special edition of The Annals of the American Academy of Political and Social Science. In their preface to the publication Lopes and Durfee (1999) suggest that opinion leaders are crucial to diffusion. The role of opinion leaders is elaborated in the same publication by Valente and Davis (1999) who explain that maximising the effectiveness of opinion leaders can further accelerate the rate of diffusion. These authors describe how diffusion theory explains how new ideas and practices spread within and between communities. The basic premise is that new ideas and practices spread through interpersonal contacts largely consisting of interpersonal communication. However, they point out that few studies have successfully traced an innovation through a network of social contacts, largely owing to the difficulty of collecting data over a period long enough for diffusion to occur.

Given the importance of interpersonal contacts in diffusion formal methods of network analysis have emerged, as introduced above. Valente and Davis (1999) define network analysis as "a set of methods that enables researchers to locate individuals who are more central to the community and thus perhaps more influential" (p.57). Valente and Davis use the terms "opinion leader" and "role model" interchangeably and suggest that "role models act as opinion leaders within their communities and can be important determinants of rapid and sustained behaviour change." (p58). They go on to suggest several potential recruitment procedures (op. cit. p.58):

1. Individuals select themselves to be peer leaders.

2. Program staff or project teams select the leaders.

3. Community members recruit participants, not leaders, who in turn each recruit new participants.

4. Some selected individuals within the community nominate others to be opinion leaders.

5. All community members are invited to nominate opinion leaders.

The authors acknowledge that there are several limitations to the effectiveness of each of these approaches. However, the fifth technique, they suggest, overcomes most of the shortcomings of the other techniques:

> "The list of opinion leader nominations that it produces provides an accurate map of who goes to whom for advice within the entire community. The strategy exploits the existing structure of information dissemination within the community and relieves the need to impose an artificial information flow network from above. This technique has been successfully employed in several arenas.
>
> A community or organization attempting to initiate behavioral change ensures the credibility and trustworthiness of opinion leaders by allowing the entire community to select opinion leaders. A second advantage of this approach is that the number of leaders selected for training can be varied depending on the needs of the intervention. Third, the boundaries used to define leaders can be varied to account for group membership properties (for example, opinion leaders can be recruited based on gender, ethnicity, geography, or the like)." (Valente & Davis, 1999 p.59)

Further to Rogers' (1995) views discussed above, Valente and Davis (op. cit. p.63) suggest that it is not opinion leaders who are early adopters, but instead "…marginals or individuals who are bridges to other networks who first adopt an innovation. When the diffusion starts with these individuals, the innovation must percolate through the network before it reaches opinion leaders who are in a position to set the agenda for change."

In regard to recruitment, Valente and Davis (op. cit.) suggest that getting buy-in is important. The opinion leaders must be not only willing to participate but also believe in the innovation. There is, however, a reward in that opinion leaders appreciate being recognised and having their position validated.

Burt (1999), Professor of Sociology at the University of Chicago and writing in the special edition of The Annals of the American Academy of Political and Social Science, reports research that demonstrates career and income advantages associated with playing the role of opinion broker. He describes these advantages as "social capital" (p.48).

Burt (1999 p.48) defines social capital as:

> "…the complement to human capital in explaining inequality. Some people enjoy higher incomes. Some people more quickly reach higher positions. Some lead more important projects. The human capital explanation is that the people who do better are better people (smarter, more attractive, more skilled, and so on). The social capital explanation is that the people who do better are better connected."

In the context of social marketing Glenane-Antoniadis et al. (2003 p.332) propose a definition of social capital as "the goodwill that is engendered by the fabric of social relations and that can be mobilised to facilitate action." They suggest that this is useful given that it captures the idea of social relationships and associations and implies that social capital is built on the foundations of trust and relies on the norms of reciprocity, specific and generalised. They explain that specific reciprocity is based on the principle that if a person does a good turn for another, that person will return the favour. Generalised reciprocity is based on the principle of "what goes around comes around" (p.333), i.e. if a person does a good turn for another, there is a belief that the favour will be returned at some point by that or another individual. They suggest that the definition is useful also because it refers to "fabric" and thus implies networks through which mutual obligations may be established.

Burt (1999) uses the notion of social capital to examine the processes that opinion leaders use in networks. He begins with the presumption that information circulates more within than between groups. The connections between groups are weaker and are called structural holes. These holes create a competitive advantage for an individual whose relationships span the holes: "People on either side of a structural hole circulate in different flows of information. Structural holes are thus an opportunity to broker information between people and control the form of projects that bring together people from opposite sides of the hole." (1999 p.48)

Controlling a structural hole gives the opinion broker a disproportionate say in whose interests are served by the bridge, although there is also uncertainty in the dynamic environment of a network. Burt argues that individuals with contact networks rich in structural holes are the individuals who know about, have a hand in, and exercise control over more rewarding opportunities. Networks rich in the entrepreneurial opportunities of structural holes are entrepreneurial networks. Network entrepreneurs are skilled in building interpersonal bridges that span structural holes and these are the people who are most likely to be opinion leaders.

In regard to the operation of network entrepreneurs, Burt introduces the notion that cohesion and structural equivalence are the responsible for contagion. Contagion occurs when there is something about a network that makes the belief or behaviour of one individual contagious to the other.

Cohesion refers to the strength of relationship between two individuals. The more frequent and empathetic the communication between two people, the more likely that the receiver of the information will adopt. Burt suggests that the receiver will subsequently discuss the innovation with others and come to a normative understanding of the costs and benefits of adoption. This has parallels in Rogers' (Rogers, 1995) discussion of homophilous and heterophilous networks described above.

Burt (op. cit.) describes Structural Equivalence as a situation where the source and the receiver have similar relationships with other people. Contagion by equivalence occurs because of competition, generally because people use one another to evaluate their relative adequacy. The more similar the source and the receiver's relations with other people, the more likely that the receiver will quickly adopt any innovation that makes the source more attractive. Each party accrues advantage through others using the information provided.

For widespread adoption to occur, contagion spreads within and between groups. Therefore, opinion leadership consists of influence exercised through strong relationships between weakly equivalent people, i.e. their influence is between rather than within groups. Burt (op. cit. p.46-47) proposes "opinion leaders are the people whose conversations trigger contagion across the social boundaries between groups." and "contagion by cohesion through opinion leaders gets information into a group, then contagion by equivalence triggers adoption within the group."

Burt (op. cit.) goes on to suggest that the first adoption within a group comes from converting a close contact. Peers, he suggests, adopt not because of the opinion leader but because of the advantages that adoption has given to the person converted by the opinion leader. These ideas inform a network approach to diffusion. Valente (1996) defines a social network as a "…pattern of friendship, advice, communication or support which exists among the members of a social system."

Valente (op. cit.) describes the evolution of the network approach to diffusion research. Initially the approach was to count the number of times an individual was nominated as a network partner (in order to measure leadership) and to correlate this variable with innovativeness. Opinion leaders were defined as those individuals with the highest number of nominations, and were theorized to be a significant influence on the rate of adoption. Subsequently Granovetter (1982 in Valente) offered a more structured approach and suggested that weak ties between people were necessary for diffusion to occur across sub-groups. Burt's (1999) work on structural equivalence offers another view and this has been followed by threshold models.

Threshold models "…postulate that an individual engages in a behavior based on the proportion of people in the social system already engaged in the behavior." (Valente, 1996 p.70) Valente (op. cit.) suggests that individuals with low thresholds will engage in collective behaviour before many other people do and those with high thresholds do so after most of the group has engaged in the behaviour. This, he argues, may provide a model of diffusion that creates adopter categories based on innovativeness relative to personal networks. Personal networks are the set of direct ties that an individual has within a social system (Wellman cited in Valente, 1996 p.71).

Valente (1996 p.71) suggests that the personal Threshold Model has the following advantages in that it may be used to:

1. Determine critical mass;
2. Predict the pattern of diffusion of an innovation; and
3. To identify opinion leaders and followers in order to better understand the two-step flow hypothesis better.

Valente (op. cit.) differentiates between network thresholds and adoption thresholds. The former is useful for collective behaviour such as riot where the behaviour of others is observable and the information that the individual needs to make a decision about adoption is complete. The threshold measured is the proportion of adopters in the system before the individual adopts. Difficulties arise where an innovation is not observable and where the benefits and risks associated with an innovation are uncertain, for example, risk controls in a workplace. Adoption thresholds offer an alternative and measure the direct communication links with others.

Valente cites the work of Coleman et al. (Coleman, Katz, & Menzel, 1966) who measured the adoption of a new pharmaceutical drug by doctors in four communities in the USA. Each doctor was asked to name three other doctors who acted as friendship advice and discussion partners and thus personal networks were mapped. The number of doctors in a network that had adopted before the subject doctor adopted was used to calculate an adoption threshold. Across the study groups some networks filled with adopters before others because of varying adoption behaviour of network partners. Valente (1996 p.73) summarises the work of Coleman and others as follows:

> "In sum, individual exposure to an innovation increases as more people in the personal network adopt the innovation. Low network threshold individuals are those who adopt before many others in their network adopt, whereas high threshold individuals are those who adopt after most of their network have adopted. Note that individuals with the same threshold may adopt at different times owing to their personal network partners' behavior [sic] influences their level of exposure."

Valente (op. cit.) suggests that innovativeness can thus be distinguished, i.e. whether individuals are innovative with respect to their personal network or innovative with respect to the social system. For example, an engineer working in a software company may purchase a new personal computer (PC) after it has been in the market for 4 years. Relative to the whole society he would be considered innovative. However, given that he is surrounded by colleagues who are likely to have adopted when the PC was first available he is a later adopter in his personal network (Valente op. cit. p.73).

Valente (op. cit.) proposes that personal network categories may be created by partitioning the network threshold distribution in the same manner as Rogers (1995) has done with time of adoption categories. Using both social system and personal networks enables clarification of the role of external influences and how both external and interpersonal influences flow through a system. To support his hypothesis, Valente (op. cit.) analysed the results of three empirical diffusion studies that had employed peer mediators or opinion leaders. These were the pharmaceutical drug innovation described above (Coleman et al., 1966), a study of diffusion of hybrid corn among Brazilian farmers (Rogers cited in Valente, 1996) and adoption of family planning methods among married women in Korea (Rogers and Kincaid cited in Valente, 1996). He reports a very strong association between adopter categories relative to social networks and social system. Forty-three percent of the doctors were classified identically in both their social system and personal network thresholds, 47% of Brazilian farmers were classified the same and 64% of Korean women were classified the same. External influence scores were almost always highest for those who are most innovative relative to both the system and personal networks. However, external influences tend to make individuals more innovative relative to the social system than their personal network. Interestingly, individuals with low thresholds are not necessarily subject to the greatest effect of external influences. Also, it appears that laggards who have very low thresholds may not adopt because they do not have exposure to an innovation through their network and are not exposed through external influence. Conversely, high threshold laggards may be exposed to an innovation but do not adopt because of resistance.

Although the diffusion patterns differed between the three study groups, Valente (op. cit.) postulates that "…opinion leaders are those individuals with lower thresholds who influence those with higher thresholds to adopt. Thus innovativeness relative to one's personal network should be associated with opinion leadership." (p.80) From his analysis of the three studies, he suggests that the highest number of nominations (for opinion leadership status) that individuals received occurred among those individuals who were very low threshold-early adopters, low threshold-early majority, high threshold-late majority and very high threshold-laggards, i.e. individuals who adopt when their system and network level exposure are about the same are more likely to be opinion leaders. Valente (op. cit.) proposes that individuals who exhibit consistency in their threshold are appropriate role models and near peers whose behaviour may be imitated.

In discussion of the value of this work, Valente (op. cit.) points out that over 50 years of diffusion research has focussed on time-of-adoption with respect to the whole system while ignoring how individuals act with respect to their personal networks and that “It may be that social network thresholds provide the means to determine which type of network influences lead to innovation adoption.” (p.85)

While the above review demonstrates that there is debate as to the adopter categories within which opinion leaders generally are found, the summary of the general principles of opinion leadership and adoption of innovations, provided by Winett et al. (1995 p.234) is useful:

> “The process of spread of an innovation through a network of people connected socially and/or by physical proximity to each other is usually construed as a classic two-step communication process. Influential opinion leaders in a network typically learn about innovations through media sources. These opinion leaders are seen by others as innovative, early adopters who then spread word of the virtues of an innovation through interpersonal communication and personal example. Adoption of the innovation through the network is at first a gradual and slow process. However, at a critical point, with sufficient communication and exemplars, the rate of diffusion rapidly escalates (“snowballs”) in a classic s-shaped function, that is, until the network has adopted the innovation to some saturation point.”

Despite the relatively widespread recognition that opinion leaders and role models can play a very important part in the social marketing process (Burt, 1999; Rogers, 1995; Valente & Davis, 1999; Wilson, 1999; Yin, 1999) and can accelerate the rate of diffusion (Valente & Davis, 1999), studies that have attempted to use such people in the diffusion of innovations through social networks have had mixed success and few studies have been able to trace an innovation owing to the length of time over which diffusion occurs (Valente & Davis, 1999). In the area of OHS there is no evidence of any attempts to employ opinion leaders using the models for their identification and employment discussed above.

2.2.5. Summary

Behaviour change models and their underpinning theories are widely applied in the public health discipline. There has, however, been very limited testing of these models in the area of OHS, and specifically in influencing the small business decision-maker behaviour. In this context the interest lies in the change of the behaviour of the person in a small business that makes the decision whether or not to adopt an OHS risk control measure.

To explain and predict behaviour change within a target population, various stages of change models have been proposed. The Transtheoretical Model (TTM) of health behaviour change construes change as a process involving a series of stages. The TTM emphasises the importance of self-efficacy and the individual's assessment of pros and cons of adopting the desired behaviour change.

While the TTM may offer a valuable insight to behaviour change that might inform strategies for interventions that influence the behaviour of *individual* small businesses decision-makers, the work of Everett Rogers' diffusion theory has defined the processes by which innovations are diffused among members of a social system and therefore may specifically inform the strategies used in *groups* of small businesses.

Diffusion theory explains how new ideas and practices spread within and between communities and it has a number of key interrelated components including social networks, characteristics of innovators, characteristics of the innovation, and the central notion of a dynamic *process* of change occurring over time. Katz (1999 p.147) suggests that:

> "Good diffusion studies can usually answer to the definition that they are addressing the spread of (1) an item, idea or practice, (2) over time, and (3) to adopting units (individuals, groups, corporate units), embedded in (4) channels of communication, (5) social structures (networks, community, class), and (6) social values or culture."

Social marketing draws together various behaviour change and intervention evaluation theories including the TTM and Rogers' diffusion theory. The objectives of social marketing set it apart from commercial marketing. The aim of the marketing process is to unfreeze behaviour and move the targets from their current respective positions in the model to the next stage.

Opinion leaders are central to the success of the social marketing model. Opinion leaders are people whose conversations make innovations contagious for the people with whom they speak and they are important in determining the rate of adoption of an innovation. Opinion leaders trigger contagion across social boundaries between groups.

There is no reference in the literature to the application of social marketing to small business decision-maker behaviour in regard to OHS.

2.3. Conclusion

The OHS problem in small business is undoubtedly significant. Both traumatic injuries and occupational disease are prevalent although the true size of the problem is unclear.

Various attempts at reaching small business owners and operators have been reported, all having limited success and many concluding that traditional strategies that focus on the straightforward delivery of information are inappropriate.

Various strategies are used in the public health discipline to influence individual behaviour and, although small business owners and operators are the focus of many small business OHS interventions, there are few reports of these strategies being adapted for use in the OHS discipline.

Given the large number of diverse small business operations in Australia, the wide geographic distribution across the continent and the nature of the behaviour change desirable, social marketing might offer the most useful alternative strategy that will lead to adoption of OHS control measures.

Social marketing has not been tested as an approach to increasing adoption of OHS control measures by small business decision-makers.

2.4. Hypothesis

On the basis of the above literature review, the following research hypothesis was proposed and tested:

> A social marketing model, currently used in other disciplines, is transferable to the OHS discipline for the purposes of increasing the rate of adoption of OHS risk controls within small businesses

2.4.1. Research Questions

Arising from the hypothesis were the following research questions:

- What are the obstacles that small business operators face in the adoption of technological OHS risk controls?
- Does social marketing offer a framework for use within the OHS discipline?
- Does the Transtheoretical Model (TTM) of health behaviour offer a means for assessing the position of small business operators on a stages of change continuum?
- Are the stages in the TTM useful for the categorisation of small business operators?
- Does the TTM support the development of targeted and tailored messages for small business operators?
- Can social networks within and between small business groupings be identified?
- Can opinion leaders in small business groupings be identified?
- Can opinion leaders in small business groupings be used to increase the adoption of technological OHS controls by followers?

2.4.2. Research Aim

The aim of the research was to apply relevant elements of a social marketing model to case study groups of small business operators to assess its capacity to increase the adoption of OHS risk control measures.

3. Methodology

3.1. Introduction

The preceding literature review enabled the mounting of an argument for the conduct of intervention research in small business, employing a social marketing model that has previously been untested within the OHS discipline in regard to the modification of small business decision-maker behaviour. The general hypothesis that the social marketing model, currently used in other disciplines, is transferable to the OHS discipline for the purposes of increasing the rate of adoption of OHS risk controls within small businesses was thus tested using three intervention case studies. The case studies were conducted within the commercial fishing industry; the wall and ceiling industry and the motor vehicle repair industry.

While there are few reports of evaluated OHS intervention studies in the literature, there has been an increasing amount of discussion in the literature since the middle of the 1990's about the conduct and validity of OHS intervention studies (see for example Goldenhar & Schulte, 1996; Gressel, 1996; LaMontagne & Needleman, 1996; Lipsey, 1996; Needleman & Needleman, 1996; Robson, Shannon, Goldenhar, & Hale, 2001; Rosenberg, Barbeau, Moure-Eraso, & Levenstein, 2001; Shannon, Robson, & Guastello, 1999; Zwerling et al., 1997).

Specifically in relation to the role that intermediaries may play in improving OHS in small business, Walters and Lamm suggest that the lack of detailed evaluation of interventions is an important omission that needs to be addressed. They argue for (Walters & Lamm, 2003 p.25) "…more research to understand *what* works to improve working environments of workers in such scenarios and *why* it works."

Goldenhar and Schulte (1996) reviewed the nature and extent of OHS intervention studies conducted between 1988 and 1993 and concluded that many lacked a theoretical basis, used small samples and tested interventions lacking in intensity to cause the desired change. To remedy this, the authors suggest that multi-disciplinary teams as well as key stakeholders from the workplaces of interest should be involved in intervention design and execution. In particular, unions and management representatives should be involved.

Other authors such as LaMontagne and Needleman (1996) have offered guidance in the conduct of successful interventions, based on their experience. These authors undertook a retrospective evaluation of the USA's OSHA standard for ethylene oxide exposure in hospitals. They point out "Whether the study design is experimental, quasi-experimental, or purely descriptive, intervention research confronts the traditionally trained occupational health scientist with some new and daunting practical challenges." (p.367) These challenges, they suggest, include gaining access to study populations, maximising participation rates, eliciting answers to sensitive questions and meeting ethical obligations. To address these challenges, they suggest that the study must have credibility (i.e. the targets of the intervention must believe that the researchers have a claim to expertise in the area of interest); relevance (i.e. the targets of the intervention must perceive the research focus to be of direct relevance to them); and sponsorship. The latter they suggests comprises legitimising and authorising sponsorship (i.e. the study's likelihood of success will be increased if the targets recognise that a respected third party has lent legitimacy to the project and another or the same authoritative party has also endorsed the work). The debate in the literature about the conduct of intervention studies has culminated in the recent publication of the "Guide to Evaluating the Effectiveness of Strategies for Preventing Work Injuries: How to Show Whether a Safety Intervention Really Works" (Robson et al., 2001) and this will inform the detail of the methodology discussed below.

In regard to intervention studies applying social marketing models to small business decision-makers, no reports in the literature have been found. Further, while some authors have outlined innovative approaches based on empirical work or anecdote (see for example Argabright, 1999), and others have implied an approach that may use diffusion theory as a basis (see for example Phillips & Hamilton, 1994; Sheehy, Cooper, & O'Brien, 1989), few reports explicitly suggest the use of diffusion theory (Gjessing & Ayres, 1992; Leviton & Sheehy, 1996).

Gjessing and Ayres (1992) of NIOSH in the USA undertook a project in the vehicle brake repair industry that suggested the use of diffusion theory as a basis for dissemination about asbestos dust controls. Personal communication with the authors suggests, however, that the model proposed in the report was not implemented. They remain of the opinion, however, their recommendations are still of merit and an evaluated intervention would be of value.

Leviton and Sheehy (1996), in their study of exposure to lead fume during soldering and lead dust during cleaning by vehicle radiator repair shops in the USA, discussed the failure of traditional approaches to increase the adoption of OHS controls by small business and argue that voluntary adoption of cost-effective technology has become exceedingly important to study. They raised three questions after their study (Leviton & Sheehy, 1996 p.410):

1. “What does behavioural science theory say about the best approaches to encourage radiator shops to install and maintain protective equipment?
2. How does small business determine which of the available products provides the best technology?
3. How can the National Institute for Occupational Safety and Health (NIOSH) and the Occupational Safety and Health Administration (OSHA) obtain small business’ acceptance of such technological controls?”

The authors propose the use of Prochaska’s (1997b) TTM and Rogers’ (1995) Diffusion theory and the categorisation of repair shop business operators against the respective stages of change. The proposal was not, however, acted upon.

The criticisms of OHS intervention research and the problems it presents led this author, in the conduct of this research, to explore interpretive and specifically action research, and employ a case study methodology.

3.2. Positivist versus Action Research

In his exploratory study of the application of action research to the discipline of OHS, Runnalls (2000) argues in his Master of Applied Science dissertation that there is insufficient money to fund positivist research that will provide clear cut answers to all the OHS problems that practitioners face. He suggests that (op. cit. p.89) practitioners need:

- " a methodology that allows them to successfully manage problems without black and white answers;
- a methodology that facilitates the negotiation of "risk" perceptions and the making of value judgements;
- a methodology which facilitates the development and implementation of responsible management of hazards posed by new technology; and
- a methodology to help them resolve problems of increasing complexity, involving large, diffusely defined systems."

Runnalls (op. cit.) suggests that action research is such a methodology and argues that:

> "…there are significant signs that there is almost a more urgent need for a different kind of research methodology - one that is able to take inputs such as the results of positivist OHS research, existing/emerging OHS principles, systems, processes, tools, injury and disease prevention knowledge, and 'local' knowledge, experience and culture, and convert them into something that then (through the use of the methodology) is able to be effectively and sustainably [sic] implemented in the real world of the workplace."

3.2.1. Positivist Research

The positivist approach can be traced back to the times of Francis Bacon and the British Empiricists of the eighteenth and nineteenth centuries, but it was the French writer Auguste Comte who introduced the term 'positivist philosophy' (Carr & Kemmis, 1986). Carr and Kemmis (op. cit.) suggest, "The word 'positive' was intended to convey an opposition to any metaphysical or theological claims that some kind of non-sensorily apprehended experience could form the basis of valid knowledge." They argue that there was a belief in the power of positive knowledge to solve practical problems. It is suggested that this belief faded as positivism did not deliver practical improvements and the term has “Become a derogatory epithet stripped of its association with the ideas of progress and liberation.” (op. cit. p.61)

Carr and Kemmis (op. cit.) suggest that subjective and social factors play a crucial role in the production of knowledge and that knowledge can be more accurately understood in psychological and sociological terms than in purely logical or epistemological terms. Further they argue that (op. cit p.103):

> “From the interpretive perspective, social reality is not something that exists and can be known independently of the knower. Rather, it is a subjective reality constructed and sustained through the meanings and actions of individuals. Positivist theories, by failing to recognize the importance of the interpretations and meanings that individuals employ to make their reality intelligible, fail to identify the phenomena to be explained. In consequence, the kind of theories that are produced are often trivial and useless, even though they may appear to be sophisticated and elaborate.”

In his text book on real world research, Robson (1997) explains that a major difference in the interpretive approach to research is that theories and concepts tend to arise from the enquiry and therefore data collection and analysis are not rigidly separated. Spradley (1980) (cited in Robson, 1997 p.19) compares positivist and interpretative researchers to petroleum engineers and explorers respectively:

> “The [petroleum] engineer has a specific goal in mind; to find oil or gas buried far below the surface. Before the engineer even begins an investigation, a careful study will be made of the maps which show geological features of the area. Then, knowing ahead of the time the kinds of features that suggest oil or gas beneath the surface, the engineer will go out to 'find' something quite specific.”

Robson (op. cit. p.19-20) suggests that scientific researchers are therefore in the position of knowing what they are looking for whereas interpretive researchers begin much more generally they explore:

> "Gathering information, going first in one direction then perhaps retracing that route, then starting out in a new direction. On discovering a lake in the middle of a large wooded area, the explorer would take frequent compass readings, check the angle of the sun, take notes about prominent landmarks, and use feedback from each observation to modify earlier information."

Stringer in the opening of his action research handbook (1996 p.6) explains that:

> "The success of scientific research can be ascribed to its insistence on precise and rigorous formulation of description, observation, and explanation. The meticulous association of what is observed and what is explained provides explanations whose power and efficacy enable us to predict and control many facets of the physical world. The success of a scientific approach to research is embodied in the technical achievements that continue to transform our modern world."

He goes on to explain that the attempts of the social and behavioural sciences to emulate the accomplishments of the physical sciences have been less successful. He ascribes this to scientific method failing to predict and control human behaviour and points out "Teachers, health workers and human service practitioners often find that the theoretical knowledge of the academic world has limited relevance to the exacting demands of their everyday professional lives" (op. cit. p.6). Further, he suggests that traditional research operates at a distance from everyday lives and "The objective and generalizable [sic] knowledge embodied in social and behavioral research often is irrelevant to the conflicts that practitioners encounter, or has little impact on the difficulties they face."

Robson (op. cit.) supports Stringer's view and suggests that research has little influence on professional practice and "Practitioners do not consume research findings." (p.433). He cites clinicians and researchers who believe that their clinical experience is the only thing that has helped them stay up to date. Stringer (op. cit.) proposes that these views of traditional science have led to a desire to find approaches to research that are more directly relevant to the work of practitioners. However, he suggests that the new research paradigms, variously labelled qualitative, naturalistic, constructivist, and interpretivist have their limitations because they fail to provide the link between theory and practice. As a result action research has re-emerged. It is:

> "…based on the assumption that the mere recording of events and formulation of explanations by an uninvolved researcher is inadequate in and of itself. A further assumption is that those who have previously been designated as 'subjects' should participate directly in research processes and that those processes should be applied in ways that benefit all participants directly." (Stringer, 1996 p. 7)

3.2.2. Action Research

Lewin (cited in Robson, 1997 p.13) stated, "It is important to understand clearly that social research concerns itself with two rather different types of questions, namely the study of general laws of group life and the diagnosis of a specific situation."

Kurt Lewin is generally credited as the founder of action research, in the 1940's. Lewin described action research as a process that proceeded in a series of steps, initiated by a general idea and a general objective (Hart & Bond, 1995). Lewin saw action research as consisting of "analysis, fact finding and conceptualisation about problems; planning of action programmes, executing them, and then more fact-finding or evaluation; and then repetition of this whole circle of activities; indeed a spiral of such circles." (Carr & Kemmis, 1986 p.164) The first step was to examine the general idea in relation to the means of achieving the objective. From this an overall plan was developed, including a decision about the first action step. Evaluation of the action step followed, the plan was modified and a decision about the next step made. A four step framework of planning, acting, observing and reflecting now forms the basis for modern definitions of action research (Hart & Bond, 1995).

Lewin developed his action research paradigm in the context of a disrupted and changing industry in post Second World War America. He came to the view that every practical problem required conceptual analysis, research and what he referred to as a "change experiment" (Hart & Bond, 1995). His early investigations were in to the effect of worker participation on the productivity of work groups. It was believed that effective leaders could use their skills of communication to increase worker participation and thus morale, satisfaction and productivity, as well as improving relations within work groups. Given that contemporary OHS theory, as well as OHS legislation, demands worker participation in OHS problem solving, Lewin's view is of particular relevance to the discipline of OHS and the use of action research in the search for solutions to OHS problems.

Hart and Bond (op. cit.) explain that Lewin worked at the factory where in the 1940's changes in work methods and jobs led to grievances about piece rates, high employee turnover, low productivity and aggression towards management. Attempts to improve the situation had failed and management wanted to learn how to overcome resistance to change. He experimented with three groups; one that did not participate in changes; a second that participated through appointed representatives; and a third that took an active part in discussions with management. Following transfer from one job to another, the non-participating group demonstrated a drop in morale and productivity and a rise in aggression and turnover while in the participating groups this was not the case. Hart and Bond (op. cit.) suggest "This drove home Lewin's point that democratic participation was far preferable to the type of autocratic coercion associated with scientific management." (p.19) One criticism of this work, however, is that democratic participation in industry took no account of the issue of power relations between management and workers and assumed that management goals were rational and unquestionable.

Carr and Kemmis (1986 p.163) explain that "Lewin saw action research as being essential for the progress of basic social research" having three important characteristics; it is *participatory*, it is *democratic*, and it *simultaneously contributes to social science and social change*. However, in each of these areas, they suggest that contemporary action researchers:

> "Would take exception to Lewin's formulation of the significance of action research. First, they would regard group decision-making as important as a matter of principle, rather than as a matter of technique; that is, not merely as an effective means of facilitating and maintaining social change, but also as essential for authentic commitment to social action. Second, contemporary exponents of action research would object to the notion that participants should, or could, be 'led' to more democratic forms of life through action research…Third, contemporary action researchers would object to the language in which Lewin describes the theoretical aims and methods of social science [which] would now be described as posivitistic and incompatible with the aims and methods of any adequate social or educational science." (p.164)

At a fundamental level, Carr and Kemmis (op. cit. p.165) suggest, “action research is the research method of preference whenever a social practice is the focus of the research activity” and that it has two essential aims: to *improve* and *involve*.

Stringer (1996) discusses the issue of democracy further and suggests that action research seeks to engage "subjects" as equal and full participants in the research process:

> “A fundamental premise of community-based action research is that it commences with an interest in the problems of a group, a community, or an organization. Its purpose is to assist people in extending their understanding of their situation and thus resolve problems that confront them. Put another way, community-based action research provides a model for enacting local, action-oriented approaches to inquiry, applying small-scale theorizing to specific problems in specific situations. (p.9)

Stringer (op. cit. p.9-10) goes on to propose that;

> “Community-based action research is always enacted through an explicit set of social values. In modern, democratic social contexts, it is seen as a process of inquiry that has the following characteristics:
>
> 1. It is democratic, enabling the participation of all people.
> 2. It is equitable, acknowledging people's equality of worth.
> 3. It is liberating, providing freedom from oppressive, debilitating conditions.
> 4. It is life enhancing, enabling the expression of people's full human potential.”

Stringer (op. cit.) suggests that collaborative exploration helps practitioners and stakeholders develop increasingly sophisticated understandings of the problems and issues that confront them; formulate more constructive analyses of their situation; and create solutions. The role of the research facilitator, in this context, becomes more facilitative and less directive.

3.2.2.1. Action Research & OHS

As explained above, action research originated in the context of a disrupted and changing industrial setting of post war USA. Hart and Bond (1995) chart the development of the approach to organisational action research from that time and cite a 1980’s programme in which a range of methods were successfully used to solve a widespread problem of occupational overuse syndrome (tenosynovitis) in a large electronics corporation. The action research approach was highly confronting for the management of the organisation and it is suggested that managers may experience shock when confronted with information gathered by a powerful group of employees.

Empowerment and worker involvement is a central tenet of modern OHS management and is consistent with modern management theory. Quinlan and Bohle (1997 p.398) suggest:

> "There are a number of good reasons why workers should be involved in the planning and implementation of health and safety programs. They are the people closest to the work process and are therefore most knowledgeable about actual work practices. They are often most aware of the problems associated with using machinery and safety equipment, and the pressures that encourage non-compliance with safe practices. Awareness of the reasoning behind health and safety policies, and a genuine opportunity to participate in their development, can also increase worker commitment to health and safety programs. Workers become more knowledgeable about hazards and preventative measures. Consequently, they may become less suspicious of the motives behind interventions like monitoring, and feel greater confidence that they will not be blamed or penalised for reporting illness or injury."

Biggins and Farr (1988) (cited in Quinlan & Bohle, 1997 p.398) argue that involving workers in day-to-day decision-making regarding occupational health and safety may lead to improvements in industrial relations, health and safety management, and economic viability, and also contribute to better design of new technology.

The significance of worker empowerment to both OHS and action research is recognised by Runnalls (2000) who says that action research offers a great deal to the OHS discipline. He argues that there is a pressing need for OHS practitioners today. That need:

> "…is not the 'silver bullet' offered by 'experts' touting slickly packaged OHS solutions. It is not an extension of the 'frontiers' of' scientific' OHS knowledge, or a different legislative framework. The most pressing need is not behaviour-based safety, higher levels of innovation, or even a 'best practice' OHS management systems approach. The principle here is that outside inputs, expert advice, and centrally developed systems and solutions (however right and good the information, ideas, or strategies), are of little actual value in the prevention of workplace injury and disease unless they are genuinely implemented to a level where they become a 'piece of reality' for people in the organisation".

Runnalls' (op. cit.) exploratory study concludes that action research, on the basis of its methodology, principles and features, as well as its application across a range of disciplines and contexts, has the potential to provide OHS practitioners with a process, mechanism and tool with the capacity to bridge the gap between theory and practice. He argues that action research can facilitate the sharing of information about successes and support sustainable improvements in OHS performance.

3.2.2.2. Action Research Methodologies

Hart and Bond (1995 p.37-54) state that action research is distinguished from other research methodologies because it:

1. Is educative; *This goes beyond the raising of the self-esteem of participants as originally proposed by Kurt Lewin and now encompasses the idea that valid knowledge is rooted in experience*;
2. Deals with individuals as members of groups; *This accepts that groups attempt to achieve their goals through the interaction of their members;*
3. Is problem focussed, context specific and future-orientated; *Problem in this context is not necessarily taken to mean that something is wrong. Instead it might be "a definition of a need for change and describes how certain issues can be addressed"*;
4. Involves a change intervention; *Lathlean (cited in Hart & Bond, 1995 p.53) has argued "that action research is about taking action in the real world and a close examination of the effects of the action taken, thus it always involves intervention"*.
5. Aims at improvement and involvement; *This aim has to take account of the fact that there may be competing definitions of what counts as improvement and success. Therefore, agreed improvements are the target*;
6. Involves a cyclic process; *The process is not linear and does not follow a series of stages. "It is a dynamic process in which the three strands of research, action and evaluation interact in a way which we picture as a Russian wedding ring"*;

7. Is founded on a research relationship in which those involved are participants in the change process.

These criteria are applied to the proposed research in Table 5 below.

Table 5 Application of Action Research Criteria to the Proposed Research

Hart & Bond's Action Research Criteria (Hart & Bond, 1995)	The Proposed Research
Educative	Will unlock the knowledge about OHS risk controls that is in the possession of the small business operators and employees and inform others
Individuals as members of groups	Will engage small business operators and employees in a range of group contexts
Problem focussed, context specific and future-orientated	Will address real-life OHS problems, in the context of specific industries and workplaces for the purposes of preventing ill health in the future
Change intervention	Will change the behaviour of small business operators in regard to their adoption of OHS risk controls
Improvement and involvement	Will improve the health of employees and productivity of businesses, taking into account the perceptions of risk control users about the positive and negative aspects of any given risk control
Involves a cyclic process	Will use the action research and social marketing research cycles
Involve participants in the change process	Opinion leaders will be central to the success of the change process through engagement with their peers who by definition become involved in that change process.

The action research process has been widely described as a cyclic process (see for example Carr & Kemmis, 1986) and presented graphically in a number of different fashions. Robson (1997) reports that John Elliot wished to introduce flexibility in to the action research process and proposed the models shown in Figure 8. This model illustrates the links between action and research on the left and right hand sides, respectively, and presents a useful process schema.

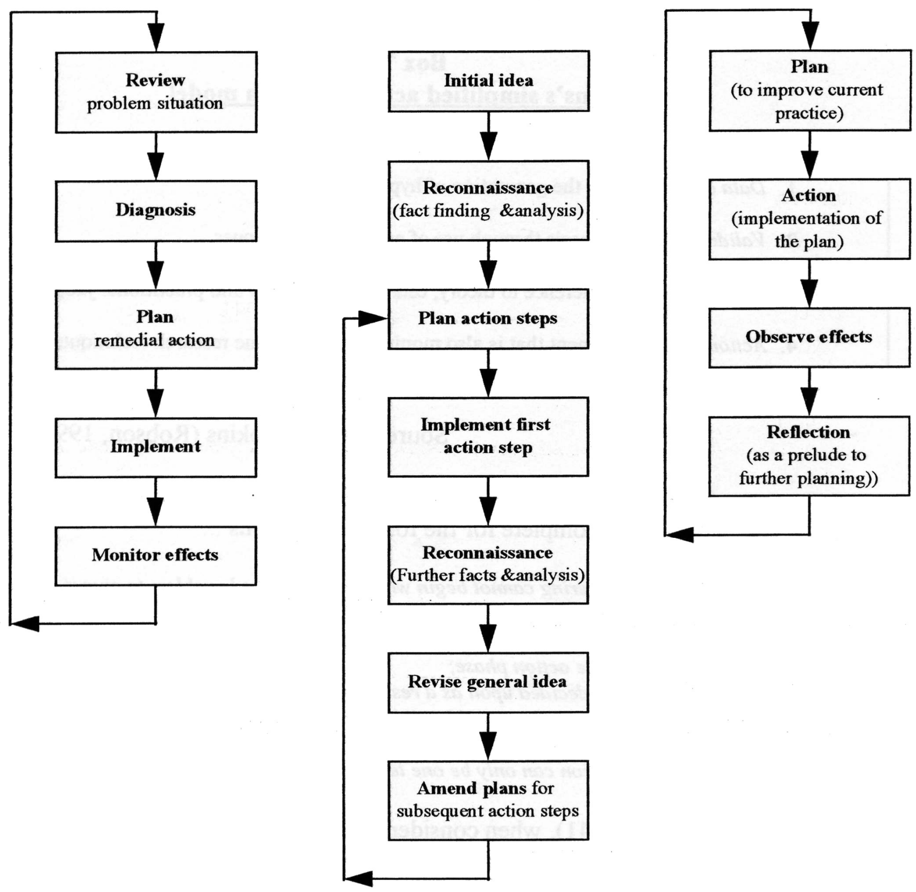

Figure 8 Elliot's Action Research Cycle

3.2.2.3. Action Research & Social Marketing

In Section 2.2.4.3.1 above, the similarities between the strategic social marketing process and action research cycles were identified. Further to this, social marketing attempts to modify the behaviour of groups (Andreasen, 1995) (as discussed above) and Hart and Bond (1995 p.16) suggest that in Kurt Lewin’s work there is an unmistakable unifying theme:

> “The group to which an individual belongs is the ground for his perceptions, his feelings, and his actions. Lewin's early laboratory experiments into group behaviour had shown the importance of the power of the group in promoting changes in attitude and behaviour, and this influenced his later work on action research.”

Despite these clear parallels between social marketing and action research, there is no explicit drawing of the comparisons in the social marketing literature that has been reviewed. Indeed three contemporary, landmark textbooks dealing exclusively with social marketing (Andreasen, 1995; Kotler et al., 2002; Weinreich, 1999a) make no direct reference to action research.

Andreasen (1995) divides strategic marketing task into six stages:

1. Listening. Conducting extensive background analysis, including listening intently to target customers.
2. Planning. Setting the marketing mission, objectives, and goals, and defining the core marketing strategy.
3. Structuring. Establishing a marketing organization, procedures, benchmarks, and feedback mechanisms to carry out the core strategy.
4. Pre-testing. Trying out key program elements such as the core marketing strategy.
5. Implementing. Putting the strategy into effect.
6. Monitoring. Tracking program progress (including more listening to customers) and adjusting strategy and tactics as necessary.

Andreasen (op. cit.) summarises this as shown in Figure 7 in Section 2.2.4.3.1. Andreasen (op. cit.) suggests that it is the monitoring function that makes the social marketing process an upward spiral. However, the monitoring is just the last step in an oscillating process within the spiral. He suggests that:

> "Good, customer-driven social marketers oscillate between going into the field to observe and talk to customers and going back to the office to think about how best to influence them. They begin by listening to the marketplace, then devise programs and structures, test them, and then implement them. But they know that programs are always works-in-process. If—as is almost always the case—monitoring suggests that there is something amiss with a program, the good marketing manager goes back to Stage 1 and once again listens to customers—this time, more carefully. This is the spiral at work. When programs are not going as well as expected, social marketers assume that they didn't understand things well enough. So they listen some more and the program then moves to Stage 2 again and devises a new strategy – or, more often, some new tactics." (p.94-95)

These oscillations are presented in a plan diagram (or "birds-eye-view"), looking down on the spiral to reveal the oscillations in the loop, as shown in Figure 9.

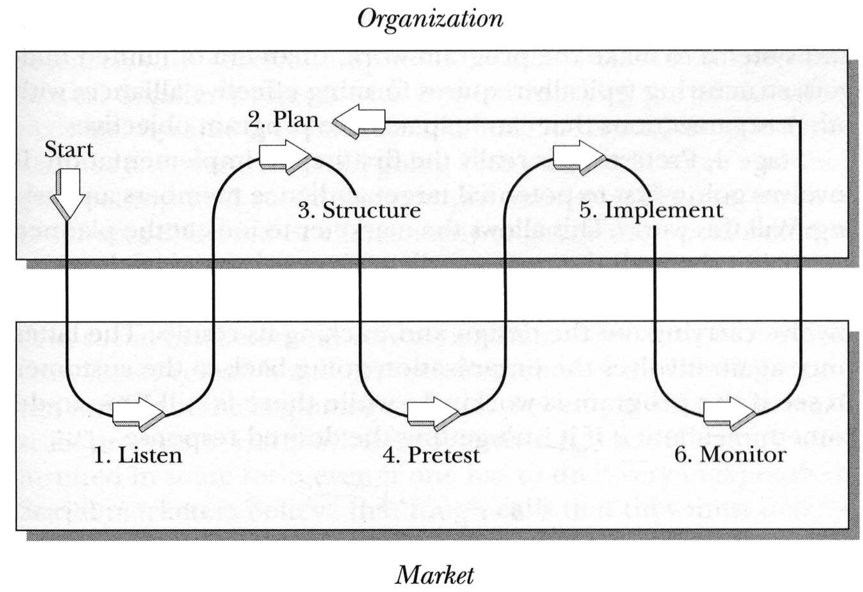

Figure 9 Strategic social marketing reviewed (Andreasen, 1995)

The identification of the similarities between social marketing and action research has led to the construction of Table 6.

Table 6 Comparison of strategic social marketing and Action Research

Andreasen's Strategic Social Marketing	Elliot's Action Research Cycle
	Initial idea
Listening	Reconnaissance
Planning	Plan action steps
Structuring	
Pre-testing	Implement first actions step
Implementing	
Monitoring	Reconnaissance
Planning	Revise general idea
	Amend plans

To test the hypothesis that the social marketing model, currently used in other disciplines, is transferable to the OHS discipline for the purposes of increasing the rate of adoption of OHS risk controls within small businesses, it was decided to undertake exploratory research and use a meld of strategic social marketing and Action Research as the framework for the methodology. This melded approach was applied to three case studies.

3.2.3. Case Study Research

Robson (1997 p.40) distinguishes between three main research categories:

1. *Experiment*: measuring the effects of manipulating one variable on another variable
2. *Survey*: collection of information in standardised form from groups of people
3. *Case study*: development of detailed, intensive knowledge about a single ‘case’, or a small number of related cases.

In selecting a research category, Robson (op. cit. p.42) suggests that the purpose should be considered and the purposes of research may be categorised as:

a) Exploratory
   - To find out what is happening
   - To seek new insights
   - To ask questions
   - To assess phenomena in a new light
   - Usually, but not always, qualitative

b) Descriptive
   - To portray an accurate profile of persons, events or situations
   - Requires extensive previous knowledge of the situation to be researched or described, so that you know appropriate aspects on which to gather information
   - May be qualitative and/or quantitative.

c) Explanatory
   - Seeks an explanation of a situation or a problem, usually in the form of causal relationships
   - May be qualitative and/or quantitative

Robson (op. cit. p.42) suggests that in turn the purpose of the research may assist in the selection of a means of collecting and analysing empirical evidence. He proposes a hierarchical relationship between the research strategies, related to the purpose; that

- Case studies are appropriate for exploratory work;
- Surveys are appropriate for descriptive studies; and
- Experiments are appropriate for explanatory studies.

3.2.3.1. Case Study Methodology

Robson (1997 p.53) defines "Case study" as "…a strategy for doing research which involves an empirical investigation of a particular contemporary phenomenon within its real life context using multiple sources of evidence".

He suggests that the important points are that case study is:

- "a *strategy*, i.e. a stance or approach, rather than a method, such as observation or interview;
- concerned with *research*, taken in a broad sense and including, for example, evaluation;
- *empirical* in the sense of relying on the collection of evidence about what is going on;
- about the *particular*; a study of that specific case (the issue of what kind of generalization is possible from the case, and of how this might be done, will concern us greatly);
- focused on a *phenomenon in context*, typically in situations where the boundary between the phenomenon and its context is not clear; and
- using *multiple methods* of evidence or data collection."

This is an expansion of Yin's definition of case study (Yin, 1989 p.23). However, Yin disagrees with Robson about the hierarchical arrangement of research strategies and argues (op. cit p.16) that case studies are far from being only an exploratory strategy. Instead, what distinguishes the research strategies is (a) the type of research question being posed, (b) the extent of control an investigator has over actual behavioural events and (c) the degree of focus on contemporary as opposed to historical events. Yin (op. cit.) proposes that case study is appropriate when the research question is of a "how, why" type, the research does not require control over behavioural events and there is a focus on contemporary events.

3.2.3.2. Case Study Design

Yin (1989) distinguishes between four types of case study design; (1) single-case (holistic); (2) single-case (embedded); (3) multiple-case (holistic); and (4) multiple-case (embedded). Single-case studies are appropriate where there is a well-formulated theory being tested and it is likely that the propositions are true. They are also appropriate where the case is extreme or rare or the case is revelatory i.e. observe a previously inaccessible phenomenon.

Multiple-case study designs have the advantage of being regarded as robust and offering more compelling evidence than single-case studies (Yin, op. cit.). Yin (op. cit.) suggests that they should be considered analogous to multiple experiments, i.e. follow replication logic rather than erroneously consider multiple cases to be analogous to multiple respondents in as survey or multiple subjects in an experiment.

Yin (op. cit. p.53) explains that replication logic requires that each case must be carefully selected so that it either:

a) Predicts similar results (a *literal replication*); or
b) Produces contrary results but for predictable reasons (a *theoretical replication*)

Sampling logic does not apply to multiple-case study analysis, because they do not represent a larger pool of cases. Instead, Yin (op. cit. p.57) suggests that "Each individual case study consists of a whole study, in which convergent evidence is sought regarding the facts and conclusions for the case; each case's conclusions are then considered to be the information needing replication by the other individual cases". The multiple-case results provide an opportunity for generalisations to be made. Yin (op. cit.) proposes the case study methodology shown in Figure 10.

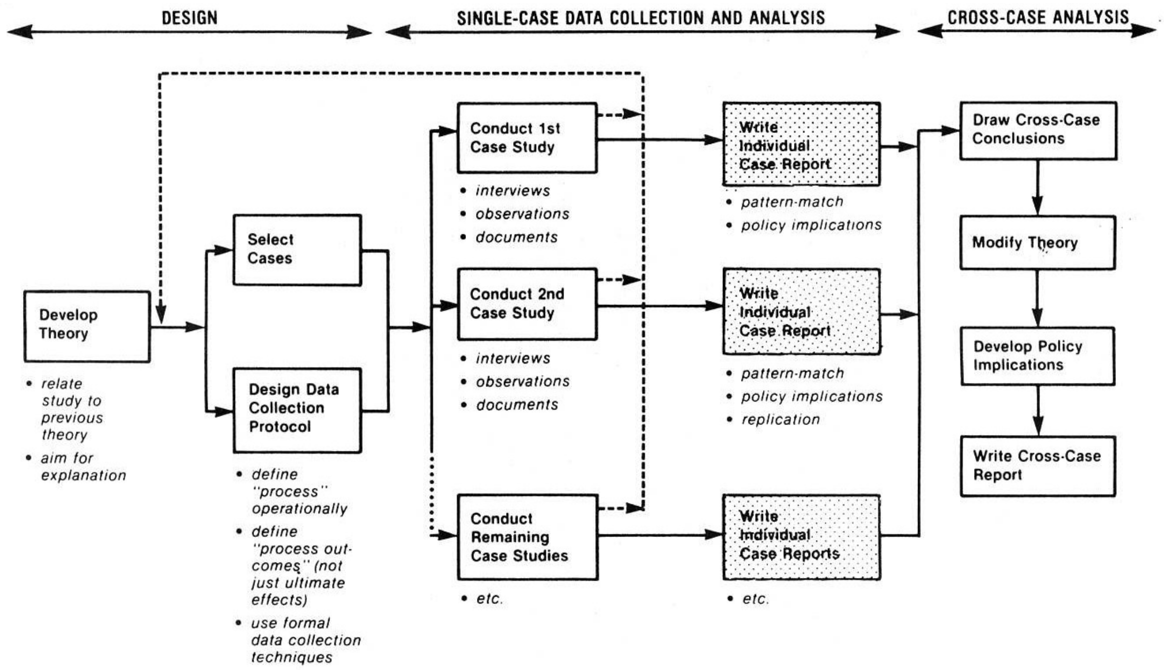

Figure 10 Case Study Method (Yin, 1989)

Case studies may be either single (holistic or embedded) or multiple (holistic or embedded). Holistic in this context refers to case studies where there are no sub-units of analysis. Embedded cases studies have multiple units of analysis. For example, the study of the diffusion of an innovation within one group of people would demand an holistic methodology whereas the observation of the diffusion of the innovation within several discrete groups as a result of one social marketing campaign would demand an embedded methodology.

The unit of analysis in a classic case study may be an individual. However, Yin (op. cit.) suggests that a case may also be an event or an entity, which is less well defined than an individual. The definition of the unit of analysis is usually related to the way the initial research questions have been defined.

3.2.3.3. Case Study Quality

Yin (1989) applies the four tests of research design (construct validity, internal validity, external validity and reliability) to case study research:

3.2.3.3.1. Construct Validity

To meet the test of construct validity the investigator must (Yin, 1989 p.42):

1. Select the specific types of changes that are to be studied (in relation to the original objectives of the study); and
2. Demonstrate that the selected measures of these changes do indeed reflect the specific types of change that have been selected.

Three tactics are available to increase construct validity. The first is the use of multiple sources of evidence, in a manner encouraging convergent lines of inquiry. A second tactic is to establish a chain of evidence. The third tactic is to have the draft case study report reviewed by key informants (Yin, 1989).

3.2.3.3.2. Internal Validity

Yin (op. cit. p.43) states that internal validity is a concern only for causal or explanatory studies and therefore is less likely to be of concern to the case study researcher. However, he suggests that the concern over internal validity for case study research may be extended to the broader problem of making inferences. He states that:

> "Basically, a case study involves an inference every time an event cannot be directly observed. Thus, an investigator will "infer" that a particular event resulted from some earlier occurrence, based on interview and documentary evidence collected as part of the case study. Is the inference correct? Have all the rival explanations and possibilities been considered? Is the evidence convergent? Does it appear to be airtight? A research design that has anticipated these questions has begun to deal with the overall problem of making inferences and therefore the specific problem of internal validity."

He suggests that the analytic tactic of pattern-matching, and the two related analytic tactics, explanation-building and time-series analysis can be used to address internal validity.

3.2.3.3.3. External Validity

This deals with the problem of knowing whether a study's findings may be generalised beyond the immediate case study. Yin (op. cit.) argues that an analogy to sampling is inappropriate when dealing with case studies, because case studies rely on analytical generalisation whereas survey research relies on statistical generalisation. He suggests, "In analytical generalization, the investigator is striving to generalize a particular set of results to some broader theory." (op. cit. p.44) and, "…a previously developed theory is used as a template with which to compare the empirical results of the case study. If two or more cases are shown to support the same theory, replication may be claimed." (op. cit. p.38) He cites an example of a neighbourhood study and suggests, "A theory is tested through replications of the findings in a second or third neighbourhood where the theory has specified that the same results should occur. Once such replication has been made, the results may be accepted for a much larger number of similar neighbourhoods…"

3.2.3.3.4. Reliability

The objective is to ensure that if a later researcher followed exactly the same procedures as described by an earlier investigator, the later investigator would arrive at the same findings and conclusions, i.e. doing the same case study again rather than replicating the work in a different case study (Yin, 1989).
Yin (op. cit. p.45) suggests that the researcher should make as many steps as possible operational and "…conduct the research as if someone were looking over your shoulder." And "…conduct the research so that an auditor could repeat the procedures and arrive at the same results."

3.2.3.4. Case Study Evidence

The sources of information collected from a case study and the principles that are used in its analysis are critical to the quality of the case study. Yin (op. cit. p.85) proposes that there are six sources of evidence that may be used in case studies:

- Documentation; e.g.
  - Communiqués
  - Minutes of meetings
  - News clippings
  - Other formal studies of the unit of analysis
- Archival records; e.g.
  - Organisational records
  - Survey data
  - Personal records
- Interviews; e.g.
  - Open-ended
  - Focussed
  - Structured
- Direct observation; e.g.
  - People
  - Buildings
  - Facilities
- Participant-observation; e.g.
  - Behaviours observed by the investigator who actively participates in the events being studies
- Physical artefacts; e.g.
  - Devices
  - Tools
  - Instruments

The benefits of these sources is maximised if more than one sources is used, i.e. construct validity is addressed; a case study database comprising notes, documents, tabular data and materials is created; and a chain of evidence is maintained. The latter refers to the case study report in which a reader is able "to follow the derivation of any evidence from initial research questions to ultimate case study conclusions." (Yin, op. cit. p.102)

Flick (2002) in his textbook of qualitative methods proposes that "Triangulation" is used to validate data and "…increase scope, depth and consistency in methodological proceedings" (p.227). He distinguishes between data triangulation, investigator triangulation, methodological triangulation and theory triangulation to explain the combination of different methods, study groups, local and temporal settings, and different theoretical perspectives in dealing with a phenomenon. Morse and Richards (2002), however, argue that the term "Triangulation" is widely misused as it strictly refers "…to gaining multiple perspectives through completed studies that have been conducted on the same topic and that directly address each other's findings." (p.76). Notwithstanding Morse and Richards' criticisms, triangulation in terms of obtaining evidence from multiple data sources will support validity.

3.3. Research Framework

Intervention researchers state that "The goal of occupational safety intervention research is to be able to say that a specific intervention either enhanced or did not enhance, worker safety." (Robson et al., 2001 p.13) It would be preferred, therefore, to use an experimental study design, which would provide the strongest causal link between the intervention implementation and the observed effects. However, this somewhat narrow goal of intervention research does not provide opportunities for developmental research and limits the application of a social marketing model that requires the research to be industry-based and use groups facing real-life OHS problems.

The research intervention undertaken was exploratory and used a meld of action research and social marketing, employing a multiple (holistic) case study methodology. In linking case study to action research, Robson (1997 p.439) suggests "The emphasis on a specific situation, of looking at practice in a particular context and trying to produce change in that context, puts action research firmly within the case study strategy…".

The intervention tested the use of a social marketing model to influence small business decision-maker behaviour in the commercial fishing, wall and ceiling and motor vehicle repair industries. The case study methodology is detailed below.

3.4. Research Intervention

Ideally the research would have measured the adoption of OHS controls by small businesses in an intervention case study group over time i.e. compare the number of businesses at the “action” and “maintenance” stages of the TTM both pre and post intervention. However, diffusion time to the point that businesses are at the action stage are often in excess of the study period (Valente & Davis, 1999). Therefore, the research measured movement of case study subjects through the stages of change i.e. the proportion of subjects at each of the stages in the TTM was measured pre and post intervention.

Three case studies were used to test the hypothesis. The case study units of analysis were made available through industry groupings and involved key stakeholders, thus legitimising and authorising sponsorship (LaMontagne & Needleman, 1996). The case studies were in the vehicle body repair industry, the commercial fishing industry and the wall and ceiling industry. Each case study unit was a small group of small business operators. Details of the rationale for each case study are summarised in Section 4 below. The research framework is summarised in Figure 11.

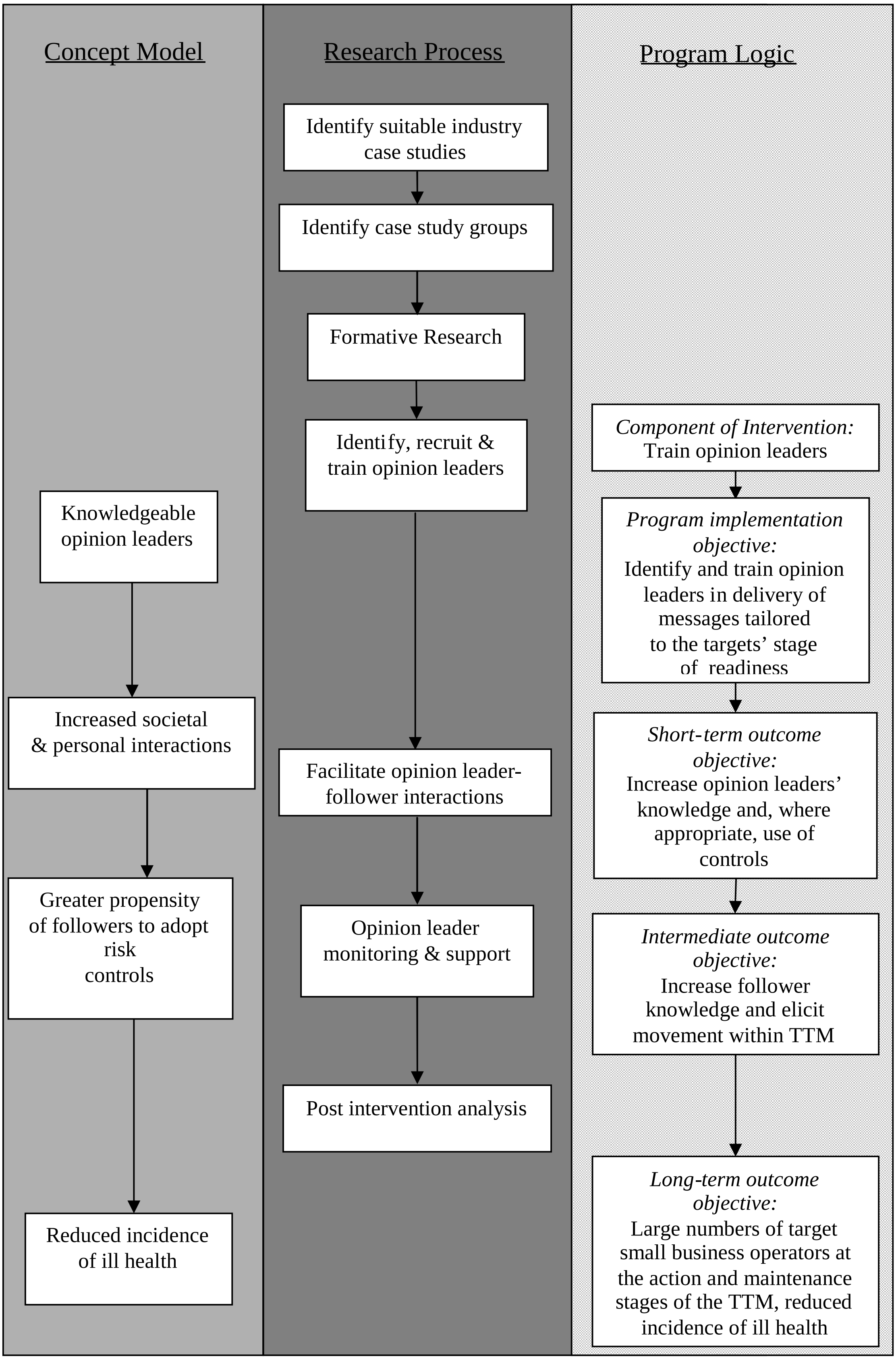

Figure 11 Research concept model, research process and research program logic (after Robson et al., 2001)

3.4.1. Intervention Model

The same general intervention model was used to varying degrees in each case study and is outlined below.

The intervention used an action research methodology in concert with a social marketing model, which Andreasen (1995) recommends commences with the writing of a statement of the goals and strategy *to be* employed. The goals and strategy were specific to the individual case studies. The generic statement written in advance of the intervention work was:

Goals

- Increase the demand by target business operators for the risk control.
- Increase the availability, use and maintenance of the risk controls by employees within the target businesses

Strategy

The targets will be small businesses in Victoria that meet specified criteria.

The behaviour change among the targets will be brought about by:

- Developing and delivering messages tailored to the target business operators' stage of readiness

  Communications strategies will be developed that focus on tailoring messages to the different stages of adoption that the targets will be at.

- Reducing the costs of adopting risk controls

In this context cost includes the time and effort required to find and use the risk control, the expense, any undesirable side effects, the loss of pleasure from the behaviour that must change, the possibility that the precaution is unavailable to the individual and similar obstacles (Weinstein, 1988).

Risk controls are often relatively expensive in capital and maintenance costs. Sometimes the use of the controls is also perceived to be awkward and therefore undesirable. Therefore, the target business operators must perceive that they are able to adopt the controls easily and believe that they have the capability to manage the controls in to the long-term.

- Bringing to bear social influences on the targets

  Within the individual case study groups there will be various ways in which social pressure could be used. Opinion leaders and role models were used within one case study.

3.4.2. Intervention Methodology

As introduced above, a meld of action research methodology and social marketing techniques was used as a research framework. The investigative method used multiple case studies. The case study protocols (Yin, 1989) for the industry groups follow.

Yin (1989 p.71) states:

> "A case study protocol is more than an instrument. The protocol contains the instrument but also contains the procedures and general rules that should be followed in using the instrument. Having a case study protocol is desirable under all circumstances, but it is essential if you are using a multiple-case design.
> The protocol is a major tactic in increasing the reliability of case study research and is intended to guide the investigator in carrying out the case study."

The three cases studies are detailed in the following section.

4. Case Studies

4.1. Commercial Fishing Case Study

(Spitzer, 1999)

In the commercial marine fishing industry where the risk of falling or being dragged into the sea is high, the use of Personal Flotation Devices (PFD's) increases the chances of survival. It is widely recognised, however, that such devices are infrequently used by fishers.

The perils of commercial marine fishing have long been recognised; Sir Walter Scott wrote in 1816 "It's no fish ye're buying—it's men's lives." (Scott, 1816) However, Schilling was the first to document the high fatality rates in his discussion of British fishers in 1966, noting that "the rates were twice as high as those for coal miners and about 20 times as high as those for the manufacturing industries" (Schilling in Schnitzer, Landen, & Russell, 1993 p.685).

In October 2000, Lincoln, Hudson and Conway (2000) convened the International Fishing Industry Safety and Health Conference in Massachusetts, U.S.A. They identified that, "Few occupations are as challenging to the worker's safety as is that of commercial fishing. Fishing vessel safety is a complex interaction involving human (skipper, crew, owner), machine (vessels, equipment), and environment (weather, management scheme)." In response to this, they identify that one of the challenges of improving safety is to identify solutions that will neither hamper the workers nor diminish the quality of the catch (Lincoln et al., 2000 p.xix).

This section reports on a preliminary evaluation of personal flotation devices (PFD) by commercial fishers, undertaken by Seafood Training Victoria. The evaluation process included trials of a range of PFD's and the collection of information by questionnaire. This researcher became involved in the project just prior to the commencement of the trials and was able to include within the questionnaire, questions pertaining to this thesis.

4.1.1. Commercial Fishing Literature Review

4.1.1.1. The size of the problem

Commercial fishing is one of the world's most dangerous occupations (Hudson & Conway, 2003; Lincoln et al., 2000; Petursdottir, Hannibalsson, & Turner, 2001). Petursdottir et al. (2001) report the ILO estimate that 24,000 fatalities occur worldwide each year in fisheries. In Denmark from 1989 to 1996 the fatality rate among fishers was 25-30 times higher than that for land-based employees; in the USA in 1996 the death rate in fisheries was estimated at 40 times the national average (Petursdottir et al., 2001); in Britain, between 1976 and 1995, the risk of fatality among commercial fishers was 52.4 times greater than that of the general workforce (i.e. 103.1 /100,000 workers) (Roberts, 2004); in New Zealand a fatality rate of 226/100,000 workers is reported, although this includes all workers in the industry and thus those employed on-shore (Chalmers, McNoe, & Stephenson, 2004). Schnitzer et al. (1993) alludes to the potential for underestimation of the size of the problem in the USA at least, as a result of death certificates recording "usual occupation", which may not be fishing, given the seasonal nature of the work.

In Australia between 1989 and 1992, the fatality rate was 16 times the national average (89.2/100,000 workers versus 5.5/100,000 workers). This rate was second only to forestry (97.2) in the same period and was more than twice that in the mining (36.4) and more than four times that in agriculture (20.6) (Mitchell et al., 2001).

Australia has an exclusive fishing zone of almost 9 million km^2, being the third largest in the world. The major species fished are prawns, rock lobster, abalone, tuna and other fin fish, scallops and edible and pearl oysters (Driscoll, Ansari, Harrison, Frommer, & Ruck, 1994; Mitchell et al., 2001). Mitchell et al. analysed fishing industry deaths in Australia between 1989 and 1992 and found that 55 workers were fatally injured in the period, equating to 14 workers each year. Forty-nine of the workers killed were employed as fishers or deckhands, a sub-group in the analysis that had a fatality rate of 145.8 deaths per 100,000 workers per year. Ninety-five percent of the workers were male with an average age of 34 years. Drowning was the most common mechanism of fatal injury (Mitchell et al., 2001)[2].

Batchelor and Bugeja (2003) undertook an analysis of commercial vessel fatalities in Victoria occurring during the period1991-2001 and found 14 (66%) fatalities occurred on fishing vessels, 12 of which were the result of drowning. The vessels involved were cray fishers (6 deaths, 4 incidents); fishing trawlers (5 deaths, 4 incidents); a squid fishing boat (1 death); and otherwise unspecified fishing boats (2 deaths).

4.1.1.2. The nature of the problem

Drowning in the commercial fishing industry occurs as a result of vessel loss at sea or fishers falling overboard. Petursdottir et al. (2001), in their review written for the Food and Agriculture Organisation of the United Nations, point out that loss of a vessel will probably result in some or all of the crew losing their lives. The problems that lead to loss of vessels are similar world wide (Lang, 2000), and may be categorised as; foundering owing to lack of stability following addition of top weight to the vessel and events such as the taking of water, failure of bilge pumps, burst pipes and sprung planks; stranding and grounding as a result of navigational errors (commonly associated with fatigue), engine or gearbox failure, propeller fouled by a rope or gear; collisions owing to failure of adequate lookout; and fire, generally associated with oil of fuel coming in contact with hot exhaust systems in engine rooms (Hopper & Dean, 1992; Lang, 2000; Roberts, 2004).

[2] A uniform definition of “drowning” was proposed at the World Congress on Drowning in 2002 as “The process of experiencing respiratory impairment from submersion/immersion in liquid” (van Dorp, Knape, & Bierens, 2002)

Mitchell et al. (2001) found that in Australia between 1989 and 1992, fourteen capsizing incidents had resulted in 23 deaths. They also report that 3 workers were killed when a cray fishing vessel collided with rocks and two workers were killed when their shark fishing vessel sank in rough weather.

Other common circumstances reported by Mitchell at al (op. cit.) were crew members falling overboard or being dragged overboard as a result of becoming entangled in fishing nets or cray pot ropes. Backus et al. (2000) interviewed 103 lobster fishers operating out of Maine, USA and found that 75 (73%) had at some stage been caught in rope resulting in loss of clothing, being pulled to the stern or pulled overboard. Forty-five (44%) reported a total of 90 entanglements within the previous 5 years. In a review of injuries and fatalities in the commercial fishing industry in New Zealand (Chalmers et al., 2004) 94% of fatalities over a given period occurred at sea, virtually all being drownings. Of 154 hospitalisations analysed, 94% occurred on board vessels and were the result of entrapment in equipment or machinery, being struck by ropes or falling objects, being thrown against the superstructure or falling. Eleven cases involved submersion. Roberts (2004) reviewed fatalities among British fishers between 1976 and 1995 and found that 40% of were the result of being entangled in lines or other equipment and knocked or dragged overboard or dragged into a winch. The author reports that 52% of drownings were the result of falling or being washed overboard.

Of the 14 deaths among Victorian fishers (1991-2001), Batchelor and Bugeja (2003) report 2 deaths while fishing (1 incident); 5 deaths (3 incidents) while retrieving cray pots; 1 death while setting cray pots; 3 deaths (3 incidents) while shooting or setting nets; 1 death while travelling back to port; and 1 death while catching shark. One death to a bystander was reported.

The fatal incidents recorded around Australia occurred in a range of sea conditions. The most common were large swells (33%) but a similar number of incidents occurred during both slight to moderate swells (27%) and in calm conditions (25%). Fatalities were most common during winter months (Mitchell et al., 2001).

4.1.1.3. Prevention of fatalities

Research on fishing vessel safety is sparse (Jin, Kite-Powella, Thunbergb, Solowa, & Talleyc, 2002 p.497) and what limited research is published predominantly focuses on the use of opportunities to minimise loss through the use of PFD's (see for example, Batchelor & Bugeja, 2003; Hopper & Dean, 1992; Hudson & Conway, 2003; Lang, 2000; Mitchell et al., 2001; O'Connor, 2004; Roberts, 2004).

Prevention of fatalities in the commercial fishing industry may usefully be considered in the context of models such as Viner's generalized time sequence model (Viner, 1996) or Reason's Accident Causation Model (Reason, 2000), both of which emphasise the importance of organisational and physical factors that create the circumstances under which an event may later occur. Reason's model is cited by Petursdottir et al. (2001) in their report to the Food and Agriculture Organization of the United Nations, thus emphasising the need for a focus on prevention rather than recovery related activities.

The generalised time sequence model, as shown in Figure 12, not only illustrates the opportunities to focus on prevention through the detection, recognition and reaction to the development of damaging conditions but also illustrates the opportunities for recovery after an event to minimise loss. Put simply, the "event" in Viner's model is the point in time at which control of a potentially damaging energy (hazard) is lost; for the purposes of this argument, the event is the point at which the vessel is over whelmed or the crewman falls overboard. The period immediately preceding the event, within *Time Zone 2*, is generally short. The loss of control of the energy begins within this time zone and there is an opportunity to regain control in this short period; for example, there is a chance to bail excess water, escape a sand bar or catch a crewman before he enters the water. The *Time Zone 1* period is generally long and is the period during which organisational and physical factors create the circumstances under which the event may later occur; for example additions to superstructure that makes a vessel top-heavy, failure to undertake preventive maintenance on engines, or a decision to fish when there is the potential for weather to turn rough. The period immediately following the event, in *Time Zone 2* is generally short and is the period during which activities to minimise damage may be undertaken; for example activation of equipment that permits location by emergency rescue services, use of life rafts and PFD's and recovery of a crew member that has entered the water. The *Time Zone 3* period is generally long and is the period during which medical, rehabilitation and counselling activities are undertaken and is therefore associated with post-rescue activities.

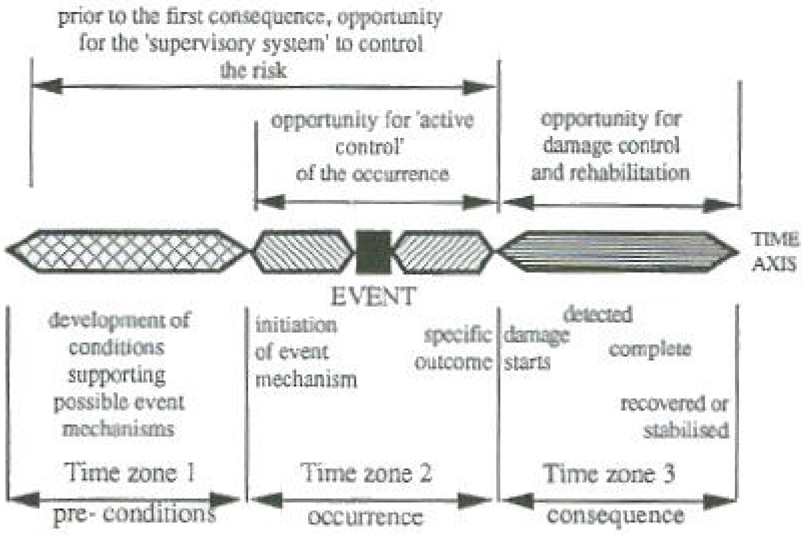

Figure 12 Generalised time sequence model (Viner, 1996)

In accord with this model, the US Coastguard task force on fishing vessel causalities (Spitzer, 1999) identified the solutions as basic and straightforward; (a) safety conscious resource and industry management regimes; (b) seaworthy boats; (c) competent crews; and (d) adequate survival equipment.

In addition to the engineering solutions that are implicit in the improvement of seaworthiness (see for example Batchelor & Bugeja, 2003; Hopper & Dean, 1992; Lang, 2000) some authors have addressed the issue of fisheries management and the impact of management strategies on vessel and fisherman safety. Roberts (2004) identified that the exhaustion of fishing grounds increases the pressure on fishers, in the UK at least, to go further out to sea in small and unsuitable vessels. Jin et al. (2002), in their development of a probability model to predict fishing vessel loss, specifically refers to the race to fish as a factor which influences risk to the safety of both vessel and crew and suggests that fishery management practices have led to highly competitive commercial practices. Brooks (2004) endorses this view in regard to rock lobster fishing in Australia and reports that local archives show no capsizes in the10 year period 1992-2002 since the introduction of quotas and a reduction in time at sea of approximately 33% since the 1980’s. He suggests that individual quotas have stabilised the lobster population thus reducing the distance that fishers have to travel to catch fish.

Woodley (2000), a fishing vessel safety coordinator for the US Coastguard, explains that the framework and rules under which fishing vessel operators compete against each other “dictate the spatial and temporal aspects of the fishing season, as well who participates” (p.161) and the race to fish encourages fishers to operate for extended periods in all weather and sea conditions and take risks. Thus quota systems can reduce speed, reduce fatigue, reduce the need to overload vessels and reduce the incentive to operate in adverse weather conditions.

In regard to engineering solutions, Batchelor and Bugeja (2003) specifically refer to the need for research in design of cray fishing boats that will lead to measures that will reduce the risk of capsizing. Driscoll et al. (1994) found that 26% of deaths in Australian waters between 1982 and 1984 were directly attributable to lack of seaworthiness or equipment failure. Törner et al. (2000) point out that, in Sweden, much effort has been put into safety education of fishers with a particular emphasis on the development of technical solutions although the rate adoption is low. They suggest that fishers often reject the evidence that accidents offer in regard to risk and consider technical solutions too costly.

Given the incidence of drowning and perhaps, the fatalism that is found among fishers (Lang, 2000; Petursdottir et al., 2001), greatest emphasis in the literature in regard to risk control is placed on the use of PFD’s i.e. a measure to reduce the risk of drowning and that is, therefore, in the latter part of Viner’s Time zone 2 (Viner, 1991).

4.1.1.4. Use of PFD’s

Mitchell et al. (2001) report that the non-use of PFD’s by fishers working in Australian waters was a common factor among drowning incidents. Among the 12 drownings of commercial fishers in Victoria between 1991 and 2001, a PFD was not being worn at the time in 9 cases, PFD use was not recorded in 2 cases and in one case a PFD was worn but was faulty. In 11 cases a PFD was available and in one case the availability is not recorded (Batchelor & Bugeja, 2003).

Hudson and Conway (2003) reviewed deaths due to hypothermia and drowning among commercial fishers in Alaska and found that PFD's were not used in 84% of 144 fatal cases among where PFD usage was known. The odds ratio for survival was 11.35 times higher when PFD's were used. O'Connor (2004) reports that people who survived fatal boating incidents in general were twice likely to have been wearing a PFD.

Lang (2000), a marine accident investigator, reports that fishers are reluctant to wear PFD's because they are perceived to be too bulky, impractical and expensive. He also suggests that fishers fear derision of their peers. Dean (1993) undertook a review of PFD's available to British fishers and lists reasons given by fishers as the PFD being too restrictive, hot or uncomfortable and that it will snag in netting, get dirty or be easily torn and damaged. Other reasons suggested are possible ridicule by peers, the bother of donning and doffing the device and a general failure to appreciate the need for a device to keep them afloat.

Brooks (2004) found wear rates of PFD's among a small group of rock lobster fishers in South Eastern Australia were low, at 0.5% for the study period of 10 weeks. He reports reasons given by fishers for not using a PFD, including the perception that they are too bulky and that they need only be donned during an emergency situation. However, Driscoll et al. (1994) report 33 cases of fishers drowning or being taken by sharks between 1982 and 1984, in which 25 victims were not wearing PFD's and in 5 cases PFD use is unknown. Of these, the circumstances of only 6 deaths suggest that there was ample time to don a PFD, while in the majority of cases there would not have been adequate warning. The authors suggest that rough weather may be the only warning in regard to the need to don PFD's and, as already discussed, a similar number of fatalities occurred among Australian fishers during calm and moderate weather as they did during rough weather. They add that regular use of PFD's is complicated by the unsuitability of many PFD's and the potential for them to increase risk to the wearer.

4.1.1.5. Increasing the use of PFD’s

From the above discussion it is clear that, in addition to organisational and engineering measures that will reduce the risk of vessel loss and persons falling overboard, increased use of PFD’s during routine work is likely to decrease the risk of fatality among crew that enter the water.

Various authors have proposed strategies for increasing PFD usage that include training and regulation and thus enforcement. However, the culture of the industry is a significant influence and Lang (2000) points out that attempts to impose change from outside are likely to fail. He suggests, “The fisherman does not take kindly to non-fishers telling him what to do. An official in a grey suit, or a seaman who has come ashore from the merchant navy, or the enthusiastic academic who tries to persuade fishers to change is as likely to aggravate the situation as improve it…The fishing community must change its attitudes and adopt a safety culture” (p.73).

In 1992, the Sea Fish Industry Authority in the UK reviewed various types of PFD and buoyancy aids that were available, in order to recommend suitable products to the industry. Flotation tests were undertaken in tanks and “acceptability trials” were commenced among local fishers, but these were limited as a result of the tank tests revealing that few of the devices available were suitable if the wearer was unconscious. The review concluded that a buoyancy device for the fishing industry must, in addition to having life saving capabilities, be (Dean, 1993):

- easy to wear and unrestricting
- free of snag points which may catch in netting
- suitable to wear with sea gear
- suitable for both winter and summer use
- damage resistant and durable
- easy to clean
- able to tolerate water splashes and spray
- easy to repack/maintain
- at an affordable price
- generally acceptable

It appears that the Sea Fish Industry Authority study did not find an ideal PFD but they concluded that developments in the integration of a PFD within the bib and brace assembly commonly worn by fishers were promising.

Following recommendations made by the Victorian State Coroner (Batchelor & Bugeja, 2003), WorkSafe Victoria, the State Government OHS enforcement agency, supported a pilot study to assess the suitability of a range of proprietary personal floatation devices as working jackets in the Victorian commercial fishing sector. The following case study is based on that pilot study.

4.1.2. Commercial Fishing Case Study Questions

The aim of the case study was to undertake formative research in the context of the social marketing model (Andreasen, 1995) introduced in Section 2.2.4.3. Within the strategic social marketing process, the case study commenced the “listening” phase as illustrated in Figure 7 in Section 2.2.4.3.1. Central to this is the identification of the stage of readiness for change of the targets i.e. the skippers of commercial fishing vessels. In regard to this, consistent with the focus of this thesis being influencing decision-maker behaviour, the desired behaviour is; *Enforcement (supervision) and personal use of personal flotation devices (PFD’s) while at sea i.e. the skipper does not accept anything less than 100% usage of a PFD.* This is to be measured against the TTM (Prochaska, Johnson, & Lee, 1998). In accord with the approach to case study development proposed by (Yin, 1989), the questions and sources of evidence shown in Table 7 were formulated.

The case study units of analysis were commercial fishing vessel skippers in Victoria operating within fishing fleets centred on the ports of Portland, Queenscliff and Lakes Entrance. Seafood Industries Victoria facilitated access to the commercial fishing vessels through a project funded by WorkSafe Victoria.

Table 7 Case study questions and sources of evidence

Questions	Sources of Evidence
What do business operators commercial fishing vessel skippers know about the risk of drowning?	Researcher administered questionnaire
What level of risk do commercial fishing vessel skippers believe is associated with working at sea without wearing a PFD?	Researcher administered questionnaire
To what extent are PFD’s used?	Researcher administered questionnaire
Is the use of PFD’s by crew enforced?	Researcher administered questionnaire
Do skippers of commercial fishing vessels believe that PFD’s are necessary?	Researcher administered questionnaire
What are the barriers to use of PFD’s?	Researcher administered questionnaire

4.1.3. Commercial Fishing Case Study Field Procedures

WorkSafe Victoria hosted four “Fishing for Safety” Forums in Portland, Melbourne, Queenscliff and Lakes Entrance respectively. The aim of the Forums was to gather the views of fishers regarding the use of available PFD’s as working jackets. Fishers from the ten fishing sub-sectors (Rock Lobster, Seine Netting, Deep Water Trawling, Abalone Diving, Mesh Netting, Scallop Fishing, Line Fishing, Shark Fishing, Squid fishing and Wrasse Fishing) represented in the Victorian fleet were invited.

At each forum the three main manufacturers of PFD’s in Australia and, latterly, one from New Zealand were given the opportunity to demonstrate their products and a group discussion was facilitated around the following questions:

- How probable is it that I might need to use a PFD one day?
- Under what circumstances will a PFD save my life?
- Is there a PFD available currently that I would be prepared to wear all the time?
- If yes, which one? What’s good about this model?
- If not, why not? What are the problems with existing models? E.g.
    - Cost
    - Design
    - Interfere with work

- Where to next?
- Am I prepared to wear a PFD at all times if these problems are fixed?

The fishers attending the forums expressed the view that that there was no PFD available currently that was suitable for use in each of the fishing industry sub-sectors. The concerns raised in regard to existing PFD’s varied by sub-sector; for example, the Squid fishers were particularly concerned that existing PFD’s may not be able to withstand punctures from squid hooks; the Danish Seine fishers were concerned that the PFD shell would not be sufficiently durable to withstand the levels of friction created by the nets. There was, however, general agreement that any PFD should possess the following features:

1. Easy to wear and remove
2. Pictograph of donning instructions on/in jacket
3. Several sizes to fit all adults
4. Support wearer face up if unconscious
5. Bright colours
6. Fluorescent tape stitched on collar, hood and shoulders
7. Have positive inbuilt buoyancy
8. Strong construction, tear and puncture resistant, fire retardant
9. Rot resistant throughout
10. Light on shoulder or hood
11. Hood to prevent heat loss
12. Plastic clip buckles
13. Retractable crutch strap (or leg strap)
14. Inbuilt personal Emergency Position Indicating Radiobeacon (EPIRB)
15. Slim design
16. Removable warm liner
17. Whistle

18. CO2 water activated inflation system or manual inflation

19. Flare on jacket

20. Bottle and fittings corrosion resistant

21. Capacity to clean jacket while on board

22. Be eligible for accreditation against an appropriate Australian Standard

Following the forums, the PFD manufacturers agreed to supply a range of their proprietary PFD's to the various fishing sub-sectors to determine their acceptability and suitability as commercial fishing work wear.

Acceptability and suitability were deemed by WorkSafe Victoria to be judged by two criteria:

1. The PFD must be sufficiently comfortable to be worn on deck at all times while working and
2. The PFD must comply with an agreed minimum performance standard i.e. possess the 22 features identified by the fishers at the forums.

It was agreed that, in the event that none of the trialled PFD's meet these criteria, the manufacturers would conduct further research to develop more suitable products. Seafood Training Victoria facilitated the PFD trial process through a project manager, a retired fisherman having 49 years experience in the Rock Lobster, Deep water trawl, Scallop, Shark, and Line fisheries. The PFD's were taken to areas centred on each of three ports on the Victorian coast. These ports were Portland (including Port Fairy, Warrnambool and Port Campbell areas); Lakes Entrance (including Port Albert, Welshpool and Mallacoota areas); and Queenscliff (including, Apollo Bay, Geelong and Hastings areas). At each port the project manager presented the range of PFD's included within the trials to skippers who were asked to choose which ones they wished to evaluate.

At the same time that the PFD's were given to skippers, the project manager collected some biographical data and provided them with a form to use to record duration and frequency of usage and the contemporaneous weather conditions. Skippers were also given a questionnaire to complete before the trial commenced and another PFD evaluation questionnaire to complete at the end of the trial period. The PFD's were taken to each of the three ports sequentially and left for a minimum period of two weeks during 2004. The usage record sheet and questionnaires are contained in Appendix 2.

This researcher became involved in the project just prior to the commencement of the trials and the project manager chose to include within their questionnaires, questions based upon the researcher's work pertaining to this thesis. At the conclusion of each trial period the project manager collected the trial PFD's and the completed questionnaires. These were reviewed and analysed by this researcher and data of relevance extracted for use in this thesis. Although WorkSafe Victoria project work such as this is not governed by a human research ethics committee, data extracted by this researcher was treated in accord with the procedures for confidentiality and data security that would be required if approval of the University of Ballarat Human Research Ethics Committee (HREC) had been necessary.

The researcher's questions included in the questionnaires aimed to elicit information about the fishers' attitudes towards PFD usage, perceived pros and cons of PFD usage and to assess whether it was possible to categorise fishers in regard to their readiness for change in respect of Prochaska's Transtheoretical Model of behaviour change (Prochaska et al., 1998; Prochaska et al., 2002). The specific behaviour change that was targeted was the enforcement of the use of PFD's by crew. The schema used to assess this is illustrated in Figure 13.

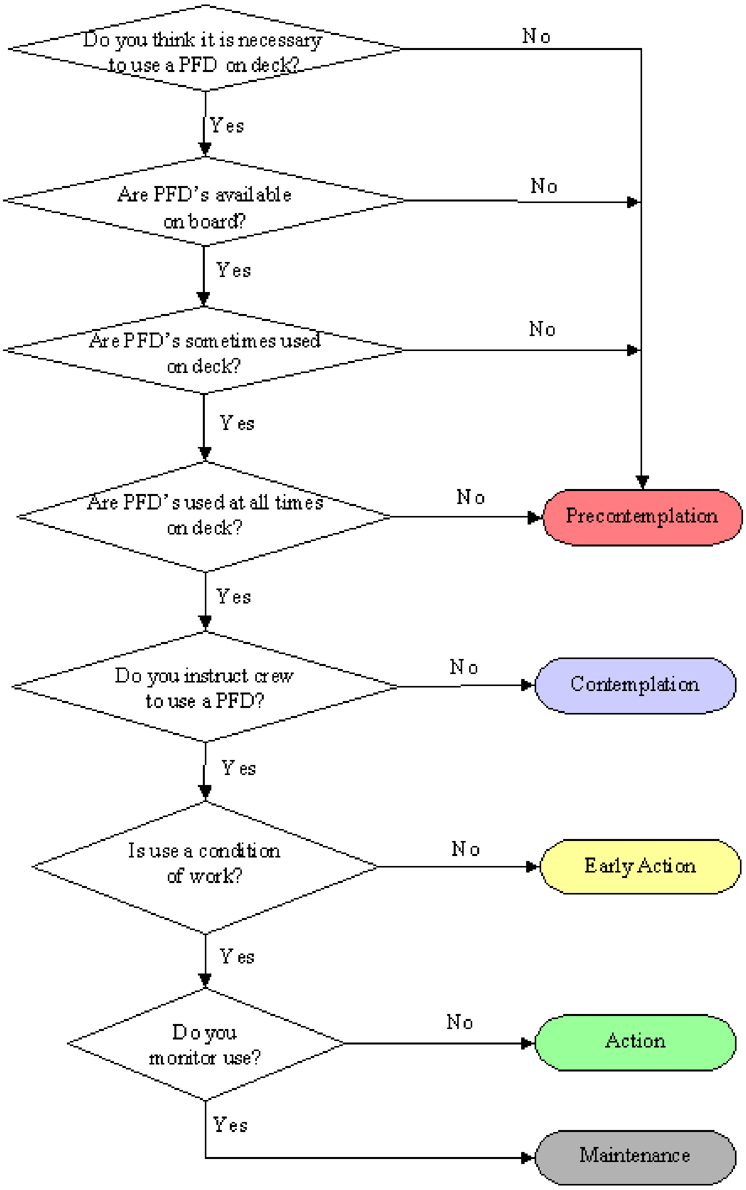

Figure 13 Schema for assessing stage of change

In addition to the PFD wearer trials, two sets in-water trials were conducted at the ports of Lakes Entrance and Queenscliff respectively by WorkSafe Victoria. These trials involved volunteer fishers donning PFD's selected from the available range and entering the water in the harbour. The aim of this exercise was to heighten awareness of the project through a highly visible activity and to provide fishers with some experience of in-water use of devices and to subsequently collect information about wearers' perceptions of the performance of different devices.

At the conclusion of all trials, the results were presented to representatives of participating manufacturers and WorkSafe Victoria hosted a seminar at each of the three ports at which the results were presented to invited fishers.

4.1.4. Commercial Fishing Case Study Results

In the conduct of formative research in social marketing programs it is important to understand knowledge, attitude, practice and belief (KAPB) of the targets (Andreasen, 1995). Thus the skippers were asked to respond to a series of questions about OHS in general and another series specifically about PFD usage by their crew.

The results of the trials of the individual PFD's are being reported elsewhere by Seafood Industries Victoria and WorkSafe Victoria. The results reported here are those that pertain specifically to the focus of this thesis, i.e. information about the trials and subjects, information about attitudes to OHS in general and information about the fishers' attitudes towards PFD usage, perceived pros and cons of PFD usage and the assessment of whether it was possible to categorise fishers in regard to their readiness for change. Further details of these results are reported in full in tables 41 to 70 and figures 80 to 107 in Appendix 3.

4.1.4.1. Details of trials and respondents

Forty-eight (48) vessels participated in the PFD trials being based predominantly in the Portland and Lakes Entrance areas as shown in Figure 14.

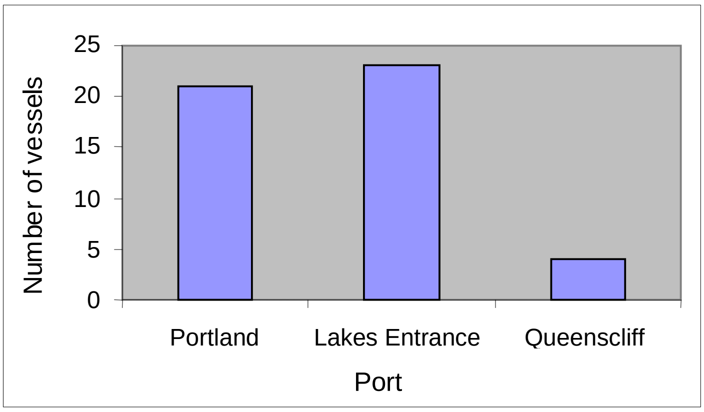

Figure 14 Distribution of participating vessels

The number trials at each port are shown in Table 8. A trial is defined as one reported evaluation of the PFD i.e. one wearer reporting their evaluation of one PFD that they may have worn one or multiple times.

Table 8 Number of trials at each port

Port	Frequency	%
Portland	25	34
Lakes Entrance	31	43
Queenscliff	17	23
Total	73	100

Although the evaluation sheets completed by the skippers and crew did not all clearly identify the skipper, the contact name is assumed to be the skipper. Where the wearer's name was different to the name of the contact on the evaluation sheet, the wearer was deemed to be crew. Of the 73 trials, the status of the wearer was identified in 65 cases. Of these 65 trials, 30 (41%) trials were undertaken by skippers.

The range of fishing types represented in the trials is shown in Figure 15 and show that there was a cross section of the sub-sectors involved. The majority of trials were under taken on rock lobster (32%) and deep water trawling (27%) fishing vessels.

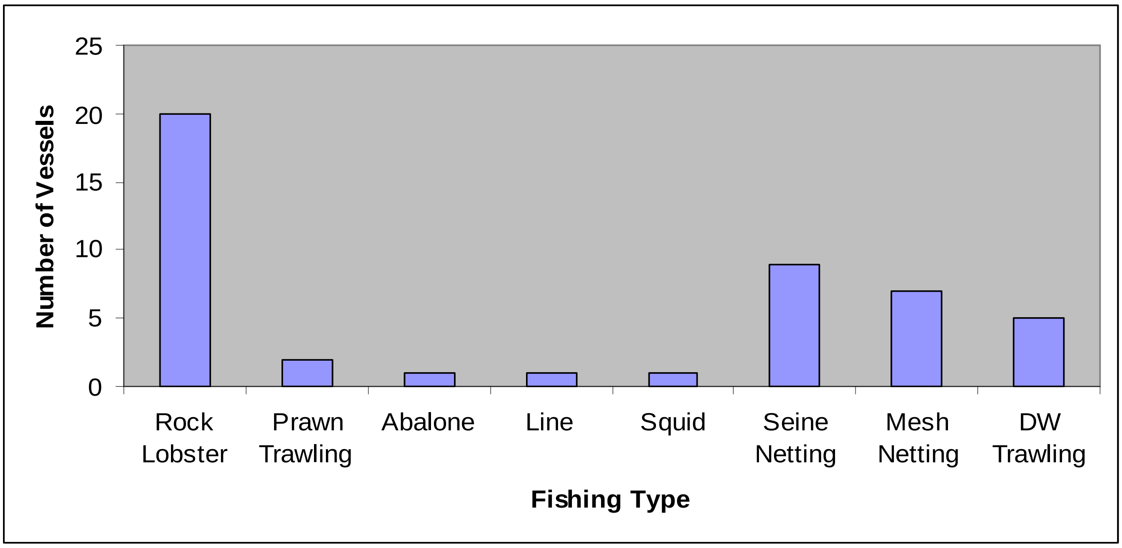

Figure 15 Fishing Types Represented by the vessels in the trials

There were seventy-three (73) trials of the PFD's within the range offered to skippers although the model of the PFD being trialled was not recorded in seven (7) cases (i.e. there were 66 valid trials). Fifty-three (53) named individuals were involved and 8 trials were undertaken anonymously and therefore the total number of different individuals involved in the trials is unknown.

The type of fishing that participating vessels undertook in each port is reported in Figure 16 and show that the majority of participating vessels were engaged in rock lobster fishing and seine netting.

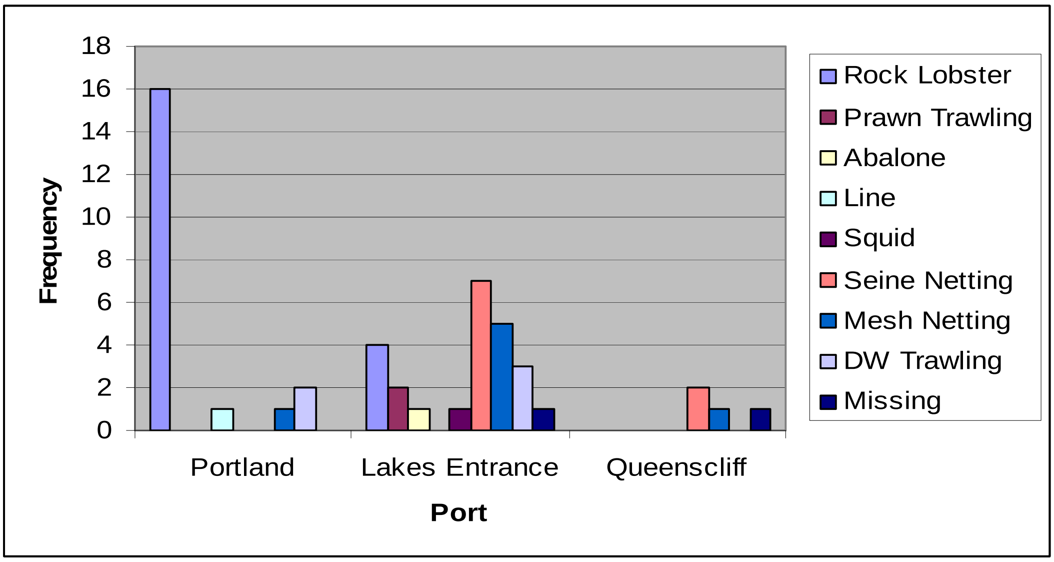

Figure 16 Type of fishing undertaken by participating vessels

There was a very poor response (n=21) to the question about the number of crew on each vessel. Convention suggests that those skippers that did respond will have interpreted the question to require the number of crew in addition to the skipper. The majority of respondents' vessels (n=7) had a crew of one (i.e. skipper plus 1), six vessels had a crew of six (6), five vessels had a crew of five (5) and four vessels had a crew of three (3).

Subjects were asked to indicate the type of PFD in current use on their vessel and, while a range were identified, it is interesting to note the number of "none" and "unknown" responses which, combined, comprised 52% (n=35) of the responses.

4.1.4.2. Attitudes toward causes of Injuries and illness

Respondents were asked to nominate from a list of seven, the three main causes of work-related injuries and illness. The list was taken from a NOHSC-commissioned community survey undertaken in 1998 (National Occupational Health and Safety Commission, 1999). The NOHSC survey revealed a general tendency within the community to focus on person-centred causes of injuries and ill-health with the majority of people citing (in descending order) lack of training and education, pressure or stress and worker being careless as the top three causes. As shown in Figure 17, the surveys of skippers revealed a similar tendency with (in descending order) worker being careless, lack of training and education and pressure or stress and worker being careless cited most frequently in the top three causes of injuries and illness.

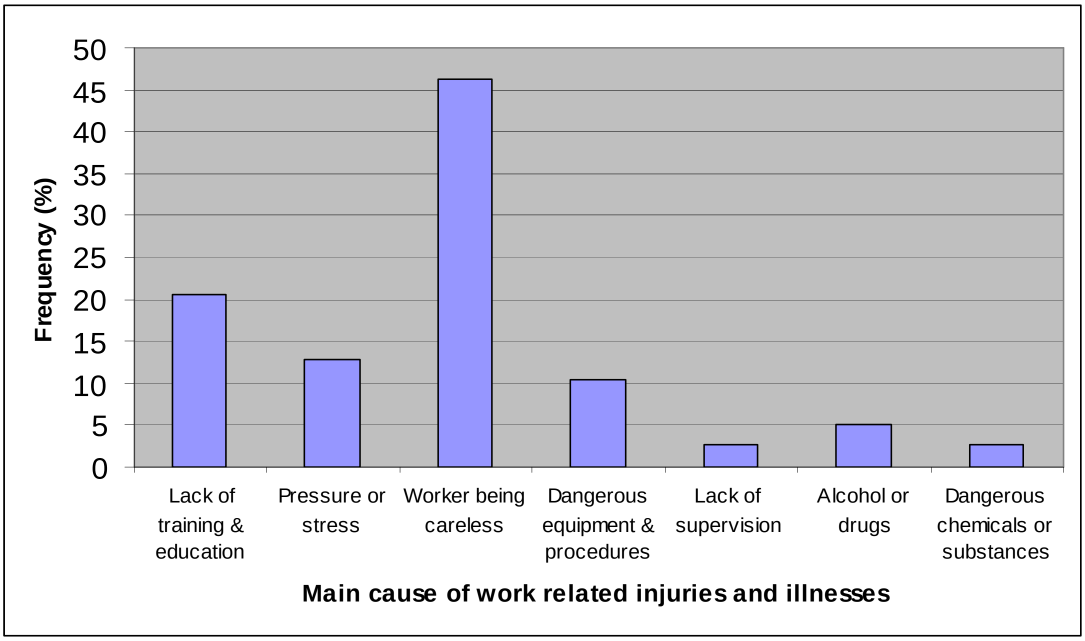

Figure 17 Main cause of work-related injuries and illnesses

The NOHSC survey found that education and awareness, training on safe practices and safe procedures and systems of work were the three most important perceived ways in the community to prevent injuries and illness. As shown in Figure 18 the survey of skippers revealed the same pattern, and suggests a propensity to focus on behaviour change to control risk rather than modification to equipment, etc.

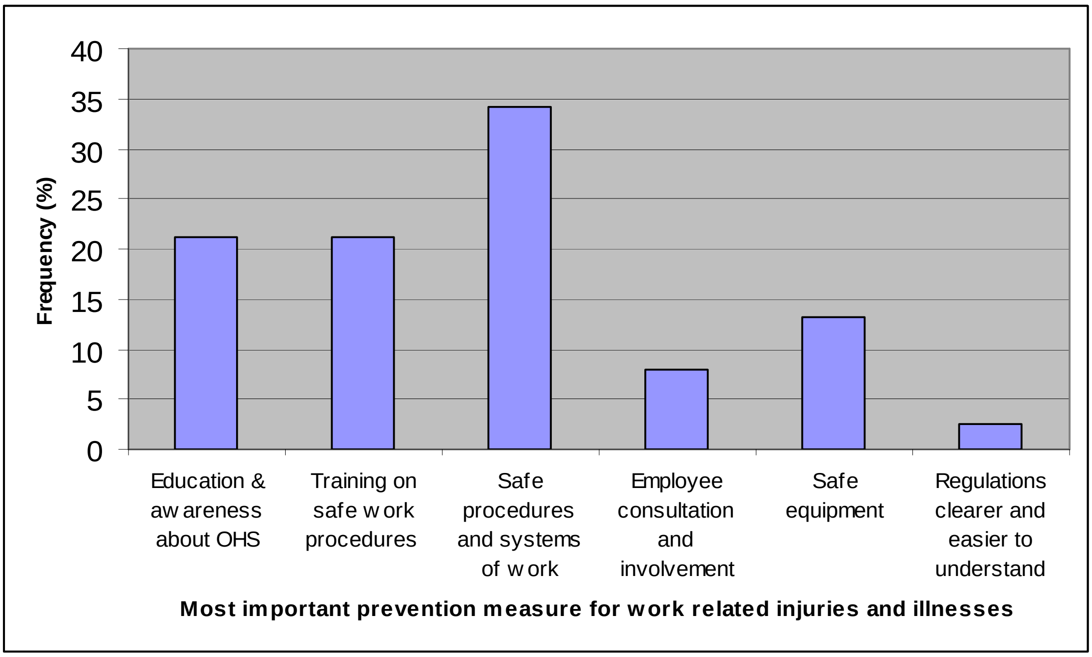

Figure 18 Most important prevention measure for work-related injuries and illness

4.1.4.3. Attitudes toward PFD use

At the conclusion of the post-trial period, respondents were asked to respond to a range of general statements about PFD use. The degree of PFD usage by skippers was gauged by asking about frequency of use. Of the 46 skippers that responded, 74% reported that they never wore a PFD. Only 6 (13%) reported that they often wore a PFD.

A series of questions followed that aimed to collect information about attitudes towards PFD use under different circumstances. The majority (71% n=30) of respondents reported that they disagreed or strongly disagreed that a PFD should be worn whenever at sea and 67% (n=24) disagreed or strongly disagreed that a PFD should be worn whenever *on deck* at sea. However, in regard to wearing a PFD when it is rough at sea, when crossing a bar or working in shore, 60% (n=9) of respondents in each case either agreed or strongly agreed that a PFD should be worn. It should be noted, however, that the response rate was poor in regard to these questions with 33 responses missing.

A further question regarding PFD use in general suggests that the majority of respondents believe that PFD's are necessary at sea with 70% (n=28) either disagreeing or strongly disagreeing with the contention that "You do not need to use a PFD at sea". Although the majority disagreed with the statement that "crew are unlikely to fall overboard" it is interesting that 42% (n=17) of respondents agreed or strongly agreed.

The majority (69%, n=26) of respondents reported that they do not think a PFD is too hard to look after, although respondents were divided on the matter of a PFD getting in the way (56% disagreed, n=20) and being uncomfortable (49% disagreed, n=17). The majority (78%, n=32) of respondents did not agree that a PFD wastes time and did not agree (81%, n=34) that "a PFD is not worth the money".

The majority (73%) of respondents disagreed with the statement that that "a PFD wouldn't save me if I fell overboard" i.e. the majority have confidence in a PFD. However, it is worth noting that 28% (n=11) reported that they did not believe a PFD would save them.

The majority (73%, n=29) of respondents reported that they prefer their crew to wear a PFD. They were then asked a series of questions that would assess their readiness for change in regard to enforcing the use of PFD's on their vessels. Respondents were categorised against the stages in Prochaska's Transtheoretical Model (Prochaska et al., 1998; Prochaska et al., 2002) using the schema illustrated in the methodology above (Section 4.1.3). The majority (92%) were found to be in the Precontemplation stage as shown in Figure 19. Respondents in this case were the skippers of the participating vessels (n=38 of 48 i.e. 79% response rate).

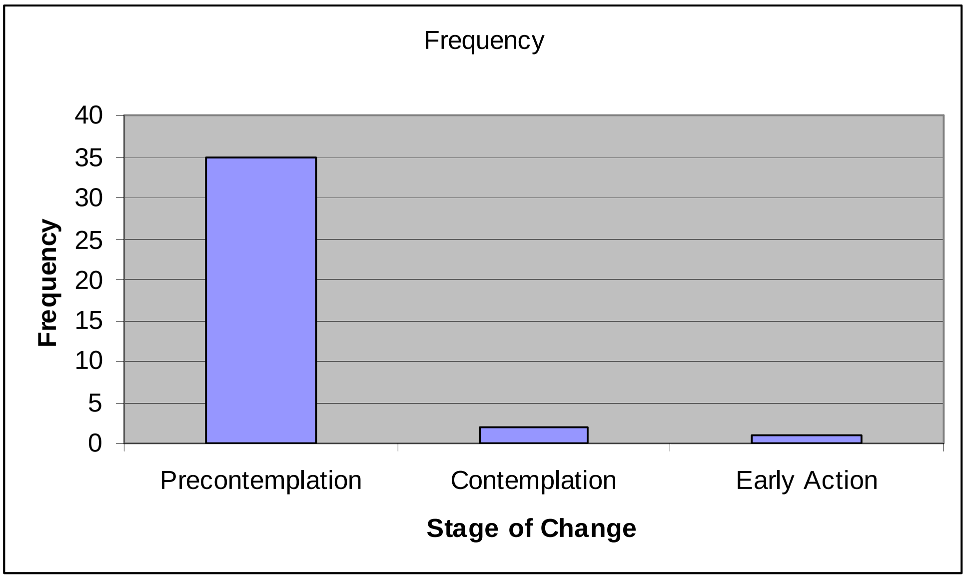

Figure 19 Stage of Change

Notwithstanding the majority of respondents (92%) being in the Precontemplation stage of Prochaska's Transtheoretical Model of behaviour change (Prochaska et al., 1998; Prochaska et al., 2002), the majority (70%) indicated that they would feel comfortable enforcing the use of PFD's. Respondents in this case were the skippers of the participating vessels (n=23 of 48 i.e. 48% response rate).

Subjects were asked to volunteer advantages and disadvantages of enforcing the use of PFD's. The free responses were grouped by like meaning and are presented in descending order of frequency in Table 9 and Table 10.

Table 9 What do you think are the advantages of enforcing the use of PFD's

Comments	Frequency	%
Life saving/safety	34	67%
Peace of mind	8	16%
Easier to locate man overboard	3	6%
During rough weather	2	4%
Comfortable	1	2%
Useful with inexperienced crew	1	2%
Crew more confident	1	2%
Reduce liability	1	2%
Number of valid advantages listed	51	100%

Table 10 What do you think are the disadvantages of enforcing the use of PFD's

Comments	Frequency	%
Catching	20	27%
Restricted movement/bulky/awkward	12	16%
Hot in summer	11	15%
Uncomfortable	10	14%
Cost	3	4%
False sense of security	3	4%
Crew won't wear/arguments	3	4%
Gets dirty easy	2	3%
Puncture	2	3%
Chafing	1	1%
Leave it to individual	1	1%
Only if improperly designed	1	1%
Part of work equipment	1	1%
Shoulder and back strain	1	1%
Weight	1	1%
Less efficient	1	1%
Maintenance	1	1%
Number of valid disadvantages listed	74	100%

Prochaska (1997b) suggests that at precontemplation stage respondents are likely to list more cons (disadvantages of the desired behaviour) than pros (advantages of the desired behaviour). The raw data (i.e. the ungrouped responses) were reviewed to assess the relationship between advantages (pros) and the disadvantages (cons) that were provided. As shown in Table 11 and Figure 20 there were 43 respondents of which 21 (49%) listed more cons than pros, 13 (30%) listed more pros than cons and 9 (21%) listed the same number of each.

Table 11 Number of pros versus number of cons listed by respondents

Pros greater than Cons	13	30%
Pros same as Cons	9	21%
Cons greater than Pros	21	49%
Total number of valid responses	43	100%

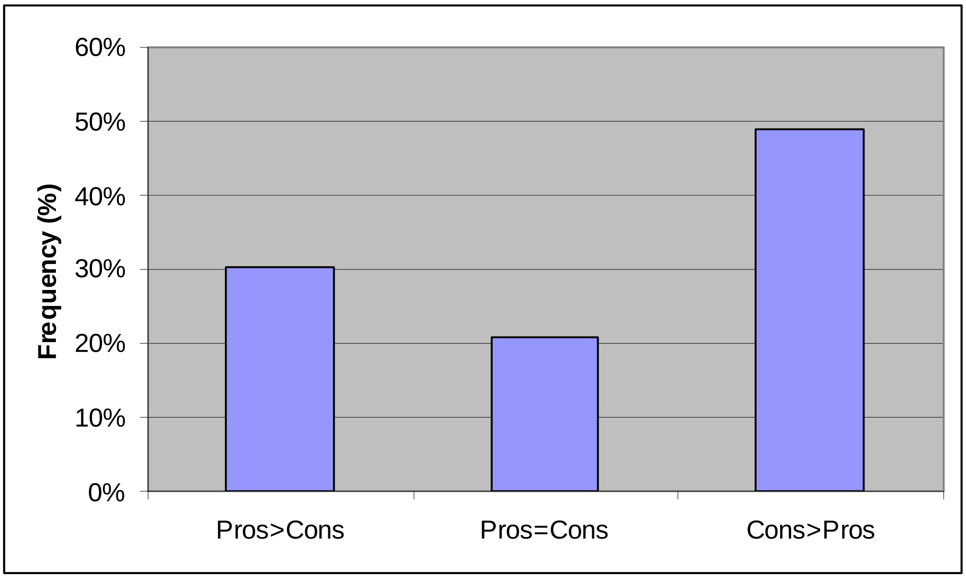

Figure 20 Number of pros versus number of cons listed by respondents

The implications of these results and the case study are discussed in the following section.

4.1.5. Social marketing Stage 1: Formative Research

4.1.5.1. Methodology

Data collection was disadvantaged by entry to the project just prior to the commencement of trials rather than at project inception. Influence on study design and the extent to which questions could be added to questionnaires was therefore limited.

Questionnaires were designed on the basis that the project manager would administer them through face to face interview at the time of PFD distribution. However, questionnaires were distributed and completed by skippers and thus there were a substantial number of invalid questionnaires and missing data items.

In reacting to the State Coroner's recommendations (Batchelor & Bugeja, 2003), WorkSafe Victoria officers unconsciously embarked on a social marketing process in accord with Andreasen's strategic social marketing model (Andreasen, 1995). That is, the Coroner focussed attention on the failure of a target population (fishers) to adopt a desired behaviour (PFD usage) and WorkSafe Victoria officers began to investigate strategies for increasing PFD usage through a listening process i.e. the forums at Portland, Melbourne, Queenscliff and Lakes Entrance. This led to the understanding that no PFD's commercially available to fishers satisfy their needs and thus the manufacturers made available some modified device for trial. These trials provided the opportunity for formative research and to obtain ethnographic information about the target population, and collective perceptions of risk and the price of risk controls (Andreasen, 1995). As Andreasen (ibid) suggests the aim of such is to gain "…a richer understanding of the customer" (p.139).

Andreasen's "backward research" (Andreasen, 1985) starts with the decisions to be made and makes certain that the research helps the social marketing program, manager reach those decisions. The steps involved, as discussed in Section 2.2.4.3.1 above, are (Andreasen, 1995 p.101):

1. Determine what key decisions are to be made using research results and who will make those decisions;

   i.e. decisions about increasing the use of PFD's made by the OHS regulatory authority (WorkSafe Victoria) and the industry body, Seafood Industry Victoria;

2. Determine what information will help management make the best decisions;

   i.e. what are the barriers and enablers to PFD usage and at what stage of readiness for change are the members of the target population

3. Prepare a prototype report and ask management if this is what will best help them make their decisions; *and*
4. Determine the analysis that will be necessary to fill in the report; *and*
5. Determine what questions must be asked to provide the data required by the analysis;

   i.e. the project proposal as written by Seafood Industry Victoria and modified by this researcher;
6. Ascertain whether the needed questions have already been asked;

   i.e. review current knowledge from the literature;
7. Design sample;

   i.e. the members of the Victorian commercial fishing fleet as proposed by Seafood Industry Victoria;
8. Implement research design;

   i.e. conduct the trials;
9. Analyse data;
10. Write report;
11. Implement the results.

Both qualitative and quantitative data were then collected as suggested by Andreasen (ibid):

Quantitative

- How many people are not doing the desired behaviour?
- What are the sub groups and which are most likely to respond?
- What are the characteristics of sub-groups?
- How much awareness is there and what are the feelings towards the new behaviour?
- What are the media habits of the target audiences?

Qualitative

- What is the extent of the problem?

- Who is most affected and where are they?
- How can the targets be reached?
- What are the beliefs about the benefits and costs of the desired behaviour?
- What are the perceptions of other people's desires?
- What is the level of self-efficacy?
- What is the competition?
- What will influence behaviour?

Thus the questions asked of the fishers addressed knowledge, attitude, practice and belief (KAPB) that are commonly undertaken in social marketing programs (Andreasen, 1995).

4.1.5.2. Results

The majority of trials were undertaken on Rock Lobster and Deep Water Trawling fishing vessels, both having quite different work characteristics. With the range of sub-sectors being represented, a useful cross section of the industry was sampled. It was unfortunate that such a small number of trials was conducted in Queenscliff and that the majority of those trials were conducted on the one vessel.

All the respondents indicated that they were operating vessels with a crew of less than 5 and in most cases the vessel operators would be classified as small business operators. In regard to the PFD's currently available on board, it is interesting to note the number of "none" and "unknown" responses which, combined, comprise 35 or 52% of the responses. However, it may be assumed that all vessels would have a basic PFD for each person on board as required by maritime regulations. It is also of interest to note that 74% of skippers reported that they never wore a PFD.

Attitudes towards PFD usage were informative and suggest that respondents in general believe that PFD's are necessary at sea although 42% indicated that it is unlikely that crew will fall overboard. Respondents indicated that PFD's do not need to be worn at all times and 71% disagreed that a PFD should be worn whenever at sea, and this was complemented by anecdotes about not wearing PFD's while in the mess, sleeping etc.

However, 67% disagreed that a PFD should be worn whenever on deck at sea. Interestingly, the majority (60%) agreed that a PFD should be worn when working in-shore, crossing a bar and when it is rough at sea, i.e. at times of increased risk and a majority (70%) disagreed with the contention that a PFD is not, in general, needed at sea.

These responses suggest an awareness of the need to don a PFD under certain circumstances and thus imply the employment of a decision making process. This decision process is influenced by the weather or the vessel's location and thus ignores the evidence reported above that many drownings occur as a result of falling or being dragged overboard in moderate or calm weather. Paradoxically, the problem of PFD's catching on nets is well recognised by fishers and "catching" was the most frequently cited disadvantages of enforcing the use of a PFD. It is possible that this paradox may be, at least in part, explained by the phenomenon of optimistic bias that can arise in circumstances of uncertainty regarding risk (Weinstein, 1988). Optimistic bias is defined by Weinstein as an "erroneous belief that our own risk is less than that faced by others…"

Brooks (2004) analysed some of the decision making processes employed by Rock Lobster Fishers in Australia and commented that a life jacket is traditionally worn in emergency situations and is associated with loss of control. Therefore, the decision to don a PFD is based on a risk assessment. He goes on to identify that risks such as those faced by fishers, being of low probability and high consequence are, in general, sometimes overestimated as a result of an error in perception. That error is, in part, related to the vividness of the perceived risk. Given the ability of fishers in his study to recall the nature of vessel loss in detail, an overestimation of risk and thus increased PFD usage might be expected. Brooks could not explain the paradox arising from his work but suggests that perhaps the risk of falling overboard is considered by the fishers to be acceptable and their familiarity with the risk diminishes it. He also alludes to the freedom of the fisherman to accept a greater level of risk and "pit [his] seamanship against the elements" and "trust [his] judgement of the 'fish-or-not-to-fish' decision." (op. cit. p.13) Kunreuther et al. (1985) explained that according to the expected utility theory a risk averse person increases demand for a protective activity if the likelihood of the event decreases at the same time that the potential consequence increases proportionately i.e. although the consequence is greater a risk algorithm suggests the risk has not changed. However, "individuals often violate the axioms on which the expected utility theory is grounded and make choices which are inconsistent with those predicted by the theory" (Kunreuther et al., 1985 p.2) and thus may offer some insight to Brooks's paradox. Further insight may be offered by the lack of confidence in PFD's among some respondents in the Victorian PFD trials, 29% of whom when asked if they agreed or disagreed with the contention "A PFD wouldn't save me if I fell overboard", reported that they did not believe a PFD would save them.

In regard to the pros and cons of PFD use, 69% of respondents did not agree that a PFD is too hard to look after and, a minority (44%) agreed that a PFD gets in the way. Few indicated that a PFD wasted time with 78% disagreeing with the contention and most seem to think that a PFD offers value for money with 83% disagreeing with the contention that "A PFD is not worth the money". Comfort seems to be a greater problem with a small majority 52% agreeing that a PFD is uncomfortable. These results are, however, likely to be influenced by the number of trails undertaken by skippers whose tasks while at sea are likely to be less physically demanding than those of the crew.

Ninety-two percent (92%) of skippers were found to be in the Precontemplation stage of change i.e. "the stage in which people are not intending to take action in the foreseeable future, usually measured as the next six months. People may at this stage be uninformed or under-informed about the consequences of their behaviour and will avoid reading, thinking or talking about their behaviours" (Prochaska et al., 1998; Prochaska et al., 2002). However, the majority of respondents reported that they prefer their crew to wear a PFD (71%) and that they would feel comfortable enforcing PFD use (70%). This contradiction may be explained in the context of the findings the research in small business where, in general, management wish to protect their workforce (Vickers et al., 2003) but typically "leave it up to the workers" (Eakin, 1992) believing that they do not have control nor legitimate authority over the health and safety behaviours of their employees and treat health and safety issues as an individual rather than corporate responsibility. Some employers are unwilling to intervene in the health practices of employees for fear of being seen as inappropriately paternalistic (Eakin, 1992; Vickers et al., 2003; Walters & Lamm, 2003). In addition, Eakin (1992) found that in general, owners of small businesses understood the concept of workplace health primarily in terms of personal behaviour of employees and referred to worker carelessness and use of personal protective equipment when asked about OHS and risk control and this is consistent with the fishers' responses to the questions regarding accident causation and risk control.

The value of personal autonomy and the desire for independence in their employees may be particularly acute in the context of Brooks's (2004) comments about fishers pitting their seamanship against the elements. Further, as reported by Weinstein (1988) worry and fear (i.e. peace of mind) can focus an individual's attention and maintain awareness of a hazard but because the threat to the individual is often not immediate, it has limited use in the decision process. Thus, the fishers may feel comfortable with the notion of enforcing the use of PFD's because they would prefer them to be used, while not being in a stage of readiness to change to exhibit this behaviour.

Informing this preference for crew to wear PFD's are the advantages (pros) of enforcing PFD use listed by respondents. Significant are the most frequently cited pros being the life saving capabilities of PFD's (67%) and the peace of mind that a PFD offers (16%).

Of note is the frequency of responses regarding the disadvantages (cons) of enforcement that relate to catching, which may be an argument in favour of not enforcing PFD use i.e. the skipper may believe that the risk of catching outweighs the risk reduction. It should be noted that the large number of comments about snagging or catching on PFD's is influenced by the large number of trials in rock lobster vessels.

4.1.6. Commercial Fishing Case Study Review

As discussed in Section 2.2.4.3.1 Andreasen has found that the information gathered by formative research will provide a number of insights to the behaviour that is being influenced. These insights include information about the targets' stages of behaviour change; positive and negative consequences that targets perceive will follow their choices; tradeoffs against those consequences; the influence of other people and self-efficacy; grouping of targets (i.e. segmentation); and the targets' perceptions of competition, which are not always the same as the social marketer's perception (Andreasen, 1995 p.143).

In regard to assessing the stage of readiness for change of the fishers, the TTM was used in this case study. The model was useful in assessing the readiness for change of the fishers and thus offers potential for the preparation of marketing messages tailored specifically for that audience. Clearly the majority of fishers were at the Precontemplation Stage and this has implications for their open-mindedness and interest in further information (Weinstein, 1988) and consequently strategies for delivery of messages that will lead to transition to Contemplation stage. For example, little interest in precautions would be expected until the hazard is thought to present a significant personal threat.

The decision to act (decision to enforce the use of PFD's) requires an individual to believe that they are susceptible that the hazard would have personally negative consequences and that the precaution would be personally effective (Weinstein, 1988) i.e. that the risk of crew falling overboard is significant; that as a result the skipper will personally suffer some negative consequences (e.g. emotional distress, prosecution, litigation, etc); and that ensuing that crew wear PFD's will reduce the likelihood of suffering those consequences. Thus the messages to be delivered to skippers must demonstrate the significance of the risk to crew and thus themselves; emphasise that the times when the risk is present is not limited to rough weather, crossing a bar or working in-shore; and highlight the risk reduction afforded by PFD use. However, on the basis of the responses to the question about disadvantages of enforcing PFD use, it is possible that skippers fear the negative consequences of PFD use i.e. catching on nets and ropes and until PFD's that are free of snags are widely available, tradeoffs may not be acceptable and the use of tailored marketing messages are unlikely to succeed in eliciting change. The WorkSafe Victoria and Seafood Industry Victoria trials have led to significant modifications to some PFD's, particularly in regard to snags and, while among the PFD's included in the trials buckles and toggles are largely protected, there will be some residual risk of catching and thus tradeoffs will possibly become important in the change process.

The risk of catching is particularly acute in industry sub-sectors such as Rock Lobster fishing and automatic inflation is inappropriate in the Abalone diving sub-sector, thus market segmentation in regard to product (type of PFD) and marketing messages is appropriate.

In social marketing, competition often comes from past habits or inertia (Andreasen, 1995) and the WorkSafe Victoria and Seafood Industry Victoria trials have identified some of the factors that influence those habits and create inertia. Marketing of the desired new behaviour will involves "demarketing" of the old behaviour (i.e. "demarketing" the "leave it up to the workers approach" (Andreasen, 1995; Eakin, 1992)). In regard to this, perceived self-efficacy (Bandura, 1977) and "internal efficacy" and "external efficacy (Andreasen, 1995) are important. As discussed in Section 2.2.4.1 internal efficacy refers to the individual's perception that they have the knowledge and skills to carry out the behaviour. External efficacy refers to the individual's perception that environmental factors will permit the behaviour to occur. Environmental factors that might interfere with behaviour might be related to the availability of necessary equipment or services or the willingness of another party to cooperate. In accord with this, Seafood Industry Victoria is making available to skippers within the Victorian fleet proforma safety manuals that incorporate a safety management plan which is tailored to meet the needs and conditions of individual vessels. From this project is emerging a plan to incorporate a section dealing with PFD's and the conditions under which they will be worn based on the vessel's size and type of fishing undertaken (Sealey, 2005). All crew will be expected to sign an agreement to comply with the safety management plan and thus both internal and external efficacy are addressed. The credibility of Seafood Industry Victoria and the personnel delivering the safety manual are influential and may overcome the problems associated with the imposition of change from outside the industry as identified by Lang (2000). It is evident that the involvement of a project manager having experience as a fisherman enabled the translation of lessons from the formative research to the safety management plan and supports the contention of Fishbien and Ajzen (cited in Andreasen, 1995) that "…in order to predict individuals' intentions to take a particular action, one must understand not only their perceptions of personal consequences but also their perception of what they think others want them to do and how likely they are to be influenced by these others."

4.1.7. Commercial Fishing Case Study Summary & Conclusions

Although the methodology employed in this case study was limited by the stage at which this researcher was invited to engage with the study and the preconceived design of the PFD trials by the sponsoring agency, the formative research process that is the starting point of a social marketing program was executed successfully and yielded a substantial amount of very useful information about the knowledge, attitude, practice and beliefs of the fishers. The simultaneous assessment of the readiness for change of the targets was particularly useful in complementing this information and providing a base on which tailored marketing messages may be built. Formative research of the type undertaken in this case study is regarded as "listening" within the strategic social marketing model (Andreasen, 1995) and as illustrated in Figure 7 in Section 2.2.4.3.1.

The case study found that commercial fishers in Victoria, like the general population have a tendency to attribute occupational injuries and ill health to carelessness on the part of the worker and favour behavioural risk control measures over higher order, engineering type controls. Thus the fishers have a "safe person" focus as discussed in section 1.

While the skippers generally do not wear PFD's themselves, they would prefer their crew to wear PFD's, especially at times when there is a greater risk of entering the water. However, while reporting that they would be comfortable enforcing the use of PFD's the majority do not take such action and the ratio of pros to cons supports the evidence of the fishers being in the Precontemplation stage of change (Prochaska et al., 1998). While comfort and convenience are a consideration of the fishers, the possibility and implications of nets or lines catching on the PFD is a greater concern. Some fishers lack confidence in the likelihood of a PFD preserving life on entering the water.

In general, the fishers reflect many of the characteristics displayed by small business operators described in the literature, including a reluctance to exert authority over employees as well as a tendency to underestimate risk.

Of particular interest is the information that suggests that fishers will assess any given situation for the need to don a PFD (e.g. rough weather, crossing a bar, working in-shore) and make a decision accordingly. This is consistent with the findings of Brooks (2004) who reviewed the decision making processes of rock lobster fishers and suggested that they perceive that they can adjust actions as conditions change. However, this ignores the evidence from the literature regarding the absence of warnings for many of the incidents in which crew fall overboard.

Brooks (op. cit.) explains there are a number of factors influencing the decision making process employed by fishers in regard to donning a PFD, the issue of professionalism and the sense of succumbing to the superiority of the sea being not least of these. A combination of the findings of the formative research undertaken within this case study and the individual PFD trials with the knowledge of decision making processes and the evidence provided by the literature will enable the development of a sound structure for next stage in a social marketing program that aims to increase PFD use, i.e. planning the pre-test of a series of tailored messages.

4.2. Plasterers' Case Study

4.2.1. Plastering Literature Review[3]

4.2.1.1. Introduction

Plastering as an occupation is described by differing terminology, depending on the country of employment. For example, in the USA plastering specialists are known as drywall or wallboard installers and, depending on the stage of installation, the workers that perform the task often differ. Further to this, the drywall specialists are often classified as carpenters. Painters are said to perform the finishing. Domestic construction carpenters in the USA undertake work associated with groundbreaking/layout, framing, roofing, interior finish other than drywall, exterior finish and remodel/demolition as well as installing drywall (Lipscomb, Dement, Li, & Nolan, 2003 p.481).

In Australia, plasterers undertake what is sometimes referred to as dry lining or hanging or fixing of plasterboard (wallboard), wet area board and ceiling panels, and the fitting and finishing of architectural enrichments. These people were traditionally described as "Fibrous Plasterers".

Fixing and finishing of plasterboard involves fixing (hanging) of sheets of plasterboard to walls and ceilings. Joints between sheets are filled with a joint compound and tape (stopping), which is subsequently sanded (finishing). In some circumstances the hanging

[3] This literature review includes information originally included in an application for research funding made by the candidate to WorkSafe Victoria and this candidate's application for transfer from probationary to full PhD candidature. The information was subsequently published by this researcher and co-author Susan Leggett. (Cowley & Leggett, 2003)

of board, stopping and finishing are treated as three independent tasks undertaken by workers specialising in those respective tasks only.

Distinct as an occupation group are solid plasterers who undertake traditional wet plastering where a thick base coat and a thin skim coat are applied to walls to be plastered. They are increasingly engaged in the application of render to the external surfaces of buildings, detailed restoration and the fitting and finishing of architectural enrichments. There are very few references in the literature to solid plasterers (see for example Health and Safety Laboratory, 2001) and the distinction between the two types of plasterers is becoming less clear as the boundaries that define their respective tasks and activities blur. The differences in terminology and occupation descriptors present difficulties when making international comparisons, especially in regard to injury incidence, injury coding and prevention.

This case study focuses on fibrous plastering with a particular emphasis on the risk of falls and manual handling injuries which predominate in workers' compensation claims databases. For clarity, the text will refer to plastering as an occupation, which in the main, refers to those hanging, stopping and finishing plasterboard and installing suspended ceilings.

4.2.1.2. The Plastering Industry

There is relatively little information in the health and safety literature relating to plastering. What there is, originates almost exclusively in the USA and the UK where building practices differ from those employed in Australia. Differences are fundamental, for example in the UK, plasterboard is usually fixed to the wall vertically, whereas in Australia it is fixed horizontally. These and other issues such as board size, use of stilts, architectural and building practice variations, and use of local materials and formulations in plastering products make direct comparisons and wholesale adoption of overseas knowledge inappropriate. What is commonly accepted internationally is the significance of the risks that plasterers are exposed to, especially in the area of manual handling and falls.

Lemasters et al. (1998), in their study of musculoskeletal disorders (MSD) among carpenters in the USA, made the point that the vast majority of research in the area of MSD has been conducted in other industry sectors where work and environmental factors area very different and thus the knowledge is not transferable.

In February 2001 there were an estimated 26,000 people in Australia registered as having the occupation “Fibrous Plasterer” (National Centre for Vocational Education Research Ltd (NCVER), 2001). It is unknown whether these figures include a number of other workers employed in related tasks (e.g. storage and delivery).

Based on remuneration reported to WorkSafe Victoria (Victorian WorkCover Authority, 2002) it is assumed that the majority of plastering businesses are small businesses (i.e. those employing less than 20 people (Australian Bureau of Statistics, 2001)) or micro-businesses (i.e. those employing less than 10 people (Walters, 2001 p.34)).

Knowledge of the industry suggests that the larger businesses are predominantly operating in the commercial rather than the domestic (residential) construction sector. Commercial sites are likely to be unionised where there is likely to be a greater degree of workplace health and safety management (Gillen, Faucett, Beaumont, & McLoughlin, 1997; Lipscomb, Dement, Loomis, Silverstein, & Kalat, 1997).

The majority of the smaller businesses are operating in the domestic (residential) construction market where it is estimated that 80% of plasterboard is supplied and in excess of 90% of solid plasterers are engaged (The Association of Wall & Ceiling Industries Victoria, 2003). Domestic projects are generally non-unionised, there are few workers on site at any given time and there is frequent movement from one site to another (Lipscomb, Dement, Gaal, Cameron, & McDougall, 2000).

4.2.1.3. The Size of the Problem

Falls and manual handling injuries are among the leading causes of occupational injury experienced by plasterers around the world, (Chiou, Pan, Zwiener, Long, & Cantis, 2001; Lipscomb et al., 1997; Pan, Chiou, Hsaio, Wassell, & Keane, 1999) and the prevalence relative to other trades makes them of particular interest.

Information about the nature of injuries among specific groups of construction workers in general is limited by issues to do with employment relationships, conditions of employment and the pace of change in the industry. Lipscomb et al. (2003), in their surveillance project in St. Louis, Missouri, suggest that these are especially salient when considering those who do plastering work. "In residential construction, particularly, the duration of work at any given site is typically shorter in nature than in commercial construction and the nature of the work changes from day to day. Job sites are typically small, with fewer workers at any given site." (Lipscomb et al., 2003 p.479)

During the year 2000, the Health and Safety Executive (HSE) in the UK undertook a preliminary investigation of the factors that can lead to musculo-skeletal disorders in construction workers (Health and Safety Laboratory, 2001). Their review of the literature found that among drywall installers studied in the USA, the compensable injury rate was high when compared to the whole construction industry and overexertion; falls from heights; and being struck by an objects were the leading types of injury.

Schneider (2001) reviewed the literature relating to manual handling in the construction sector in the USA and reports that 26% of injuries among drywall installers were attributable to over-exertion. Lipscomb et al. (1997) in an analysis of injury data found that drywall installers in Washington State had a significantly elevated rate of back sprains and simultaneous sprains to the back and neck. Chiou et al. (2000) reviewed traumatic injury among drywall installers reported between 1992 and 1995 and report that falls and overexertion injuries among drywall installers accounted for 84% of the total days away from work with falls being the second highest cause of injury. The compensable injury rate in the USA, at 27.5 cases per 100 drywall installers, was 3 times the average for all construction occupations combined.

Lipscomb et al. (2003) found that among the tasks undertaken by carpenters in domestic construction, 5% of injuries occurred during drywall installation. However, the authors concede that the injury frequency associated with the various tasks undertaken by carpenters is a likely reflection of the time they spend working in the respective stages of construction. The Construction Safety Association of Ontario (CSAO) (2003) report that drywall installers have more lost time injuries relating to non-traumatic events than all other construction trades combined.

Within the plastering subsection of the Victorian construction industry, the direct costs in compensation incurred by the Victorian WorkCover Authority's scheme during the three-year period 1 July 1997 to 30 June 2000, was more than $6m. Of the 352 claims in the period, strains and sprains were the most significant, representing 56% of all claims. Field et al. (2000) in their report to the Victorian WorkCover Authority on Claims, Fatalities and Injury Severity Outcomes Falls from Heights report that plasterers are also over represented in the claims data pertaining to falls from heights. Plasterers represented 2% of all falls claims. Forty-one percent (41%) of the falls claims were falls from greater than two metres and these represent an injury rate of 17 per 10,000 workers, which is 17 times the average injury rate for all occupations combined (1 per 10,000 workers). Thirty-six percent (36%) of the falls claims in plasterers were falls from a ladder. There were no fatalities reported in the study period.

Further to the financial impost of these injuries, Shaw et al. (2002) reported to the 12th Annual Construction Safety and Health Conference in the USA, in a paper on drywall ergonomics, that due to the nature of plastering work, many workers in the USA leave the field before the age of fifty. Furthermore, in a study of non-fatal construction-related falls in the USA by Gillen et al. (1997), 10% of the sample had either permanently left construction work or chose not to return due to limitations on physical ability caused by the injury. Wakula and Wimmel (1999), report that 25% of the early retirement amongst plasterers in Germany is due to spinal degeneration attributable to the physical nature of the task. Svendsen et al. (2004) and Lemasters et al. (1998) refer to the healthy worker effect on data collection regarding MSD in the sector.

4.2.1.4. The Source of the Problem

Installation of board and panels involves lifting, carrying and supporting of substantial weights. These weights are often presented in awkward shapes that have to be moved in confined spaces such as passageways, stairwells, etc, and across surfaces of varying cleanliness and integrity. Lemasters et al. (1998) point out that drywall and ceiling work requires the repetitive grasping, lifting, forceful operation of screw guns, often reaching above shoulder height or below knee level and the carrying of gypsum boards that can weigh more than 40kg. Besides these factors the authors identify that construction workers often perform job tasks under adverse environmental conditions, at varying elevations, with the composition of work crews constantly changing and tasks are often completed at maximum pace to meet construction deadlines imposed by others.

Lipscomb et al. (2000) analysed 2,567 workers' compensation claims made by carpenters in Washington State and found that wallboard was associated with over 25% of the more serious injuries and 40% of overexertion injuries. Also wallboard was the object most commonly associated with "struck by" injuries.

In Australia, plasterboard is available in a variety of sizes, which are typically 10mm or 13mm thick. Usual width is 1,200mm although some lengths are available in 1,350mm widths. Lengths range from 2,400mm to 6,000mm. The weight of 10mm plasterboard is approximately 7.6kg/m^2, making one sheet of 1,200 x 6,000mm board 55kg. The weight of 13mm plasterboard is approximately 9kg/m^2, and one sheet of 1,200 x 6,000mm board 65kg.

The HSE report (Health and Safety Laboratory, 2001) various methods of lifting plasterboard, all of which create overexertion hazards. The method likely to be most frequently used in Australia (pinch grip across the top edge of the horizontal board) is identified as the most stressful as illustrated in technique number 2 in Figure 21. Conversely, however, horizontal lifting with both hands positioned at the top of the plasterboard has been determined by Pan et al. (2000) and Chiou et al. (2001) to be the best lifting posture as demands on balance control and postural sway are limited.

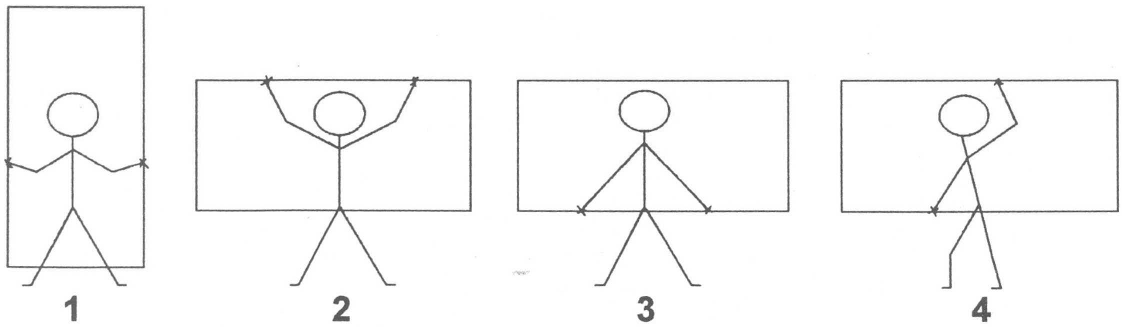

Figure 21 Methods of Lifting Plasterboard (Health and Safety Laboratory, 2001)

Lappalainen et al. (1998) undertook a pilot study that examined the effect of reducing the width of plasterboard from 1200mm to 900mm. The subjects' perceived the strain was 40-50% less in different parts of their body during the handling of the narrower board. The subjects also believed that the 900mm board needed less strength to handle, improved their back posture, positively influenced work pace and also positively affected safety because of the better view and easier movement.

Lipscomb et al. (1997) report, that it is not uncommon for plasterers to use their heads to hold plasterboard sheets in place during attachment of the sheets to the ceiling. The HSE (Health and Safety Laboratory, 2001) found that fixing plasterboard to ceilings was reported as the most stressful task, exacerbated by the constant extension of the neck and trunk, and mounting scaffolding or stilts to undertake the task had the greatest fall potential. Further they report on an examination of the postural stability of different techniques of lifting and hanging sheets.

It has been suggested that falls are more prevalent on domestic sites because of improper working platforms. Horizontal hanging, as practiced in Australia, produces the greatest postural sway and instability, which in turn leads to an increased risk of fall injury (Health and Safety Laboratory, 2001; Lipscomb et al., 1997).

Chiou et al. (2000) analysed traumatic injuries among Wall and Ceiling Lining Workers in the USA between 1992 and 1995 and found that falls were the second highest cause of injury. They found that the task of raising the plasterboard to the ceiling in particular placed heavy demands on the workers’ postural stability and that they may not be able to use their body movement strategy efficiently and accurately in response to any possible momentary loss of balance. Also, fixing to a ceiling or the upper half of the wall is often done in confined and elevated spaces, such as on the rung of a ladder or a plank on a scaffold. Lipscomb et al. (2003 p.485) found that "Poor housekeeping was involved in circumstances leading to the majority of injuries resulting from falls on the same level, as well as some overexertion injuries – particularly moving large objects where view was obstructed".

In their review of literature related to prevention of falls from roofs, Hsiao and Simeonov (2001 p.548) report that, while working on roofs, workers' balance is controlled "based only on visual memory and or assumptions about the extent of the surface of the support". This supports anecdotal evidence from plasterers, which suggests that workers concentrating on ceiling related tasks such as plaster finishing who are constantly looking upward often fall off trestles and similar forms of height access equipment due to erroneously perceiving the plank to be longer than it really is.

Finishing of plasterboard involves pushing tape into joints and the transfer by hand of quantities of wet and dense material to a wall or ceiling. It is necessary to reach corners and joins in plasterboard with a trowel and therefore requires reaching above head height and stooping. Other finishing tasks involve the lifting and carrying of bags of plaster, buckets of water, architectural enrichments and tools and equipment, and the mixing of ingredients. Wet mix is carried to the point of application.

Everett and Kelly (1998) reviewed the finishing task and found that finishing vertical joints involved constant bending up and down; in one case over an eight hour shift a worker involved in vertical joint finishing bent down 746 times and reached up 835 times. Horizontal joints by comparison allowed the workers to work at a consistent height of approximately 1.22m from the floor.

Applying tapes to joints requires considerable amounts of wrist flexion and work over shoulder height and sanding of joints is a stressful job carried out at great pace (Health and Safety Laboratory, 2001). In fact, Pan et al. (1999), report that one third of the thirty participants in their study on perceived hazards in taping and sanding had previously experienced injuries related to the task.

In the literature there is no specific reference to the health and safety of tasks associated with the fixing and finishing of wet area board or fixing of suspended ceilings. Anecdotally, however, there are many similarities in the range of physical activities demanded and the organisation of the work.

Injuries in the construction sector in general are acknowledged as being related to several work organisation factors including the simultaneous presence of incompatible trades (European Foundation for the Improvement of Living and Working Conditions, 1991), speed of work (Lipscomb et al., 2003), episodic employment, changing and unpredictable worksites and rapid contractor turnover (Ringen & Stafford, 1996). Lemasters et al. (1998) point out that psychosocial and work organisation factors have played a major part in the occurrence of upper extremity musculoskeletal disorders among office workers but few studies have addressed the issue among construction workers. They discuss the time pressure under which construction workers are placed and also relate the presence of other trades on site to the loss of control of the work and its organisation and these factors in turn to the increase of psychosocial stress. The authors related their findings in regard to shoulder, hip and knee disorders among carpenters, including a subset of drywall workers, to the issue of psychosocial stress. Anecdotal evidence suggests that finishing trades people (plasterers and painters) are under greatest pressure in regard to time given that their work schedule is dependant upon the completion of work by other trades and is undertaken at the end of the construction contract period during which time may have been lost and has to be recouped.

4.2.1.5. Prevention of falls and manual handling injuries

The literature regarding plasterers largely reviews injury data in order to establish priority areas, or identifies and attempts to quantify risk factors, while few authors focus on prevention/intervention strategies. There are few evaluations of innovations that might reduce risk. Pan and Chiou (1999) note the misplaced emphasis in the literature and Hsiao and Stanevich (1996 p.547) state that “despite the importance that has been placed on worksite construction safety and the high injury rate... research into construction ergonomics in the United States has been relatively limited”.

While noting the dearth of intervention research in the construction sector, Ringen and Stafford (1996) suggest there is a need for research in policies and project design, management, supervision and organisation of the worksite, substitution of equipment, materials and tools and worker and supervisor training.

In their recent analysis of injury risks in the Victorian construction industry, Larsson and Field (2002) identify plasterers as an "injury blackspot". They recommend in-depth analyses of the specific tasks and risk exposures identified and development of appropriate engineering, ergonomics and design solutions. They also recommend a thorough analysis of how tasks made necessary by the architectural and structural design of the construction project are performed by the different trades during the construction process, such that improvements and a better fit between demands and performance can be made. These recommendations concur with those made during Hsiao and Stanevich's (1996) study of several construction trades in the USA.

Research undertaken in the USA by Chiou et al. (2000) concluded that intervention strategies for drywall installers should focus on tasks performed on elevated and in restricted working areas along with tasks that require drywall lifting. Laboratory studies into handling methods and devices to assist in reducing the incidence of falls and manual handling related injuries were also recommended. Chiou et al. (2001) recommend studies examine tasks performed at heights to attempt to gain an understanding of mechanisms which lead to falls.

The UK Health and Safety Executive suggest (Health and Safety Laboratory, 2001) that the types of action most likely to be effective for plasterers involve planning to eliminate unnecessary manual handling and encouraging more use of the manual handling solutions that already exist; ensuring that suitable access equipment and manual handling aids are provided for the workers in sites; ensuring that adequate and safe methods of working on ceilings and upper parts of walls are provided[4]; and encouraging the industry to use narrower sheets of plasterboard.

[4] HSE report that they "did not hear of stilts being used in this country, unlike North America, but such a method seems inherently unsafe." Stilts ***are*** used in Australia.

In the domestic construction sector in particular, organisational risk controls, such as job scheduling, project planning and site management that, for example, prevent the simultaneous presence of incompatible trades, allows sufficient time for work to be completed, and ensures safe access and egress, do not seem to widely practiced and there are no reports of evaluations.

Ore and Stout (1996) reviewed traumatic occupational fatalities in the US and Australian Construction Industries and suggest that many of the solutions that could potentially reduce the risk to construction employees are already available. Mitchell and Else (1992) have previously argued, in general terms, that the solutions to health and safety problems are largely known and that in many cases there is not so much a need for new solutions so much as there is a need to unlock the knowledge stored at individual work sites and make it more widely available.

Hsiao and Stanevich (1996) undertook a review of falls from roofs and suggest a "three tiered approach" including a combination of engineering, administrative controls and personal protective equipment to address the problem and more specifically ergonomic design of tools, work practices and work environments which may assist prevention and injury reduction.

Stuart and Zellers (1996 p.697) report on an ergonomic evaluation of a drywall board transport handle and comment that for engineering or administrative controls to be considered effective they must "result in a reduction in ergonomic and physical stress as assessed through objective and subjective measurements…" and it should be "…determined how the new tool or work practice affects job performance or productivity and be determined how it affects psychosocial factors".

From the formal literature, the Internet, trade magazines and industry communiqués, a large range of tools and aids having the potential to reduce risk have been identified. However, with few exceptions, there remains very little evidence-based intervention and most recommendations for risk control are based on opinion rather than objective evaluation of the risk reduction capacity of solutions.

Formal evaluation of plastering solutions that has been undertaken include the work of Lappalainen et al. (1998) in Europe who demonstrated the benefits derived from reducing the width of plasterboard. There has also been an assessment of a plasterboard transport handle that clips onto plasterboard to assist a sole worker to relocate plasterboard from its storage location to the area where it will be installed (Stuart & Zellers, 1996). It was found that the design did not reduce risk. The handle is, however, unavailable commercially, while several alternative designs are available commercially.
Fosberg, Graff and Wernersson, (1995) evaluated a experimental autonomous plastering robot. The device demonstrated mechanical and calibration problems and was largely unsuccessful.

Some evidence exists which suggests that some solutions such as plaster trolleys or dollies, already in widespread operation, are having positive effects, (Chiou et al., 2000). Shaw et al. (2002) recently reviewed spring powered plaster boxes, corner applicators and a power finisher that use compressed air to fill the plaster box and push the jointing compound onto the wall. While the potential for reduction in physical stress and musculoskeletal disorders is recognized (the study reports a 75% decrease in force required for finishing with the spring powered tools and 2% of the muscle activity using the compressed air finisher when compared with traditional plasterboxes), the researchers recommend confirmation through long term field studies.

Spring powered tape machines and trowel boxes are still undergoing evaluation in Australia. However, information obtained to date suggest that there may be positive effects of using these tools (Cowley & Culvenor, 2003; Department of Labour and Industries, 2002; Shaw et al., 2002).

Some solutions such as stilts remain contentious given the possibility that they may reduce risk in regard to some tasks but increase risk in regard to others. Some studies (cited in Pan, Chiou, Hsaio, Wassell et al., 1999) recognize that physical stress associated with the constant up and down motions from scaffolds and trestles is reduced by using stilts and that they do in fact increase mobility during taping and finishing. Subjective evaluations suggest that physical stress or the risk of falls are no greater when using stilts as opposed to ladders and scaffolds (Pan, Chiou, Hsaio, Wassell et al., 1999). In further support of the use of stilts, Everett and Kelly (1998) suggest that the use of stilts puts workers at a constant height that may be comfortable. Conversely, workers may be at an increased risk of falling due to difficulties in regaining momentary balance loss (cited in Pan, Chiou, Hsaio, Wassell et al., 1999). Despite there being no firm conclusions regarding the use of stilts, current opinion in Victoria is that workers are placed at a greater risk of knee injuries and falls (WorkSafe Victoria, 2002).

In terms of increasing adoption of innovations, economic arguments may not be readily available as a lever. Ringen and Stafford (1996 p.318) suggest that "…the factors that govern the economics of construction are incredibly complex, and the assumptions that are made to simplify the underlying economy for the research are difficult to justify." One barrier to adoption of risk controls may be the initial decrease in productivity that results from unfamiliarity with innovations. Training and education has been cited as a measure to overcome this in the construction sector (Schneider & Susie, 1994; Stuart & Zellers, 1996). Lowery et al. (2000) found that some trades involved in working at heights (including plasterers) had lower rates of injury payments after a targeted safety program.

Albers et al. (1997) introduced ergonomic training to apprentice carpenters (plasterboard installers) in the USA. They discovered that the apprentices did not believe that they could play a major role as ergonomic innovators in their work places, including introducing redesigned tools and non-traditional work practices. The apprentices identified their employers as barriers to ergonomic innovation and the majority did not believe that contractors would adopt ergonomic interventions without a legal requirement.

Everett and Kelly (1998 p.353), in regard to barriers to adoption of solutions, cite various union agreements that prohibit the use of some plaster finishing tools such as bazookas, banjos and other forms of finishing tools. In Victoria, union agreements have until recently prevented the use of trowel boxes on commercial sites.

Other factors include the architectural choices, which influence material choice which may in turn influence work methods, the characteristics of the site itself, and tools used. Bushnell et al. (2002), in a report on a survey to determine the barriers to the use of vacuum attachments on drywall sanders, found that much importance was placed by finishers and contractors on the protection of the client's property and personnel. Through this work, they identified that increasing the use of vacuum attachments could be achieved through several avenues, including changing perception through health advertisements and promotion of research results, training to eliminate disadvantages and improved equipment design.

4.2.2. Plasterers' Trowel Box Case Study Questions

4.2.2.1. Introduction

The University of Ballarat made an application to the WorkSafe Victoria Safety Development Fund (SDF) to undertake an intervention among plastering business operators in Victoria. The aim of the project was to promote and increase the adoption of engineering risk controls that that would reduce the risk of falls and manual handling injuries using the principles of social marketing. The 3-year project was and, at the time of writing, continues to be conducted in partnership with the Association of Wall and Ceiling Industries, Victoria Pty Ltd (AWCIV).

Among other activities, the project focussed on the promotion of two tools that would reduce the risk of falls and manual handling injuries among plasterboard sheet fixers and finishers respectively. One tool is a trowel box and the other a panel lifter. These devices were identified by officers of the AWCIV and other industry representatives and workers as worthy of promotion given the potential risk reduction and their contemporaneous use in the industry.

<u>Trowel boxes</u>

Joints between plasterboard sheets are typically completed with a three coat jointing system (Boral, 2003). This means applying a first coat of jointing compound into which jointing tape is embedded. This joint is skimmed to remove air bubbles and excess compound. After drying a second coat of jointing compounds is applied and allowed to dry before being lightly sanded. A finishing compound is finally applied and sanded to leave a smooth finish.

Application of jointing compound to plasterboard using a hand trowel requires repetitive application of force as the jointing compound is pushed into joints. Application to ceiling joints is of greatest interest given the application of overhead force. In the domestic construction sector, hand trowel work is undertaken while on a plank supported by trestles or while mounted on stilts as shown in Figure 21. Subjective assessment of the task has raised concern about maintained extension of the neck, rotation of the shoulder and twisting of the lower back and there is a risk of falling.

Figure 22 Hand trowelling of plasterboard join

A trowel box, illustrated in Figure 23, is a relatively new innovation in Victoria that delivers second and topcoat jointing compound into the rebate created by the bevelled edges of two sheets of plasterboard fixed side by side. The jointing compound is delivered through a slot in the delivery side of the box that is held in contact with the board surface. Pressure manually applied through the handle on to a hinged plate on the reverse side delivers the correct amount of compound in a crown such that it dries flat. There are two brands of trowel box available in Victoria of which one uses a spring to apply additional pressure on to the hinged plate that delivers compound; otherwise the devices are very similar.

Trowel boxes purportedly increase productivity and reduce the musculoskeletal and falls injury risks associated with finishing of joints. A trowel box permits application of jointing compound to ceilings from floor level and potentially reduces neck extension, shoulder rotation and stresses on the lumber spine. Reduction of fatigue is also of interest given the significant increase in speed of jointing when using a trowel box and the reduced need to mount, dismount and relocate trestles or mount and dismount and use stilts. Further, in regard to trestles, many plasterers report knee pain following repeated dismounting of trestles by jumping down to floor level.

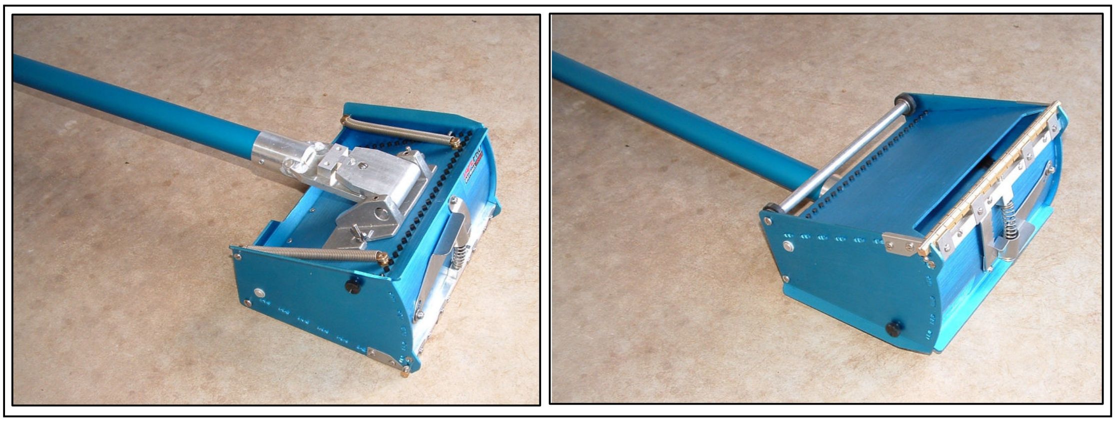

Figure 23 Trowel Box underside (left) and compound delivery side (right)

Figure 24 shows a trowel box in use. A trowel box is one component of a system that includes devices for the application of base coat and tape and second and topcoat compounds, internal and external corner joints, etc.

Figure 24 Trowel box in use

Panel Lifter

As reported above, the HSE found (Health and Safety Laboratory, 2001) that fixing plasterboard to ceilings was reported by plasterers as the most stressful of the tasks they undertake, exacerbated by the constant extension of the neck and trunk, and mounting scaffolding to undertake the task had the greatest fall potential. Chiou et al. (2000) found that the task of raising the plasterboard to the ceiling in particular placed heavy demands on the workers' postural stability and that workers may not be able to use their body movement strategy efficiently and accurately in response to any possible momentary loss of balance. In Australia, where 6m sheets of plasterboard are commonly fixed to ceilings, extremely high demands are placed on the musculoskeletal system of the plasterer (fixer). Typically 6m sheets are fixed to a ceiling by a team of three workers; they position the sheet on edge at the base of a trestle, mount the trestle on to which they lift the sheet on edge; the sheet is then lifted up and overhead and held up against the ceiling battens or rafters with one hand, while a collated screw gun held in the other hand is used to apply screws with the other hand. The Fixing of 6m sheet is shown in Figure 25[5.]

Figure 25 Fixing 6m plasterboard sheet to a ceiling

Formal evaluation of potential higher order plastering solutions that has been undertaken include the work of Lappalainen et al. (1998) in Europe who demonstrated the benefits derived from reducing the width of plasterboard. Undoubtedly board size and weight reduction are attractive from an OHS point of view but remain problematic from an

[5] 6,000mm x 1,200mm x 10mm board weighs approximately 55kg and 6,000mm x 1,350mm x 13mm board weighs approximately 73kg

industry point of view. Not least of these problems is the increased number of butt joints (i.e. end-to-end joining of panels where no rebated edge is provided).
To address some of the problems in the short to medium terms there have been a number of engineering solutions developed. One such solution that addresses the lifting of plasterboard to ceilings is a cable winch device as shown in Figure 26. This device has a telescopic mast mounted with a frame that supports the panel while offering some pivoting to deal with raked ceilings as well as fixing to walls. The devices are currently imported to Australia. They are in widespread use and the recent arrival of alternative lower cost devices in Australia is increasing their use (Cowley, 2005b).

Use of a panel lifter overcomes a number of the manual handling problems associated with raising panels to ceilings in particular, but plasterers must still mount trestles or other height access equipment to fix the panel. A recent development that facilitates driving of fixing screws from the floor level is a collated screw gun extension as shown in Figure 27. This device is fitted to the plasterer's collated screw gun and extends the length of the driver bit such that ceilings typically up to 2.7m may be reached from floor level. Thus a panel lifter used in conjunction with a screw gun extension reduces exposure to manual handling *and* falls risk.

Figure 26 Cable winch panel lifter

Figure 27 Screw gun extension

4.2.2.2. Project aim & objectives

The aim of the project was to gather information about plasterers in Victoria that would enable the subsequent development of a targeted intervention that will increase the adoption of trowel boxes and panel lifters (the risk control measures).

The objectives of the pilot project were:

- Identify the barriers and enablers to the adoption of the risk control measures (trowel boxes and panel lifters in particular);
- Identify strategies that will increase the demand by plasterers for the risk control measures;
- Trial strategies that will increase the adoption of the risk control measures to plasterers.

Therefore the aim of the case study was to undertake formative research in the context of the social marketing Model (Andreasen, 1995) introduced in Section 2.2.4.3 and use the findings of this research to plan and structure an intervention during which pre-testing of the marketing messages would be undertaken as illustrated in Figure 7 in Section 2.2.4.3.1.

4.2.2.3. Case Study Field Procedures

Central to strategic social marketing is the identification of the stage of readiness for change of the targets i.e. the owners or operators of plastering businesses. In regard to this and consistent with the focus of this thesis being influencing decision-maker behaviour, the desired behaviour is; *Provision and supervision of the use of maintained panel lifters and trowel boxes at times when use is appropriate while fixing and finishing plasterboard.* This is to be measured against the TTM (Prochaska et al., 1998).

In accord with the approach to case study development proposed by (Yin, 1989), the questions and sources of evidence shown in

Table 12 were formulated.

Table 12 Case study questions and sources of evidence

Questions	Sources of Evidence
What do plastering business operators know about the risk of falls and manual handling injuries?	Focus group Industry Forum
Do business operators and plasterers believe that risk controls are necessary?	Industry survey Focus group Industry Forum Direct observation
What risk controls are currently used?	Industry survey Focus group Industry Forum Direct observation
Are risk controls well maintained?	Focus group Direct observation
Is the use of risk controls enforced?	Focus group Industry Forum Direct observation
What are the barriers to use of the risk controls?	Industry survey Focus group Industry Forum
Where do business operators get OHS information?	Industry survey
Who are opinion leaders?	Focus group Industry Forum

The case study units of analysis were groups of plastering business operators that were members of the AWCIV. Plasterers were visited on site and informal interviews conducted with business operators and fixers and finishers. Plastering activities on construction sites were observed.

Threats to validity during the case study were confounding variables such as activity by WorkSafe, activity by trade and industry associations and any of the three major suppliers of plasterboard (Boral, Lafarge and CSR), changes to legislation and codes of practice. Continuous environmental scanning was therefore necessary and, given the involvement of WorkSafe Victoria and the AWCIV in the project and that manufacturers' representatives are members of the AWCIV, the risk of interference with case study groups for the duration of the project was minimised.

4.2.2.4. Social marketing Objectives

Strategy planning is central to social marketing (Andreasen, 1995) and therefore the following goals and strategy were set:

<u>Goals</u>

- Increase the demand by target business operators for trowel boxes and panel lifters;
- Increase the adoption of trowel boxes and panel lifters by plasterers.

<u>Strategy</u>

The targets were plastering businesses in Victoria.

The behaviour change among the targets was to be brought about by:

- Developing and delivering messages tailored to the plastering business operators' stage of readiness

  Communications strategies will be developed that focus on tailoring messages to the different stages of adoption that the targets will be at i.e. some business operators will already be using the devices while some do not believe that they are necessary.

- Reducing the costs of the devices

  In this context the cost of the controls is not only the more tangible financial cost of any risk control but also the time and inconvenience of locating and using a control.

  The devices are relatively expensive in capital cost (approximately $2,000 each) and the trowel box in particular potentially has high maintenance costs. The use of panel lifters is perceived to be slower than manual lifting.

  Therefore, the repairers must perceive that they are able to adopt the controls easily, derive financial benefit from their use and believe that they have the capability to manage the controls into the long-term.

- Bringing to bear social influences on the targets

  Within the industry group there are various ways in which social pressure will be used, for example, through the VACC itself, opinion leaders within the industry and among geographical groupings and through role models.

4.2.2.5. Social marketing Stage 1: Formative Research

The formative research assesses the knowledge and attitudes about the particular risk and risk controls in question within the intervention and control groups. Therefore, the following general questions were addressed:

- Are the targets aware of the risks associated with the particular hazard in question?
- What are their attitudes towards the risk, i.e. the likelihood and severity of an event?
- Are the targets aware of the risk controls associated with the particular hazard in question?
- Do the targets use appropriate risk controls?

- What are the perceived benefits of the risk controls?
- What are the perceived costs associated with the risk controls?
- What is the level of perceived internal and external self-efficacy?
- What is the competition in regard to adoption of risk controls?
- What are the targets' perceptions of the need to adopt the risk controls?
- What are the targets' perceptions of the desires of others?
- What will influence the targets in regard to behaviour change?
- What factors influence internal and external self-efficacy?
- How do the targets get information about OHS?
- Who do the targets gets OHS information from?

These questions were addressed through a telephone survey of plastering business operators; a focus group meeting; an industry forum and several construction site visits.

Industry Survey

A telephone survey of a small sample of plastering businesses that were members of the AWCIV was conducted during March and April 2003. Twenty-six businesses were identified by representatives of the AWCIV as having made positive attempts to improve OHS and therefore appropriate to interview. Of the 26 businesses contacted, 23 business operators made themselves available to participate at the nominated times. The surveys employed a semi-structured interview process using the questions and flow chart shown in Appendix 4. The questions were designed and interviews conducted by the researcher and a research assistant.

Focus Group Meeting

A focus group was conducted with the aim of eliciting information regarding the use of trowel boxes and panel lifters. The focus group was also used to elicit information regarding the use of stilts for the purposes of meeting the objectives of the broader SDF project.

Participants were nominated by representatives of the AWCIV and were all either familiar with or users of trowel boxes and panel lifters and comprised the following participants:

- 3 plasterers (male)
- 2 plastering business operators/managers (male)
- 1 plastering trade trainer (male)

A focus group methodology was employed as described by Krueger and Casey (2000). A Question Route as reproduced in Appendix 4 was devised using the findings of the workplace visits.

Reference Group Meetings

For the purposes of conducting the SDF project, two industry reference groups were established comprising business operators active in a) domestic construction (includes storage and handling of plaster products in warehouses and distribution outlets and delivery from these outlets to site) and b) commercial construction.

Several meetings with each group were conducted and during one meeting with each group an open and informal discussion on the topic of trowel boxes and panel lifters was facilitated using information collected during the focus group meeting. Each commercial construction reference group and domestic construction reference group was attended by between 5 and 10 participants respectively.

At the completion of the focus group and through discussions at the reference group meetings it became apparent that it was inappropriate to market (i.e. promote) both trowel boxes and panel lifters for two different reasons; in regard to trowel boxes there was no evidence that they reduced risk to the user and construction industry trade unions maintained during oral communications that there was in fact an *increase* in risk associated with use. Although the basis for this assumption was not elucidated, construction trade union representatives prohibited the use of trowel boxes on commercial building sites and other sites where there was a union presence.

In regard to panel lifters, a risk assessment revealed a number of problems with the cable winch devices; the most significant being the potential for uncontrolled descent of the mast in the event of cable failure. The operator of the device must stand directly under the board being raised to operate the winch and, after identifying this problem, a number of plasterers reported incidents of cable failure and consequent "near misses"[6]. Other problems identified relate to the device being unsuitable for 6m boards and the need to support the overhanging ends of such boards during ascent. Imported devices do not cater for 6m boards as Australia and New Zealand are the only countries to use this length. Thus the formative research program was suspended while further assessments and solutions were explored.

4.2.2.6. Trowel boxes: building an evidence base

In the first instance a qualitative comparative risk assessment of trowel box and hand trowel use was undertaken by this researcher and an ergonomist. At the conclusion of this it was agreed that the evidence was still equivocal and, given the responsibility attached to any recommendations regarding trowel box use, it was decided to collect empirical evidence through the conduct of a laboratory-based quantitative comparative assessment of trowel box and hand trowel use. Given that hand trowels are used while mounted on either trestles or stilts, both techniques were compared with trowel box use in the latter study.

<u>Qualitative risk assessment</u>

Aim

The aim of the qualitative risk assessment was to assess the relative risk associated with trowel box and hand-trowel use.

[6] Subsequently the researcher has interviewed a plasterer that suffered head and neck injuries as a result of the uncontrolled decent of a cable winch panel lifter following cable failure.

Objectives

- Undertake subjective task analysis to identify body regions that were considered most likely to be at risk during trowelling activities;
- Identify activities and postures that were likely to increase the risk of musculo-skeletal injury;
- Identify activities and postures that were likely to increase the risk of falls;
- Make recommendations for risk minimisation as appropriate.

Trowel box use was demonstrated to the researcher during November 2002 and two weeks later plastering activities involving the use of both trowel boxes and hand trowels techniques were observed at domestic construction sites. The ceiling heights at the sites were 2.7m and 3.0m respectively.

During in-field observations, photographs and video of the tasks were recorded. Measurements of weights and dimensions were made. The plastering methods were discussed informally with those present.

The qualitative assessment found that both hand trowel and trowel box use exposes plasterers to a range of musculo-skeletal hazards (Culvenor & Cowley, 2003) associated with bending to retrieve joining compound from a bucket, the maintenance of awkward shoulder postures working with one or both hands above shoulder height and the maintenance of awkward neck posture while finishing ceiling joins.

Specifically in regard to hand trowel use, sustained force is applied through the wrist, elbow and shoulder and through the arm while holding the hawk; highly repetitive movements of the trowel arm and wrist are performed; kneeling, squatting, crawling or bending is required while working, especially while working on low joins in wall board; trestles are manoeuvred, applying force to the shoulder, elbow, wrist and fingers; and loading is applied to knees and hips when mounting and dismounting trestles. In addition, a potential for falls and slips when mounting and dismounting trestles was identified.

Specifically in regard to trowel box use, additional compressive load is applied to the neck when trowelling the ceiling owing to the upward force applied by the hands; there is sustained force applied to the elbow and shoulder; and there is a potential for tripping and striking another person or object when walking and looking upwards.

It was concluded, therefore, that both methods involve some risk. Trowel box use reduces the risk of falling from trestles although the risk is not eliminated because trowel boxes cannot be used for all ceiling work. However, the frequency and duration of trestle-mounted work are reduced. A trowel box similarly reduces the repetitive wrist and arm movements associated with hand trowel use and the sustained force on the wrist and arm that result from holding a hawk (Culvenor & Cowley, 2003).

While not eliminating other risks associated with using the hand trowel, notably the very awkward neck and shoulder postures associated with working overhead, the speed of the trowel box compared to the speed of hand trowel use reduces the duration of the task and therefore the exposure.

Based on the above, the trowel box method of jointing compound application did not appear to increase the risk of musculo-skeletal injury and, given the reduced need to mount and dismount trestles, potentially reduces the risk of associated strains and sprains and falls (Culvenor & Cowley, 2003).

<u>Quantitative risk assessment</u>

Aim

The aim of the quantitative risk assessment was to assess the relative risk of injury associated with trowel box use and hand-trowel use while mounted on trestles and stilts.

Objectives

- Undertake objective task analysis to identify body regions that were considered most likely to be at risk during trowelling activities;

- Identify activities and postures that were likely to increase the risk of musculo-skeletal injury;
- Identify activities and postures that were likely to increase the risk of falls;
- Undertake kinematic analysis of two trowelling techniques;
- Make recommendations for risk minimisation as appropriate.

In the assessment of trowel box use the following null hypotheses was tested:

Ho1: *The average and maximum extent of neck inclination, neck extension, shoulder rotation, lumbar lateral flexion and lumbar extension is greater when using a hand trowel while mounted on a trestle than it is when using a hand trowel while mounted on stilts.*

Ho2: *The average and maximum extent of neck inclination, neck extension, shoulder rotation, lumbar lateral flexion and extension is greater when using a trowel box than it is when using a hand trowel.*

Methodology

The quantitative assessment was laboratory-based for reasons of trial reproducibility and control of variables. A 6.0m long x 2.4m high x 2.5m wide wall and ceiling frame was erected in a laboratory at the University of Ballarat. A ceiling height of 2.4m was chosen based on reports by plasterers this was the most common ceiling height within residential constructions. The house frame was constructed having one long side and each end open, as shown in Figure 28 and Figure 29, to permit 2-dimensional video data collection.

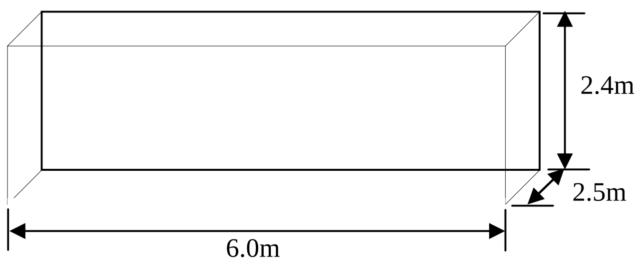

Figure 28 Diagrammatic representation of the wall & ceiling Frame

Figure 29 Wall & ceiling frame as constructed

The ceiling of the frame was lined with two 6m x 1.2m x 10mm sheets of plasterboard, fixed in accord with industry practice. This configuration presented one 6m long join running the length of the centre of the frame. The rear side and the two ends were lined with curtains that provided a background against which to collect video data. Each end-curtain was removed during filming as required by the direction of movement of the respective subjects during trials. Video data were collected and subsequently analysed using Motus 2D motion analysis software. This software enables the calculation of angles assumed by human body segments through the identification of pairs of reflective markers located on those sectors (Cowley, Culvenor, Leggett, & Saunders, 2004).

One subject was recruited for the purposes of piloting the data collection processes and a further eight (8) subjects were recruited as participants in the trials. Subjects were required to meet the following criteria (Cowley et al., 2004):

- The plasterer has five (5) or more years of experience as a plasterer involved in fixing and finishing plasterboard;
- The plasterer has experience using each of:
  - Trowel boxes;
  - Stilts; and
  - Trestles;
- The plasterer has no history of injury relating to plaster fixing and finishing;
- The plasterer is not currently suffering back, shoulder or upper limb disorders.

Subjects were recruited through direct contact with plastering businesses identified through the AWCIV and the Yellow Pages and were paid at typical industry rates for their time. Each subject was allocated a code number to preserve anonymity.

Variables

Given the findings of the qualitative comparative risk assessment, the following body regions and variables were the focus of kinematic examination (Cowley et al., 2004):

1. Neck - neck inclination (rotating the neck back to look up or forward to look down)
2. Lumbar spine - extension (bending forwards or backwards) and lateral flexion (bending side to side)
3. Shoulder - rotation

In addition it was decided that analysis of trowel box handle angle would be undertaken to assess technique. An assessment of force applied through the handles of the respective trowels was desirable but dismissed owing to the technical difficulties and associated costs of transducer development and data collection on vertical and elevated surfaces. Attempts were made to measure ground reaction forces using a force plate but the necessity for the subjects to traverse the plate on stilts and use a hand trowel while mounted on a trestle rendered the methodology impractical.

Examination of neck inclination and lumbar extension permitted calculation of neck extension. Neck extension/extension is defined by Delleman, Haselgrave and Chaffin (2004 p.88) as, “the amount of inclination of the head with respect to the amount of inclination of the trunk”.

Data Collection

Reflective markers were placed on subjects next to the ear and adjacent to the eye and on the lumbar spine and shoulders as illustrated in Figure 30 and Figure 31 reflective markers positioned on subject. The two markers on the side of a subject’s head represented the two ends of a horizontal line while the subject is at rest and thus enabled an assessment of neck inclination relative to the horizontal while using a trowel; the marker on each shoulder represented the two ends of a horizontal line while the subject is at rest and thus enabled an assessment of shoulder rotation relative to the horizontal while using a trowel; the two markers on the lumbar spine represented the two ends of a vertical line while the subject is at rest and thus enabled an assessment of lumbar flexion and extension relative to the vertical.

Two reflective markers were positioned on the trowel box handle thus enabling an assessment of handle angle relative to the horizontal plane.

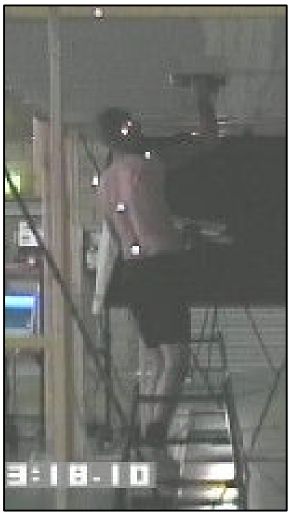

Figure 30 Reflective markers positioned on subject

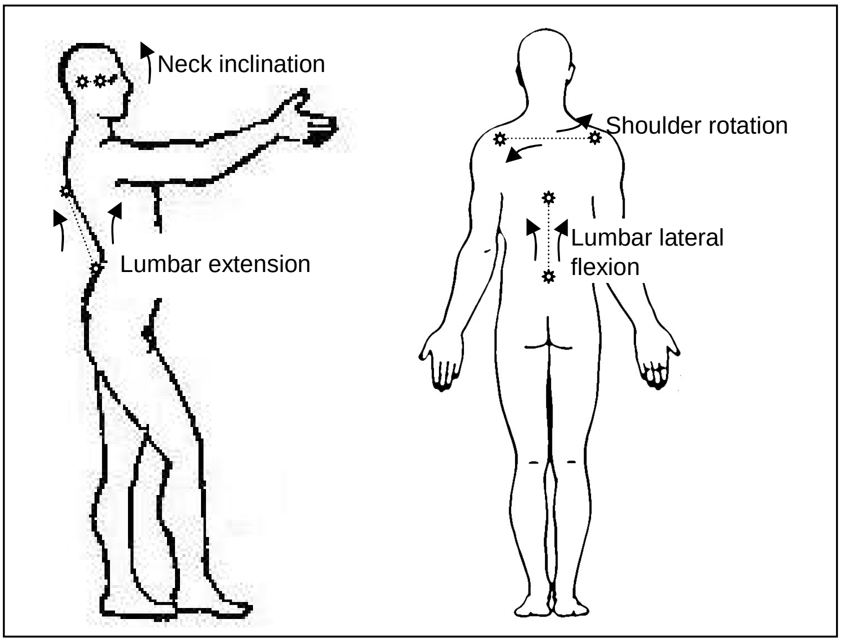

Figure 31 Variables measured and reflective marker positions

Video cameras were positioned to film the lateral view of each subject through the open side of the house frame. Another video camera was positioned at each end of the house frame to film the posterior view of each subject, regardless of the preferred direction of movement while using a hand trowel. Lights were placed above each camera to illuminate the markers.

Each subject applied topcoat jointing compound to the length of the join in the ceiling-mounted plasterboard sheets using each of three techniques:

1. Hand trowel while mounted on plasterers’ trestles and plank;
2. Hand trowel while mounted on plasterers’ stilts; and
3. Trowel box.

Each technique is illustrated in Figure 32.

Figure 32 Trestle and stilts-mounted hand trowel use and trowel box use

Each application (trial) was repeated five (5) times, the compound being scraped off after each application. Therefore each subject completed 3 x 5 (15) trials. The order in which each subject used each technique was randomised using random number tables applied to subject code number.

Subjects adjusted trestle and stilt heights to suit their preferences and used their own trowels and trowel boxes in the manner in which they were accustomed. At the time of the trials it was found that subjects allocated code numbers 1, 3, 5, 6 and 7 respectively preferred to hand-trowel in a reverse direction and subjects allocated code numbers 2, 4 and 8 respectively preferred to hand-trowel in a forward direction. Reverse trowel use involves each application commencing at arms length in front of the plasterer and the trowel being drawn backwards along the join, over the plasterer's head. In this case the plasterer walks backwards beneath the line of the join. Forward trowel use involves each application commencing over the plasterer's head and the trowel being pushed forwards along the join at arms length in front of the plasterer. In this case the plasterer walks forwards beneath the line of the join.

The moisture in the jointing compound caused the paper covering on the plasterboard to deteriorate after a varying number of applications and removal. When this deterioration became apparent, the plasterboard was removed and replaced with new sheets.

The trowel box and stilts-mounted hand trowel trials were conducted over the full six metre length of plasterboard join, while the hand trowel/trestle trials were limited by the length of the trestle and the subject's reach.

Data Analysis

Video data was analysed using Motus 2D motion analysis software by a research assistant. Trowel action within a one (1) metre length of the house frame at the middle of the plasterboard length was analysed on the basis that during trowel box trials the subject would be moving at a steady state and be adopting a typical posture for that subject by the time they reached the middle. The middle one-metre length of join was identified by two reflective markers placed on the front of house frame.

In the hand trowel trials, one *event* was analysed. An event was taken to commence in the video frame in which the hand trowel was judged to first touch the plasterboard and end in the video frame in which the hand trowel was judged to first leave the plasterboard surface. In each trial, each event chosen for analysis commenced and was completed within the middle one-metre length of plasterboard. Typically within that metre, one or two complete hand trowelling events were performed. Out of the two events, the event which gave the best maintained visual access to the reflective markers was chosen for analysis. In one trial of each technique for each subject, two different events were sampled to compare for reproducibility.

Data generated by Motus 2D software was exported to Microsoft Excel and statistical analysis undertaken using SPSS software. For each variable within each trial the mean and the maximum angles were calculated i.e. the average of the angles measured in all video frames within each trial was calculated for each body sector and the maximum angle measured in each trial was recorded.

Pursuant to testing the null hypothesis it was necessary to compare the variables associated with use of a hand trowel in the forward direction with use of a hand trowel in the reverse direction before comparison of techniques was undertaken. Given the larger number of missing data associated with trials of stilts-mounted subjects, data collected during trestle mounted trials was used. Following this, comparison of data collected during hand trowel use while mounted on stilts and trestles respectively and during forward and reverse use of a hand trowel were compared with trowel box use as listed in Table 13.

Table 13 Results analysis: techniques and subjects

Technique		Technique	Subjects
Hand trowel - Stilts	versus	Hand trowel - Trestle	All n=8
Trowel box	versus	Hand trowel - Trestle	
Trowel box	versus	Hand trowel - Stilts	
Hand trowel - Stilts	versus	Hand trowel - Trestle	Forward Trowel n=3
Trowel box	versus	Hand trowel - Trestle	
Trowel box	versus	Hand trowel - Stilts	
Hand trowel - Stilts	versus	Hand trowel - Trestle	Reverse Trowel n=5
Trowel box	versus	Hand trowel - Trestle	
Trowel box	versus	Hand trowel - Stilts	

In addition, intra-subject comparisons were made for the purposes of assessing individual effects of variations in technique use.

Perceived Exertion

Perceived exertion was chosen as a non-invasive, reliable and valid measure for the purposes of comparing the perceived workload associated with the three plastering techniques included in this study. It was concluded that heart rate would not provide a valid measure given the short duration of each trial.

Perceived exertion is defined as “the feeling of how heavy and strenuous a physical task is.” (Borg, 1998) The Borg Rating of Perceived Exertion scale was used. This scale is commonly used in exercise testing and has high reliability and validity in many investigations using different kinds of procedures (Borg, 1998 p.31; Noble & Robertson, 1996 p.70).

At the time of introducing subjects to the processes to be employed during the trials and discussing the informed consent procedure as per University of Ballarat HREC requirements the process for rating of perceived exertion was explained to subjects.

The Perceived Exertion scale was administered immediately after the completion of each set of five trials. Subjects were asked to accompany a researcher to a quiet location within the laboratory where the scale was introduced in accord with the instructions and prompts that accompany the Borg scale (Borg, 1998 p.47). The instructions given to subjects defined perceived exertion; provided an understanding of the range of sensations that corresponded to the scale; explained the nature of the scale and the need for a response to be in the range of 6 to 20; explained that every response will be correct (Noble & Robertson, 1996). The Borg scale used and the results are reproduced in Appendix 5.

Results

Raw data are presented in Appendix 5 Trowel Box Results.

Subjects & Equipment

Subject heights are recorded in Appendix 5 Trowel Box Results. The heights ranged from 1.85m to 1.70. All subjects reported that their right hand was dominant and all subjects held their hand trowel in this hand and held their hawk in their left hand. A trowel box loaded to normal capacity was found to weigh approximately 5kg.

Inter-trial reproducibility

Reliability analysis was undertaken through the calculation of a single measure intra class correlation coefficient (ICC) (2-way method with absolute agreement) for each technique across all trials for all subjects using SPSS statistical software.

Strong and very strong correlations were found for the majority of techniques, indicating good inter-trial reproducibility as shown in Table 14. The exception was the measurement of the maximum values for shoulder rotation while using a trowel box (ICC 0.43, α 0.78).

Table 14 Inter-trial reliability intra-class correlation coefficient (ICC)

	Technique					
Variable	Trowel Box		H/Trowel (Trestle)		H/Trowel (Stilts)	
	ICC	Alpha	ICC	Alpha	ICC	Alpha
Shoulder rotation: average	0.76	0.94	0.93	0.98	0.92	0.98
Shoulder rotation: maximum	0.43	0.78	0.93	0.99	0.95	0.99
Neck inclination: average	0.99	1.00	0.92	0.98	0.97	0.99
Neck inclination: maximum	0.98	1.00	0.91	0.98	0.92	0.98
Lumbar flexion: average	0.94	0.99	0.93	0.99	0.83	0.96
Lumbar flexion: maximum	0.95	0.99	0.94	0.99	0.91	0.98
Lumbar extension: average	0.93	0.99	0.97	0.99	0.93	0.99
Lumbar extension: maximum	0.95	0.99	0.98	1.00	0.98	1.00
Trowel box handle angle: average	0.87	0.98				
Trowel box handle angle: maximum	0.87	0.97				

Inter-technique variance

Repeated measures analysis of variance was used to assess the extent to which the average difference between the angles of each variable (i.e. angle of the body sector under scrutiny) adopted by subjects using the different techniques (as listed in Table 13) approached zero (0). Mean and maximum angles measured were compared. To establish the validity of these comparisons it was necessary to first assess the relationship between the body sector angles adopted by plasterers using a hand trowel in a forward direction and those using a hand trowel in a reverse direction. Comparisons of trestle mounted and stilts mounted hand trowel use were also made.

Forward versus reverse trowel use

A larger number of missing data points was associated with trials of stilts-mounted subjects, so data collected during trestle mounted trials was used for the comparison of forward with reverse hand trowel use. The average shoulder rotation, neck inclination, lumbar extension, neck extension and lumbar lateral flexion were calculated as shown in Table 15.

Table 15 Comparison of mean angles during forward and reverse hand trowel use while trestle-mounted

	Variable				
Trowel Direction	**Shoulder rotation (degrees)**	**Neck inclination (degrees)**	**Lumbar extension (degrees)**	**Neck extension (degrees)**	**Lumbar lateral flexion (degrees)**
Forward	24.0	31.8	-0.3	32.1	-13.8
Reverse	20.3	41.0	21.8	20.0	-0.9
Difference	3.7 (p=0.97)	9.2 (p=0.43)	22.1 (p=0.20)	12.1 (p=0.02)	12.9 (p=0.05)

The average difference between shoulder rotation, neck inclination and lumbar extension during forward and reverse hand trowel is not considered to be important. However it appears the combination of neck inclination and lumbar extension resulted a difference in neck extension and lumbar lateral flexion between the two techniques (12.1^{o}, p= 0.02 and 12.9^{o} p=0.05 respectively) that rendered it important that subsequent comparisons of variables were made for pooled subjects, as well as sub-groups comprising those that trowel in a forward direction and those that trowel in a reverse direction.

Trestle-mounted versus stilts-mounted hand trowel use

Table 16 and Table 17 show the mean and average maximum shoulder rotation, neck inclination, lumbar extension, neck extension and lumbar lateral flexion for the pooled subjects, as well the sub-set of those subjects that use a hand trowel in a forward direction and those that use a hand trowel in a reverse direction while mounted ***on trestles*** and while mounted ***on stilts***. There does not appear to be a difference between the techniques within the pooled subjects. However, there does appear to be some difference between the average neck inclination among the sub-set of subjects that use a hand trowel in a reverse direction (5.9º, p=0.02) while mounted on trestles and stilts respectively.

Table 16 Comparison of mean shoulder rotation and lumbar lateral flexion while using a hand trowel while mounted on stilts and trestles respectively

		Variable			
Technique	**Subjects**	**Shoulder rotation**		**Lumbar lateral flexion**	
		Mean (degrees)	Maximum (mean) (degrees)	Mean (degrees)	Maximum (mean) (degrees)
H/Trowel (Trestle)	All (n=8)	21.7	26.1	-5.7	-9.7
H/Trowel (Stilts)		21.3	25.3	-4.8	-7.5
Difference		0.4 (p=0.93)	0.8 (p=0.85)	0.9 (p=0.58)	2.2 (p=0.17)
H/Trowel (Trestle)	Forward trowel users (n=3)	24.0	30.4	-13.8	-16.2
H/Trowel (Stilts)		24.7	30.0	-12.2	-15.8
Difference		0.7 (p=0.91)	0.4 (p=0.88)	1.6 (p=0.85)	0.4 (p=0.94)
H/Trowel (Trestle)	Reverse trowel users (n=5)	20.3	23.5	-0.9	-5.8
H/Trowel (Stilts)		19.1	22.6	-0.5	-2.8
Difference		1.2 (p=0.79)	0.9 (p=0.96)	0.4 (p=0.59)	3.0 (p=0.14)

Table 17 Comparison of lumbar extension, neck inclination and neck extension while using a hand trowel while mounted on stilts and trestles respectively

		Variable					
Technique	**Subjects**	**Lumbar extension**		**Neck inclination**		**Neck extension**	
		Mean (degrees)	Maximum (mean) (degrees)	Mean (degrees)	Maximum (mean) (degrees)	Mean (degrees)	Maximum (mean) (degrees)
H/Trowel (Trestle)	All (n=8)	13.3	21.1	37.5	43.9	24.5	40.5
H/Trowel (Stilts)		11.6	17.5	40.5	48.2	28.0	29.0
Difference		1.7 (p=0.55)	3.6 (p=0.54)	3.0 (p=0.62)	4.3 (p=0.38)	3.5 (p=0.91)	11.5 (p=0.51)
H/Trowel (Trestle)	Forward trowel users (n=3)	-0.3	-3.3	31.8	37.8	32.1	41.1
H/Trowel (Stilts)		0.3	-2.0	30.1	37.6	30.2	40.1
Difference		0.6 (p=0.83)	1.3 (p=0.81)	1.7 (p=0.79)	0.2 (p=0.84)	1.9 (p=0.40)	1.0 (p=0.50)
H/Trowel (Trestle)	Reverse trowel users (n=5)	21.8	36.4	41.0	47.7	20.0	11.9
H/Trowel (Stilts)		19.7	31.5	46.9	54.8	26.7	22.3
Difference		2.1 (p=0.16)	4.9 (p=0.20)	5.9 (p=0.02)	7.1 (p=0.07)	6.7 (p=0.15)	10.4 (p=0.07)

Trestle-mounted and stilts-mounted hand trowel use versus trowel box use

Table 18 and Table 19 show the mean and average maximum shoulder rotation, neck inclination, neck extension and lumbar extension and flexion for the pooled subjects, forward trowel users only and reverse trowel users only across all trials while using a ***hand trowel*** while mounted on ***trestles*** versus using a ***trowel box***. While there do not appear to be significant differences between the techniques at the p=0.05 level across the majority of variables, the mean and maximum lumbar extension is greater among hand trowel users within the pooled subjects group (16.1º, p=0.01 and 24.6º, p=0.04 respectively) and the reverse hand trowel users group (p=0.04 and p=0.03). Also the mean and maximum lumbar lateral flexion is greater among trowel box users within the pooled subjects group (p=0.02 and p=0.11 respectively) and the sub-set of this group that use a hand trowel in a reverse direction (7º, p=0.01 and 5º,p=0.11 respectively). Mean and maximum neck extension is greater (35.5º, p=0.03 and 26.6º, p=0.01 respectively) among trowel box users in the pooled subjects group. Maximum neck extension is also greater (46.1º, p=0.05) among sub-set of this group that use a hand trowel in a reverse direction while they are using a trowel box.

Table 18 Comparison of shoulder rotation and lumbar lateral flexion while using a hand trowel while mounted on trestles and using a trowel box respectively

		Variable			
Technique	**Subjects**	**Shoulder rotation**		**Lumbar lateral flexion**	
		Mean (degrees)	Maximum (mean) (degrees)	Mean (degrees)	Maximum (mean) (degrees)
H/Trowel (Trestle)	All (n=8)	21.7	26.1	-5.7	-9.7
Trowel box		18.1	25.8	-12.7	-14.7
Difference		3.6 (p=0.13)	0.3 (p=0.95)	7.0 (p=0.02)	5.0 (p=0.11)
H/Trowel (Trestle)	Forward trowel users (n=3)	24.0	30.4	-13.8	-16.2
Trowel box		18.1	25.8	-12.7	-14.7
Difference		5.9 (p=0.15)	4.6 (p=0.07)	1.1 (p=0.71)	1.5 (p=0.92)
H/Trowel (Trestle)	Reverse trowel users (n=5)	20.3	23.5	-0.9	-5.8
Trowel box		18.1	25.8	-12.7	-14.7
Difference		2.2 (p=0.56)	2.3 (p=0.36)	11.8 (p=0.01)	8.9 (p=0.11)

Table 19 Comparison of lumbar extension, neck inclination and neck extension while using a hand trowel while mounted on trestles and using a trowel box respectively

		Variable					
Technique	**Subjects**	**Lumbar extension**		**Neck inclination**		**Neck extension**	
		Mean (degrees)	Maximum (mean) (degrees)	Mean (degrees)	Maximum (mean) (degrees)	Mean (degrees)	Maximum (mean) (degrees)
H/Trowel (Trestle)	All (n=8)	13.3	21.1	37.5	43.9	24.5	40.5
Trowel box		-2.8	-3.5	57.8	63.6	60.0	67.1
Difference		16.1 (p=0.01)	24.6 (p=0.04)	20.3 (p=0.09)	19.7 (p=0.21)	35.5 (p=0.03)	26.6 (p=0.01)
H/Trowel (Trestle)	Forward trowel users (n=3)	-0.3	-3.3	31.8	37.8	32.1	41.1
Trowel box		-2.8	-3.5	57.8	63.6	73.4	82.2
Difference		2.5 (p=0.15)	0.2 (p=0.41)	26 (p=0.30)	25.8 (p=0.64)	41.3 (p=0.27)	41.1 (p=0.29)
H/Trowel (Trestle)	Reverse trowel users (n=5)	21.8	36.4	41.0	47.7	20.0	11.9
Trowel box		-2.8	-3.5	57.8	63.6	51.9	58.0
Difference		24.6 (p=0.04)	39.9 (p=0.03)	16.8 (p=0.27)	15.9 (p=0.31)	31.9 (p=0.11)	46.1 (p=0.05)

Table 20 and Table 21 show the mean and average maximum shoulder rotation, neck inclination and lumbar extension and flexion for pooled subjects as well as the sub-set of subjects that use a hand trowel in a forward direction and the sub-set of subjects that use a hand trowel in a reverse direction, across all trials, while using a ***hand trowel*** while mounted on ***stilts*** versus using a ***trowel box***. While there do not appear to be significant differences between the techniques at the p=0.05 level across the majority of variables, the mean lumbar extension is greater (14.4º) among hand trowel users within the pooled subjects group (p=0.03) and the sub-set of these subjects that use a hand trowel in a forward direction (3.1º, p=0.03). Mean and maximum neck extension is greater (32º, p=0.03 and 38.1º, p=0.01 respectively) among trowel box users in the pooled subjects group.

Table 20 Comparison of shoulder rotation and lateral flexion while using a hand trowel while mounted on stilts and using a trowel box respectively

		Variable			
Technique	**Subjects**	**Shoulder rotation**		**Lateral flexion**	
		Mean (degrees)	Maximum (mean) (degrees)	Mean (degrees)	Maximum (mean) (degrees)
H/Trowel (Stilts)	All (n=8)	21.3	25.3	-4.8	-7.5
Trowel box		18.1	25.8	-12.7	-14.7
Difference		3.2 (p=0.21)	0.5 (p=0.83)	7.9 (p=0.11)	7.2 (p=0.17)
H/Trowel (Stilts)	Forward trowel users (n=3)	24.7	30.0	-12.2	-15.8
Trowel box		18.1	25.8	-12.7	-14.7
Difference		6.6 (p=0.30)	4.2 (p=0.27)	0.5 (p=0.71)	1.1 (p=0.83)
H/Trowel (Stilts)	Reverse trowel users (n=5)	19.1	22.6	-0.5	-2.8
Trowel box		18.1	25.8	-12.7	-14.7
Difference		1.0 (p=0.69)	3.2 (p=0.59)	12.2 (p=0.14)	11.9 (p=0.20)

Table 21 Comparison of lumbar extension, neck inclination and neck extension while using a hand trowel while mounted on stilts and using a trowel box respectively

		Variable					
Technique	**Subjects**	**Lumbar extension**		**Neck inclination**		**Neck extension**	
		Mean (degrees)	Maximum (mean) (degrees)	Mean (degrees)	Maximum (mean) (degrees)	Mean (degrees)	Maximum (mean) (degrees)
H/Trowel (Stilts)	All (n=8)	11.6	17.5	40.5	48.2	28.0	29.0
Trowel box		-2.8	-3.5	57.8	63.6	60.0	67.1
Difference		14.4 (p=0.03)	21.0 (p=0.10)	17.3 (p=0.36)	15.4 (p=0.44)	32.0 (p=0.03)	38.1 (p=0.01)
H/Trowel (Stilts)	Forward trowel users (n=3)	0.3	-2.0	30.1	37.6	30.2	40.1
Trowel box		-2.8	-3.5	57.8	63.6	73.4	82.2
Difference		3.1 (p=0.03)	1.5 (p=0.39)	27.7 (p=0.56)	15.4 (p=0.58)	43.2 (p=0.17)	42.1 (p=0.16)
H/Trowel (Stilts)	Reverse trowel users (n=5)	19.7	31.5	46.9	54.8	26.7	22.3
Trowel box		-2.8	-3.5	57.8	63.6	51.9	58.0
Difference		22.5 (p=0.24)	35.0 (p=0.27)	10.9 (p=0.71)	8.8 (p=0.86)	25.2 (p=0.16)	35.7 (p=0.09)

Trowel box angle was measured and, relative to the horizontal, the all-subject average was 43.3º (median 43.0º).

Intra-subject comparisons

Given the observed variation between hand trowel techniques and postures adopted during trowel box use during the trials, it was concluded that intra-subject comparisons should be made in regard to the three techniques. The purpose of this was to assess whether some individual subject's hand trowel techniques increased or decreased body sector angles relative to those adopted during trowel box use.

For each subject, the mean body sector angles and the greatest and smallest maximum angles measured during the five trials using each technique were calculated and plotted as histograms. All results and histograms are presented in figures 109 to 114 in Appendix 5. The results illustrate the similarities in posture adopted by individuals while using a hand trowel while mounted on stilts and trestles respectively.

Figure 33 demonstrates the range of angles of neck extension and is included below for illustrative purposes. In addition to the mean angles recorded being shown in Figure 33, the maximum angles recorded are also illustrated. Figure 33 shows the greatest maximum angle and the smallest maximum angle recorded during the 5 trials.

As would be expected, greater neck extension during trowel box use was found among those subjects having greater neck inclination and negative lumbar extension (i.e. subjects 1, 2, 5 and 8). Among subjects 3, 4, 6 and 7 neck extension during trowel box use does not differ greatly from that adopted during hand trowel use. However, in regard to subjects 1, 2 and 8 in particular, the degree of neck extension seems improbably large and suggests the possibility of data collection error as discussed below.

Mean neck inclination among individual subjects during hand trowel use on stilts and trestles respectively was similar. Subjects 1, 2, 5 and 8 exhibited much greater mean neck inclination during trowel box use while subjects 3, 4, 6 and 7 exhibited less neck inclination.

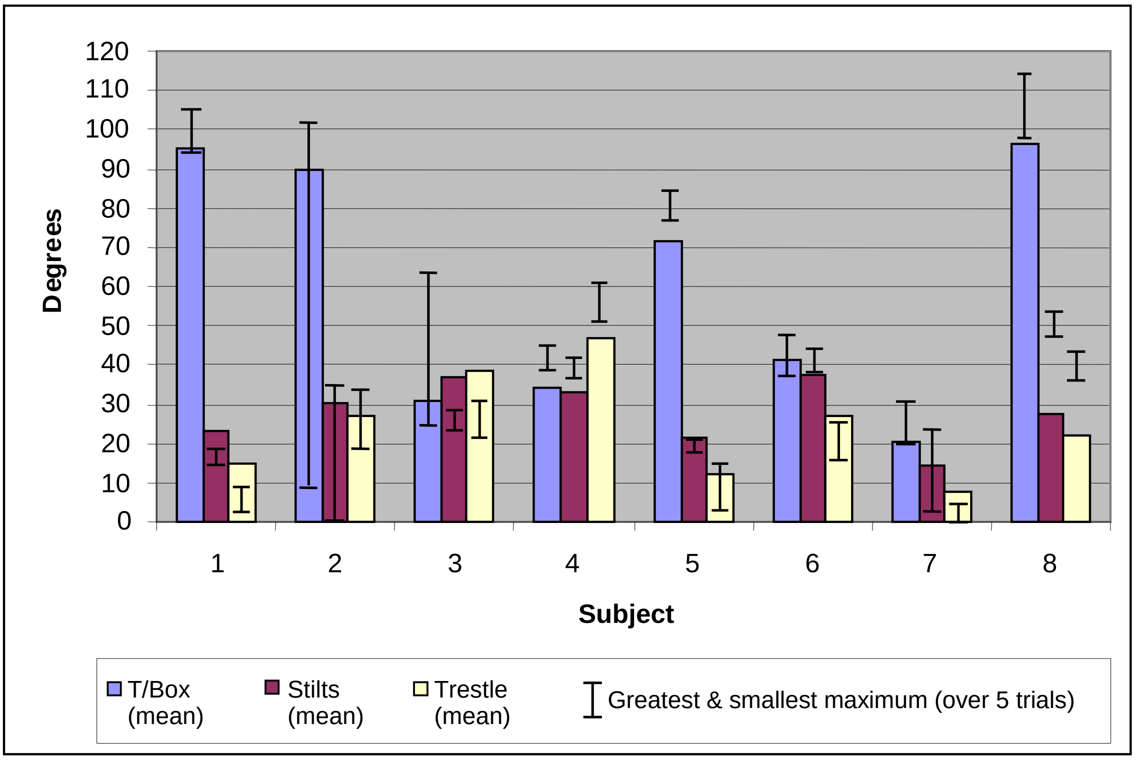

Figure 33 Neck extension: mean and maxima within 5 trials

Mean shoulder rotation among individual subjects using a trowel box was found to be similar to that during hand trowel use. While, subjects 1, 3 and 5 exhibit much greater maximum rotation the extent of the maximum rotation (e.g. 92° in the case of subject 5) seems improbably large and suggests the possibility of data collection error as discussed below.

Mean lumbar extension among individual subjects during hand trowel use on stilts and trestles respectively was similar. Subjects 2, 4 and 8 use a hand trowel in the forward direction and exhibited relatively little average lumbar extension. Five subjects inclined the trunk, on average over the trials, in a forward direction (negative extension indicates that the trunk was inclined in the forward direction and vice versa) during trowel box use. It appears that in all cases where mean lumbar extension negative (i.e. the trunk was inclined in a forward direction) the amount of extension was less during trowel box use.

In the case of subjects 1, 3 and 5 the extent of the lumbar lateral flexion seems to have been greater during trowel box use.

The mean trowel box handle angles ranged between 55° and 34° relative to the horizontal and there was little variation in angle during use.

Perceived Exertion

Results are presented in Figure 34 as intra-subject comparisons in accord with the approach recommended by Borg (1998). All subjects rated trowel box use as easier than at least one of the hand trowel techniques.

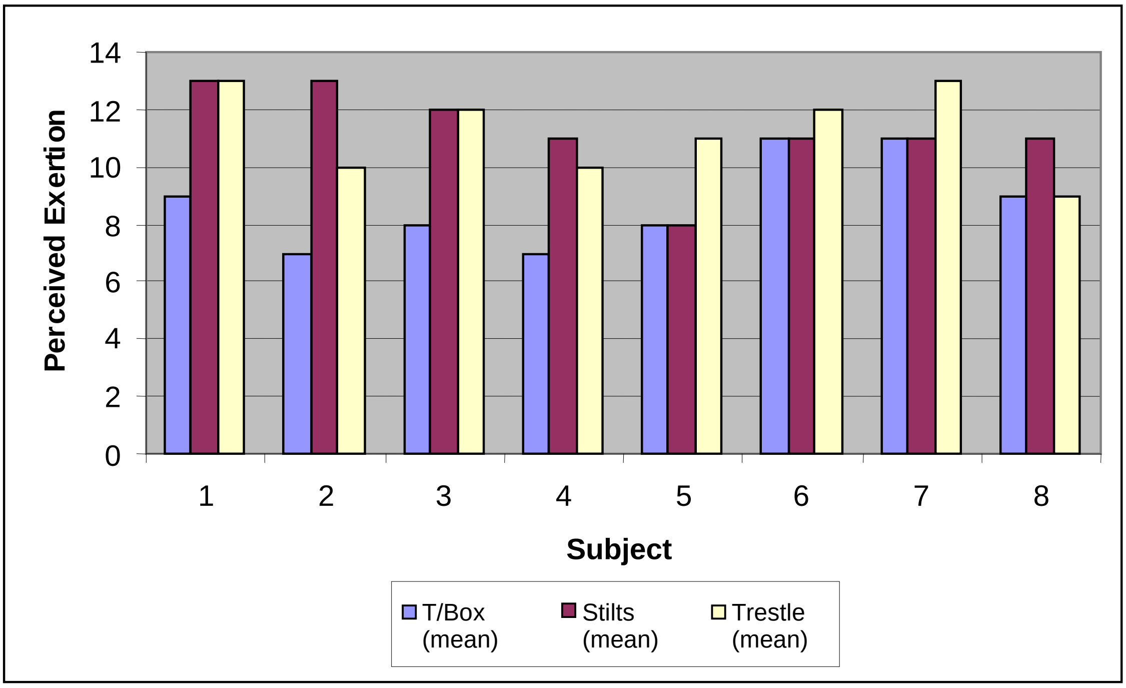

Figure 34 Results: Perceived Exertion associated with three plastering techniques

Discussion

Methodology

The small number of plasterers sampled in this quantitative study limits the strength of the analysis. The sample size was further compromised by the unforseen difficulties at recruitment stage that arose as a result of the preference of individuals to use a hand trowel in either a forward or reverse direction. However, sample size was limited by the availability and cost of subjects and the large amount of time associated with video data analysis. Notwithstanding these limitations, there appears to have been good inter-trial reproducibility.

At the time of data collection only a two-dimensional (2D) video technique was available. The 2D technique may have introduced data recording errors that 3D techniques may have overcome. For example, forward trowel use sometimes involves greater rotation of the upper body in the horizontal plane than does reverse hand trowel use and this may have led to misinterpretation of some variables during the 2D analysis owing to the loss of perspective between lateral and posterior measure, i.e. introduced parallax error. This is illustrated in Figure 35.

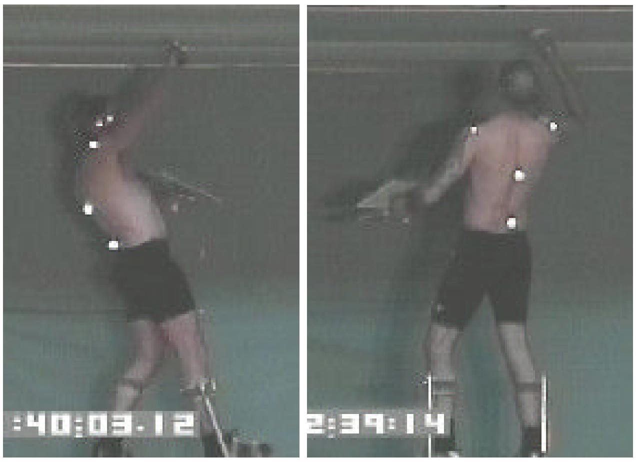

Figure 35 Reverse versus forward hand trowel use as viewed through the open side of the wall & ceiling frame.

While there does not appear to a be statistically significant difference between forward and reverse hand trowel techniques in regard to shoulder rotation and neck inclination, there does appear to be some effect in regard to lumbar lateral flexion and neck extension thus, for completeness, analyses included assessment of pooled subjects as a group as well as sub-sets of those who used a hand trowel in a forward direction and those that used a hand trowel in a reverse direction. Similarly, there appeared to be little variation in hand trowel technique while mounted on stilts rather than a trestle except in regard to the average neck inclination among reverse hand trowel users.

Notwithstanding these differences in the sub-sets of subjects, with reference to the null hypotheses, the study focussed on *all* plasterers regardless of preferred direction of hand trowel use and work platform (i.e. stilts or trestle). Within the all-subjects groups there did not appear to be any statistical difference between a) reverse and forward hand trowel use and b) stilts and trestle-mounted hand trowel use. Therefore in this regard it would appear to be appropriate to compare the pooled subject group with trowel box users.

<u>Plastering technique comparisons</u>

Hammarskjold, Ekholm, and Harms-Ringdahl (1989; 1990) examined the reproducibility of carpenters' actions while nailing, sawing and screwing and concluded that the intra-individual work technique does not alter significantly from one occasion to another but the work techniques for the same task differ between individuals. These conclusions are supported by the findings of this study and any consideration of the inter-subject results should acknowledge the apparent variation in execution of the three plastering techniques between subjects.

Shoulder rotation & lateral flexion

Svendsen et al. (2004) undertook a cross-sectional study of exposure-response relations between work with highly elevated arms and shoulder disorders among a cohort of 1,886 from three occupational groups; machinists, car mechanics and house painters. They identified that several occupations that require work with elevated arms, monotonous repetitive work and forceful exertions have been associated with shoulder complaints and disorders. They hypothesised that work with elevated arms causes degenerative changes in the rotator cuff tendons. However, they acknowledge that few studies have focussed on elevation angles greater than 90º. They found that the prevalence of dominant sided shoulder complaints and disorders was about twice as high among house painters as in the other two groups and exposure response relations were found between current upper arm elevation above 90º and shoulder disorders.

Lemasters et al. (1998) undertook a questionnaire based survey of 522 carpenters in the Ohio district, comprising a subset of 113 of workers that specialised in drywall and ceiling work in regard to symptoms of musculoskeletal disorders. A subset of the total group was subject to physical examination. They found that all specialities in the carpentry sectors had a high rate of musculoskeletal disorders, with drywall workers being second highest after those doing form work. Disorders of the shoulders, hands and wrists were most prevalent among drywall workers.

Stenlund, Lindbeck and Karlsson (2002) analysed the work techniques of 40 house painters during the sanding of a ceiling, commenting that sanding of ceilings is one of the most strenuous construction work tasks for the shoulders. These authors also comment that painters adopt individualised and entirely different techniques to perform the task.

Each of the three plastering techniques explored within this study require plasterers during ceiling work to apply force while the arm is elevated above 90º. Lemasters et al. (1998) report that drywall and ceiling work entails the repetitive, forceful overhead work and is related to the high incidence of upper extremity musculoskeletal disorders. Their field study of carpenters undertaking drywall ceiling work found the most stressful postures stressed the neck, shoulder, elbow and back regions. Stenlund et al. (2002) suggest that this repetitive, forceful and sustained overhead work exposes plasterers to risk of rotator cuff and biceps muscle damage and compression of the tendons that leads to impairment of circulation and accelerated degradation. Little is known about the effects of lateral bending (Delleman et al., 2004).

Given that all ceiling plaster work requires the arm to be elevated more than 90º and the range of arm movements at this elevation would make kinematic analysis problematic, shoulder rotation and lumbar lateral flexion were employed as indicators of sector angle for the purposes of technique comparison. Lumbar lateral flexion increases as a consequence of arm and thus shoulder elevation.

The study found that, for the pooled subjects, there is no significant difference between the average shoulder angle and the average extent of lateral flexion between hand trowel use while mounted on stilts and hand trowel use while mounted on a trestle and there was similarly no significant difference between both hand trowel techniques and the use of a trowel box. There is no apparent relationship between plasterer height and shoulder rotation as might be expected given the freedom of plasterers to adjust stilts and trestles to suit themselves during hand trowel work and the ability to adjust grip on the trowel box handle. Further, the difference between the shortest and tallest subject was only 150mm and seven of the eight subjects were in the range 1.76 to 1.85m.

At an individual subject level it appears that lateral flexion is greater among those who demonstrated a greater degree of shoulder rotation. These results do, however, need to be treated with a degree of caution given the potential for parallax error in regard to shoulder rotation in the horizontal plane to exaggerate results as discussed above. The extreme and unlikely maximum shoulder rotation recorded in the cases of subjects 1 (85º) and 5 (92º) support this.

Neck inclination, lumbar extension and neck extension

Delleman et al. (2004) report that neck pain is a major musculoskeletal health problem, occurring in many different occupational groups and that neck posture is a risk factor in this regard. Most research has focussed on neck inclination and neck flexion/extension has only relatively recently received attention. The authors add that little is known about the effects of neck twisting.

Bernard (1997) examined the epidemiologic evidence that associates selected musculoskeletal disorders (MSD) of the upper extremity and the low back with exposure to physical factors at work and concluded that there is strong evidence for support of an association between static or specific postures and neck and neck/ shoulder MSD. Specifically Bernard (op cit) found evidence for a causal relationship between highly repetitive work and neck and neck/shoulder MSD. “Repetitive work” is generally taken to involve continuous arm or hand movements which affect the neck/shoulder musculature and generate loads on the neck/shoulder area although the elevation of the arm is not detailed. Bernard also cites evidence for forceful exertion (forceful arm or hand movements, which generate loads to the neck/shoulder area) and the occurrence of neck MSD and strong evidence that working groups with extreme working postures involving the neck/shoulder muscles are at increased risk for neck/shoulder MSD.

The WorkSafe Victoria Code of Practice for Manual Handling (WorkSafe Victoria, 2000) offers guidance regarding neck and back posture and uses 20º for forward bending and 5º for backward bending as a guide in relation to repetitive or sustained work. “Repetitive” work is defined as being more than twice per minute and “sustained” is defined as being for more than 30 seconds. In regard to mean lumbar extension all reverse trowel-using subjects exceeded the 5º guidance limit and maxima values were substantially in excess of the limit during hand trowel use. During trowel box use, some maximum values only exceeded the guidance limit. In regard to neck bending all subjects exceeded the guidance limit while using all three techniques.

This study found that there does not appear to be a statistically significant difference between the amount of neck inclination during hand trowel and trowel box use. However, there does appear to be a statistically significant difference between the amount of lumbar extension (i.e. lumbar inclination) demonstrated during hand trowel use and during trowel box use and consequently neck extension is influenced and a statistically significant difference between the techniques is found in this regard.

The difference (not significant) between lumbar extension exhibited by subjects during hand trowel use and trowel box use is greater among those that hand trowel in a reverse direction owing to the greater degree of overhead and reaching behind involved in this technique.

Lumbar extension or forward inclination increases the load placed on the spine. When upright the weight of the body is balanced around the spine. As the centre of gravity moves forward, this load must be balanced by the generation of a tensile force within the muscles behind the spine and therefore compression within the spine. Similarly, inclination of the neck increases the load and is balanced by tensile forces in muscles (Culvenor, 2005).

Review of the mean and maxima values for lumbar extension among the individuals’ data suggests that among all subjects, less lumbar extension is demonstrated during trowel box use. However, notwithstanding the possible influence of parallax error during data analysis, greater neck inclination is demonstrated by subjects 1, 2, 5 and 8, and owing to their apparent tendency for the truck to move toward the vertical and inclination to the rear, neck extension increases.

These results do, however, need to be treated with a degree of caution given the potential for parallax error in regard to head rotation in the horizontal plane to exaggerate results as discussed above. The extreme and unlikely maximum neck inclination recorded in the cases of subjects 1 (95.6º) and 8 (105º) support this and review of video tapes confirms that these subjects rotated their heads while using a trowel box.

While it appears that all subjects exceeded the WorkSafe Victoria (WorkSafe Victoria, 2000) guidance limit while using all three techniques, relative to hand trowel use, less neck inclination was demonstrated by subjects 3, 4, 6 and 7 and less neck extension was demonstrated by subjects 3 and 4 during trowel box use.

Perceived Exertion

The assessment of Perceived Exertion suggests that trowel boxes are generally perceived to require less effort to use than hand trowel techniques. All subjects perceived the exertion to be less than at least one of the hand trowel techniques. Inter-subject comparisons are inappropriate and comparisons are based on intra-subject ratings given that the language used in the rating scale has particular meaning to most individuals and they are their own controls, i.e. if someone has a tendency to give slightly high or low ratings, it has little effect on intra-individual comparisons (Borg, 1998 p.48).

A threat to validity is introduced by the unusual environment and dress of the plasterers during the trials (Borg, 1998 p.45), however, the scale was administered similarly after each set of trails and thus any effect of the environment or clothing is likely to impact equally across each technique; the ratings are being used for the purposes of inter-technique comparison rather than as absolute measures.

Summary

The study has found that there is not a significant difference in shoulder rotation exhibited by subjects between techniques. In three cases however, the maximum amount of shoulder rotation was greater while using a trowel box, although parallax error may have exaggerated the values given their extreme and unlikely magnitude. Lumbar lateral extension is directly related to shoulder rotation and similar results were found.

Lumbar extension decreased significantly during trowel box use and while there was an apparent increase in neck inclination, this was not statistically significant. However, there was statistically significant increase in neck extension during trowel box use, notwithstanding concerns about the influence of parallax error during data analysis.

In regard to increased neck extension, the duration of trowel box use is substantially less during normal use. Field work observations and timing of ceiling finishing as a part of this study has estimated that trowel box use halves the time to complete a join in 6m board. The total duration of finishing is not directly related to this figure given that hand trowel use requires continual movement and relocation of trestles and mounting and dismounting of trestles and stilts to replenish hawks while trowel boxes require greater clean up time. Data collected during these observations suggest that hand trowel use by an experience plasterer will finish approximately 150m^2 per hour while trowel box use by an experience plasterer will finish approximately 460m^2 per hour. In addition to being a faster plastering technique, the assessment of perceived exertion suggests that it is less tiring.

It became clear through observation of plasterers during the trials and from the measurements taken during the individual trials that individual technique significantly influences the posture assumed during hand trowel and trowel box use. Stenlund et al. (2002 p.456) identified this in regard to painters undertaking ceiling sanding, commenting, “They adopt individualised and entirely different techniques to perform the task. The question is whether one technique is less strenuous than the other, or whether some techniques may even cause damage to the shoulder.” The authors found statistically significant differences in muscle forces and symptoms of MSD between techniques; a pushing technique used by seven of the forty subjects being least dangerous.

Similarly in this study, it appears that some trowel box techniques results in greater shoulder rotation, neck inclination, neck extension, lumbar extension and lumbar lateral flexion than others. Given that inclination of trunk and neck angle away from the vertical and elevation of the arm as indicated by rotation of the shoulder will increase load on the spine and possible increase risk in regard to rotator cuff, it is assumed that smaller angles in regard to each variable are preferable. This being the case, training of trowel box users in the emulation of postures similar to those adopted by subjects 3, 4, 6 and 7 would be appropriate. However, attempts by individuals to exactly replicate these postures may not be appropriate given that load cannot be changed during trowel box use so users distribute this load as best they can across all body sectors. Fitness and muscle strength will influence this and thus emulation within the boundaries of comfort rather than copying and experiencing discomfort is to be preferred.

4.2.2.7. Panel lifters: finding a solution

An engineering company in Ballarat (ASEMA Pty Ltd) was approached regarding the development of and modifications to an imported panel lifter that would address the problems identified and render it fail safe. Advice was provided regarding plasterers' needs and marketing considerations.

The engineers employed by ASEMA Pty Ltd were of the opinion that radical redesign and fabrication of a novel device would be more appropriate than modification of an existing device and proceeded to develop a prototype. This prototype embraced the following features:

- Pneumatic operation via small compressor
- Fail-safe via incorporation of controlled descent valves
- Improved manoeuvrability
- Suitable for 6m panels

A prototype was reviewed and further advice given regarding adjustments to meet plasterers' needs before a demonstration was facilitated at a commercial construction site where plasterers were working. During this demonstration opinions of plasterers were canvassed and reported to ASEMA representatives who modified the prototype, sought comment and then proceeded to fabricate a working model. This working model was then supplied for working trials to a plastering business, being a member of the AWCIV, which engaged in both commercial and residential (domestic) plastering contracts.

After a period of two weeks, plasterers working for this business were visited on site, use of the device was observed and opinions regarding the pros and cons of the device were canvassed. A screw gun extension was obtained and the plasterers asked to use this in conjunction with the panel lifter as shown in Figure 36. Opinions regarding the pros and cons were canvassed.

Figure 36 Fail-safe panel lifter in use with screw gun extension

Following these trials final modifications were made to the design before a production model was made available.

Subsequently another manufacturer has fabricated a prototype winch device having fail-safe features, improved manoeuvrability and the capability to raise 6m panels. This prototype has been reviewed on-site with working plasterers and at the time of writing a modified prototype is being fabricated and made ready for field trials.

4.2.2.8. Industry Forum

An industry forum was held on 25th November 2003 in order to introduce AWCIV members to the SDF project and to confirm and extend knowledge gathered regarding trowel box and panel lifter use as well as eliciting information regarding other aspects of plastering work and OHS in accord with the case study formative research questions. Fifty (50) plastering business representatives attended the forum.

Following a plenary session at which the researcher presented a summary of the SDF project and findings to date, participants were asked to participate in one of five workshop groups being:

1. Storage, loading and unloading
2. Manoeuvring plaster and plaster products on site
3. Hanging Sheets and Cornice
4. Stopping and Finishing
5. Work at heights

Participants were advised by AWCIV representatives regarding the most appropriate workshop group to join based on prior knowledge of those businesses' operations. Approximately ten (10) people participated in each group, being led by a facilitator who guided participants through a series of questions.

4.2.3. Plasterers' Trowel Box Case Study Results – formative research

During each of the industry survey, focus group meeting, reference group meetings, site visits and the industry forum it became apparent that there was general awareness of OHS as a priority matter and a general understanding that the greatest risk was associated with manual handling and working at height. However, there was no apparent knowledge of the size of the problem in absolute terms or relative to other construction industry sectors. Given the absence of reliable information regarding the size of the problem this lack of knowledge is unsurprising.

4.2.3.1. Industry Survey

The industry survey sought information about a range of issues pertinent to the SDF project as a whole. The results presented here pertain to the issue of trowel box and panel lifter use.

The twenty-six businesses represented in the survey comprised eight that solely undertook residential projects, eight that solely undertook commercial projects, seven that undertook both commercial and residential projects, two involved in manufacturer, storage and retail, and one that undertook commercial and residential projects and were also involved in manufacturer, storage and retail. Those respondents that represented businesses involved in commercial and residential plastering (n=23) stated that their company undertook all the plastering tasks from hanging to finishing

Eleven of the respondents' businesses used trowel boxes and thirteen used panel lifters and reported with confidence that their employees liked the equipment.

Benefits of the equipment in terms of safety and productivity were reported to included, in regard to trowel boxes, increased speed of work and the reduced workload leaving workers feeling better at the end of the day; greater productivity and less strain and effort; less wear and tear and less falls such as walking of the scaffold or planks while using a hand trowel to finish a ceiling; less movement up and down off stilts and scaffolds; less absenteeism owing to strains; less use of stilts. In regard to panel lifters there were also general comments about reduced strain and risk of back injury and that having two workers using a lifter while a third does other work is better than having all three lifting (6m) panels. Panel lifters were mentioned as being particularly useful when raising heavier board.

Cons associated with equipment included awkwardness in some circumstances and that they are not practical for every situation and panel lifters can get in the way within small rooms; expense; potential to slow a job but this is off-set by savings in regard to injury costs; awkwardness of trowel boxes on wall joins; maintenance.

In regard to overcoming problems, there was a suggestion that the design of some plastering equipment could be improved to reduce the cons while other suggestions related to changing the design of houses through influencing architects and board design through manufacturers. Training and education was also mentioned as a way of overcoming some of the cons. There was no awareness of alternative devices that would overcome the cons.

Reasons for not using the equipment reported by respondents included lack of familiarity, not having had the opportunity to try the devices and union influences on site. Another reason stated was that employers wished their trades-people to practice traditional techniques before moving on to new techniques that did not demand the same level of skill.

In addition to the employment of trowel boxes, panel lifters and other equipment that would reduce risk, respondents listed a number of other factors that would improve safety. These included: inspection of sites before work started; completion of job safety analyses and safe work procedures; cleaning and regular house-keeping activities with a particular focus on keeping floors clear; job rotation; improved house design; appropriate dress such as boots; supervision.

Respondents were asked a series of questions about sources of information. Only two respondents said they had seen other businesses using equipment that was good. Nineteen reported that they had access to the internet while only 11 of these reported using the internet to access OHS information, citing unfamiliarity with computers and the internet and access to information through other sources as reasons.

In regard to important sources of OHS information, eighteen (18) cited the AWCIV; thirteen (13) cited WorkSafe Victoria; four (4) plasterboard manufacturers; three (3)professional or employer organisations; and one (1) other plastering related organisations. When asked to identify from a list, where they had learned anything about health and safety from any in the previous year or so, twenty respondents cited pamphlets and newsletters; seventeen (17) cited professional or employer associations; sixteen (16) cited newspapers and magazines; fifteen (15) cited training courses or seminars; fifteen (15) cited government bodies or organizations; fourteen (14) cited posters and signs;

fourteen (14) workmates or colleagues; twelve (12) cited supervisors or managers; ten (10) cited internet; nine (9) cited television; and five (5) cited radio.

When asked where they would go for help if they had an OHS problem, sixteen (16) said they would go to the AWCIV; six (6) to WorkCover; two (2) to their OHS manager (1 commercial contractor and one commercial and residential contractor); one (1) to a health and safety representative; one (1) to their insurance company and one (1) to the manufacturer of the plasterboard.

4.2.3.2. Focus Group

The focus group identified a number of pros and cons associated with the use of trowel boxes as shown in Table 22.

Table 22 Pros and cons associated with trowel box use

Pros	Cons
Not working on scaffolds and stilts	Retarding agent (citric acid) can reduce quality
Efficiency	Environmental impact/mess clean up – requires running water
Longer working life in the trade (particularly in regard to shoulder, arms and lower back pain)	Efficiency leads to industrial relations issues
Reduces job time	Not viable in small areas
Financially more attractive	Do not have basis for trade with just the trowel box – i.e. needs to complement hand trowelling as a skill
Finish is flatter requiring less sanding (hand trowel leaves less edge but harder)	Knowledge of the availability of the parts
High quality, more uniform from several gangs – consistency of work	Limited understanding/knowledge of the system as a whole
Cleaner – Less cement dropped onto floor	Limited understanding/knowledge of the capabilities of the system
No wastage of cement	Questionable quality in the wrong hands
Tradesperson's efficiency increases more rapidly – learn quicker	Need perseverance initially
Not as much training required	Current training packages are outdated

In concluding, the focus group participants commented that all things considered trowel boxes are better than hand trowelling.

The focus group identified a number of pros and cons associated with the use of panel lifters as listed in Table 23.

Table 23 Pros and cons associated with panel lifter use

Pros	Cons
Take flex out of large sheets (>4.2m)	Bulky & manoeuvrability limited in small area
Reduces risk with long sheets	Maintenance (brake)
Good to use for anything greater than	Can collapse
4.2m (if 2 people available; if 3-4 people available, lifter not worth using)	Cable fraying
Enable person to work on their own	Fail to danger
Use with collated screw guns extension	Need clean floor
Suitable for range of products – use with domes, roses, ceiling panels	Limited in commercial units owing to other equipment
Very good on raked ceilings	Takes more time to use than manual lift
Good for heavier, fire rated sheets	Reduce overhead work but are in the way and still have to get trestle/plank to fix i.e. to reach to drive screws

4.2.3.3. Industry forum workshops

The discussions at the forum complemented the focus group meeting outcomes by engaging the views of a wider number of participants.

In general, the problems relation to stopping and finishing, were seen as being related to hand trowelling actions, which impacted on the wrist and shoulder; the repetitive nature of the work; the need for balancing on planks; and the jointing compound bucket height.

Given the evidence base in support of trowel box use, the workshop group was asked to answer the following questions about trowel boxes:

Assuming trowel boxes are worthwhile:

- What needs to be done to decrease the risk of the solution during use?
- How can this information be best transmitted to workers?
- What else needs to be considered?

In terms of decreasing risk, design of trowel boxes was the subject of discussion that ranged over the size and weight of the box, handle design, the suitability of the pump for loading the trowel box and whether a harness similar to a fishing rod holder would be beneficial. Training and instruction were seen as essential to ensure that users understood the theory and practical aspects of use, adopted the best posture during use, understood how to mix jointing compound to correct consistency, adjust box settings, etc. and thus not get frustrated with poor performance and give up use. It was suggested that a TAFE training module dealing with trowel box use should be developed. In addition it was agreed that suppliers had a duty to train purchasers and it was suggested that provision of trade nights and a video presentation might be appropriate. The potential for coaching of users was discussed.

To increase adoption of trowel boxes it was suggested that market segments need to be recognised, these being in particular self-employed contractors, employer contractors and employees on wages. The benefits of trowel box use should be promoted through marketing of the productivity and quality gains and savings in jury costs, and through observation of competent users.

The barriers to use of trowel boxes were reported include tradition and resistance to change. Of particular concern is the erosion of a tradesperson's skill base through the introduction of new technologies. A further barrier was thought to relate to the adoption of new practices as a result of oral communication and copying of others thus not only limiting the opportunity for training in correct use of trowel boxes but also increasing the potential for the transfer of incorrect techniques. A further barrier was identified in the outdated TAFE curriculum for apprentice plasterers and the failure of many apprentices to complete their apprenticeship[7] and thus learn the full range of trades practices which include use of newer technologies. Related to this were issues to do with providing professional development to trades people that have been in the sector for a number of years. Other concerns expressed related to resistance owing to an increase in the amount of equipment that needs to be transported to sites and the time it takes to set up and clean after use.

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[7] Anecdotal reports suggest that many apprentices fail to complete their apprenticeship. After learning basic plastering skills they are able to find employment at rates of pay much higher than that offered to apprentices.

There was some discussion regarding panel lifters although the industry forum preceded the development of the prototype fail safe panel lifter. The discussion was facilitated on the basis that a fail-safe, fit-for-purpose panel lifter might become available. In general it was agreed that they reduced overhead work as well as freeing other workers to work elsewhere. They were recognised as being particularly advantageous for solo workers. Conversely however the continual relocation of the device was seen as a disadvantage. Although it was generally agreed that panel lifters reduced the risk of back injury, where there are more than four people are working the practicality is reduced as space and ease of use is limited.

4.2.3.4. Social Marketing

The formative research process was employed as the first stage in a social marketing-based intervention. The success of this process de-railed the social marketing procedure as a result of it identifying that there was no evidence base to support the promotion of two key solutions to plastering problems i.e. trowel boxes and panel lifters that would reduce the exposure of plasterers to risk of manual handling injury and falls.

Considerable time was expended on the quantitative assessment of trowel boxes and the development of a prototype fail-safe panel lifter each of which have subsequently been proven. Simultaneously, the use of screw gun extensions in concert with panel lifters, enabling ceiling panels to be fixed from floor level, was evaluated. From the formative research also emerged information about a range of other technical and organisational risk controls, each of which have been evaluated. One organisational risk control that emerged as central to the success of the trowel box and panel lifter solutions was that of "plaster-readiness". The term "plaster-ready" was coined during this research and describes "the extent to which a building site working environment is ready firstly to receive and store plasterboard and then subsequently for wall and ceiling activities to be undertaken."

The conditions that influence plaster readiness for wall and ceiling activities are:
site condition, building condition, access for vehicles to site, access for plasterboard into the building, presence of incompatible work activities on site, maintenance of housekeeping, access and egress, and improved future building design. A range of criteria

were developed under each of these headings to describe the conditions that need to be met to achieve plaster readiness.

Plaster readiness can only be achieved by the scheduling of construction and finishing tasks to allow unrestricted and clear access for wall and ceiling workers when engaged in delivery, storage, manoeuvring, installation and finishing. Thus plaster readiness is essential as a pre-condition for safe use of trowel boxes and panel lifters and became a major area of development. Subsequently the term has been introduced into a draft revision of Australian/New Zealand Standard AS/NZS2589:1997 Gypsum linings—Application and finishing (Pimm, 2005) and meetings with major building contractors have been arranged to discuss methods that may be employed to instil the concept within building contractor sector of the construction industry.

Notwithstanding the importance of plaster readiness being accepted as a prerequisite for the use of technical solutions on site, the formative research process and the quantitative assessment of trowel box use were used to develop marketing messages in readiness for promotion of solutions through a social marketing intervention. These key messages in regard to a trowel boxes were; that they are fast; enable working from the floor which is safer given that falls from trestles are common; less tiring and do not require frequent climbing, dismounting and movement of trestles; they do not remove the skills needed of plasterers as these skills still needed for the more intricate and challenging work; they place less strain on shoulder that results from ceiling work; less strain and injury saves money and prolongs working life.

In regard to panel lifters the key messages were that they remove strain associated with lifting large panels overhead and the new type developed as a result of this project comfortably takes 6m sheets; they remove the need to climb while fixing ceiling panels if used in combination with screw gun extensions; reduce the number of people needed to hang panels; fail safe; manoeuvrable on site; compact for transport; less strain and injury saves money and prolongs working life.

In regard to screw gun extensions the key messages were that, if they are used with panel lifters, they remove need to climb to fix ceiling panels which means working from the floor which is safer because falls from trestles is common; they are fast; the work is less tiring because they reduce the need for frequent climbing, dismounting and movement of trestles.

An expert copywriter was engaged to convert these messages into text that would accompany pictures within a promotional brochure. The use of a professional writer was justified by the need to produce promotional material that used the minimum number of words to convey the key messages in a largely pictorial manner. The brochure is included as Appendix 6.

During the formative research processes aspects of opinion leadership were discussed with participants and it emerged that, while contractors rarely communicate with one another outside the AWCIV forums or outside worksites where they may chance meetings, they do visit and are largely loyal to one supplier of materials. In association with AWCIV officers it was thus decided that the marketing of solutions would capitalise on contractors' respect for their suppliers and utilise their outlets for solution promotion. A pilot marketing program was then designed that focussed on delivery of key marketing messages via demonstrations of solutions and distribution of the brochures at a series of 13 trade nights held at supplier outlets across Victoria between the beginning of June and the end of August 2005. "Trade nights" are events common in the sector and generally involve an after-work meeting at a supplier's premises to which contractors and employees are invited to attend and learn about some technical development or innovation of relevance to their trade.

At the trade nights a short presentation was delivered to explain the SDF project and its findings and to promote the solutions using the key messages. A wall and ceiling frame similar to that used during the trowel box study was erected and used to demonstrate the use of a panel lifter, trowel box and other technical solutions. The trade nights were promoted through the AWCIV and via leaflets distributed by host suppliers to their casual and account customers.

Simultaneously an incentive offered by WorkSafe Victoria for plasterers to adopt the solutions was promoted. This incentive comprised an offer of 50% of the cost of the solution up to a maximum of $500 per plastering business (i.e. per Australian Business Number (ABN) registered in Victoria) and was an element of the SDF program.

During the early trade nights, or pre-testing phase, it became apparent through discussion with attendees and reflection that some of the messages in the presentation, in particular in regard to the financial benefits of injury reduction, were overly complex for the audience and perhaps irrelevant given that many attendees were self-employed and thus did not pay workers compensation premiums. The presentation was amended and anecdotal feedback from attendees suggested the messages were clearer. Trade nights were followed up with telephone calls to attendees that had registered and delivery of multiple brochures to all plasterer supplier outlets in Victoria affiliated to the three major manufacturers.

At the time of writing, the number of businesses purchasing solutions through the cash rebate process had reached 35 and was increasing. Meetings with AWCIV officers and marketing specialists from the three major manufacturers to discuss further increasing promotion of the solutions using the key marketing messages have been scheduled.

In regard to the need to support the adoption of trowel box use with training and education, a training module was developed for inclusion in the TAFE curriculum by AWCIV officers during the project; a combined promotional and training DVD was prepared by one of the trowel box manufacturers; and that manufacturer has, as well as attending each trade night, undertaken a number of trade nights independently.

4.2.4. **Case study review**

As discussed previously, Andreasen has found that the information gathered by formative research will provide a number of insights to the behaviour that is being influenced. Generally, these insights include information about the targets' stages of behaviour change; positive and negative consequences that targets perceive will follow their choices; tradeoffs against those consequences; the influence of other people and self-efficacy; grouping of targets (i.e. segmentation); and the targets' perceptions of competition, which are not always the same as the social marketer's perception (Andreasen, 1995 p.143).

This case study demonstrated the value of applying the formative research process and listening to the target audience. While the process rapidly de-railed the social marketing intervention owing the absence of an evidence base supporting the use of two key solutions, that interruption was invaluable in; a) generating a robust evidence base in terms of risk reduction capacity of the solutions; and b) development of strong and clear marketing messages.

The formative research process initially used focus and reference groups to gain a deep insight to the issues surrounding the solutions and the opportunity to confirm the findings at a larger industry forum was invaluable.

Quantitative assessment of the trowel box as a solution was essential before it could be promoted as such with confidence. The findings that in general the body angles adopted during trowel box use were no greater than during hand trowel use, and where neck extension increases there is a compensatory reduction in duration were significant. Further, a good trowel box technique can result in a posture that is safer than that adopted during hand trowel use. The faster completion of plasterboard joint finishing reduces exposure to musculoskeletal risk and increases job variety. Working from the floor reduces the amount of climbing and dismounting of trestles or stilts and the risk of falls. The technique also reduces fatigue. On the basis of these findings the trowel box technique was supported as solution that would reduce risk to plasterers.

The formative research process also identified an absence of evidence to support panel lifters as a solution and this led to a risk assessment that confirmed that the lifters in the market were not fit for purpose and presented a risk of injury through cable failure. This in turn led to development of a fail-safe device.

The combination of the formative and the empirical research processes led to the definition of the plaster ready concept. Plaster readiness is not only a pre-requisite for trowel box and panel lifter use but is also leads to significant risk reduction across construction sites and leads to increased productivity and efficiency[8].

[8] Simple pay back models for typical residential construction projects have been developed in consultation with plastering contractors to support the introduction of plaster readiness throughout the industry sector.

Marketing messages were subsequently developed and pre-tested through a small number of trade nights. Subtle changes to these messages led to more successful delivery and the marketing program has continued with the support of a solution subsidy program. The delays in the project that resulted from the empirical trowel box study and panel lifter and plaster ready developments have, however, prevented any further application of the social marketing model and its evaluation.

4.3. Motor Vehicle Repair Case Study

4.3.1. Motor Vehicle Repair Literature Review

Occupational asthma occurs when workplace exposures to particular substances result in a biological change in a person's airways, known as the hypersensitive state, so that subsequent exposure to the same substance triggers an asthma attack (Health & Safety Executive, 2004b). Bernstein defines occupational asthma as, "variable airflow limitation and bronchial hyperresponsiveness due to causes and conditions encountered in the occupational environment and not outside the workplace" (Arif, Delclos, Whitehead, Tortolero, & Lee, 2003 p368).

In recent years regulatory and employer bodies in Australia, Europe and the USA have become increasingly concerned that some employers in the motor vehicle body repair (MVR) sector may not be adequately or appropriately controlling exposure to airborne isocyanates during spray painting and are therefore increasing the risk of occupational asthma among employees (National Institute of Occupational Safety and Health, 1996, 2000; Pisaniello & Muriale, 1989).

4.3.1.1. The size of the problem

Isocyanates appear to be the most common cause of occupational asthma in most countries (Nordman, Karjalainen, & Keskinen, 1999). In the UK, the Health and Safety Executive (HSE) SWORD[9] and OPRA programmes repeatedly cite isocyanates as the

[9] The Surveillance of Work-related and Occupational Respiratory Disease (SWORD) is a scheme that relies on systematic, voluntary and confidential reporting of all new cases seen by consultant chest physicians in the UK. The Occupational Physicians Reporting Activity (OPRA) is a separate scheme for all types of work-related disease. Both schemes are run from the University of Manchester as

agent most commonly associated with occupational asthma accounting for between 13 and 17% of all occupational asthma cases (Health & Safety Executive, 2003, 2004d; Health and Safety Executive, 2001). In that country, the vehicle spray-painting occupation group has the highest incidence of asthma, with over 80 times the overall rate for the UK working population (Health & Safety Executive, 2004a).

It is estimated that the incidence of occupational asthma among spray painters diagnosed by consultant physicians in the UK through the SWORD scheme is 65 cases per 100,000 workers, per year (Health & Safety Executive, 2004c). However, as most cases of occupational respiratory disease are not seen by a consultant physician and because the SWORD program is based on voluntary reporting, the total incidence of the disease may be several times higher (Health & Safety Executive, 2004b; Taylor, 2002). Piney (2003) points out that 10% of cases of asthma among MVR employees reported within the SWORD scheme are not paint sprayers but are individuals who are indirectly exposed; people such as supervisors and managers.

Similarly, in the USA isocyanates are recognised as the agent most frequently associated with occupational asthma (Goe et al., 2004; National Institute of Occupational Safety and Health, 2000). In its 1996 Alert NIOSH reports a prevalence rate of 12% for occupational asthma among spray painters and describes three cases of occupational asthma in the paint shops of a large assembly plant where six additional workers showed symptoms of occupational asthma (National Institute of Occupational Safety and Health, 1996). The same NIOSH Alert reports one fatality due to occupational asthma following exposure to isocyanates during spray painting. Goe et al. (2004) reviewed the work-related asthma (WRA) cases recorded by the US Sentinel Event Notification Systems for Occupational Risks (SENSOR) between 1993 and 1995 and categorised cases as either Work Aggravated Asthma (WAA) or New Onset Asthma (NOA). Of the 1101 cases of WRA 210 (19.1%) were classified as WAA and 891 as NOA. As is the case in the UK, it is suggested that these figures are underestimates because most cases are either not recognized as work-related or not reported as such (Arif et al., 2003; National Institute of Occupational Safety and Health, 2004).

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constituents of the Occupational Disease Intelligence Network (ODIN) known as The Health and Occupation Reporting network (THOR) since April 2002 (Health & Safety Executive, 2004e).

Redlich et al. (2001) examined 75 isocyanate (HDI) exposed auto body repair shop workers in the USA and found that while there were few clinical cases of asthma, 58% of workers tested positive for sub-clinical immune responses as a result of exposure. The authors are unclear whether such responses indicate some degree of immunologic sensitisation to isocyanates or predict future asthma but conclude that there was a high prevalence of immune responses in the population studied. Interestingly, the authors raise the possibility that the true prevalence of asthma is underestimated because the sensitised workers have left the industry (i.e. the healthy worker effect).

Arif et al. (2003) reviewed data collected by the US Third National Health and Nutrition Examination Survey (NHANES III) and found a three fold elevated risk of WRA and work-related wheezing among vehicle and mobile equipment mechanics and repairers. Taylor (2002) cites research that found isocyanates were responsible for approximately 50% of cases of occupational asthma in Ontario, Canada.

While occupational disease recording in Australia does not collect correspondingly detailed data, the similarities in spray painting techniques in Australia suggests that the problem may be equally great (Pisaniello & Muriale, 1989).

Ahmet and Goulding (2002) reviewed spray painting safety from the perspective of the OHS regulator in Victoria (WorkSafe Victoria). In terms of estimating the number of claims in the motor vehicle repair industry they acknowledge that the workers compensation claims database can only be used as a guide owing to underreporting as well as the database being limited to claims that result in excess of 10 days off work. However, they identified that between July 1988 and April 2001 there were 23 claims in the “smash repair (including towing)” sector related to “inhalation”, representing 15% of all claims in this sector. These 23 claims had a mean cost of $56,257 although this figured is skewed owing to a maximum claim cost of $697,422. The median claims cost was $2,317. Inhalation is the most expensive average claim in all spray-painting sectors, these being vehicle smash repair, furniture manufacture and structural fittings and joinery (Ahmet & Goulding, 2002).

4.3.1.2. The nature of the problem

Sensitisation to isocyanates, for the majority of people, can only occur following significant and prolonged exposure. Once a person is sensitised any exposure to isocyanates is likely to result in asthma like symptoms. Such attacks have on occasions resulted in death (Piney, 2003).

Occupational asthma can persist for several years and in many cases indefinitely after avoidance of exposure to the initiating agent (Taylor, 2002). It is very unlikely that a sensitised person will be able to work with paints containing isocyanates again (Health & Safety Executive, 1998). In addition to the personal consequences of this to the sufferer, the social and financial consequences are significant. Taylor (2002) found that movement of employees after the onset of symptoms was invariably to a job with lower exposure. He cites research undertaken in Europe that found 59% of the sufferers in a study group had lost or changed their jobs and 74% reported loss of income as a result of respiratory effects. In another study, 57% reported difficulty in finding alternative employment and 49% had lost income.

In their review of work-related asthma Goe et al. (2004) found that 79% of New Onset Asthma (NOA) cases reported still experiencing breathing problems at the time of the interview. They found that 52% of NOA cases had visited an emergency department and 25% of NOA cases had been hospitalised for work-related breathing problems. Of those no longer exposed, NOA cases were twice as likely as Work Aggravated Asthma (WAA) cases to have left the company of employment (i.e. 47% versus 23%).

Taylor (2002) suggests that the considerable risk and consequent social and financial losses associated with asthma induced by inhalation of agents at work should, "…at a minimum, act as a stimulus to the investigation and evaluation of effective means of intervention to reduce the incidence of the disease." (p.570)

Sensitisation of the skin is also possible, resulting in persistent rashes, although this is much less common (Ahmet & Goulding, 2002). Liu et al. (2000) report that little is known about the extent of human isocyanate skin exposure in auto body shops and the effectiveness of personal protective equipment (PPE). They examined three auto body shops of different size and found that surfaces such as workbenches, spray painting equipment and cleaning tools were contaminated with isocyanates. Painters with frequent unprotected contact with contaminated surfaces were found to have moderate to heavy contamination of some skin surfaces. Latex gloves used for skin protection showed significant penetrations by isocyanates even after a single painting session. Pisaniello and Muriale (1989) found that among South Australian spray painters gloves were only sometimes used and they were “almost always household rubber gloves in rather poor condition” (p.576).

Paints containing isocyanates are often used in spray painting. These coatings, sometimes referred to as “two-pack paints”, are supplied in two parts that must be mixed before use. The coatings are primarily irritating to the eyes, throat and respiratory tract (Ahmet & Goulding, 2002). The widespread introduction of isocyanate-free paints is clearly the preferred strategy for the control of risk. However, paint technology at present will not permit this (Phelan, ; Pisaniello & Muriale, 1989). New paint formulations are limiting the amount of free isocyanate that is liberated during spraying, but as long as isocyanate containing materials are used there will be a need for better control by spray booths and personal protective equipment.

Exposure to isocyanates can occur during paint mixing, spraying, rubbing down and during the bake cycle:

<u>Mixing</u>

> Isocyanate hardener in two-pack systems contains isocyanate mainly in the form of large pre-polymer molecules that have low vapour pressure. There will be a small amount of un-reacted isocyanate monomer that is more volatile. However, this is usually less than 0.5% in the hardener and therefore what escapes in to the mixing room atmosphere will be rapidly diluted and poses little risk if there is good ventilation. The concentrations may, however, be sufficient to trigger a reaction in a sensitised person (Piney, 2003).

Spraying

Different spray systems are more or less efficient at transferring paint onto surfaces, but all create what is known as “overspray”. This is comprised of relatively large droplets of paint that do not land on the target surface but on surrounding surfaces and objects. It also consists of small paint droplets or semi-solid particles that are invisible under normal lighting conditions. The overspray, which will contain an amount of isocyanate monomer as vapour, will mix with and remain suspended in the surrounding air for prolonged periods. How long its remains suspended will depend upon the particle size and the effectiveness of the ventilation (Piney, 2003).

Piney, a specialist inspector with the UK Health and Safety Executive (HSE) reports that short term exposures can be high even in bespoke down-draught spray-bake booths. He reports that clearance times can be anything up to 30 minutes, during which peak exposures to isocyanates may be well above 20μg/m^3. The HSE has measured short-term concentrations of 1,500μg/m^3 inside a bespoke oven and concentrations of 4,000μg/m^3 have been recorded in other spray spaces (i.e. work areas having general ventilation) (Piney, 2003).

Piney explains that a well designed spray booth will sweep away a large proportion of the overspray, but it does not happen instantly owing to the paint aerosol being trapped in re-circulating stagnant air. He explains that while air will flow relatively evenly around the sides of the vehicle being sprayed, there is usually a re-circulating volume of stagnant air close to the walls of the booth. The size and spread of the re-circulating columns of air depend on the size and shape of the vehicle being sprayed, the internal design of the booth and particularly the shape of the ceiling.

It is reportedly common in Australian MVR shops to apply topcoat paint in spray booths while applying primer coat (especially small areas) in the workshop or a spray space. Similar approaches are used in the UK and Piney (2003) points out that this practice can result in exposure of the spray painter and others in the work area to very high airborne concentrations of isocyanates.

Baking

After spraying a vehicle in a spray-bake booth the system is closed and heat used to cure the paint. The heat causes some of the isocyanate monomer vapour to vaporise as the paint hardens (polymerises). Given the re-circulation of air during the bake cycle it is possible that the concentration of isocyanate in the booth will increase. Entry to the booth immediately after the bake cycle is complete may result in exposure to high concentrations of isocyanate. Lack of booth maintenance can lead to a fall in the internal negative pressure during bake cycles and this in turn can result in leakage of contaminated air in to the adjacent work room (Piney, 2003).

Rubbing Down

Rubbing down (sanding) of isocyanate paint film such as primer paint, will release dust that may contain measurable isocyanate and may result in elevated peak exposures (Piney, 2003).

4.3.1.3. Prevention of asthma

At this time alternatives to isocyanates that deliver equivalent surface coating quality in terms of appearance and hardness are unavailable (Phelan, 2003). WorkSafe Victoria officers therefore advocate the use of air-supplied respiratory protective equipment (air-supplied RPE) by spray painters (WorkSafe Victoria, 2003). Such equipment is generally of the full-face or hood type, supplied with filtered, breathing quality air under constant positive pressure. The alternative that is very widely used is the ori-nasal filtering face piece type device (commonly referred to as a half-mask). However, as Piney (2003) points out, “the charcoal filters in these devices do not filter out the paint spray and several cases of occupational asthma have been known to occur amongst sprayers wearing such inadequate RPE. One of the problems is that the charcoal filters out the paint solvent which the sprayer then cannot smell and he believes he is protected.” (p.8)

Air-supplied half-masks are sometimes used but potentially do not offer the protection required given the peak airborne concentration of isocyanates of 1,000-2,000 μg/m^3 during spraying. Air fed half-masks typically offer a protection factor of 50 (i.e. reduce the airborne contaminant concentration inside the mask relative to that outside by 50 times if the mask is fitted properly) whereas air fed hoods typically have a protection factor of at least 100 (Piney, 2003).

For the purposes of assessing the level of risk control in the MVR sector Pisaniello and Muriale (1989) undertook a survey of 45 car body repairers in South Australia. At the 45 sites, 99 spray painters were interviewed of which 57 had sometimes sprayed isocyanates outside the paint spray booth. 45 of the 57 interviewees reported that, typically, they would do this twice per week.

Pisaniello and Muriale (1989) found that air supplied respiratory protection, which is recommended, was available in only 18 of the 45 workshops. However, within these 18, twelve reported that it was not in regular use. In 27 of the 45 workshops half-face cartridge respiratory protection was used and one used a dust mask. Among the users of half-face cartridge respiratory protection, there was inadequate storage and maintenance of the protection and only 32% of half mask users passed the saccharin fit test (i.e. 68% of users were not obtaining an adequate face seal) (Pisaniello & Muriale, 1989). Failure of respiratory protection is widely recognised and saccharin fit tests of 211 half mask users in the pharmaceutical industry in north-west England yielded similar results, with a failure rate of 69% (Burgess & Mashingaidze, 1999). Among users in those organisations where there was no training in mask use, the failure rate was 100%.

A follow up survey of cases reported in the UK SWORD program found that failure to use respiratory protection and inappropriate procedures when mixing chemicals accounted for one third of the new cases of asthma and, in particular, isocyanates were implicated (Taylor, 2002).

Ahmet and Goulding (2002) report similar observations made by WorkSafe Victoria (regulatory) inspectors. They report open areas within a small to medium workshops, without ventilation, where other employees (and the public) are exposed to over-spray; the spraying of flammable paints in close proximity to ignition sources; “home made” spray booths with inappropriate extraction and/or made of inappropriate material (i.e. material that can ignite); spray booths built to comply with relevant Australian Standards but having no maintenance program; extraction below recommended limits; touch up done in open areas; respiratory protection not being used at all; incorrect respiratory protection used, in particular, air supplied respiratory protection not being used when spraying paints containing isocyanates; respiratory protection not being stored and maintained correctly; material safety data sheets (MSDS) not accessible to employees exposed to spray painting substances; where MSDS are available no discussion about the information within them and the hazards, potential risks and appropriate controls; no register identifying the Hazardous Substances (and Dangerous Goods) used; no training on respiratory protective devices, appropriate spray method, appropriate use of booth, hazards associated with ignition sources; no risk assessment as required by legislation; and no health surveillance for employees exposed to paints containing isocyanate.

Therefore, while the prevention of asthma through the application of higher order controls such as the introduction of isocyanate-free paints and improved engineering controls are desirable and remain the long term goal, the increased use of air-supplied RPE is important until that goal is achieved.

4.3.2. Motor Vehicle Repair Case Study Questions

The University of Ballarat made an application to the WorkSafe Victoria Small Business Innovation Fund to pilot an intervention among Motor Vehicle Repair (MVR) business operators in Victoria. The aim of the project was to develop a targeted intervention that would improve the respiratory health of spray painters using the principles of social marketing. The project was conducted with the cooperation of the Victorian Automobile Chamber of Commerce (VACC).

4.3.2.1. Pilot project aim & objectives

The aim of the project was to gather information about vehicle body repairers in Victoria that will enable the subsequent development of a targeted intervention that will improve the respiratory health of spray painters.

The objectives of the pilot project were to:

- Identify the barriers and enablers to the adoption of appropriate risk control measures while spray painting
- Identify strategies that will increase the demand by vehicle body repairers for isocyanate paints that have limited free isocyanates.
- Trial strategies that will increase the availability and use of air-supplied respiratory protection by spray painters
- Trial strategies that will increase the protection afforded by personal respiratory protection

Therefore the aim of the case study was to undertake formative research in the context of the social marketing Model (Andreasen, 1995) introduced in Section 2.2.4.3 and use the findings of this research to plan and structure a pilot intervention during which pre-testing of the marketing messages would be undertaken as illustrated in Figure 7.

4.3.3. Motor Vehicle Repair Case Study Field Procedures

As discussed in Section 2.2.4.3.1, the identification of the stage of readiness for change of the targets of a social marketing program is central i.e. the owners or operators of motor vehicle repair shops are the targets of the program within this case study. In regard to this and consistent with the focus of this thesis being influencing decision-maker behaviour, the desired behaviour is; *Enforcement (supervision) of the use of maintained spray booth and air-supplied respiratory equipment while spraying two pack paint, i.e. the body repair shop manager/operator does not accept anything less than 100% usage of air-*

supplied respiratory protection and a spray booth. This is to be measured against the TTM (Prochaska et al., 1998).

In accord with the approach to case study development proposed by (Yin, 1989), the questions and sources of evidence shown in Table 7 were formulated.

Table 24 Case study questions and sources of evidence

Questions	Sources of Evidence
What do business operators and spray painters know about health effects of isocyanates?	Focussed interview (business operators) Focus group (paint suppliers)
What level of risk do business operators and spray painters believe is associated with spraying isocyanates?	Focussed interview (business operators) Focus group (paint suppliers)
What risk controls are used?	Focussed interview (business operators). Direct observation Findings of WorkSafe Project 888 Spray Painting
Are risk controls well maintained?	Focussed interview (business operators). Direct observation
Is the use of risk controls enforced?	Focussed interview (business operators) Direct observation
Do business operators and spray painters believe that risk controls are necessary?	Focussed interview (business operators) Focus group (paint suppliers)
What are the barriers to use of the risk controls?	Focussed interview (business operators) Focus group (paint suppliers)
Where do business operators get OHS information?	Focussed interview (business operators) Documentation from VACC
Who are opinion leaders?	Focussed interview (business operators).

The case study units of analysis were groups of vehicle body repairers in (1) Bendigo and (2) Ballarat who were members of the VACC. The VACC facilitated access to the body repairers through a project funded by WorkSafe Victoria.

Individual body repairers were visited and focussed interviews conducted with business operators and spray painters. Direct observation of workplaces was conducted.
A paint supplier focus group was conducted and of the findings of WorkSafe Victoria OHS inspector visits to MVR repair shops were analysed. Thus the sources of evidence used in this case study may be summarised as shown in Figure 37. This figure lists on the left hand side the sources of information used during the formative research phase, in the

order in which the information was gathered. To the right of the figure are listed the intervention processes that followed the formative research phase. This figure will be used throughout the case study to guide the reader by highlighting the area of the figure that pertains to the activity being described.

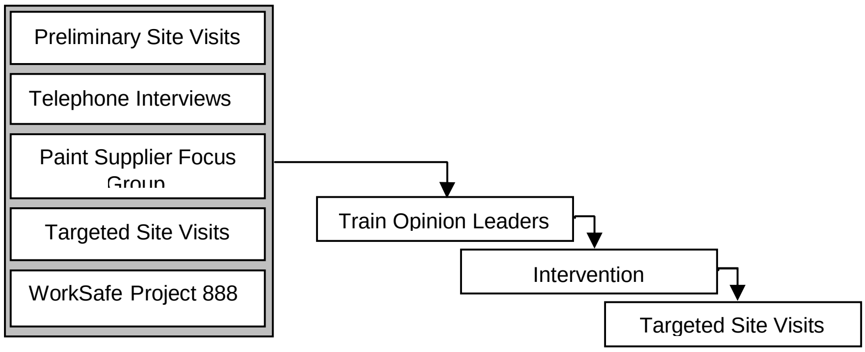

Figure 37 Case study methodology schematic

Threats to validity during the case study were confounding variables such as activity by WorkSafe, activity by trade and industry associations, changes to legislation and codes of practice. Continuous environmental monitoring was therefore necessary and WorkSafe Victoria personnel undertook to minimise the risk of interference with case study groups for the duration of the project.

4.3.4. Social marketing Objectives

Strategy planning is central to social marketing (Andreasen, 1995) and therefore the following goals and strategy were set:

Goals

- Increase the demand by target business operators for isocyanate paints that have limited free isocyanates.
- Increase the availability and use of air-supplied respiratory protection by spray painters

- Increase the protection afforded by personal respiratory protection

Strategy

The targets will be vehicle body repairers in Victoria that are members of the VACC.

The behaviour change among the targets will be brought about by:

- Developing and delivering messages tailored to the body repairers' stage of readiness

  Communications strategies will be developed that focus on tailoring messages to the different stages of adoption that the targets will be at i.e. some repairers will already be using adequate airborne contaminant control measures while some do not believe that they are necessary.

  VACC already uses traditional communication channels that include communiqués and trade seminars. However, to maximise the breadth and speed of adoption of the airborne contaminant controls it will be necessary to determine what other channels may be used to reach the targets.

- Reducing the costs of adopting airborne contaminant controls

  In this context the cost of the controls is not only the more tangible financial cost of any airborne contaminant control technique but also the time and inconvenience of locating and using a control.

  Air-supplied respiratory protection is relatively expensive in capital and maintenance costs. The use of air-supplied respiratory protection is also perceived to be awkward and therefore undesirable.

  Therefore, the repairers must perceive that they are able to adopt the controls easily and believe that they have the capability to manage the controls in to the long-term.

- Bringing to bear social influences on the targets

  Within the industry group there are various ways in which social pressure will be used, for example, through the VACC itself, opinion leaders within the industry and among geographical groupings and through role models.

4.3.5. Social marketing Stage 1: Formative Research

In addition to gathering ethnographic and business-related information, the formative research assesses the knowledge and attitudes about the particular risk and risk controls in question within the intervention and control groups.

Therefore, the following general questions were addressed:

- Are the targets aware of the risks associated with the particular hazard in question?
- What are the targets’ attitudes towards the risk, i.e. the likelihood and severity of an event?
- Are the targets aware of the risk controls associated with the particular hazard in question?
- Do the targets use appropriate risk controls?
- What are benefits of the risk controls as perceived by the targets?
- What are the costs associated with the risk controls as perceived by the targets?
- What is the level of internal and external self-efficacy as perceived by the targets?
- What is the identified competition in regard to adoption of risk controls?
- What are the targets’ perceptions of the need to adopt the risk controls?
- What are the targets’ perceptions of the desires of others?
- What will influence the targets in regard to behaviour change?
- What factors influence internal and external self-efficacy?

- How do the targets get information about OHS?
- From whom do the targets get OHS information?

4.3.5.1. Preliminary Site Visits

Figure 38 illustrates the stage of the case study methodology that pertains to this section.

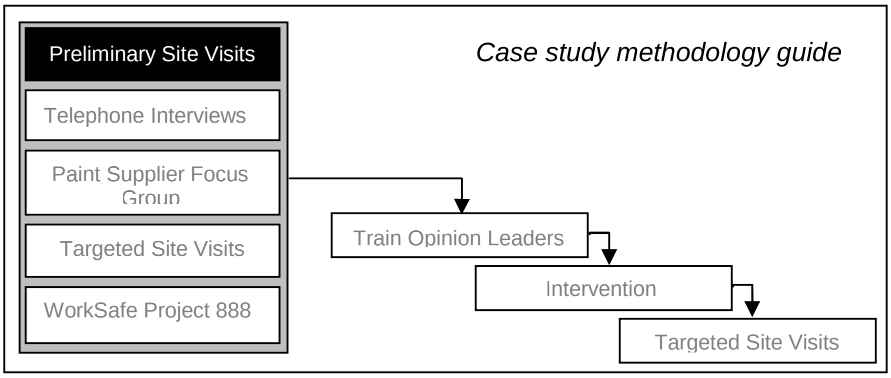

Figure 38 Case Study Methodology - Preliminary Site Visits

Seventeen (17) body repairers in the Melbourne suburb of Footscray and the regional city of Ballarat were identified in the VACC membership database and contacted by telephone to request a visit. Fourteen (14) body repairers in total agreed to a visit, half (7) being in Footscray and half (7) in Ballarat. The body repair shops were visited in March 2002. The selection process attempted to provide a representative cross section of the VACC classifications of business by size (1-3 employees; 4-9 employees; 10 or more employees).

During each visit, the body repair shop manager or a management representative was interviewed and the spray-painting facilities inspected. A semi-structured interview technique was used. The questionnaire is attached in Appendix 7. The aim of the visits was to elicit information about spray-painting facilities and practices that would support the development of a subsequent detailed and discerning survey.

4.3.5.2. Telephone Interviews

Figure 39 illustrates the stage of the case study methodology that pertains to this section.

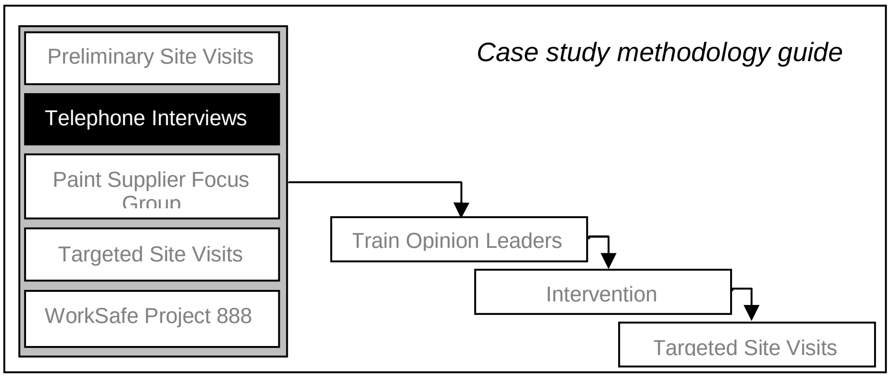

Figure 39 Case Study Methodology - Telephone Interviews

A telephone survey was conducted, using a survey instrument developed after the preliminary visits. This survey sought to confirm the findings of the preliminary visits and build the knowledge base regarding MVR operators' sources of OHS information, attitudes towards health and safety and knowledge and attitudes regarding isocyanates and risk.

A sample of fifty (50) body repairers was the target for telephone interviews. The sample was drawn from the VACC membership database as shown in Table 25.

Table 25 Telephone Interview Sample Selection – Target Numbers

Business size category	Number of businesses in database	% of all businesses	Representative target sample size
0-5	460	70%	35
6-10	108	16%	8
11+	93	14%	7
Total	**661**	**100%**	**50**

In an attempt to achieve the target while allowing for non-respondents, in excess of the target sample number was drawn from the VACC database as shown in Table 26. In the 0-5 business size category, making contact with the appropriate person was particularly difficult and the target was not reached.

Random numbers were used to draw the sample, i.e. each member listed in the database in each business-size category was allocated a random number using Microsoft Excel. The random numbers and the corresponding VACC members were then sorted in ascending order and the sample group isolated from the lowest numbers up to the total required.

Table 26 Interview sample selection - Total Numbers Contacted

Business size category	Number of businesses telephoned	Number of businesses agreeing to participate	Target sample size
0-5	45	23	35
6-10	13	8	8
11+	10	7	7
Total	**661**	**38**	**50**

Prior to the researcher first making contact with the body repairers that were to be approached with a request for participation, letters were sent from the VACC introducing the researcher and requesting cooperation.

During initial telephone contact with the body repairer, the project was explained and participation requested. If the body repairer agreed to participate, a time for conduct of a telephone interview was agreed and a questionnaire was mailed to them. At the appointed time the researcher telephoned the body repairer, confirmed their willingness to participate having seen the questionnaire and conducted the structured interview. The interview sought to elicit answers to only the questions in the questionnaire. The questionnaire is attached in Appendix 8.

4.3.5.3. Paint Supplier Sales Representative Focus Group

Figure 40 illustrates the stage of the case study methodology that pertains to this section.

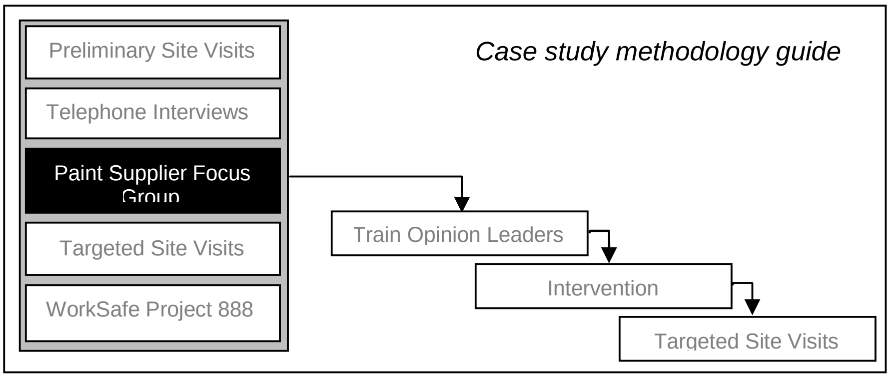

Figure 40 Case Study Methodology - Paint Supplier Focus Group

PPG Paints manufactures and supplies vehicle-refinishing paints to approximately 40% of the market in Victoria. The company employs approximately 50 sales representatives in the Victoria sales region and they are engaged in supply and product demonstration and they actively promote the use of appropriate RPE by spray painters.

The PPG Paints sales team periodically assembles for sales meetings at their Melbourne training centre. The author was allocated a period within one of these meetings to discuss spray-painting health and safety matters during September 2003.

A focus group methodology was employed as described by Krueger and Casey (2000). The following Question Route was devised using the findings of the workplace visits:

<u>Introduction</u>

- Introduce oneself and explain the background to the project

<u>Opening Question</u>

- What do body repair shop operators and spray painters know about the potentially harmful effects of two-pack paints?

Introductory Questions

- Why do some people spray small amounts of two-pack paint without a respirator?

Transition question

- What factors influence the use of respirators when spray painting?

Key Questions

- In what ways do business operators supervise the use of respirators and to what extent do spray painters choose for themselves whether to wear an air-supplied respirator?
- What influence do vehicle body repair business operators have on one another?

Ending Questions

- Summary.
- All things considered, what can be done to increase the use of respirators?

4.3.5.4. Targeted Site Visits

Figure 41 illustrates the stage of the case study methodology that pertains to this section.

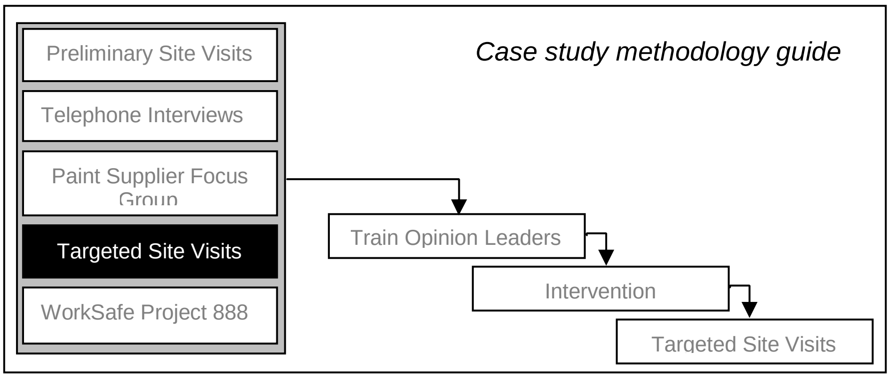

Figure 41 Case Study Methodology - Targeted Site Visits

All VACC member MVR operators in Ballarat (n=10) and Bendigo (n=11) were targeted for direct contact and interview. These visits and interviews sought to confirm that the MVR operators' exhibited similar characteristics to those of the broader sample interviewed during the telephone interviews; to elicit information specifically about their attitudes regarding isocyanates and risk and risk control; and to identify communication channels between MVR operators.

Each MVR operator was telephoned and appointment made for an interview. Site visits were then made, focussing on a semi-structured interview and researcher-administered questionnaire. If the business operators offered the researcher a tour of facilities, this was accepted but no specific request for inspection of facilities was made.

The questionnaire used during these visits is attached in Appendix 10. The questions included in the questionnaires aimed to elicit information about the MVR operators' attitudes towards spray painting risk, RPE usage, perceived pros and cons of RPE usage and to assess whether it was possible to categorise MVR operators in regard to their readiness for change in respect of Prochaska's Transtheoretical Model of behaviour change (Prochaska et al., 1998; Prochaska et al., 2002). The specific behaviour change that was targeted was the subjects' readiness to enforce the use of air-supplied respiratory protection. The schema used to assess this is illustrated in Figure 42.

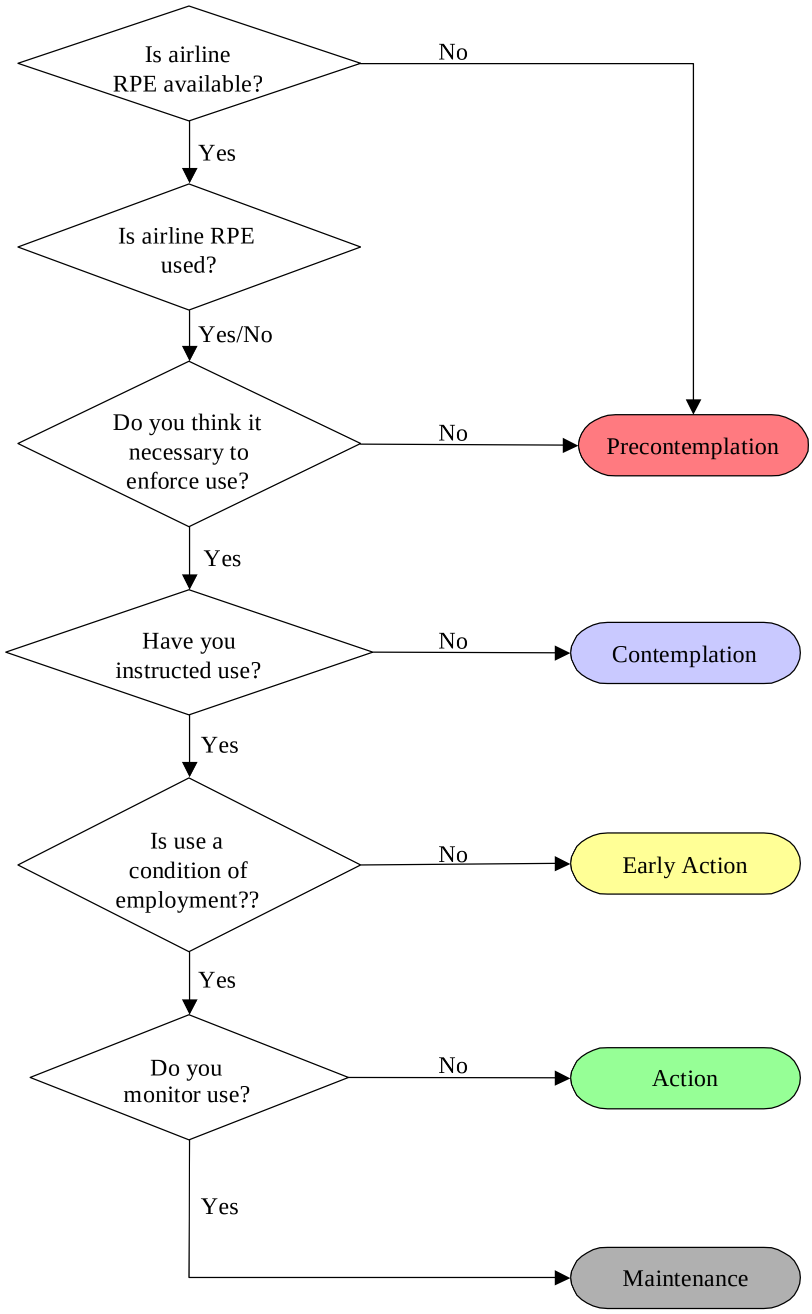

Figure 42 Schema for assessing stage of change

4.3.5.5. Review of WorkSafe Project 888 Spray Painting

Figure 43 illustrates the stage of the case study methodology that pertains to this section.

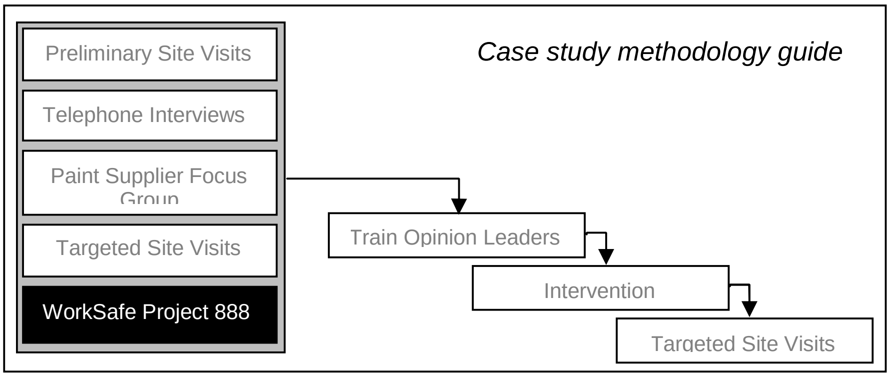

Figure 43 Case Study Methodology - WorkSafe Project 888

During the period 1st July 2002 to 29th February 2004, 29 WorkSafe inspectors completed 915 workplace visits to 345 different workplaces that fell under the industry code F4865K “smash repairs including towing”. The visits were conducted under the auspices of what WorkSafe refer to as “Project 888 Spray Painting”.

On becoming aware of the program of visits under Project 888 Spray Painting, the author reviewed the checklist used by inspectors during their visits and requested access to the phrase code that was used against each of a selection of pertinent questions, the number of times (frequency) each was used and the text that accompanies each use of the phrase code. The text entered by inspectors against each use of the respective phrase codes (n=691) was reviewed. The codes requested are listed in table 214 in Appendix 9. The visits undertaken during the period 1st July 2002 to 29th February 2004 excluded MVR operators in Ballarat and Bendigo.

4.3.6. Social marketing Stages 2 & 3: Identify & Train Opinion Leaders

Figure 44 illustrates the stage of the case study methodology that pertains to this section.

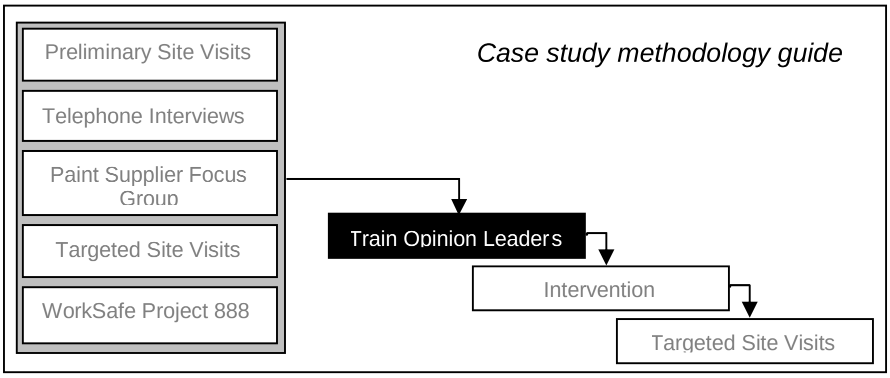

Figure 44 Case Study Methodology - Train Opinion Leaders

During the targeted visits in Ballarat and Bendigo, opinion leaders were identified through self-reporting and nomination. Simultaneously the VACC Body Repair Division manager was asked for his opinion regarding the MVR operator(s) who were likely to be in communication with the largest numbers of MVR operators in the respective cities.

A network diagram was constructed to confirm the status of the individuals that were believed to be opinion leaders (Burt, 1999; Valente, 1996; Valente & Davis, 1999) in Ballarat and Bendigo populations respectively. This diagram is reproduced within Section 4.3.9 below.

The identified opinion leaders were re-visited before each seminar and informed of the detail of the seminar and its intent. They were informed that they appeared to be in contact with the largest number of MVR operators in their respective cities and as a result may carry some influence with their peers, i.e. they were potentially opinion leaders (Valente & Davis, 1999). They were provided with copies of specially prepared information sheets that would be distributed at the seminars, the content of which was discussed. These sheets are reproduced at Appendix 11. Based on the outcomes of the various previous interviews and surveys, the pros and cons of enforcing airline respiratory protection as perceived by MVR operators were documented and discussed with the opinion leaders.

The aim of these discussions with the potential opinion leaders was to provide Opinion Leaders with the knowledge and skills to influence the behaviour of MVR shop operators (followers) such that they enforce (supervise) the use of air-supplied respiratory equipment while spraying two-pack paint, i.e. the body repair shop manager/operator does not accept anything less than 100% usage of air-supplied respiratory protection and a spray booth

The objectives of these discussions with the potential opinion leaders were such that, at the end of the discussion, they should be able to:

- Explain their role in influencing followers
- Explain that exposure to isocyanates may cause asthma
- Explain the health related consequences of sensitisation as an acute and permanent response
- Explain why 100% usage of air-supplied respiratory protection is essential while spraying isocyanate-based paints
- List the pros and cons for enforcing the use of air-supplied RPE as reported by followers
- Counter the cons for enforcing the use of air-supplied RPE as reported by followers with pros
- Counter arguments against the validity of the pros
- List the pros for enforcing the use of air-supplied RPE as to be delivered to followers
- Explain to followers the process for providing information about asthma and issuing a letter to employees that explains the necessity for air-supplied RPE

4.3.7. Social marketing Stage 4: Intervention

Figure 45 illustrates the stage of the case study methodology that pertains to this section.

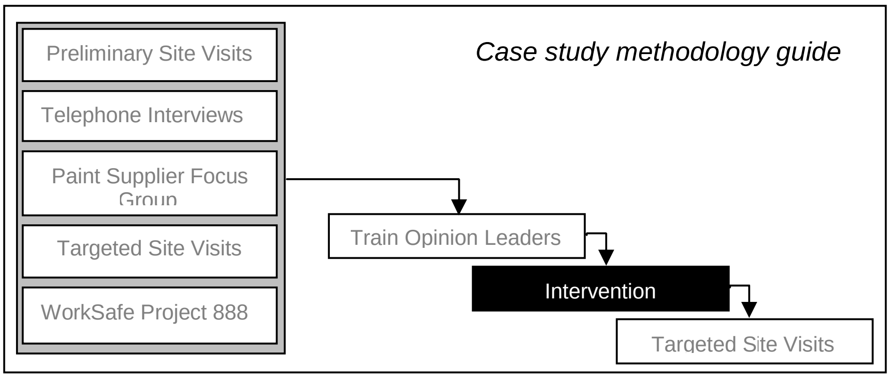

Figure 45 Case Study Methodology - Intervention

A program logic (Robson et al., 2001) for the intervention was constructed. This program logic was based on the hypothesis that opinion leaders, as an element of the social marketing model (Andreasen, 1995; Valente & Davis, 1999), may be used to increase the adoption of technological OHS controls by followers in small business groupings. The program logic is shown in Figure 46.

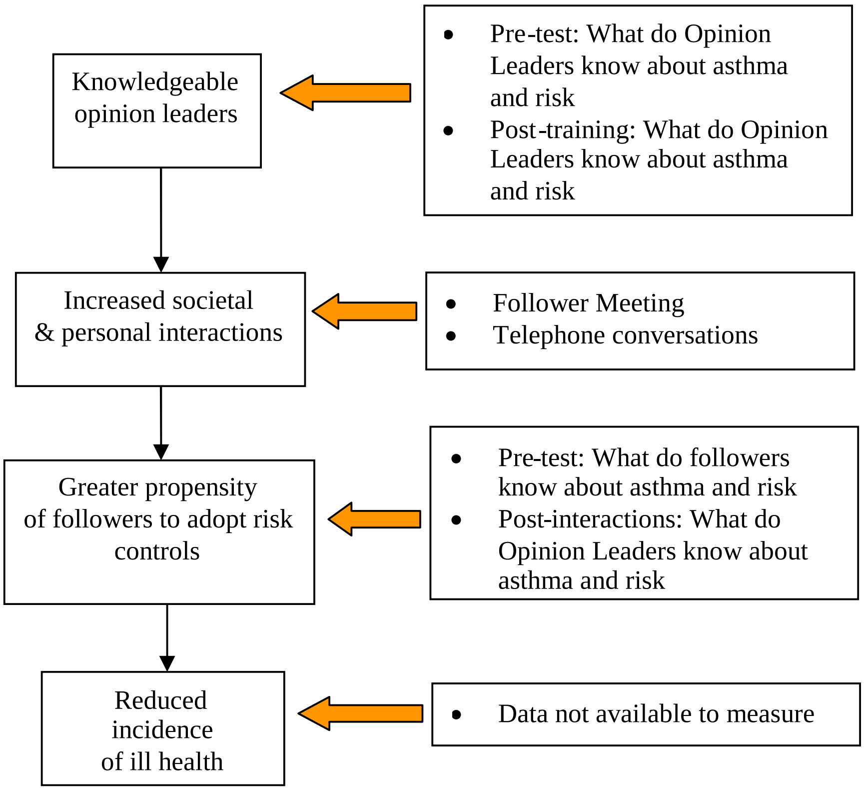

Figure 46 Intervention Program Logic

During the site visits, each MVR operator was forewarned of an impending meeting of local operators and guidance on dates, times and venues sought. A number of attempts were made to find suitable dates that did not clash with busy periods in the sector (e.g. within one month preceding and following Christmas, two weeks preceding and following Easter, during school holidays) and days that were suitable (e.g. days free of other events such as public holidays, "trade evenings" hosted by materials suppliers, VACC, etc, and days other than Mondays and Tuesdays that are unsuitable owing to the necessity to clear work that has accumulated over the preceding weekend and Fridays that are unsuitable owing to the desire to complete work prior to the weekend). An evening seminar was finally scheduled in Ballarat and Bendigo respectively on consecutive days during March 2004. A written invitation was sent by facsimile and this was followed by a telephone call to each invitee.

At the seminar the researcher made a short presentation on the topic of spray painting and asthma risk associated with isocyanates. This presentation was followed by a meal during which there was an informal discussion regarding knowledge of the risk associated with spray painting of isocyanate-containing paints and risk control practices. The researcher led this discussion.

During the mealtime discussions the researcher engaged with the potential opinion leaders and facilitated the elicitation of their opinions regarding control of isocyanate exposure risk. The discussion was prompted with the following questions:

- "Were you aware that isocyanates may cause asthma?"
- "Do you currently enforce the use of air-supplied respiratory protection?"
- "What will you do as result of your attendance at this meeting?"

The aim of the meeting was to persuade MVR shop operators to enforce (supervise) the use of air-supplied respiratory equipment while spraying two-pack paint, i.e. the body repair shop manager/operator does not accept anything less than 100% usage of air-supplied respiratory protection and a spray booth.

The objectives were such that, at the end of the meeting, attendees should be able to:

- Explain that exposure to isocyanates may cause asthma
- Explain the health related consequences of sensitisation as an acute and permanent response
- Explain why 100% usage of air-supplied respiratory protection is essential while spraying isocyanate-based paints
- List more pros than cons for enforcing the use of air-supplied RPE
- Explain the process for providing information about asthma and issuing a letter to employees that explains the necessity for air-supplied RPE

At the conclusion of the meetings, each attendee was provided with the specially prepared information sheets and asked to discuss these with their spray painters, copies of which are attached as Appendix 11.

Also at the conclusion of the meeting, attendees were asked to complete a brief evaluation form that included questions to elicit information regarding self-efficacy and followers' attitude towards opinion leaders. Attendees were asked to indicate whether they strongly disagreed, disagreed, were neutral, agreed or strongly agreed with the statements; "I will enforce the use of airline supplied respirators"; 'I know how to enforce the use of airline supplied respirators"; and "the opinions of other body repairers on these matters are important to me". Attendees were also asked whether the opinion of any one body repairer was particularly important during the meeting. If they indicated in the affirmative, they were asked to name that body repairer.

Within 2 weeks of each meeting, the opinion leaders were telephoned and engaged in a general discussion about the meeting and asked what now might be done to encourage meeting attendees and non-attendees to take action regarding risk control. In each case there was reluctance on their part to telephone other MVR operators but there was a willingness to communicate in writing. Two letters were drafted on behalf of both opinion leaders:

1. A letter addressed to VACC member attendees, reminding them of their attendance, the content of the presentation and discussions and encouraging them to take risk control action.

2. A letter addressed to VACC member non-attendees, reminding them of their invitation to attend the meeting, describing the content of the presentation and discussions and encouraging them to take risk control action. The specially prepared information sheets distributed at the evening meeting accompanied this letter and recipients were asked to discuss these with their spray painters.

The opinion leaders commented on the drafts, minor changes were made and then sent. At the request of the Ballarat opinion leader, the letters to MVR operators in Ballarat was sent on University of Ballarat letterhead over the opinion leader’s signature from the opinion leader’s office. The Bendigo opinion leader sent the letters on his business letterhead from his office. In both cases the researcher provided stamps to the opinion leaders. The text of the letters is reproduced in Appendix 12.

4.3.8. Social marketing Stage 5: Post-intervention cross-case analysis

Each MVR operator in Ballarat and Bendigo was telephoned and interviewed within 8 weeks of the meetings. These interviews sought to confirm that the letters from the opinion leaders had been received, read and digested and sought to elicit information regarding knowledge of the risk associated with the use of isocyanates and the use of risk controls. The questionnaire is reproduced at Appendix 10.

4.3.9. Motor Vehicle Repair Case Study Results

4.3.9.1. Preliminary Site Visits

Figure 47 illustrates the stage of the case study methodology that pertains to this section.

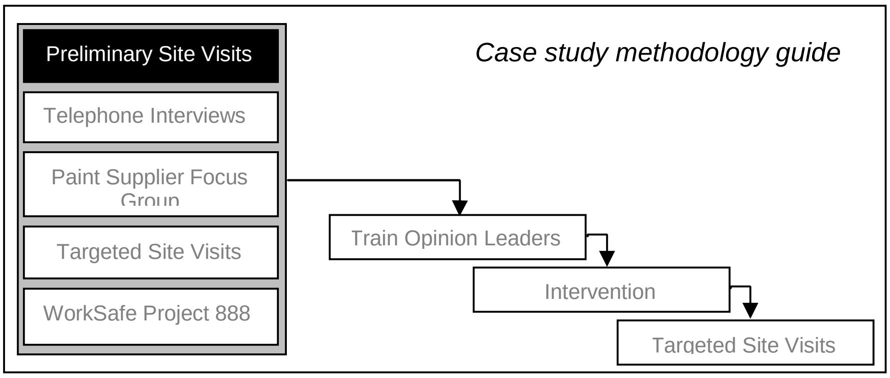

Figure 47 Case Study Methodology - Preliminary Visits Results

Five (5) businesses in Metropolitan Melbourne and nine (9) businesses in regional Victoria were surveyed. The number differed from the target as a result of business operator availability. As shown in Table 27, thirteen (13) of the fourteen (14) businesses visited employed more than three (3) people. Eleven (11) of the businesses visited were older than 20 years and the majority (n=7) of the business operators interviewed had been involved in panel repair work for between 6 and 20 years. Six (6) of the operators had been involved in panel repair work for more than 20 years. Most businesses visited (n=8 or 57%) used more than 10 litres but less than 20 litres of two-pack paint each week. Only one business visited undertook mostly commercial work (spray painting of trucks), while the remainder undertook mostly insurance work i.e. motorcar panel repair.

Table 27 Size of businesses visited

	Frequency	Percent %
1-3	1	7
4-9	7	50
>10	6	43
Total	14	100

The majority of businesses (n=9 or 64%) reported that the VACC was their most important source of OHS information. Only one (1) business operator reported that other body repairers were an important source of information. Thirteen (13) interviewees reported that the most important source of information about painting were paint suppliers. All businesses reported that they always received material safety data sheets when they purchased chemicals.

Only one (1) business operator reported that they knew anyone in the panel repair business that had good ideas in relation to OHS or that was doing well in regard to managing chemical safety or doing well in regard to managing OHS.

All businesses visited made respiratory protection available and one business operator reported that respiratory protection is not always used when spraying two-pack paints. Thirteen (13) of the fourteen (14) businesses made air-supplied respiratory protection available although only four (4) businesses reported that it is always used while spraying two-pack paints. Seven (50%) of the interviewees reported that air-supplied respiratory protection is never used while spraying two-pack paints.

A subjective assessment of the condition of respiratory protection at each of the businesses was assessed. At three (3) of the businesses, the condition was assessed to be “poor”, at three (3) of the businesses it was assessed as “fair” and at seven (7) it was assessed as “good”. Four (4) interviewees reported that they undertook “regular maintenance” of RPE. The majority (64%) reported that they undertook “occasional maintenance”. One interviewee reported that he never undertook maintenance.
The condition, adequacy and suitability of storage facilities for respiratory protection were also assessed; at six (6) of the businesses the condition was assessed to be “satisfactory” and at the majority of the businesses (n=8) it was assessed as “unsatisfactory”. Four (4) interviewees reported that gloves were used when spraying two-pack paint.

All businesses visited possessed spray booths on-site although only nine (9) reported that spray painting was always done inside the spray booth. The majority (10) interviewees reported that they never quantitatively assessed the performance of their spray booth in terms of airflow although all reported that they undertook maintenance on spray booth filters. Seven (7) reported that they undertook maintenance at least every six months.

Paint storage, weighing and mixing facilities were inspected during each visit; seven (7) businesses had a bunded paint storage area and thirteen (13) had a paint storage area kept free of a source of moisture. Only one facility contained some alkali materials. Three (3) businesses did not have any fire fighting equipment near or in the paint storage area although all businesses inspected had a paint storage area that was a distance of at least two metres from any heat source. Only seven (7) of the businesses inspected had a paint storage area that was a distance of at least two metres from any electrical source. Four (4) of the businesses visited had a procedure and facilities to deal with a spill of isocyanates in the paint storage area and two (2) of businesses had installed signage regarding the materials in the paint store area.

All businesses inspected had a paint mixing area that was a distance of at least two metres from any heat source although four (4) did not have a designated paint mixing area. Only four (4) of the businesses inspected had a paint mixing area that was a distance of at least two metres from any electrical source. Signage regarding the materials handled in the paint mixing area was assessed; signage was installed at eleven (11) of businesses, of which the signage in 7 (50%) was considered to be poor.

Nine (9) of the businesses inspected had a designated paint weighing area and only three (3) had a paint weighing area that was within a clear area of at least two metres diameter. Six (6) businesses inspected stored paint in the paint weighing area. Only one (1) business kept containers (paint, thinners, etc) open in the weighing area closed while not in use. One (1) of the businesses visited had a procedure and facilities to deal with a spill of isocyanates in the paint weighing area. Two (2) of the businesses visited had a procedure and facilities to deal with a spill of isocyanates during general handling.

Signage regarding the materials handled in the paint weighing area was assessed; signage was installed at eleven (11) of businesses, of which the signage in 7 (50%) was considered to be poor. Five (5) businesses did not have any fire fighting equipment close to or in the paint weighing area.

Four (4) of the businesses visited had designated facilities available for clean up of spray guns and personnel. Thirteen (13) of the businesses visited were able to demonstrate the availability of MSDS. None of the businesses visited had oxygen available for first aid purposes following an acute response to isocyanates exposure.

The general standard of housekeeping at the businesses visited was subjectively assessed and six (6) had a standard rated as “good”, six (6)had a standard rated as “fair” and two (2) had a standard rated as “poor”.

4.3.9.2. Telephone Interviews

Figure 48 illustrates the stage of the case study methodology that pertains to this section.

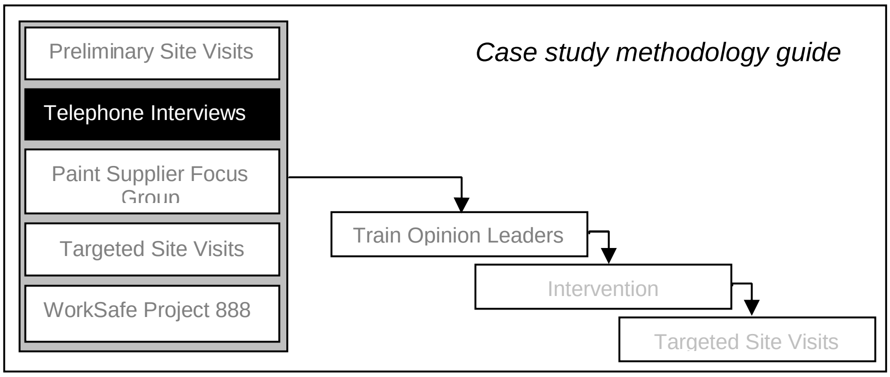

Figure 48 Case Study Methodology - Telephone Interviews Results

General Information about respondents

Of the thirty-eight (38) businesses operators that agreed to participate and with which appointments were made, thirty (30) were surveyed. The eight (8) business operators that did not participate either declined on the grounds of being too busy or repeatedly failed to make themselves available at appointed times.

As shown in Figure 49, thirty (80%) were located in the suburbs of Melbourne, one (3%) was in Geelong and 5 (17%) were in regional areas.

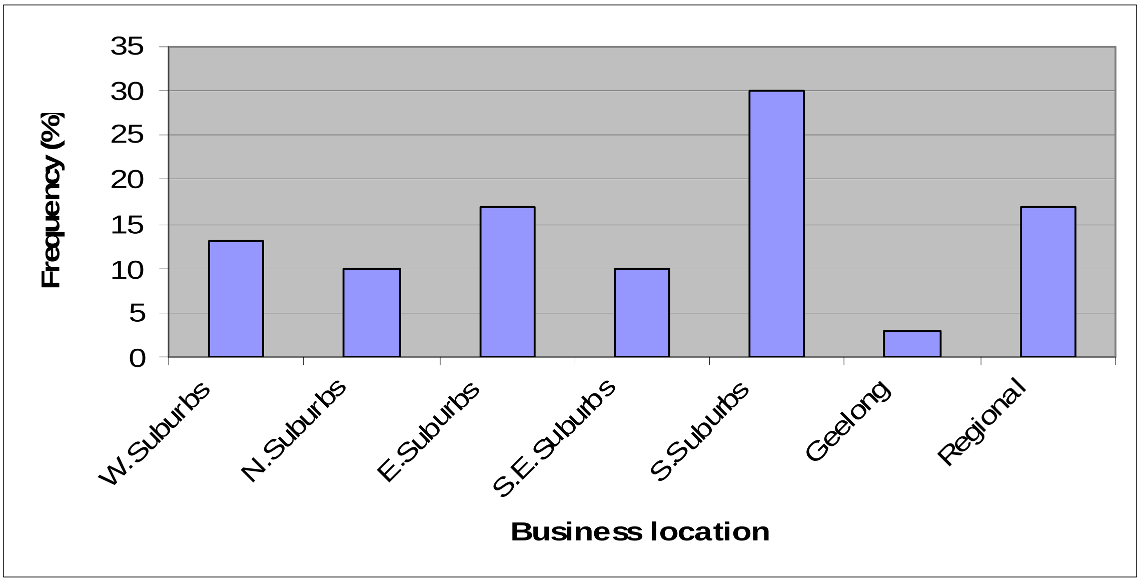

Figure 49 Location of participating businesses

As shown in Table 28, twenty-three (23) of the thirty (30) participating businesses employed more than three (3) people. Seventeen (57%) of the participating businesses were older than 20 years and the majority (n=22) of the business operators interviewed had been involved in panel repair work for more than 20 years. Twenty-eight (93%) of the businesses surveyed undertook mainly insurance-related body repair work. Two (2) businesses reported that they undertook more private work than insurance, this being specialty vehicle renovations.

Table 28 Size of participating businesses

	Frequency	Percent %
1-3	7	23
4-9	12	40
>10	11	37
Total	30	100

The majority (73%) of the business operators interviewed had completed a TAFE trade qualification and three (3) had completed a university degree. Of those business operators who had completed a TAFE qualification only seven (23%) recalled there being OHS instruction included in the curriculum

Sources of Information

Interviewees were asked where they recalled recently seeing information or reading about OHS. As shown in Table 29, the VACC was most frequently cited.

Table 29 Where respondents had most recently seen or read about OHS

Source of information	Frequency	Percent %
VACC	21	70
TV	3	10
Amstad	1	3
Posters	1	3
Quality information	1	3
Trade Journal	1	3
Trade Magazine	1	3
WorkCover	1	3
Total	30	100

The VACC was cited as the most important source of *general* OHS information for the business operators while paint suppliers were cited as the most important source of *painting* related OHS information. Eighty percent (80%) of the business operators interviewed reported that they had access to the Internet. Less than half (47%) of respondents reported receiving an MSDS every time they purchased chemicals. Professional bodies or employer associations (i.e. the VACC) are the most significant sources of OHS information that the business operators use.

Interviewees were read the following statement and asked to respond with either “strongly disagree”, “disagree”, “neutral”, “agree” or “strongly agree”: “I know where to get advice on workplace health and safety”. All participants either agreed or strongly agreed that knew where to get advice. Only 23% (n=7) of the respondents reported that they would be likely to go to another body repairer for help in regard to an OHS issue while 30% reported that they would be likely to go to another body repairer for help in regard to a painting issue. The VACC and WorkSafe Victoria were reported to be the most likely source of help in regard to an OHS issue.

Attitudes and beliefs about OHS in general

Respondents were asked to list the three most important health and safety problems that they believed they were likely to experience in their business. The issues that specified in the responses given are listed in Table 30.

Table 30 Top three OHS problems likely to be faced

Issue Specified	Frequency
Paint	7
Cuts	6
Slip, trip or fall	5
Dust & Fume	4
Eye	4
Burns	4
Carelessness	3
Fire	3
Workers not using safety equipment	2
Car falling	2
Noise	2
Manual handling	2
Dermatitis	1
Electricity	1
MSDS out of date	1
Product information	1
Sharp instruments	1
Plastic Filler	1
Drugs & alcohol	1

Respondents were asked to select from a list, what they believed was the most important cause of work-related injuries and illness in the community in general. As shown in Figure 50, worker being careless and lack of training and education were the most frequently cited causes.

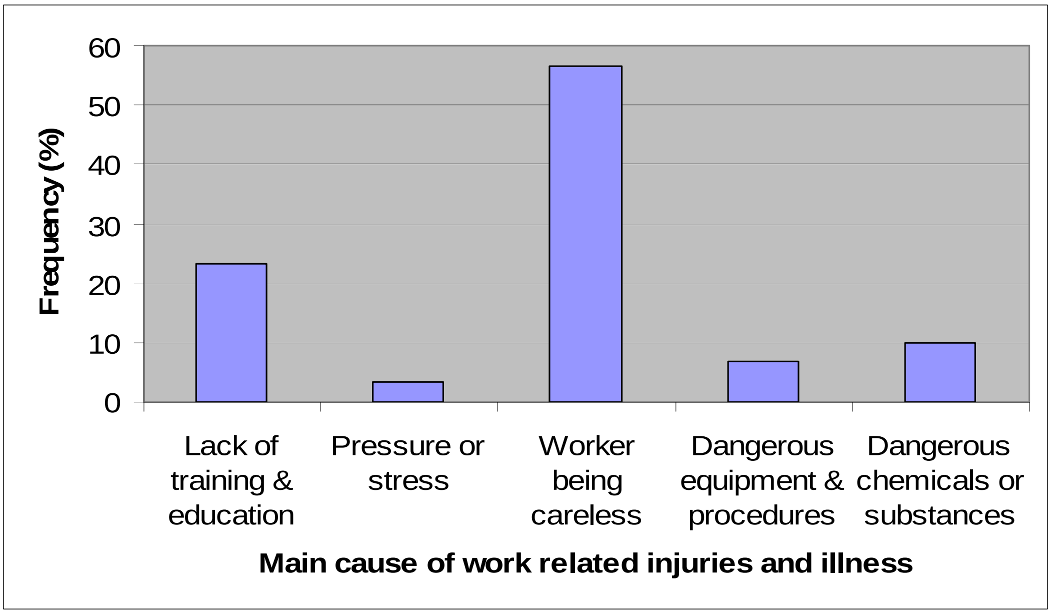

Figure 50 Main cause of work-related injuries and illnesses

Respondents were asked to select from a list what they believed was the most important prevention measure for work-related injuries and illness in the community in general. The responses given are listed in Figure 51.

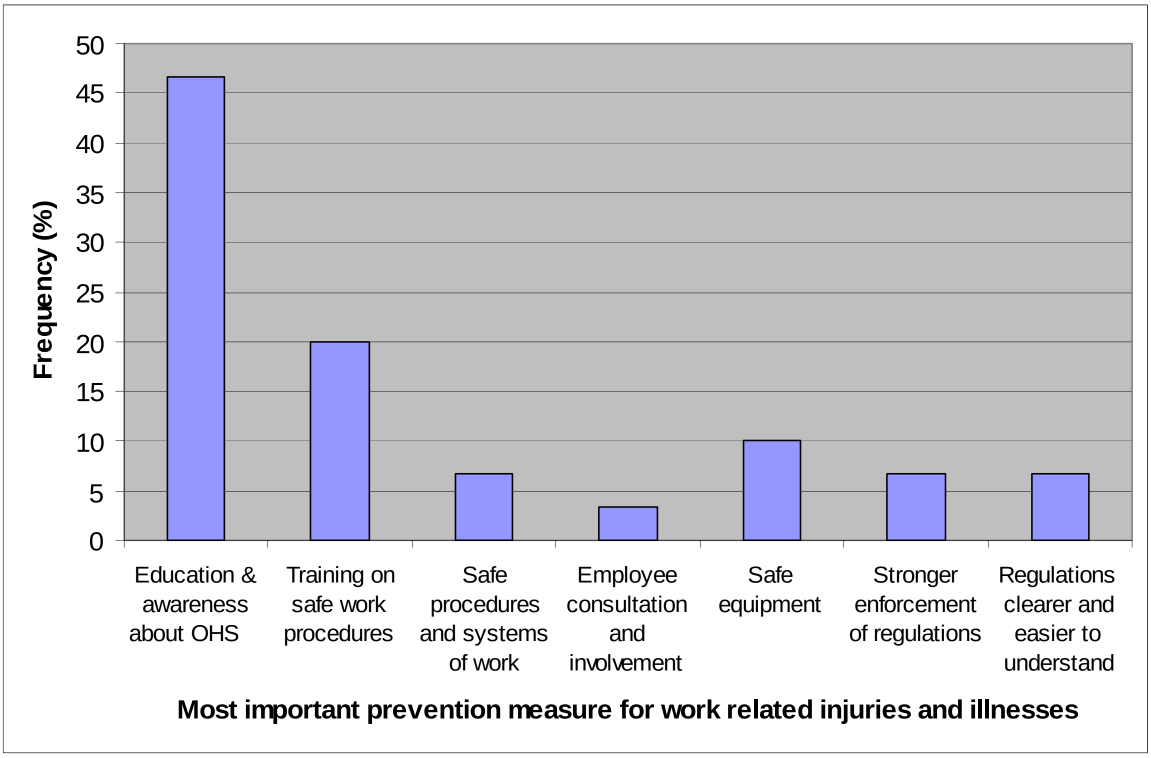

Figure 51 Most important prevention measure for work-related injuries and illnesses

Respondents were asked to select from a list, what they believed was the proportion of work-related injuries and illness in the community in general that could be prevented. As shown in Figure 52, 50% responded that they believed nearly all injuries and illnesses could be prevented.

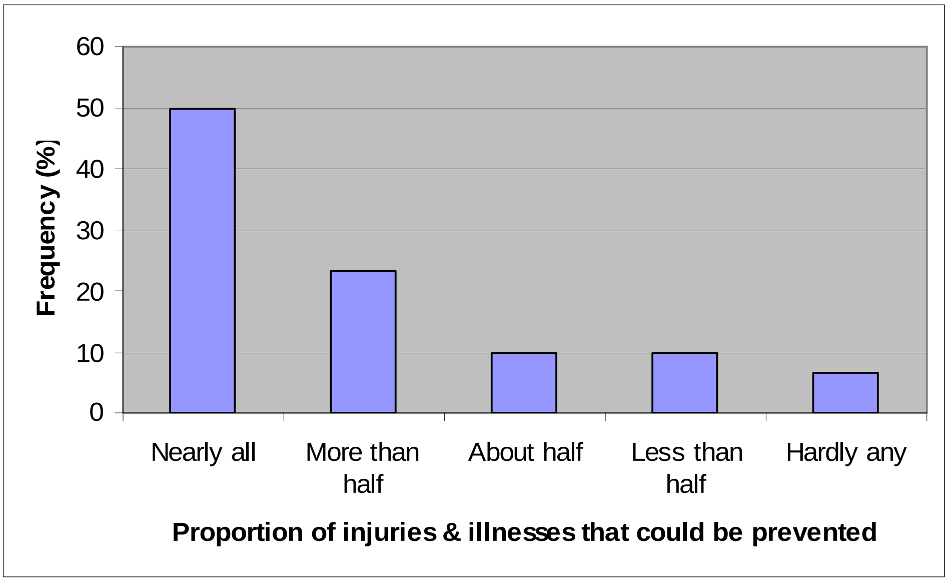

Figure 52 Proportion of injuries and illnesses that could be prevented

Beliefs about risk in small business

Participants were asked a series of questions to assess their attitudes and beliefs about the importance of OHS in their business. Participants were read a statement to which they responded with “strongly disagree”, “disagree”, “neutral”, “agree” or “strongly agree”.

The majority of respondents reported that health and safety is a high priority and one of their biggest concerns; 97% either agreed or strongly agreed with the statement that “Compared to all the other things that can go wrong, health and safety is a high priority”; 67% either agreed or strongly agreed with the statement that “In this business health and safety is one of my biggest concerns”; while 93% either disagreed or strongly disagreed with the statement that “Health and safety is not as important as other things like GST”.

The majority of respondents reported that they believe that it is not only large businesses that face OHS problems and that OHS is significant as an issue for small businesses. Seventy-three percent (73%) either disagreed or strongly disagreed with the statement that "Larger businesses face the real risks from health and safety" although it is worthy of note that 20% agreed with the statement. Eighty-seven percent (87%) of respondents either disagreed or strongly disagreed with the statement that "Health and safety is not likely to be a problem here - the business is too small" while 97% either disagreed or strongly disagreed with the statement that "Health and safety is not as important to businesses like mine as it is to larger ones". Twenty-six percent (26%) of respondents agreed or strongly agreed that "Injuries and ill health are a major problem for businesses of this size" while 69% either disagreed or strongly disagreed with the statement that "Compared to large businesses, small businesses do not have many health and safety problems".

The majority of respondents believed that ill-health of their spray painters would present them with a major business problem with 86% either disagreeing or strongly disagreeing with the statement "If any of my spray painters got sick because of the paint it would not be a major problem for my business" and 84% either agreeing or strongly agreeing with the statement "Ill-health of my spray painters would be a problem for my business".

Spray painting facilities and practices

All businesses surveyed possessed spray booths on-site and 33% reported that they used more than 20 litres of two-pack paint each week. However only twenty-four (80%) of business operators reported that spray painting was always done inside the spray booth. Six (20%) interviewees reported that two-pack paints were sometimes sprayed outside the spray booth.

All businesses reported that they undertake maintenance on their spray booth filters and twenty-one (70%) reported that they undertook maintenance at least every six months. Six (6) operators reported that they never quantitatively assessed the performance of their spray booth in terms of airflow. Four reported that they assess the airflow monthly; seventeen (17) more than once each year and three (3) less than once each year.

All of the businesses surveyed made respiratory protection available although only twenty-two (73%) reported that respiratory protection was always used while spraying two-pack paints.

Twenty-one (70%) of the businesses surveyed made air supplied respiratory protection available. Of these, the majority (60%) reported that air-supplied respiratory protection is not always or is never used while spraying two-pack paints. Only eight (40%) businesses reported that air-supplied respiratory protection is always used while spraying two-pack paints. Two (10%) of the businesses surveyed *never* use air-supplied respiratory protection while spraying two-pack paints, even though it is available.

Knowledge & attitudes about spray painting health risk

Participants were asked a series of questions to assess their knowledge about the health effects of exposure to isocyanates and two-pack paints. Participants were read a statement to which they responded with “strongly disagree”, “disagree”, “neutral”, “agree” or “strongly agree”.

As shown in Figure 53 and Figure 54 twenty (67%) of respondents agreed or strongly agreed with the statement that two-pack paints can cause lung damage, although 17 (57%) did not know (were neutral) that two-pack paints could cause asthma. Three (10%) either disagreed or strongly disagreed that two-pack paints could cause asthma.

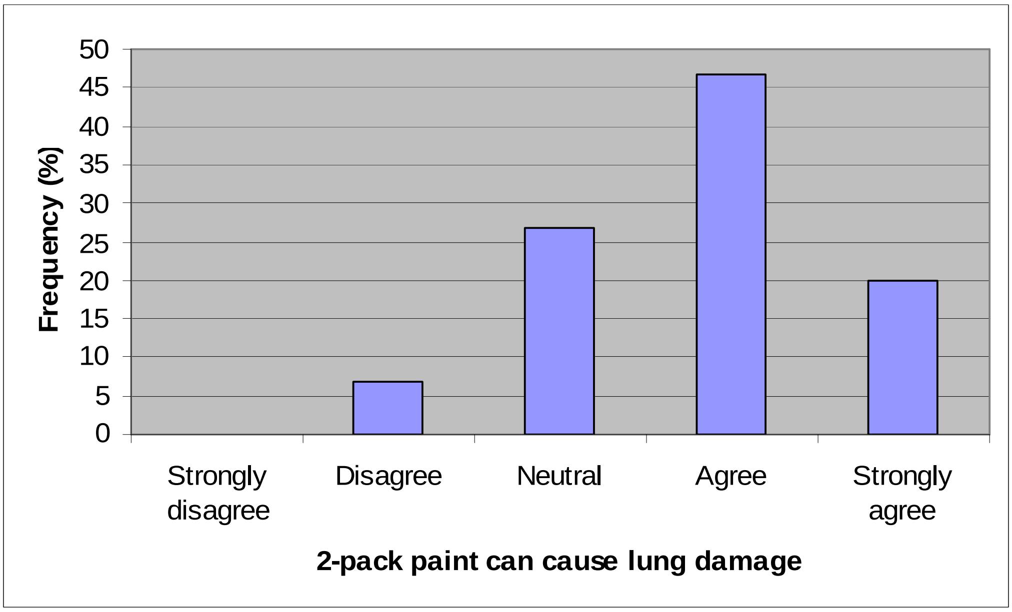

Figure 53 two-pack paint can cause lung damage

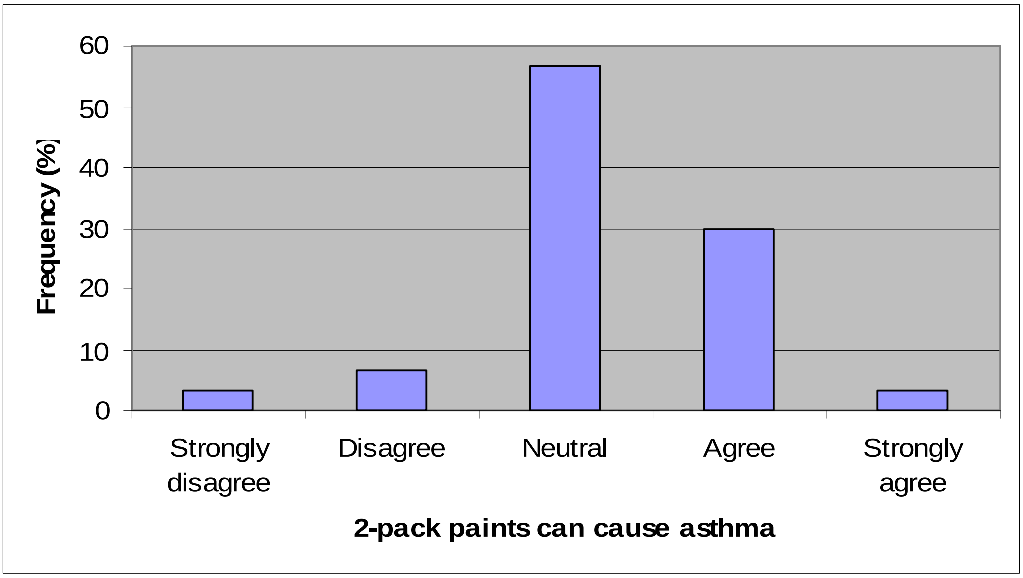

Figure 54 two-pack paint can cause asthma

Eighteen (60%) respondents disagreed or strongly disagreed with the statement that two-pack are safe these days, and twenty-four (80%) disagreed or strongly disagreed with the statement that two-pack paints are unlikely to hurt you.

The majority (23 or 77%) of respondents disagreed or strongly disagreed with the statement that two-pack paints are not harmful if just splashed on the skin and, supporting this and indicating strong inter-question reliability, 24 (80%) respondents agreed with the statement that isocyanates can be harmful if they get on the skin.

Twenty (66%) respondents disagreed or strongly disagreed with the statement that "Gloves are unnecessary when spraying two-pack paints" i.e. the majority of respondents recognise that gloves should be used while spraying two-pack paint. Only 6 respondents (20%) believed gloves are unnecessary.

Twenty-three (77%) of respondents disagreed or strongly disagreed with the statement that two-pack paints are not harmful if just splashed on the skin and, supporting this, twenty-four (80%) respondents agreed with the statement that isocyanates can be harmful if they get on the skin.

Twenty (66%) of respondents disagreed or strongly disagreed with the statement that "Gloves are unnecessary when spraying two-pack paints" i.e. the majority of respondents recognise that gloves should be used while *spraying* two-pack paint. Only six (20%) respondents believed gloves are unnecessary.

Fifteen (50%) respondents strongly disagreed or disagreed with the statement "Gloves are unnecessary when mixing two-pack paint". However, fifteen (50%) were either "neutral" or "disagreed" or "strongly disagreed", which suggests that there is less certainty among respondents regarding the necessity for gloves when *mixing* two-pack paints as compared to when *spraying*.

Attitudes regarding RPE & Spray Booths

Participants were asked a series of questions to assess their attitudes about the use of respiratory protection and spray booths while spraying and handling two-pack paints. Participants were read a statement to which they responded with "strongly disagree", "disagree", "neutral", "agree" or "strongly agree".

The majority (28 or 94%) of respondents agreed or strongly agreed with the statement that a respirator *and* spray booth should be used when spraying two-pack paints and similar proportions (26 or 87%) rejected the suggestion (disagreed or strongly disagreed) that either a respirator *or* spray booth should be used when spraying two-pack paints. Twenty (67%) of respondents agreed or strongly agreed that they knew how to test the fit of a respirator.

Twenty-nine (97%) of respondents disagreed or strongly disagreed with the statement that it is OK to spray small amounts of two-pack paint without a respirator and similar proportions (27 or 90%) agreed or strongly agreed that even when doing a small spray job with two-pack paint, a respirator should be used. However, there was a range of attitudes in regard to the need for *air-supplied* respirators among respondents. Half of the respondents indicated that they believed air-supplied respirators should be used, with 53% (n=16) either disagreeing or strongly disagreeing with the statement that “You do not need to use air-supplied respirators when spraying two-pack paint”, and 67% (20) either agreeing or strongly agreeing with the statement that an air-supplied respirator should always be used when spraying two-pack paints. Nineteen (63%) either disagreed or strongly disagreed with the statement that they do not think it is necessary for spray painters to use air-supplied respiratory protection.

The attitudes among respondents about the need for respirators while handling paints were contradictory; thirteen (43%) either agreed with the statement that a respirator is not necessary while weighing and mixing paint while twenty seven (90%) either agreed or strongly agreed with the statement that respirators should be used at all times when handling two-pack hardeners. It is possible that the respondents differentiated between paints in general and two-pack hardeners.

Fifteen (50%) respondents agreed with the statement that an airline-supplied respirator prevents you seeing properly. Twenty-five (83%) respondents either disagreed or strongly disagreed with the statement that an airline-supplied respirator is too expensive for their business given the amount of two-pack spray paint they use, and twenty-three (77%) either disagreed or strongly disagreed with the statement that an air-supplied respirator is not worth the money when a simple mask is sufficient for spraying. Nineteen (63%) respondents disagreed or strongly disagreed that an air-line supplied respirator is too much trouble and that the majority (73%) respondents disagreed or strongly disagreed that an air-supplied respirator requires too much effort to keep it working properly. Sixteen (53%) respondents agreed or strongly agreed that an air-line supplied respirator will save money in the long run.

Twenty-two (73%) respondents indicated that they prefer their spray painters to use air-supplied respirators because they think it is better for them. However, the majority (18 or 60%) of respondents allow their spray painters choose for themselves whether to wear an air-supplied respirator. Twenty-five (83%) respondents indicated that their painters prefer to use a simple half mask respirator. Twelve (40%) respondents agreed that their painters complain about the time that air-supplied respirators waste although only five (16%) respondents agreed or strongly agreed that an air-line supplied respirator takes too long to put on.

Twenty-eight (94%) of respondents disagreed or strongly disagreed with the statement that a respirator provides adequate protection when spraying two-pack paints and that a spray booth is not really necessary and twenty-two (73%) agreed or strongly agreed that even when doing a small spray job with two-pack paint, a spray booth should be used. Twenty-two (63%) either disagreed or strongly disagreed that with the statement that "it is OK to spray small amounts of two-pack paints outside the spray booth". These results support earlier data regarding the use of both a respirator and a spray booth but suggest that there is some acceptance of spraying outside a booth.

All respondents either disagreed or strongly disagreed that only bigger businesses need spray booths and all except one respondent indicated that they believed that a spray booth is worth the investment. Only two (2) respondents indicated that a spray booth requires too much effort to keep it working properly.

4.3.9.3. Paint supplier sales representative focus group

Figure 55 illustrates the stage of the case study methodology that pertains to this section.

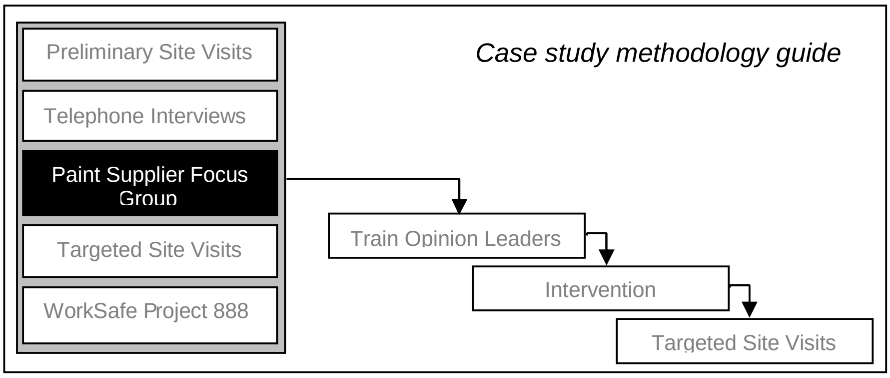

Figure 55 Case Study Methodology - Paint Supplier Focus Group

The sales representatives were in general agreement that the knowledge that MVR operators possess is largely amassed through personal oral communication and that most MVR operators know that there is some risk associated with the use of two-pack paints but they do not know what that risk is. The belief was expressed that the largely hidden health risk associated with isocyanate exposure is perceived to be low in relation to the more apparent risk associated with dust exposure and fire.

The sales representatives agreed that, in their experience, all spray painters use RPE although this is usually a half mask type device. They observed that younger spray painters are more likely than older painters to use air-supplied devices having become accustomed to them at trade school where relatively new devices are used. There was agreement that the comfort and visibility problems associated with older air-supplied respiratory equipment used in the past have made many painters reluctant to use any form of air-supplied device today and that low quality air also deters spray painters.

It was acknowledged that contemporary air-supplied devices can still pose problems with regard to reflected light on the visor and the attenuation and masking of spray gun noise that are used to monitor the spraying process. However, it was agreed that persistence can result in a learning effect and these problems are overcome. Other problems reported by painters relate to the cold air temperature of supplied air and the inconvenience of air-lines when repeated entry and exit of the booth is required. Generally a half-mask device is perceived to be more convenient despite the disadvantage of the increased breathing resistance that becomes noticeable on exertion.

The sales representatives acknowledged that the cost of air-supplied devices sometimes limits the number available and, given the reluctance of painters to share devices, they remain unused. Further, having purchased air-supplied devices, employers are surprised when they find that there are on-going costs associated with maintenance and thus devices fall in to disrepair and disuse.

It was noted that when air-supplied devices are available, business operators generally permit spray painters to decide for themselves whether or not they will use them. There was an expressed belief that this is often because the operator does not like enforcing the use and they also fear applying pressure to the painter may result in them moving to a different MVR operator.

The sales representatives knew that a substantial amount of spray painting work is undertaken in unregulated workplaces such as spray painters' sheds at their homes. The licensing of MVR operators and the requirement for proof of licence to be presented at point of sale of two pack paints was discussed as a means to reduce such activity. Further, the provision of written information in short, concise, frequent communiqués is more likely to be read. Posters treating the issue of sensitisation and asthma are potentially effective.

The sales representatives had identified that the level of cooperation between MVR operators is generally greater in regional areas than it is in metropolitan Melbourne.

4.3.9.4. Intervention

4.3.9.4.1. Targeted site visits

This section presents the results of the targeted site visits. Details of the results are presented in tables 215 to 241 and figures 233 to 257 in Appendix 10.

Figure 56 illustrates the stage of the case study methodology that pertains to this section.

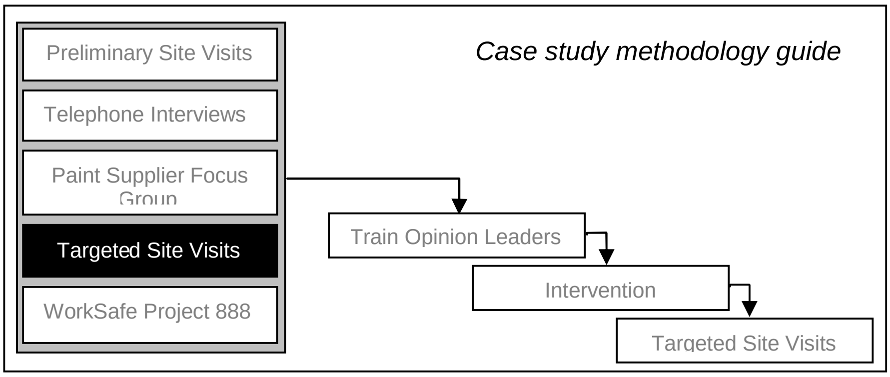

Figure 56 Case Study Methodology - Targeted Site Visits Results

General Information about respondents

Of the twenty-one businesses listed as members of the VACC in Ballarat and Bendigo, one had ceased trading and one did not undertake any spray painting. Of the remaining businesses in each of the cities, all agreed to participate in the survey. Details of these are shown in Table 31.

Table 31 Details of targeted businesses - Bendigo

Location	Code	N^o of Employees	N^o of Painters	Age of business (years)	Business operators' time in MVR	WorkSafe Victoria visit within previous 12 months
Bendigo	Bd5-1	1	2	>20	>20	No
	Bd5-2	2	2	>20	>20	No
	Bd5-3	1	2	>20	>20	No
	Bd5-5	3	3	>20	>20	No
	Bd5-6	3	3	6-20	6-20	No
	Bd10-1	3	3	>20	>20	No
	Bd11-1	3	4	>20	>20	No
	Bd11-2	3	6	>20	>20	No
	Bd11-3	3	2	>20	>20	Yes
Ballarat	Br5-1	2	4	>20	6-20	No
	Br5-2	3	3	>20	6-20	Yes
	Br5-3	2	2	>20	>20	Yes
	Br5-4	2	2	6-20	>20	No
	Br5-5	1	1	6-20	6-20	Yes
	Br10-1	2	3	>20	>20	No
	Br11-1	3	2	>20	6-20	No
	Br11-2	3	5	>20	>20	Yes
	Br11-3	3	5	>20	>20	No
	Br11-4	3	5	>20	>20	No

Fifteen of the nineteen business operators estimated that they use more than 20 litres of two-pack paint each week. All businesses used more than 10 litres. All (100%) of the businesses surveyed undertook mainly insurance-related body repair work and operated a spray-bake booth.

Sixteen (16) of the nineteen (19) businesses visited were older than twenty (20) years. All of the business operators had been involved in vehicle body repair for more than six (6) years, fourteen (14) of whom had been involved for more than twenty (20) years.

Seventeen (17) of the nineteen (19) business operators interviewed had completed a TAFE trade qualification. The remainder had completed no further education after leaving school. Of those business operators who had completed a TAFE qualification five (5) (26%) recalled there being OHS instruction included in the curriculum.

Eighteen of the nineteen (95%) of the business operators interviewed had access to the Internet and the VACC was reported to be the most important source of OHS information for the business operators. Two (2) of the businesses had received information about spray-painting safety from WorkSafe Victoria within the previous 12 months but could not recall to what the information pertained.

Nine (9) of the business operators indicated that they valued the opinion of other local MVR operators. Two (2) subjects mentioned the opinion of paint suppliers being of value and the remaining eight (8) indicated that there was no one's opinion that they valued. No one named any one in regard to valuing opinion in regard to business in general. WorkSafe had visited five (26%) of businesses within the previous 12 months.

Eleven (11) of the subjects indicated that other MVR operators make contact with them to discuss business matters. Twelve of the subjects reported that contact with other MVR operators was usually by telephone, while three (3) reported face-to-face contact being usual. However, many operators were reluctant to identify individuals that they interacted with. Interactions with individuals and the VACC that were identified are illustrated in the network diagram shown as Figure 57. This diagram was used to identify the opinion leaders in Ballarat and Bendigo, i.e. Br11-3 and Bd11-2 respectively.

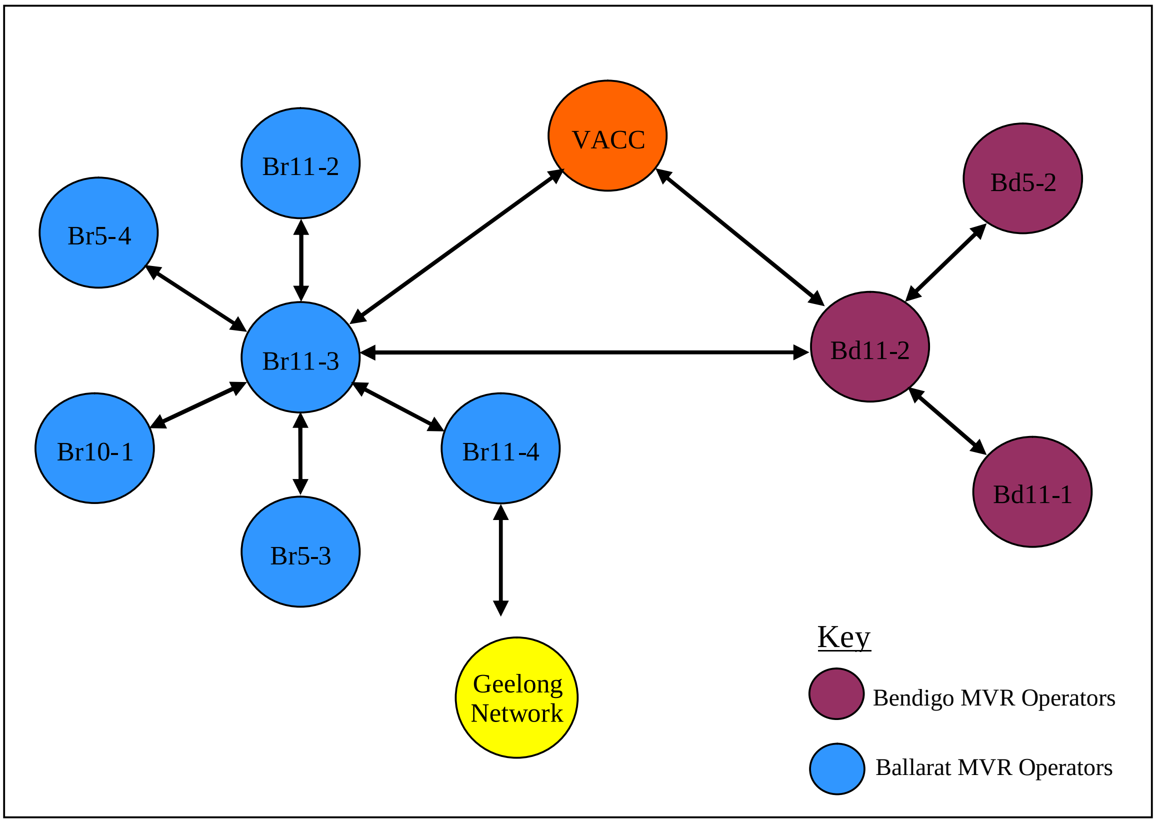

Figure 57 Ballarat & Bendigo MVR Network Diagram

Attitudes about OHS in general

Respondents were asked to select from a list what they believed was the most important cause of work-related injuries and illness in the community in general. The responses were consistent with those collected during the telephone survey with 42% (n=8) citing worker carelessness and 42% (n=8) lack of training and education. Thirty-seven percent (37%) indicated that education and awareness about OHS and twenty-six percent (26%) training on safe work procedures were the most important prevention measure for work-related injuries and illness in the community in general.

Thirty-seven percent (37%) of respondents indicated that they believed that nearly all work-related injuries and illness in the community in general could be prevented and thirty-two percent (32%) indicated that more than half could be prevented.

Spray painting facilities and practices

As mentioned above, all businesses surveyed possessed spray booths on-site. Twelve (63%) of the business operators reported that two-pack paints were sometimes sprayed outside the spray booth.

All of the businesses made respiratory protection available and the operators reported that respiratory protection was always used while spraying two-pack paints. Eighteen (18) of the nineteen (19) businesses made air supplied respiratory protection available and, of these eighteen, twelve (12) provided hood type, three (3) provided full face piece type, two (2) provided visor type and one (1) provided both hood and visor type. Only three (3) of the businesses which made air-supplied respiratory protection available reported that it is always used while spraying two-pack paints.

The supervision of the use air-supplied respiratory protection was assessed through questions relating to the subjects' "stage of change" using the schema described in Section 4.3.5.4 i.e. the subjects' readiness to enforce the use of air-supplied respiratory protection was assessed using Prochaska's Transtheoretical Model of change (Prochaska et al., 2002), the results of which are summarised in Figure 58.

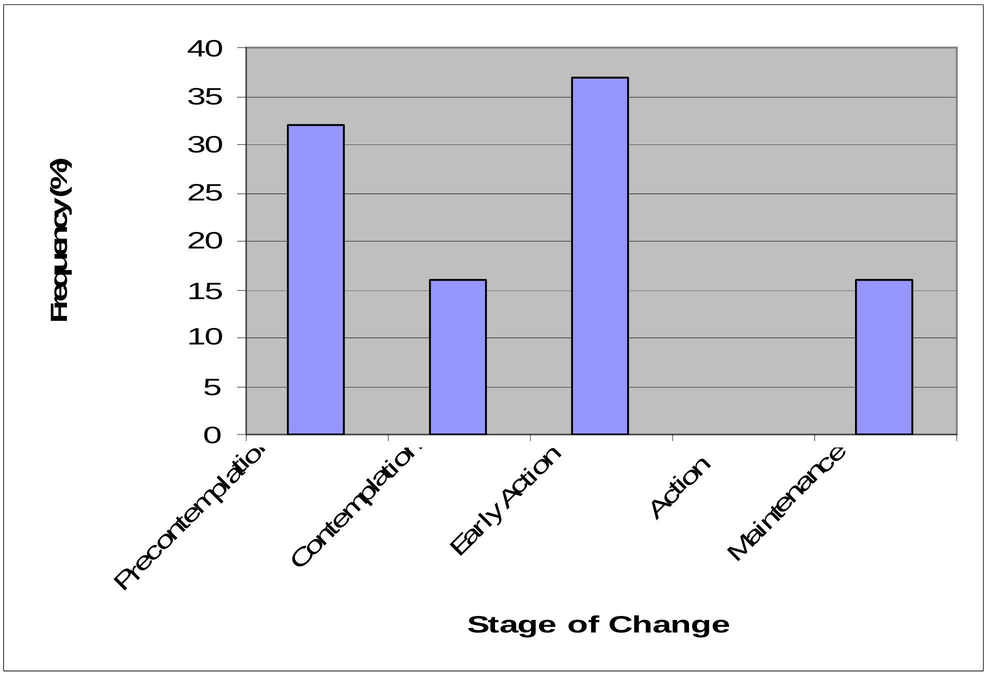

Figure 58 Stage of change – pre intervention

Subjects were asked to volunteer advantages and disadvantages of enforcing the use of air-supplied RPE. The free responses were grouped by like meaning and are presented in descending order of frequency in Table 32 and Table 33.

Table 32 Pros of enforcing the use of air-supplied RPE— pre intervention

Comments	Frequency	%
Health of worker	17	57%
Protect business	7	23%
Legal compliance	3	10%
Professionalism	2	7%
Morale	1	3%
	30	100%

Table 33 Cons of enforcing the use of air-supplied RPE— pre intervention

Comments	Frequency	%
Comfort & awkwardness	9	32%
Visibility	6	21%
Lose employee	4	14%
Painting performance	2	7%
Up to worker	2	7%
Painters dislike	2	7%
Time	1	4%
Maintenance	1	4%
Sore throat	1	4%
	28	100%

Prochaska (1997b) suggests that at precontemplation stage respondents are likely to list more cons (disadvantages of the desired behaviour) than pros (advantages of the desired behaviour). The raw data (i.e. the ungrouped responses) were reviewed to assess the relationship between advantages (pros) and the disadvantages (cons) that were provided. As shown in Table 34 and Figure 59 there were 18 respondents of which ten (56%) listed more cons than pros, six (33%) listed more pros than cons and 2 (11%) listed the same number of each.

Table 34 Number of pros versus number of cons listed by respondents – pre intervention

Pros greater than Cons	6	33%
Pros same as Cons	2	11%
Cons greater than Pros	10	56%
Total number of valid responses	18	100%

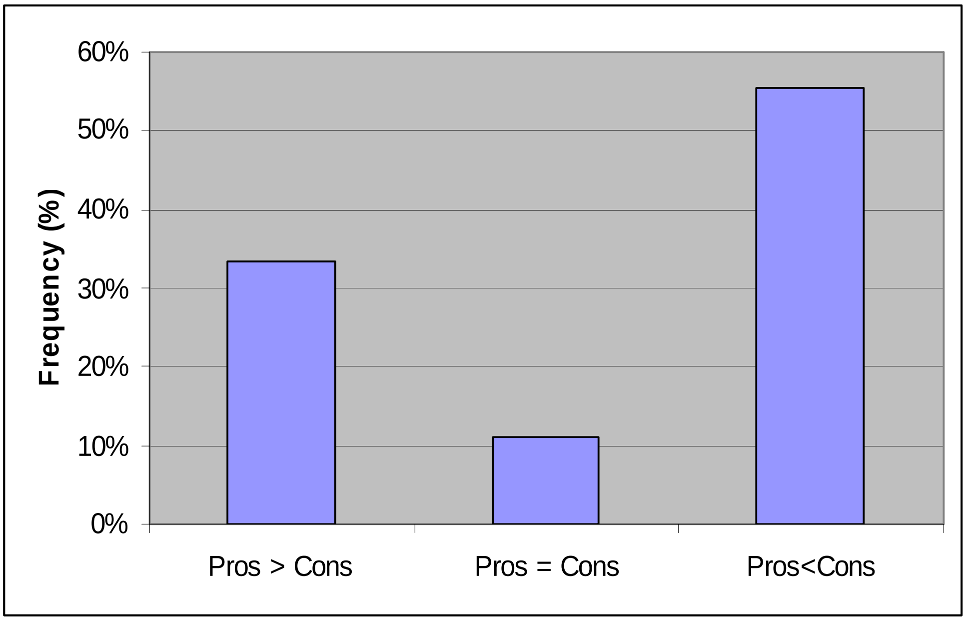

Figure 59 Number of pros versus number of cons listed by respondents – pre intervention

Knowledge & attitudes about spray painting health risk

Participants were asked a series of questions to assess their knowledge about the health effects of exposure to isocyanates and two-pack paints. These questions were distilled from the bank used in the earlier telephone survey. Participants were read a statement to which they responded with “strongly disagree”, “disagree”, “neutral”, “agree” or “strongly agree”.

The majority (13 or 68%) of respondents agreed or strongly agreed with the statement that two-pack paints can cause lung damage, while 53% (n=10) did not know (were neutral) that two-pack paints could cause asthma.

Twelve (64%) of respondents disagreed or strongly disagreed with the statement that two-pack paints are safe these days and they all (i.e. 18 or 94%), except one respondent, disagreed or strongly disagreed with the statement that two-pack paints are unlikely to hurt you.

Attitudes about RPE & Spray Booths

Participants were asked a series of questions to assess their attitudes about the use of respiratory protection and spray booths while spraying and handling two-pack paints. Participants were read a statement to which they responded with “strongly disagree”, “disagree”, “neutral”, “agree” or “strongly agree”.

All except one respondent (n=18) disagreed or strongly disagreed with the statement that “It is OK to spray small amounts of two-pack paint without a respirator” and the same number (n=18) agreed or strongly agreed that even when doing a small spray job with two-pack paint, a respirator should be used.

There was a range of attitudes to the need for air-supplied respirators among respondents. There is however, an indication that the majority of respondents believed that air-supplied respirators should be used, with fourteen (73%) either disagreeing or strongly disagreeing with the statement that “You do not need to use air-supplied respirators when spraying two-pack paint”, and fifteen (79%) either disagreeing or strongly disagreeing with the statement that “I do not think it is necessary for spray painters to use air supplied respiratory protection”. Twenty-two (73%) respondents prefer their spray painters to use airline-supplied respirators because they think it is better for them and ten (52%) agreed or strongly agreed that an air-line supplied respirator will save money in the long run.

Fifteen (50%) respondents agreed with the statement that “An airline-supplied respirator prevents you seeing properly” and nineteen (63%) disagreed or strongly disagreed that an air-line supplied respirator is too much trouble. Six (32%) respondents agreed that their painters complain about the time that air-supplied respirators waste. Eighteen (95%) respondents indicated that their painters prefer to use a simple half mask respirator.

Thirteen (69%) either disagreed or strongly disagreed that with the statement that “It is OK to spray small amounts of two-pack paints outside the spray booth”, confirming that there is some acceptance of spraying outside a booth.

4.3.9.4.2. Opinion leaders' and MVR operators' meetings

Figure 60 illustrates the stage of the case study methodology that pertains to this section.

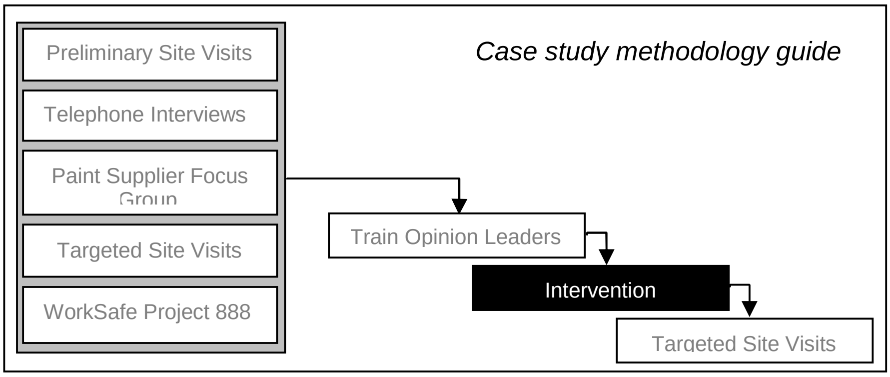

Figure 60 Case Study Methodology - Targeted Site Visits Results

Attendance at the meetings was disappointing although the respective opinion leaders reassured the researcher that they were consistent with their expectations of attendances at similar events.

The Bendigo and Ballarat meetings were held at motel function rooms on 30 and 31 March 2004 respectively. Seven (7) people representing five (5) businesses attended the Bendigo meeting. One of the attendees was a painter sent by a business operator who did not attend. Eight (8) people representing five (5) businesses attended the Ballarat meeting. Two of the attendees were spray painters sent along by a business operator who did not attend. One of the attendees was a paint shop supervisor attending on behalf of a business operator. One operator brought his painter who is his son. Meeting attendance details are recorded in Table 35.

Table 35 MVR Operator Meeting Attendance

Panel Shop Reference Number	Operator Meeting Attendance	Painter Meeting Attendance
Bd5-1	No	No
Bd5-2	Yes	No
Bd5-3	No	No
Bd5-5	No	No
Bd5-6	Yes	No
Bd10-1	Yes	No
Bd11-1	No	Yes
Bd11-2	Yes	No
Bd11-3	No	Yes
Br5-1	No	No
Br5-2	No	No
Br5-3	No	No
Br5-4	Yes	Yes
Br5-5	No	No
Br10-1	Yes	No
Br11-1	No	No
Br11-2	No	No
Br11-3	Yes	No
Br11-4	No	Yes
N=19		

The meetings were reported to be of value by those in attendance. Each attendee was presented with information sheets that they were asked to share with their spray painters and the attendees who were not business operators were asked to report to their respective employers. The opinion leaders were asked to talk to other MVR operators about the evening and the information delivered.

The evaluation questionnaires completed by attendees that were MVR operators, indicated that all (n=7) agreed or strongly agreed that they will enforce the use of air-supplied RPE. One of the respondents disagreed that they knew how to enforce the use of air-supplied RPE while the remainder agreed that they did know how to enforce its use.

All respondents (n=7) agreed or strongly agreed that the opinions of other body repairers on matters of spray painting safety are important to them and three respondents identified specific body repairers at the meetings that were of particular importance. In each case, the body repairer identified was the opinion leader identified by the researcher.

4.3.9.4.3. Post opinion leader and MVR operator meeting interviews

This section presents the results of the post-intervention targeted site visits. Details of the results are presented in tables 242 to 256 and figures 258 to 270 in Appendix 10. Figure 61 illustrates the stage of the case study methodology that pertains to this section.

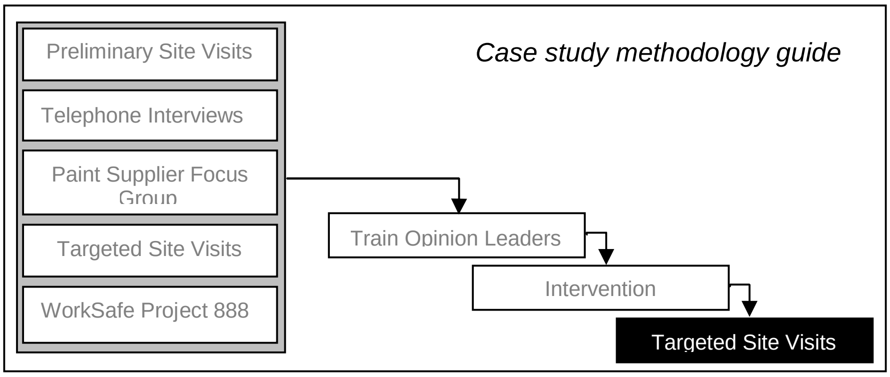

Figure 61 Case Study Methodology - Targeted Site Visits

All MVR operators in Ballarat and Bendigo that participated in the earlier surveys were approached for a repeat interview during July 2004. One (1) MVR operator in Ballarat declined to participate on the grounds that he was suspicious about the researcher's motives given the frequency of contact. One (1) MVR operator in Bendigo had left the business he operated at the time of the first interview and had joined another MVR operator included in the study. These changes resulted in their being seventeen (17) respondents to the interviews.

Since the last contact, three (3) of the respondents had been visited by a WorkSafe Victoria officer and in each case this visit had been within the previous seventy-two (72) hours. None of the respondents reported that they had received any information about spray painting safety from WorkSafe Victoria.

Fourteen (14) of the fifteen (15) respondents reported that they had received the letter from their respective opinion leader. Thirteen (13) of these reported that they had read it. Eleven (11) of these respondents reported that they had read the accompanying spray painting safety information sheets and ten (10) reported that they had discussed the sheets with their painters. Four (4) of the respondents suggested they were more likely to read information of the type sent if it was sent by another MVR operators while seven (7) indicated they are more likely to read information that comes from WorkSafe Victoria and one (1) indicated they are more likely to read information that comes from the VACC.

For the purposes of comparison with the initial targeted visits, the supervision of the use air-supplied respiratory protection was assessed through questions relating to the subjects' "stage of change" using the schema described in Section 4.3.5.4 i.e. the subjects' readiness to enforce the use of air-supplied respiratory protection was assessed using Prochaska's Transtheoretical Model of change (Prochaska et al., 2002), the results of which are summarised in Figure 62.

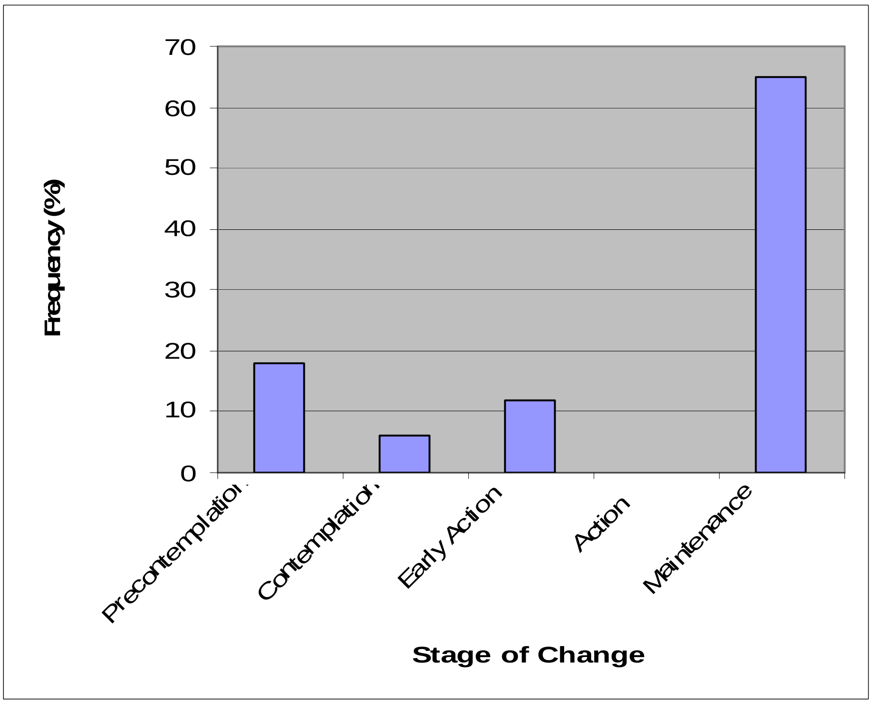

Figure 62 Stage of Change - post intervention

Subjects were asked to volunteer advantages and disadvantages of enforcing the use of air-supplied RPE. The free responses were grouped by like meaning and are presented in descending order of frequency in Table 36 and Table 37.

Table 36 Pros of enforcing the use of air-supplied RPE – post intervention

Comments	Frequency	%
Health of worker	13	59%
Protect business	5	23%
Legal compliance	4	18%
	22	100%

Table 37 Cons of enforcing the use of air-supplied RPE– post intervention

Comments	Frequency	%
Comfort & awkwardness	7	64%
Visibility	3	27%
Painters dislike	1	9%
	11	100%

Prochaska (1997b) suggests that at precontemplation stage respondents are likely to list more cons (disadvantages of the desired behaviour) than pros (advantages of the desired behaviour) and the pros increase between precontemplation and contemplation. Generally, from contemplation to action, cons of changing are lower in action than in contemplation. The pros of changing are higher than the cons for people in action. The raw data (i.e. the ungrouped responses) were reviewed to assess the relationship between advantages (pros) and the disadvantages (cons) that were provided. As shown in Table 38 and Figure 63 there were 15 respondents of which ten (67%) listed more pros than cons, four (27%) listed more cons than pros and 1 (7%) listed the same number of each. Thus the ratio of pros to cons listed by respondents has crossed over during the intervention period.

Table 38 Number of pros versus number of cons listed by respondents – post intervention

Pros greater than Cons	10	67%
Pros same as Cons	1	7%
Cons greater than Pros	4	27%
Total number of valid responses	15	100%

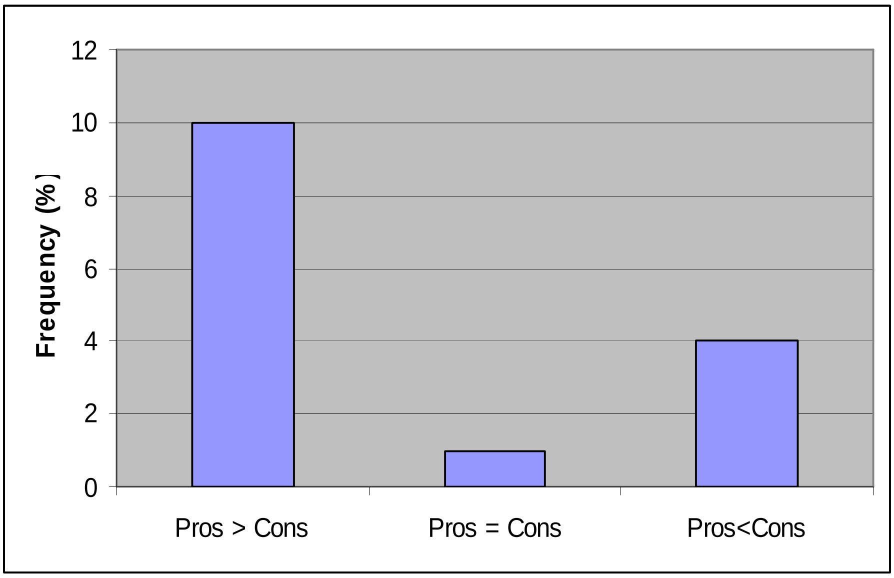

Figure 63 Number of pros versus number of cons listed by respondents – post intervention

Sixteen (16) respondents either disagreed or strongly disagreed with the statement that two-pack paints are safe these days and that two-pack paints are unlikely to hurt you. One agreed with the statement that they are safe these days and was neutral about the paints being unlikely to hurt you on the basis that they are safe if used properly. Fourteen (14) respondents agreed with the statement that two-pack paints can cause lung damage (three (3) were neutral) and thirteen (13) respondents agreed with the statement that two-pack paints can cause asthma (four (4) were neutral).

Respondents were asked about their attitude towards the use of RPE. Although three respondents did not agree that air-supplied RPE is necessary while spraying two-pack paints, all respondents reported that they *prefer* their painters to use air-supplied RPE and all agreed that a respirator of some kind should be used even when doing a small spray paint job.

Fifteen (15) of the seventeen (17) respondents either disagreed or strongly disagreed that it is acceptable to spray small amounts of two-pack paint outside the spray booth. One respondent was neutral and one agreed that it was acceptable. The latter two responses were qualified with the comments that it is more a matter of fact than it is acceptability.

4.3.9.5. Review of WorkSafe Project 888 Spray Painting

Figure 64 illustrates the stage of the case study methodology that pertains to this section.

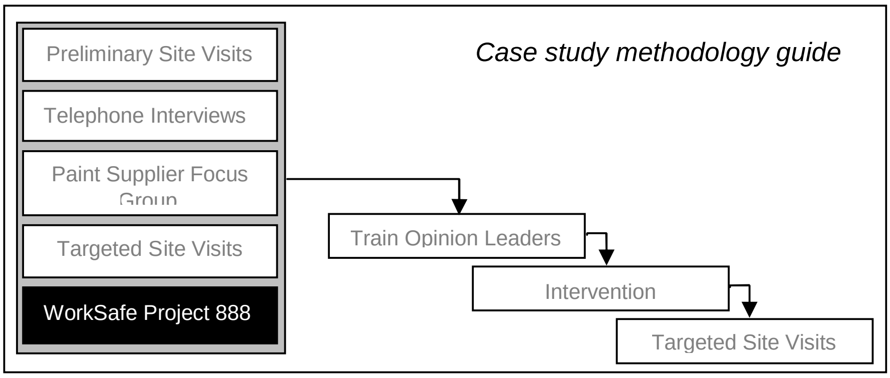

Figure 64 Case Study Methodology - WorkSafe Project 888 Results

There are 1,282 registered workplaces under the industry code F4865K that identifies MVR operations. Therefore the visits represent direct contact with 38% of all registered workplaces where vehicle repair is undertaken. A number of workplaces were visited on several occasions. Multiple visits are likely to have followed the serving at one workplace of multiple compliance notices having varying compliance deadlines. Each deadline for compliance can result in a return visit by an inspector.

WorkSafe Inspectors use "phrase codes" to describe physical condition and workplace arrangements that are in need of remedy. The frequency of use of the respective phrase codes is listed in Appendix 9. Review of the text that accompanied the respective standard phrases used revealed that, while there was some difference in their interpretation either between inspectors or between visits and therefore use at different workplaces, the majority of the text demonstrated what appears to be appropriate and relevant use of the respective phrases.

Review of the phrase codes used and the accompanying text revealed that the number of directions served (n=63) in regard to Material Safety Data Sheets (MSDS) was lower than might have been expected. However, this author's experience is that the paint supply companies are increasingly providing users with copies of MSDS stored on compact disk for loading on to personal computers located adjacent to paint mixing rooms.

The infrequency of use of the phrase code “OHS-0356: Adequacy of hazardous substance controls” (n=5) that was used as a direction to address matters relating to spray booths, paint mixing areas and respirators contradicted this author’s experience during workplace visits. However, Phrase Code “OHS-0357: Maintaining hazardous substance controls”, used largely to address issues relating to spray booth maintenance, was used more frequently (n=36) and it is possible that these codes (OHS-0357 and OHS-0466/DG-0139) were considered by some inspectors to be mutually exclusive or to some extent collapsed together.

The quality of breathing air for use with air supplied breathing apparatus was frequently cited (n=109) and is significant given the importance of good air quality in encouraging the use of airline respiratory equipment. This author was unable to verify air quality monitoring during targeted site visits during the case study work given the need to access written records. Reliance upon MVR operators’ self reports was abandoned early in the visits given the apparent contradictions between self-reports of air quality assessment and anecdotes. A comparison with the inspectors’ data is therefore not possible.

Phrase code “OHS-0467: Respiratory equipment when spraying with isocyanates” (n=39) addressed inadequate (non-airline) and non-use of RPE. The author’s experience and industry surveys suggest that the inspectors may not have been given an accurate picture of air-supplied RPE usage. In a number of cases the absence of such equipment is unequivocal. However, the presence of equipment does not necessarily indicate use and during several workplace visits this author was informed that the airline equipment was indeed only taken out of its storage for the benefit of WorkSafe inspectors.

The use of other phrase codes relating to ignition sources and fire protection in hazardous areas supported this author’s observations during workplace visits. The code relating to health surveillance for isocyanates exposure was most frequently used (n=154) and supports this author’s experience that very few business operators understand that isocyanates are associated with asthma and therefore, by implication, it is unlikely they understand the legislative requirement for health surveillance where designated hazardous substances are in use (National Occupational Health & Safety Commission, 1994; Victoria, 1999; Victorian WorkCover Authority, 2000). While health surveillance is to some extent a bench marking exercise and does little but identify exposures and damage that has occurred, it potentially offers an opportunity to educate employees about isocyanate exposure and risk.

In conclusion, the data suggests that 28% of workplaces had, in some way, an inadequate supply of breathing air for respiratory protection and 11% did not have air-supplied respiratory protection available.

4.3.10. Motor Vehicle Repair Case Study Discussion

4.3.10.1. Methodology

The preliminary visits were undertaken to provide a basis for the design of the telephone survey i.e. to assist with the development of the formative research process (Andreasen, 1995).

The visits were very informative and the researcher found the business operators to be very cooperative. In the metropolitan areas in particular, operators required extra reassurance about the credentials of the researcher before they were prepared to divulge information, but overall the business operators were very candid.

Securing the involvement of business operators in the telephone survey was particularly difficult and time consuming. While many were initially willing to participate and nominated a time to complete the survey over the telephone, the majority were unavailable when called at the nominated time. In the majority of cases, the interview had to be rescheduled and in many cases the interview was rescheduled several times. The researcher detected that many of the operators did not operate appointment diaries in the usual sense, instead reacting to demands as they arise during any workday. A number of interviews were conducted at a time that the operator was unaware had been scheduled for an interview, but they happened to be in the office and able to take the call.

It is possible that the telephone survey technique introduced some sample bias, despite using a random number technique to select participants. It is possible that those operators who were well organised and participated at the nominated appointment time, were the operators who were well organised in other ways, including OHS management. Those operators who repeatedly rescheduled, some of whom were ultimately discarded from the sample, may have been those who were less well-organised and therefore less able to manage OHS. This is conjecture, however.

The researcher had made an assumption that the larger businesses may find participation in the survey easier because they were able to delegate tasks and thus free themselves for the period. However, no pattern emerged in this regard, smaller business operators in many cases being more prepared to spend time in conversation on the telephone.

During the telephone survey, based on the information gleaned during the visits, the researcher got a sense that some respondents were providing what they thought to be the desired answer as opposed to what was the reality. On balance, it is the researcher's belief that the visits provided richer information. Given the operator's mode of operation in which they respond to demands presented at the premises, securing involvement and gaining their trust was simpler. For these reasons the face-to-face interviews undertaken during the targeted visits in Ballarat and Bendigo were successful notwithstanding the difficulties associated with making appointments for the visits.

As was the case with the preliminary visits, the subjects of the targeted visits were very candid during the interviews and in most cases there was an interest on the part of the MVR operator in finding out more about OHS and at the end of the interview there was often extended discussions about OHS in general.

Having built some rapport with most of the MVR operators visited during the targeted visits the response to the invitations to the meetings was disappointing. However, those that did attend reassured the researcher, that meetings of MVR operators are rarely better attended. They also suggested that the approach taken was probably the best in terms of reaching MVR operators.

The rapport established with the MVR operators supported the post meeting evaluations although in one case in Ballarat, the MVR operator declined to answer questions on the grounds that he was suspicious of the researcher's motives. Interestingly, in this father and son operated business, where the son is increasingly in the role of business operator, the father overheard the son's comments and stepped in to engage with the researcher in protracted discussions about OHS and wished to volunteer more information than was requested. The information provided was not included in the results of the survey given the father's semi-retired role and the initial interview being with the son.

In general, it would appear that face-to-face meetings with the MVR operators were more fruitful than telephone interviews. The use of meetings to reach business operators was successful as an approach but it is possible, based on responses discussed below, that an invitation from WorkSafe to a meeting having the same format may have had a better response. Alternatively, finding pre-existing arrangements for interactions between MVR operators and taking the opportunity to facilitate interactions with opinion leaders may be fruitful. For example, at the conclusion of the study it was discovered that one MVR operator in Bendigo had recently hosted a "trade night" for a paint supplier representative at which a number of local MVR operators had been present.

4.3.10.2. Results

4.3.10.2.1. Social marketing Stage 1: Formative Research

About the respondents

Among the operators interviewed during the preliminary visits, the telephone survey, and the targeted visits were many years of experience in the body repair business, in both cases large proportions having more than 20 years experience. Many of the operators had completed TAFE training in the area of body repair (77% of telephone respondents and 90% of Ballarat and Bendigo operators), but few of these (23% of telephone interview respondents and 26% of Ballarat and Bendigo operators) recalled any course content relating specifically to OHS.

The majority of business surveyed undertook predominantly insurance-based work. This is of relevance given that many of the operators visited suggest that the insurance companies are now limiting the financial allowance for repair work to the extent that viability is threatened. This being the case it is possible that there is pressure to relax in regard to OHS and to complete repair work as quickly as possible.

To get a sense of the volume of work undertaken by respondents, they were asked about the volume of paint they used. While the visits suggested that the majority of businesses used between 10 and 20 litres of two-pack paint each week, the telephone survey found that equal numbers of respondents used less than 10 litres, between 10 and 20 litres and more than 20 litres. The majority of Ballarat and Bendigo operators estimated that they used more than 20 litres per week. There were, however, some indications that many of the operators did not in fact know how much they used and they guessed for the purposes of providing an answer to the question.

Sources of information

The VACC emerged as a very important source of OHS information for the body repairers. Many operators cited the VACC as their principal source and their first point of call if they have queries. Paint suppliers are also an important source of information, particularly, as would be expected, in regard to painting technology. The respondents were confident that they knew where to find help in regard to OHS.

The majority (80% n= 24) of the respondents to the telephone survey had access to the Internet but only 5% (n=2) cited it as a source of OHS information. Eighteen of the nineteen operators in Ballarat and Bendigo had access to the internet.

Most respondents had MSDS available at their premises, many citing the paint supplier's compact disk version as their source. Approximately half of the telephone respondents received MSDS each time they purchased chemicals.

Only 23% (n=7) of the telephone respondents indicated that they would go to another body repairer for help in regard to OHS and only one of the operators visited indicated that they knew another body repairer who has good ideas in regard to OHS. This suggests limited use of existing networks in regard to solving OHS problems. This matter is discussed further in Section 4.3.10.2.3 below.

Attitudes and beliefs about OHS

When telephone interviewees were asked what OHS problems they were likely to face, paint was most frequently cited. However, there is likely to be bias in this regard owing to the respondents' knowledge of the focus of the survey. Cuts, slips and trips, dust and fume, eye injuries, burns and fire were also frequently cited.

Telephone interviewees and Ballarat and Bendigo operators were asked to nominate from a list of seven, the three main causes of work-related injuries and illness. The list was taken from a NOHSC commissioned community survey undertaken in 1998 (National Occupational Health and Safety Commission, 1999). The NOHSC survey revealed a general tendency within the community to focus on person-centred causes of injuries and ill-health with the majority of people citing (in descending order) lack of training and education, pressure or stress and worker being careless as the top three causes. The surveys of body repairers revealed a similar tendency with (in descending order) worker being careless, lack of training and education and pressure or stress being cited most frequently in the top three causes of injuries and illness.

The NOHSC survey found that education and awareness, training on safe practices and safe procedures and systems of work were the three most important perceived ways in the community to prevent injuries and illness. The telephone survey of body repairers revealed the same pattern, and suggests a propensity to focus on behaviour change to control risk rather than modification to equipment, etc.

The telephone survey indicates that the operators are concerned about OHS and believe it is an important issue for small business. However, while interpreting these results it should be remembered that the respondents were responding to a survey about OHS and may have believed it important to give the answers that they thought were appropriate.

The respondents indicated that they are concerned about the impact that ill-health of a worker such as a spray painter will have on their business. A number of operators indicated the difficulty they have in finding and retaining good spray painters.

Knowledge about isocyanates

While the majority of respondents to the telephone survey believed that two-pack paints are harmful and might cause lung damage, the majority (57% n= 17) were neutral with regard to the issue of asthma. It is interesting to note that 40% (n=12) of respondents were either neutral or agreed with the contention that two-pack paints are safe these days. Responses in similar proportions were found among the Ballarat and Bendigo operators and the findings are supported by the opinions of the paint supplier representatives.

Frazier et al. (2001) reviewed a random sample of MSDS for isocyanate-containing products in the United States. They report that the most common respiratory effect of exposure listed in the MSDS was “respiratory irritation” (p.91). Effects often described were non-specific and used terms such as “shortness of breath”. “Allergic respiratory sensitization” was listed by 70% of the manufacturers as an adverse effect, but the authors point out that this phrase may not communicate clearly that asthma is a risk.

Spray painting facilities and practices

All businesses visited and surveyed had at least one spray booth. Respondents indicated that they believed that spray booths are worth the investment required and did not believe that they were inconvenient or problematic. Although all businesses undertook maintenance of the filters, airflow monitoring was less common. It is possible that there was some confusion regarding the meaning of “air flow monitoring” and the researcher suspects that of those that reported that they did monitor airflow; a number simply undertook irregular qualitative monitoring. During the visits, a number of operators explained that they simply watch the movement of over spray in the booth to determine when fan maintenance may be necessary.

Most respondents believed that even small spray jobs should be undertaken in a spray booth. Two questions asked during the telephone survey revealed that seven (24%) of the respondents were either neutral or believed that spraying small amounts of paint outside the booth was acceptable. Six (20%) of the telephone survey respondents and 5 (36%) of operators visited stated that they do sometimes spray two-pack paint outside a booth. Twelve (63%) of the businesses in Ballarat and Bendigo reported that two-pack paints were sometimes sprayed outside the spray booth.

Of note is the practice of one operator visited during the preliminary visits that disciplined and finally discharged a spray painter for spraying outside the spray booth. The spray painter repeatedly undertook small spray jobs in the general workshop area to save time. This business operator has been sensitised to isocyanates and even when sitting in his office, which is removed from the workshop, immediately senses the presence of the chemical in the air as a result of early symptoms of an asthmatic reaction.

During the preliminary visits, paint storage, weighing, mixing and general handling facilities were inspected and assessed against the Australian Paint Manufacturers' Association Guidance Note: Paint Handling Areas in Panel Shops (Australian Paint Manufacturers' Association, Undated) (see Appendix 13).

Half of the paint storage facilities inspected were bunded and all but one was free of moisture and alkali materials. While all of the storage areas and paint mixing areas were clear of heat sources, the majority had electrical equipment closer than 2m. The majority of businesses did not have any means or procedure for dealing with a spill of paint and did not have fire-fighting equipment available near the storage or weighing and mixing areas.

Nine of the fourteen businesses had designated paint weighing areas but very few (21% n=3) had a clear 2m radius area around. Paint was stored within the mixing area in 6 (43%) of the facilities inspected. Only one business inspected kept open containers in the paint weighing area.

Signage around paint storage, mixing and weighing areas was generally poor and the standard of housekeeping was generally either good or fair. At two businesses the housekeeping was rated as poor. Given the potential for ignition of vapours in storage, mixing and weighing areas and the concern expressed by a number of operators in regard to the potential for fire, the standard of the facilities is perhaps surprising.

Respiratory and skin protective equipment

All businesses made respiratory protection available. However, one of the fourteen businesses visited and eight of the thirty-eight businesses telephoned indicated that it is sometimes not used when spraying two-pack paint. Nevertheless, all operators telephoned, except two that were neutral, agreed that a respirator should be used even when undertaking small spray jobs. There was less certainty regarding the need to use respiratory protection while weighing and mixing paint, but most believed that a respirator should be used while handling two-pack hardeners (i.e. the catalyst added to the paint during mixing).

Some ambivalence emerged from the responses to a series of questions asked during the surveys regarding the need for air-supplied respiratory protection; all except one of the businesses visited during the preliminary visits made air-supplied respiratory protection available although only 4 (29%) indicated that it is always used when spraying two-pack paints. Seven (50%) stated that the equipment is never used. Of the businesses telephoned, 21 (70%) made air-supplied respiratory protection available but only 8 (40%) stated that it is always used and 2 (10%) stated that it is never used. All except one of the Ballarat and Bendigo operators, made air-supplied respiratory protection available, although only three (3) of these reported that air-supplied respiratory protection is always used while spraying two-pack paints. Combining the results of the preliminary visits, the telephone survey and the targeted visits reveals that 83% of businesses surveyed (n=63) made air-supplied respiratory protection available and of these 29% (n=15) reported that it is always used when spraying two-pack paint, i.e. 71% admitted that air-supplied RPE is not always used when spraying two-pack paint.

The telephone survey revealed that operators believe that air-supplied respiratory protection is cost-effective and does not present difficulties in terms of maintenance and use. However, they believe that their spray painters find it less convenient than simple half mask respirators and, in addition to taking too much time, there is some indication that they impede vision while spraying. The responses of the Ballarat and Bendigo operators were consistent with these findings.

In general, the operators prefer their spray painters to use air-supplied respiratory protection but, consistent with the "leave it up to the workers" (Eakin, 1992) approach that is common among small business operators as discussed in Section 2.1.2, they let the painters decide whether they will use it. One business operator interviewed by telephone suggested that enforcing the use of air-supplied respiratory protection might encourage the spray painter to move to another body repair shop where its use is not enforced, and this was a risk he was not prepared to take given the difficulty in finding good spray painters.

During the preliminary visits thirteen (13) of the fourteen (14) operators stated that they undertook regular or occasional maintenance of their RPE, although inspections suggested that this might not be accurate. In the majority of cases (57% n=8) the storage of RPE was unsatisfactory, being, for example, on benches, floor or in paint storage or spraying areas. Many of the businesses indicated that they used Sundstrom half mask respirators. A number of the businesses visited used non-Sundstrom filters that are reported to offer shorter break-through times.

The majority of operators telephoned believed that they knew how to test the fit of a respirator. However, anecdotal evidence suggests that many people believe they know how to fit a respirator without knowing how to conduct a qualitative, negative pressure fit-test per se. This anecdotal evidence is consistent with the findings of work by Burgess and Mashingaidze (1999) reported in Section 4.3.1.3 above support this.

The telephone survey revealed that most operators believe that skin contact with isocyanates can be harmful and that gloves should be used when spraying two-pack paints. There was, however, less certainty regarding the need for gloves when handling and mixing two-pack paints. Notwithstanding this, nine (64%) of the 14 businesses visited reported that gloves are not used when spraying two pack paints. Those businesses that did use gloves used latex surgical gloves that offer little resistance to permeation by solvents.

Consequently, the following generalisations may be made as a result of the formative research: business operators recognise OHS as important and, in regard to safety while spray-painting, recognise the value of spray booths and respiratory protection. However, spray booths do not receive regular maintenance or airflow checks. The respiratory protection in use is commonly limited to filtering face-piece type (rather than air-supplied) and is poorly maintained and inappropriately stored. Air-supplied RPE is generally available but its use is not enforced and the decision to use the equipment is left to the spray painter. The business operators tend towards victim blaming in regard to workplace injuries and favour safe-person risk controls; they do not understand the asthma risk associated with the use of isocyanate paints and, while they accept that the paints may be harmful, they assume the effects are long term rather than acute i.e. they do not understand that sensitisation may occur in a short period of time following exposure to a relatively high airborne concentration of paint vapour and thus painting of relatively small vehicle repairs outside a spray booth is common. Without an understanding of sensitisation there is little recognition that sensitisation may result in loss of the painter from their business and their industry; loss of a painter from their business represents a significant business risk. Thus the formative research process was invaluable in gaining "a richer understanding of the customer" (Andreasen, 1995 p.139).

Both qualitative and quantitative data were collected as suggested by Andreasen (1995 p.101). The quantitative data identified; how many people were not reporting the desired behaviour; how much awareness of the problem and the solutions there was; what the feelings were towards the new behaviour; and what the media habits of the target audiences were. The qualitative data identified; the extent of the problem; who was most affected; how they could the targets be reached; what the beliefs about the benefits and costs of the desired behaviour were; the perceptions of other people's desires; the level of self-efficacy; the competition; and factors that will influence behaviour.

Thus the questions asked of the MVR operators addressed knowledge, attitude, practice and belief (KAPB) that are commonly undertaken in social marketing programs (Andreasen, 1995). Further, the data collected through the paint-supplier representative focus group and the analysis of the WorkSafe Victoria inspection program supported the data collected from the MVR operators themselves. These led to the key conclusion that air-supplied RPE is not comprehensively used while spraying two-pack paints and enforcement of use is unlikely to increase unless MVR operators understand the acute risk associated with isocyanate exposure.

To increase the enforcement of air-supplied RPE, tailored marketing messages were necessary to emphasise the benefits of and de-emphasise the disadvantages enforcement. Thus messages were developed and piloted with target groups in Ballarat and Bendigo, employing opinion leaders in the process.

4.3.10.2.2. Social marketing Stage 2: Identify Opinion Leaders

The importance of interpersonal or social networks and opinion leaders in persuading individuals to adopt or reject an innovation is discussed in Section 2.2.4.3.2 above. Valente (1996) defines a social network as a "…pattern of friendship, advice, communication or support which exists among the members of a social system." and Andreasen (1995 p.254) summarises three approaches to examining and understanding those networks and identifying opinion leaders and advocates asking people questions that identify; to whom they turn for advice with respect to the behaviour domain in question; to whom they give advice; with whom they talk about other subjects of importance; to whom they turn when they need help in the behavioural area; and with whom they socialise.

Where answers to these questions are not easily obtained, an alternative approach is simply to ask people to name those who have the reputation for being influential in the behavioural subject area or one can ask for self-reports wherein individuals indicate whether others turn to them for information or advice (Andreasen ibid.).

Thus questions asked during the formative research in Ballarat and Bendigo attempted to support the construction of a network diagram (Figure 57 in Section 4.3.9.4.1). In Ballarat and Bendigo only nine of the nineteen businesses acknowledged that they valued the opinion of other body repairers and disappointingly there was reluctance to name individuals with whom they communicate. Thus the simple approach advocated by Andreasen was adopted and complemented by conversations with VACC representatives and the business operators around the subject of local communications.

The emergence of the two opinion leaders in the network diagram was supported by the unprompted suggestion by the manager of the body repair division of the VACC of the names of the same people as being likely opinion leaders.

Interestingly, network bridges (Valente & Davis, 1999 p.63) as discussed in Section 2.2.4.3.2 above emerged between the two networks and between the Ballarat network and an unexplored network in the town of Geelong, some 88km away[10]. A greater preparedness by MVR operators to identify individuals within their respective networks would have been useful, and the reluctance to divulge information was disappointing given that conversations with the researcher made it clear that there are many more links between the operators and there is frequent use of those links. However, the researcher was unprepared to labour the matter with respondents for fear of compromising their involvement in other aspects of the case study.

4.3.10.2.3. Social marketing Stage 3: Train Opinion Leaders

The researcher initiated several telephone and face-to-face interactions between the researcher and the respective opinion leaders. The conversations during these interactions initially focussed on the identification of them as opinion leaders, explanation of what that meant and how interaction between them and their peers would be best facilitated.

[10] Ballarat and Bendigo are approximately 122km apart

Nearer the time of the MVR meetings the interactions focussed on the suitability of the marketing messages that had been developed and thus the education of the opinion leaders in regard to the risk of sensitisation associated with exposure to two-pack paint and the importance of enforcing the use of air-supplied RPE.

Initially it was anticipated that the opinion leaders would be asked to make an informal presentation on the subject at the meetings. However, it rapidly emerged that neither of the opinion leaders would be comfortable in such a role and it was decided that the researcher would deliver the key messages at the meetings and the opinion leaders would be drawn in to discussions in such a way that their support for the key proposition (that use of air-line supplied RPE should be enforced whenever two-pack paint is being sprayed) was evident.

The researcher would have preferred to engage more formally and more extensively with the opinion leaders prior to the MVR meetings but, as with all MVR operators dealt with, access to people for periods in excess of about 15 minutes was difficult given business demands.

4.3.10.2.4. Social marketing Stage 4: Intervention

Based on the findings that MVR operators appear to underestimate the risk associated with exposure to isocyanate paints, information sheets that addressed the matter of exposure and asthma and the consequences of asthma were produced. These sheets also addressed the pros and cons of enforcing the use of air-supplied respiratory protection. The arguments in favour of enforcing its use attempted to address the various barriers that MVR operators had suggested prevented them from enforcing the use. These information sheets are presented in Appendix 11.

Meetings in concert with opinion leader activity were used to promote the enforcement of the use of air-supplied respiratory protection. This activity included the distribution of written information about asthma risk and its control by the opinion leaders. While the reading of this information by the members of the respective peer groups seems to have been limited, a number of MVR operators did accept the principles and in several cases, action in regard to risk control was reportedly initiated as a direct result of the intervention.

The results show that there were some changes in attitude towards the health risk associated with isocyanate exposure in the period between the targeted visits and repeat interviews in Ballarat and Bendigo. The before and after MVR meeting results are summarised below and suggest that there was not a substantial change in attitude to wards health risk in general but there was a greater realisation that two pack paints are not safe and acceptance of the asthma risk associated with isocyanate exposure.

The results of the evaluations completed at the end of each meeting indicted that attendees did understand that exposure to isocyanate spray paints may cause asthma and there was confidence in regard to enforcement of the use of air supplied RPE, i.e. the attendees appeared to possess self-efficacy (Bandura, 1977).

4.3.10.2.5. Social marketing Stage 5: Post-intervention cross-case analysis

The results suggest that there were some changes in attitude towards the health risk associated with isocyanate exposure in the period between the targeted visits and repeat interviews in Ballarat and Bendigo. The results of interviews conducted before and after the MVR meetings are summarised below and suggest that there was not a substantial change in attitude towards health risk in general but there was a greater realisation that two-pack paints are not safe and acceptance of the asthma risk associated with isocyanate exposure. In accord with this apparent change in attitude was a change in the profile of responses in regard to the respondents' stage of change as measured using the TTM, i.e. after the MVR meetings and distribution of the information sheets, a larger proportion of the respondents appeared to have a greater understanding of the risk associated with exposure to two-pack paint and reported that they enforced the use of air-line RPE.

As might be expected given the general understanding of painting hazards exhibited by business operators, there was little change in attitude regarding the risk of two-pack paint causing lung damage (McNemar-Bowker Chi Squared Test p=0.77), and the risk of harm in general (McNemar-Bowker Chi Squared Test p=0.51) as shown in Figure 65 and Figure 66.

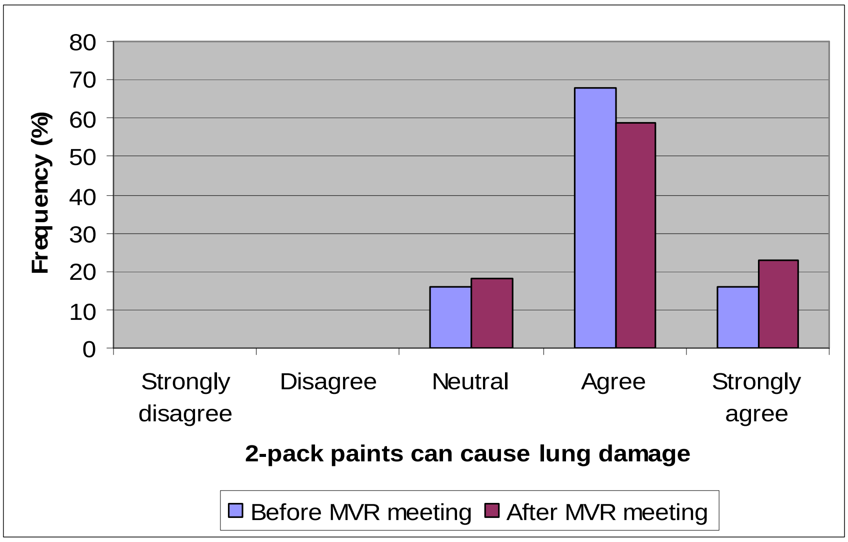

Figure 65 Attitudes towards risk of lung damage as a result of exposure to two-pack paint, before and after MVR meetings

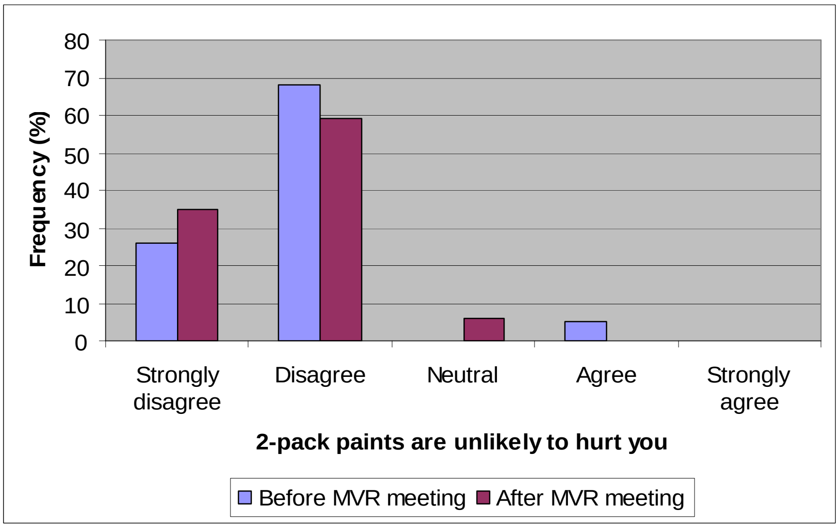

Figure 66 Attitudes towards risk of harm in general as result of exposure to two-pack paint, before and after MVR meetings

However, as shown in Figure 67 there appears to have been some change (McNemar-Bowker Chi Squared Test p=0.10) in the profile of responses from MVR operators in regard to the statement “two-pack paints are safe these days”. This contrast with the responses to the general statements about lung damage and harm may be explained by qualifying remarks that a number of respondents made that suggested that they believed two-pack paint may cause harm but are safe if used properly. Following the intervention, this attitude has apparently changed.

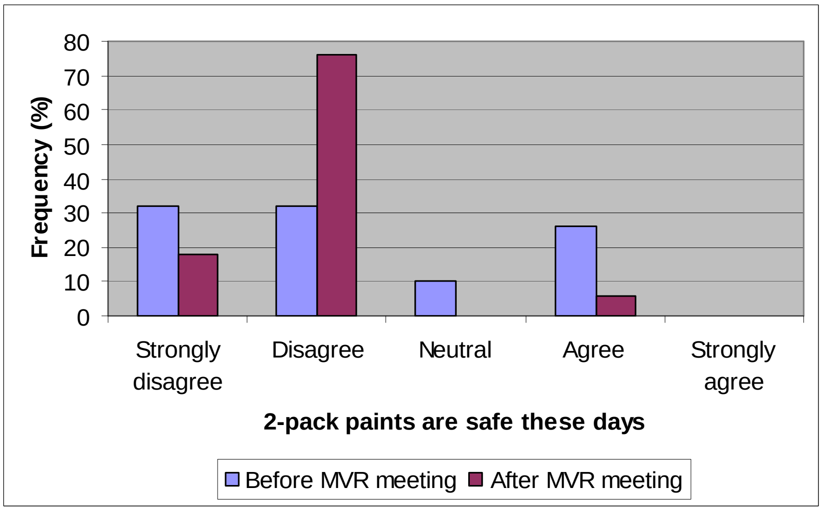

Figure 67 Attitudes towards safety of two-pack paint in general, before and after MVR meetings

Importantly in regard to the apparent ignorance of the asthma risk associated with isocyanate exposure, as shown in Figure 68, there was some change in the profile of responses from MVR operators in regard to the statement "two-pack paints can cause asthma" (McNemar-Bowker Chi Squared Test $p=0.13$) suggesting a greater understanding of the risk after the MVR meetings and distribution of the information sheets. Before the intervention, ten (53%) of respondents were neutral in regard to contention, while after, four (23%) were neutral.

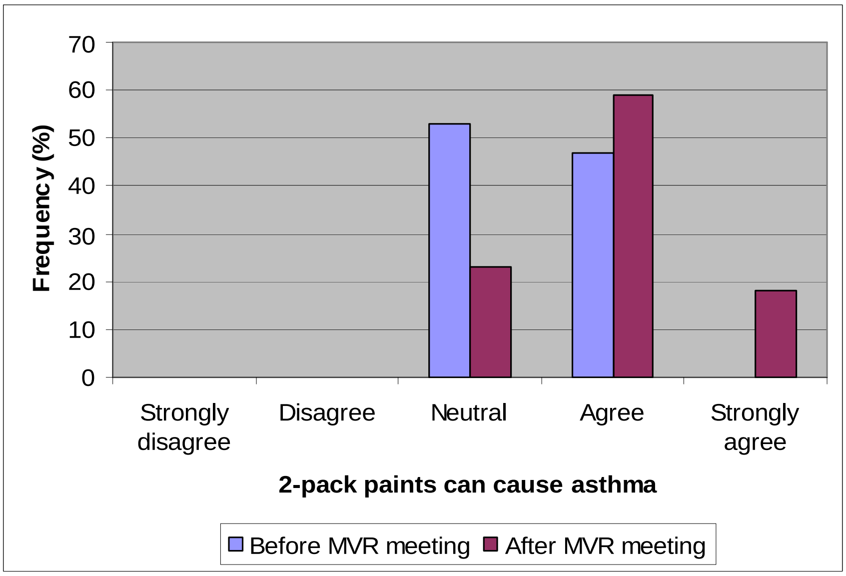

Figure 68 Attitudes towards the association between two-pack paint and asthma, before and after MVR meetings

Further to this, after the MVR meetings and distribution of information sheets, more respondents did appear to understand the risk associated with spraying even small amounts of two-pack paint outside a booth (McNemar-Bowker Chi Squared Test p=0.09) as illustrated in Figure 69. Before the intervention five respondents ((26%) agreed with the contention while after, only one (6%) agreed.

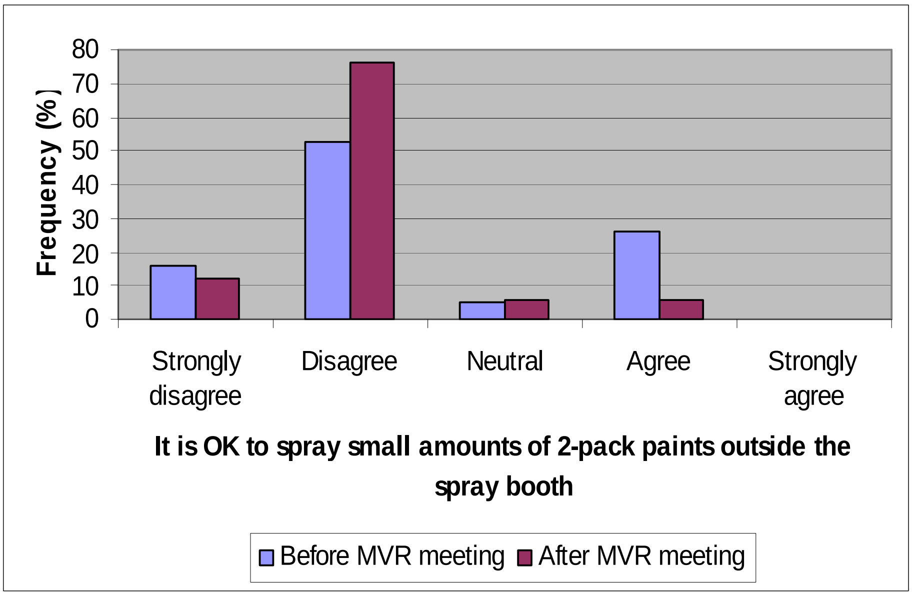

Figure 69 Attitudes towards the use of spray booths and risk to health, before and after MVR meetings

Attitudes toward the use of RPE in general did not change, as illustrated in Figure 70 and Figure 71, i.e. there was little change in the attitude towards contention that “It is OK to spray small amounts of two-pack paint without a respirator” (McNemar-Bowker Chi Squared Test p=0.61) and the contention that “Even when doing a small spray job a respirator should be used” (McNemar-Bowker Chi Squared Test p=0.43). There were, however, changes in the profile of responses from MVR operators in regard to the need for air-supplied RPE as illustrated in Figure 72 (“You do not need to use air supplied respirators when spraying two-pack paint”, McNemar-Bowker Chi Squared Test p=0.03) and Figure 73 (“I do not think it is necessary for spray painters to use air supplied respiratory protection”, McNemar-Bowker Chi Squared Test p=0.07). However, the change was apparently in the strength of opinion with, before the intervention, five (26%) of respondents strongly disagreeing and nine (47%) disagreeing with the contention that “you do not need to use air supplied respirators when spraying two-pack paint”, while after the intervention, eleven (64%) of respondents strongly disagreed and two (12%) disagreed with the contention. The numbers that were either neutral or agreed changed from five (26%) to four (24%).

In regard to the contention that “I do not think it is necessary for spray painters to use air supplied respiratory protection”, before the intervention, three (16%) of respondents strongly disagreed and 12 (63%) disagreed, while after the intervention, eight (47%) of respondents strongly disagreed and eight (47%) disagreed with the contention. The numbers that were either neutral or agreed changed from four (20%) to one (6%).

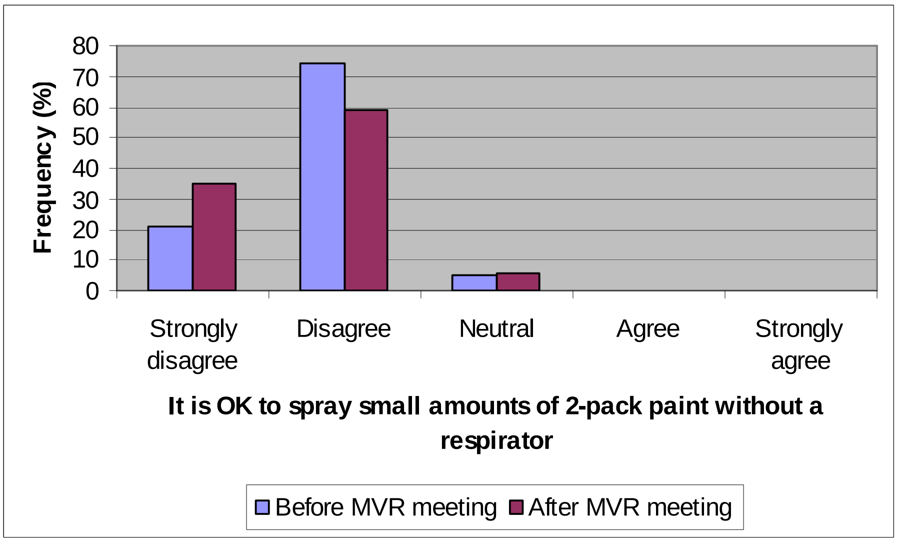

Figure 70 Attitudes towards the use of RPE when spraying two-pack paint, before and after MVR meetings

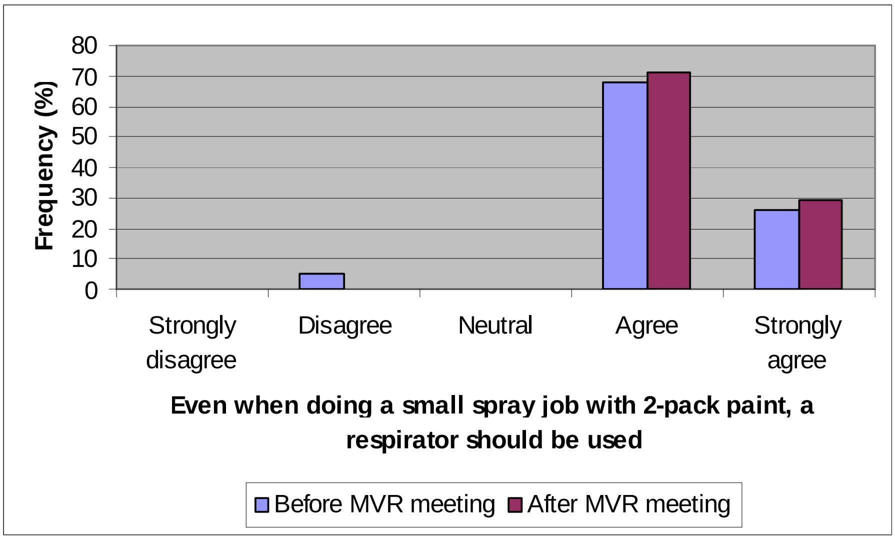

Figure 71 Attitudes towards the use of RPE when spraying small amounts of two-pack paint, before and after MVR meetings

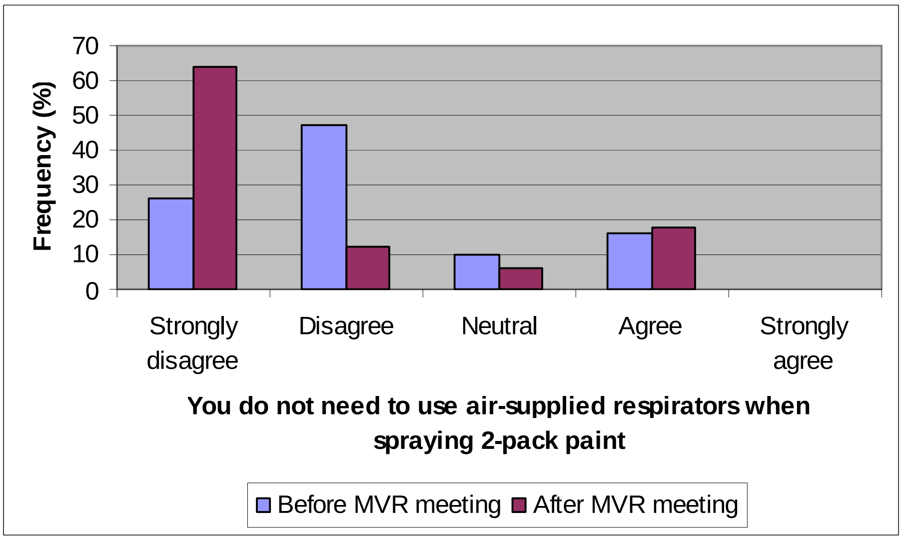

Figure 72 Attitudes towards the need for air-supplied RPE, before and after MVR meetings

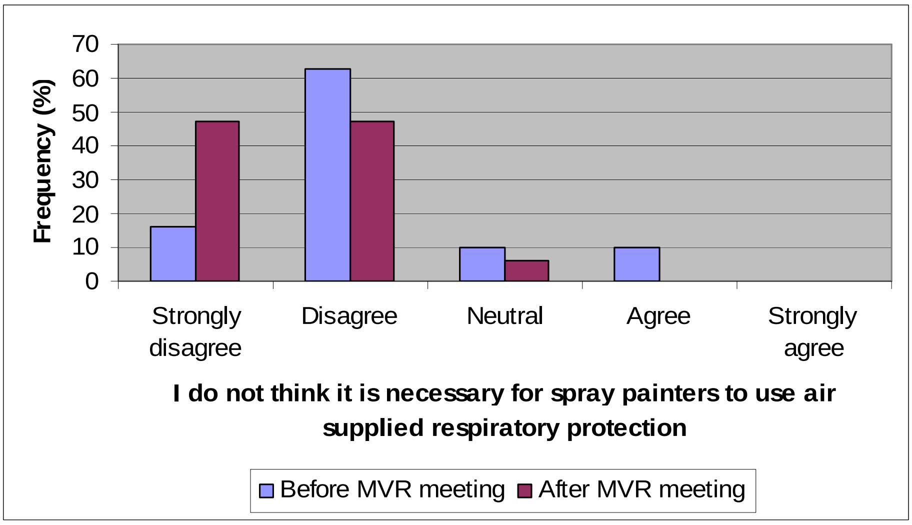

Figure 73 Attitudes towards the necessity for the use of air-supplied RPE, before and after MVR meetings

Consistent with the apparent understanding that air-supplied RPE is better than filtering face piece type, regardless of its *necessity*, there was not a significant shift (McNemar-Bowker Chi Squared Test p=0.51) in regard to the respondents' preference for their painters to use air-supplied RPE. Before the intervention only two (10%) of respondents either disagreed or were neutral in this regard, the remainder agreed or strongly agreed. After the intervention all respondents agreed or strongly agreed. This is illustrated in Figure 74.

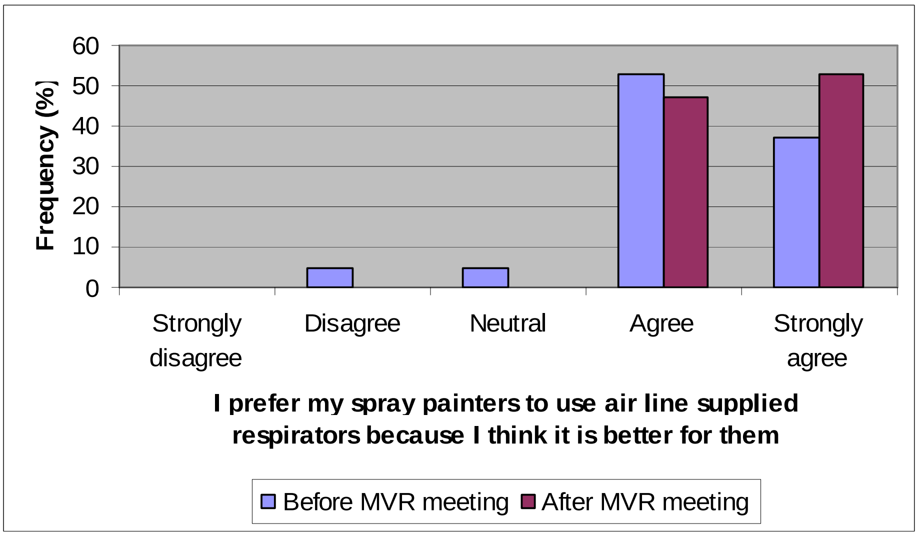

Figure 74 Preference for employed painters to use of air-supplied RPE, before and after MVR meetings

In regard to the belief that air-supplied RPE will save the MVR operators money in the long term; the findings suggest that the respondents remain unconvinced about the financial value of the investment (McNemar-Bowker Chi Squared Test p=0.51) as illustrated in Figure 75.

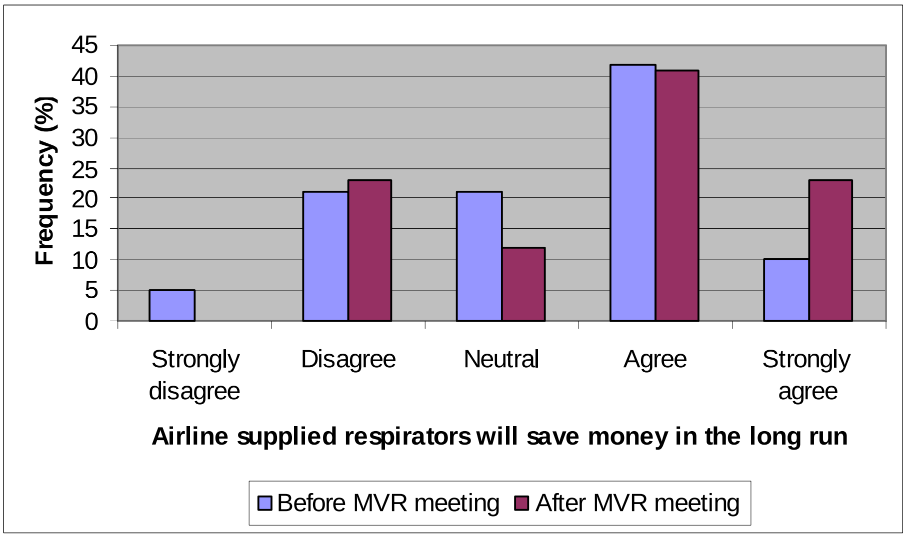

Figure 75 Attitudes towards the financial value of air-supplied RPE, before and after MVR meetings

There were apparent changes (McNemar-Bowker Chi Squared Test p=0.12) in the profile of responses from MVR operators in regard to their preparedness to enforce the use of air-supplied RPE as illustrated in Figure 76. Before the intervention, three (16%) of respondents were classified as being in the maintenance stage of change, while after the intervention eleven (65%) were classified as being in the maintenance stage of change.

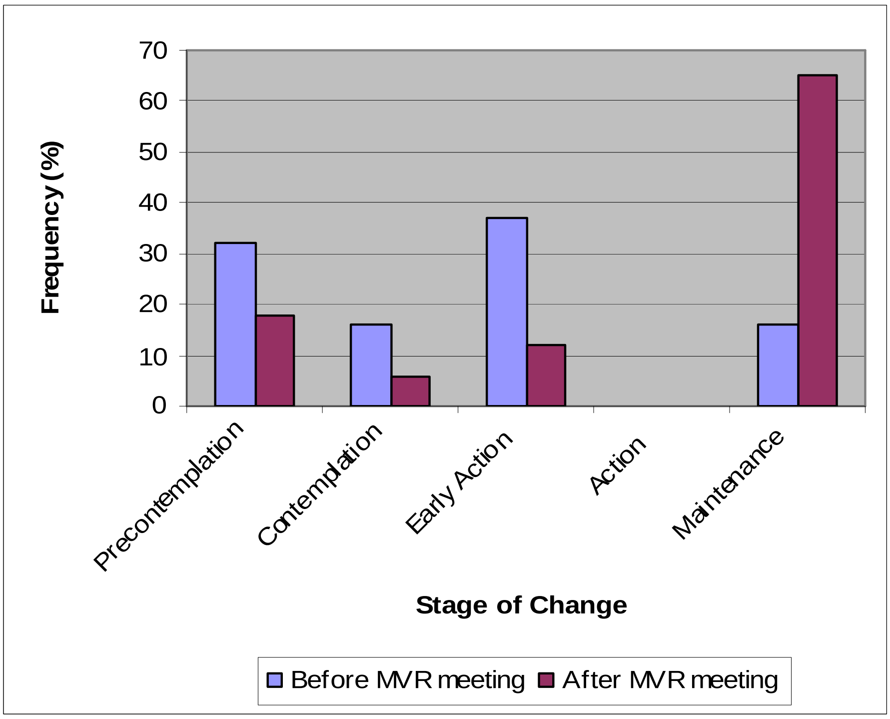

Figure 76 Stage of change regarding the enforcement of the use of air-supplied RPE, before and after MVR meetings

4.3.11. Motor Vehicle Repair Case Study Review

The case study demonstrated the value of applying social marketing techniques in combination with the TTM to assess the degree to which targets reported that they were not exhibiting the desired behaviour; to identify the perceived costs and benefits of the desired behaviour; and to develop tailored marketing messages.

The preliminary visits to MVR businesses gave the researcher an opportunity to learn about the nature of the spray painting operations as well as operator processes, practices, concerns and attitudes towards OHS. This enabled the formulation of the questions to be used during the formative research phase i.e. the telephone interviews. As such it was possible to explore knowledge, attitudes, beliefs and practices (KAPB (Andreasen, 1995)) and, in particular determine the perception of the relative importance of the asthma risk and the likelihood of it affecting the respective MVR operators. Andreasen suggests that, as a part of the backward market research process (Andreasen, 1985), one can assess the targets' against the matrix illustrated in Figure 6 in Section 2.2.4.3. This matrix is presented in a modified form in Figure 77 below. Targets are more likely to adopt the desired behaviour if the perceived consequences of *not* adopting the behaviour are *important* and *likely* to be experienced. Therefore, the aim of the social marketing program is to change the profile of the target group so that a maximum number of members are in cell number one. In the context of this case study, this matrix refers to the importance of painter respiratory health and the likelihood of a painter suffering asthma as a result of exposure to isocyanate vapour.

	High likelihood of painter suffering asthma	Low likelihood of painter suffering asthma
Painter health is of high importance	1	2
Painter health is of low importance	3	4

Figure 77 Matrix for assessing likelihood and importance of a condition (after Andreasen, 1995)

The formative research revealed that painter health is highly important to MVR operators but, while they remain ignorant of the sensitisation risk, likelihood is low. Thus the matrix may be used to demonstrate that the intervention should attempt to increase the perception of likelihood such that MVR operators may be categorised in cell number 1.

To support the strategies used to change the perceptions of the targets the formative research process (i.e. the telephone interviews) elicited further information about their perceptions of importance and likelihood and about the costs and benefits of adopting the desired behaviour.

The formative research processes therefore delivered the key KAPB information that, in general, the targets knew that two-pack paints might be harmful but did *not* know that the harm may be sensitisation leading to asthma. This finding is supported by the work of Cowie et al. (2005) who reports that there is real confusion about the health effects of isocyanates among those employed in MVR shops in the UK. They report that people think that isocyanates contain cyanide or cause cancer. This finding within the case study led to the acceptance of the practice of spraying paint while using only filtering face-piece RPE and of spraying small repair jobs outside a spray booth. The subjects knew that air-supplied RPE is better than filtering face-piece RPE but were not likely to enforce its use because they preferred to leave it up to the workers to decide whether to don or not. The benefits of enforcing air-supplied RPE use were recognised as being the provision of better protection. However, this perception was based on the erroneous belief that the effects of exposure to isocyanate were chronic rather than acute. It was also based on the perception that filtering face-piece RPE offered adequate protection, albeit not at such a high level as air-supplied RPE. The costs of enforcing the use of air-supplied RPE were perceived to be associated with the risk of losing painters who rejected the demands and consequently moved to another employer.

The targeted visits to the Ballarat and Bendigo MVR operators confirmed the findings of the formative research and classification of those operators against the Transtheoretical model (TTM) of health behaviour change (TTM) facilitated assessment of those operators' readiness to enforce the use of air-supplied RPE i.e. adopt the desired behaviour. The numbers of pros versus number of cons that were listed by the MVR operators were consistent with Prochaska and Velicer's (1997b) hypothesis regarding persons in the contemplation stage of change listing. This assisted with the subsequent development of tailored marketing messages for delivery to targets by the opinion leaders.

The effectiveness of those messages is supported by the evidence of the change in profile of the targets following the intervention. However, it cannot be concluded that the intervention *caused* the change in profile given the potential confounding factors associated with the case study, not least of these being the potential for change as a results of the activity in the sector by WorkSafe Victoria. Despite the researcher attempting to minimise this influence by securing the agreement of WorkSafe Victoria management to defer activity in the Ballarat and Bendigo regions until the case study was complete, it is possible that network bridges between the geographical study areas and areas where WorkSafe were active conveyed information that influenced case study validity.

The identification and graphic depiction of peer networks was invaluable in understanding the flow of communication within and between the case study groups. However, it was disappointing that many MVR operators were unprepared to divulge information about their communication networks given that many individuals alluded to regular use of communication channels within networks. In a number of cases it was suggested that the networks included many non-VACC member operators and, on reflection, broadening the case study to include all operators in each town would have been beneficial. However, at the commencement of the study, VACC were the project sponsors and thus limited the study population. In the course of the study VACC support and interest diminished owing to several changes in personnel.

Other limitations in data provision and involvement of peers with opinion leaders were related to suspicion and business competition. Increasingly MVR operators report that they are subject to restrictions on pricing and therefore profit imposed by insurance companies (almost every MVR involved in the case study relied on vehicle repairs that were insurance-funded). The payments from insurance companies to Victorian MVR operators was $23 per hour, a rate that has increased by only $2 per hour in the thirteen years to 2003 (Switzer, 2003). This compares with an hourly rate of $55 to $65 per hour simultaneously charged in other allied motor vehicle industries. The MVR operators reported that a reduction in the number of insurances companies increased their bargaining power and restrictions placed upon prices paid for repair work. This has, in turn, increased the competition and suspicion between operators. Further, a perception that the VACC has not acted in support of members has led to declining membership and further decline in cooperation between operators. Switzer (2003), in his review of this issue for the Australian newspaper reports that collective negotiation of better hourly rates has been restricted by the Australian Competition and Consumer Commission (ACCC) that would view such action as collusion. Interestingly, MVR operators report that more favourable rates of pay have been negotiated in New South Wales and that in the UK similar problems have led to a restructuring of the quoting system used by MVR operators and insurance companies.

While financial constraints on MVR operators increase they report that attention to OHS decreases. Many business operators reported that they did not expect the business to survive into the long term in its current form and, in the succession planning process some were beginning to specialise in markets such as detailing for vehicle retailers, vintage vehicle repair and “hot-rod” building. The sudden awareness of the short-term risk associated with the acute nature of sensitisation processes appeared to influence some of the operators in this regard i.e. the threat of loss of spray painters in the short-term is significant.

While the influence of the opinion leaders and the targeted messages contained within the information circulated is equivocal in terms of the statistically significant change found in the profile of responses to questions by the MVR operators, the social marketing tools and the TTM were found to be of value. The case study has demonstrated that ignorance regarding the risk of sensitisation limits the likelihood of adoption of the desired behaviour and, notwithstanding the results, MVR operators report that WorkSafe information is influential. Therefore is possible that melding the use of opinion leaders with the distribution of messages containing targeted messages will be fruitful. Further, the identification of opinion leaders that are targeted for the delivery of messages by WorkSafe inspectors may increase adoption through the delivery of those messages via the peer group communication networks. Potentially, greater interaction by WorkSafe inspectors with opinion leaders, compensated for by less interaction with peers will deliver more cost-effective adoption of desired behaviours.

5. Discussion

The hypothesis that underpinned the research reported within this thesis was that the social marketing model, currently used in other disciplines, is transferable to the OHS discipline for the purposes of increasing the rate of adoption of OHS risk controls within small businesses. The focus of the work was on small business decision-maker behaviour in regard to influencing the adoption and management of risk controls. The hypothesis was tested through the conduct of three case studies involving small businesses in; the commercial fishing industry; the plastering sector of the construction industry; and the motor vehicle repair (MVR) industry.

This section reviews the research methodology employed and draws together the key ideas that have emerged from the research and reflects on those ideas in the light of the literature review and against the research hypothesis and the research questions. In particular, the discussion explores the findings of the research in regard to the attitudes of the small business operators involved in the case studies and the obstacles they face in the adoption of technological OHS risk controls. The value of social marketing as a framework for use within OHS interventions is discussed. As a central element of the framework, the Transtheoretical Model (TTM) of health behaviour is reviewed in regard to its value and efficacy in the categorisation of small business operators; for assessing the position of small business operators on a stages of change continuum; and in tailoring marketing messages to suit that position. The role of social networks and opinion leaders among small business as an element of a social marketing intervention are also discussed. Finally, the implications of the research findings in regard to OHS interventions are discussed.

5.1. Research Methodology

At research design stage, the value of action research as a methodology to be employed when exploring real-life problems, such as those encountered within the OHS discipline, was discussed and justified (see Section 3.2.2). The close parallels between the social marketing and action research methodologies meant that, within this research, they were complementary. The relationship between social marketing and action research is discussed in further detail below.

Case study was identified as a methodology that was suitable for doing exploratory research that would "…involve empirical investigation of a phenomenon within its real life context…"(Robson, 1997 p.53). Robson (op. cit.) suggests that case study is suitable to; find out what is happening; to seek new insights; to ask questions; to assess phenomena in a new light; and is usually, but not always, qualitative.

Three case studies were made available and evidence was, to varying degrees, gathered through each to enable testing of the hypothesis. Yin (1989 p.57) suggests that "Each individual case study consists of a whole study, in which convergent evidence is sought regarding the facts and conclusions for the case; each case's conclusions are then considered to be the information needing replication by the other individual cases". Although the timeframes within which the research was completed prevented each being "whole studies", the multiple-case results provide an opportunity for generalisations to be made. Central to case study is drawing on multiple sources of evidence. The MVR case study was a whole study that drew on various sources during the formative research phase in particular, namely; site visits; telephone interviews; meetings; and data from WorkSafe Victoria regarding a program of inspections among MVR operations located outside the regions where the case study participants were located.

Case study construct validity (Yin, 1989 p.42) was assured through the early selection of the specific types of changes that were to be studied. This specifically referred to the use of a stages of change model that has previously been tested in other domains; namely the Transtheoretical Model (TTM) of health behaviour (Prochaska et al., 1998; Prochaska et al., 2002; Prochaska & Velicer, 1997b). The tactic of increasing construct validity through the establishment of a chain of evidence was employed (Yin, 1989).

Although Yin (op. cit. p.43) states that internal validity is a concern only for causal or explanatory studies and therefore is less likely to be of concern to the case study researcher, he suggests that the concern over internal validity for case study research may be extended to the broader problem of making inferences. He states that:

> "Basically, a case study involves an inference every time an event cannot be directly observed. Thus, an investigator will "infer" that a particular event resulted from some earlier occurrence, based on interview and documentary evidence collected as part of the case study. Is the inference correct? Have all the rival explanations and possibilities been considered? Is the evidence convergent? Does it appear to be airtight? A research design that has anticipated these questions has begun to deal with the overall problem of making inferences and therefore the specific problem of internal validity."

During the case studies there was reliance upon self-reports by respondents to the various questions asked of them. Given that there was a reliance upon a statement of intention by respondents regarding their behaviour and that this differs from an observable act (Weinstein, 1988), the formative research framework (Andreasen, 1985, 1995) and the TTM were particularly useful and delivered convergent information.

In regard to external validity in case study and confidence that findings may be generalised, Yin (1989) argues that an analogy to sampling is inappropriate. He suggests, "In analytical generalization, the investigator is striving to generalize a particular set of results to some broader theory." (op. cit. p.44) and, "…a previously developed theory is used as a template with which to compare the empirical results of the case study. If two or more cases are shown to support the same theory, replication may be claimed." (op. cit. p.38) Notwithstanding the differing extents to which the three case studies were performed, each supported the theory through the successful application of different elements of a social marketing framework.

Yin (op. cit.) suggests that the aim of reliability in case study is to ensure that if a later researcher followed exactly the same procedures as described by an earlier investigator, the later investigator would arrive at the same findings and conclusions, i.e. doing the same case study again rather than replicating the work in a different case study. Thus the research was conducted "….so that an auditor could repeat the procedures and arrive at the same results." (Yin, 1989 p.38) and all survey instruments, intervention tools and details of case study subjects have been recorded in appendices to this thesis to the extent that the requirements of the University of Ballarat Human Research Ethics Committee will permit.

Notwithstanding the above, the choice of a qualitative research methodology resulted in the employment of a mixed methods approach. Application of the action research spiral invoked a positivist methodology for the conduct of empirical research into the efficacy of trowel boxes. Thus various methodologies were drawn on as required during the evolving exploratory study. The specific detail and suitability of action research and social marketing as research methodologies are discussed in subsequent sections of this discussion.

5.2. OHS & Small Business

5.2.1. Attitudes toward OHS

The case studies led to interaction with a diverse range of people engaged in small businesses operating in three very different industry sectors; namely commercial fishing, construction and motor vehicle repair (MVR). However, a number of commonalities were identified and many of the characteristics of the individuals that were observed are consistent with reports in the literature.

Few businesses that participated in the research had formal arrangements for managing OHS. This was observed among MVR operators in regard to managing hazardous substance exposure and risk of, and response to fire; it was observed among plastering contractors in regard to their failure to undertake risk assessments of equipment; and among fishers that had only very recently introduced to the concept of vessel OHS management plans. It is suggested (Vickers et al., 2003; Walters & Lamm, 2003) that unsatisfactory arrangements for control of risk account for work in small business being more dangerous than in larger business.

Jones (1997), Mayhew (1997c) and Lamm (1999) suggest that small businesses are less able to match the resources that larger businesses have at their disposal and Jones (1997) suggests that, because of economic pressures, provision of safety equipment and updating of process equipment may be a low priority. In this regard, Walters (2001) proposes that typically small businesses have limited development of safety management resources, less trade union involvement, limited access to external health and safety services, limited experience on the part of both workers and employers and infrequent inspection. Conversations with MVR operators confirmed these factors and, in particular, the perception that insurance companies were paying less for vehicle repair work led to the prospect of expenditure on risk controls being dismissed in some cases. However, 38% of businesses in the MVR sector in Victoria were subject to visits by WorkSafe inspectors focussing on spray painting safety and the review of WorkSafe Project 888 suggests that these visits did bring about some change. Few plastering contractors or fishers reported any interaction with WorkSafe inspectors.

Elliott and Shanahan (1995), Vickers et al. (2003) and Lamm (1999) have suggested that there is a lack of recognition of the OHS problem within small businesses and that small business employers generally perceive their workplace as being low risk. This was found to be the case among the fishers and MVR operators that participated in the cases studies with neither groups recognising the risks associated with working without PFD's and without air-line supplied RPE, respectively. Eakin (1992) pointed out that, despite the prevalence of injuries and ill-health in the sector as a whole, adverse events at individual worksites are rare and identified this as a factor in reducing the perception that there could be a negative event. She suggests that this in turn reduces the likelihood of preventive action. Mayhew and Gibson (1996) interviewed 500 builders across Queensland and found that the perception of exposure to hazards and illness and injury patterns were mismatched. In particular chronic back injuries were common, but manual handling tasks were rarely identified as hazardous. In this regard, the current study showed that few plastering contractors were aware of the potential for uncontrolled descent of masts on certain models of panel lifter and few MVR operators were aware that asthma may be a consequence of isocyanate exposure. The "healthy worker effect" (Redlich et al., 2001) and the potential for underestimation of the true prevalence of asthma in the MVR sector was discussed earlier. Further to this, Ashford and Zwetsloot (2000) suggest that in any enterprises acute chemical accidents are rare and therefore, even where controls have been implemented, there may be no positive feedback and therefore no reward for the effort.

In regard to the causes and prevention of accidents, the findings of the MVR operator and fisher case studies is consistent with the work of Eakin (1992) who found that, in general, owners understood the concept of workplace health primarily in terms of personal behaviour of employees and referred to worker carelessness and use of personal protective equipment when asked about OHS and risk control i.e. they adopt a fault doctrine that attributes blame to victims of accidents and they favour lower order or “safe place” risk controls (Culvenor et al., 2003; Wigglesworth, 1978). These beliefs about accident causation and risk control are contrary to contemporary occupational health and safety theory and practice and correspond with the findings of a survey of Health and Safety Representatives in South Australia during 1996 (Culvenor et al., 2003) and a NOHSC-commissioned community survey undertaken in 1998 (National Occupational Health and Safety Commission, 1999). The NOHSC survey revealed a general tendency within the community to focus on person-centred causes of injuries and ill-health with the majority of respondents citing (in descending order) lack of training and education, pressure or stress and worker being careless as the top three causes. Respondents to the NOHSC survey similarly focussed on person-centred prevention measures, citing “education and awareness”, “training on safe work procedures” and “safe procedures and systems of work” as the three most important perceived ways in the community to prevent injuries and illness. Respondents within the MVR operators’ and fishers’ groups revealed similar tendencies when asked the same questions as were used in the NOHSC survey.

Aggregation of the responses of MVR operators and fishers (n=88) to the NOHSC survey questions lends further support to Eakin’s (1992) generalisations about small business operators[11]. Figure 78 show the aggregated responses of the MVR operators and fishers group to the question “in the community at large, what is the main cause of work-

[11] The NOHSC survey was not applied within the plasterer case study

related injuries and illnesses" and compares these with the NOHSC findings from members of the community (n=2510) asked the same question (National Occupational Health and Safety Commission, 1999).

The proportions of the two groups that nominated the respective main causes from the NOHSC survey list were compared and found to differ (chi squared p=<0.001). As shown in Figure 78, while both the NOHSC respondents and the combined MVR operators and fishers group tended to focus on personal behaviour as the main cause of injury and illness, fifteen percent (15%) of NOHSC survey respondents and 49% of the sample of small business respondents cited worker carelessness as the main cause of work-related injury and illness. Aggregation of the responses to the three causes that may be regarded as "safe-person" related (i.e. worker being careless; lack of training and education; and alcohol or drugs) and comparison with an aggregation of the other causes that may be regarded as management-related or out of the control of the worker (dangerous equipment and procedures; lack of supervision; pressure or stress; dangerous chemicals or substances; boring or repetitive work) found that the groups differ (chi squared p=<0.001). This difference suggests that the group of combined small business operators exhibited a stronger tendency towards "safe-person" causes of injuries and illnesses. The frequencies used in these comparisons are contained in table 257 in appendix 14.

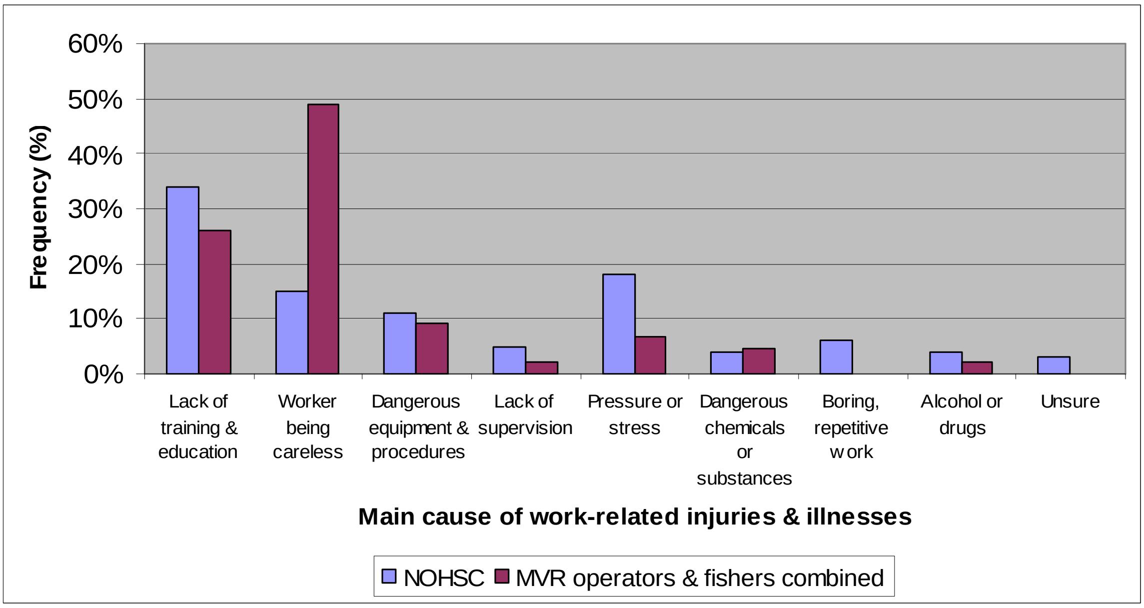

Figure 78 Causes of work-related injuries and illnesses: NOHSC survey of community perceptions and perceptions of MVR operators and fishers

In regard to prevention of work-related injuries and illnesses in the community in general, respondents were asked to select from a list, what they believed was the most important prevention measure. As shown in Figure 79, among both the NOHSC survey sample and the combined group of MVR operators and fishers, “education and awareness about OHS”, “training on safe work procedures” and “safe procedures and systems of work” were the three most important perceived ways to prevent injuries and illness. This again reflects a “safe-person” attitude towards risk control among the case study groups. The proportions of the two groups that nominated the respective most important ways to prevent work-related injuries and illnesses, chosen from the NOHSC survey list, were compared and found to be consistent with one another (chi squared p=<0.10). The frequencies used in these comparisons are contained in table 258 in appendix 14.

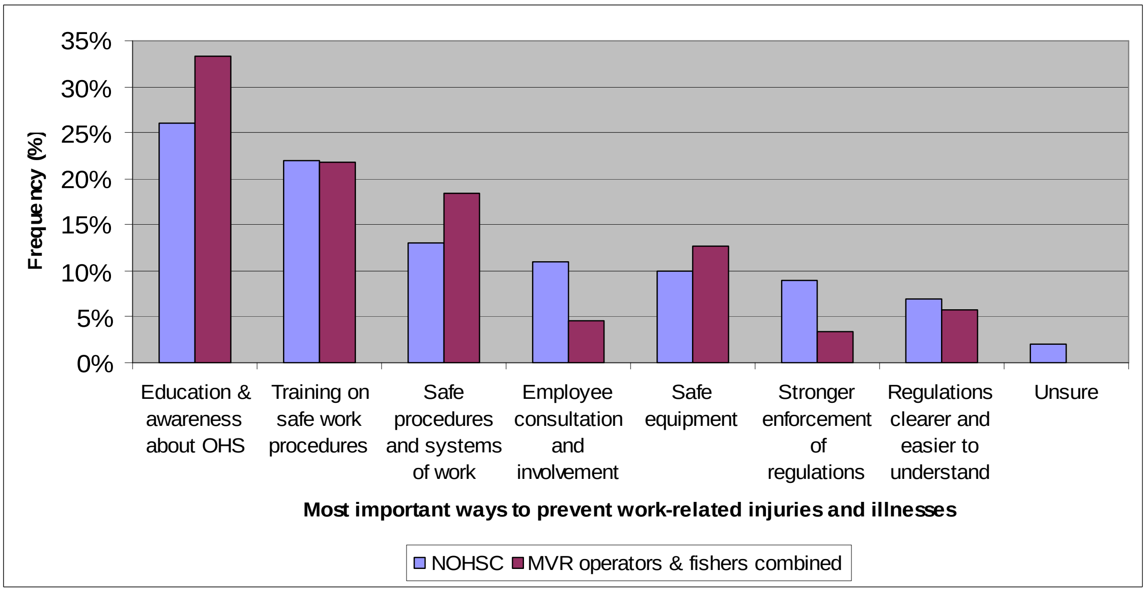

Figure 79 Prevention of work-related injuries and illnesses: NOHSC survey of community perceptions and perceptions of MVR operators and fishers

Eakin (1992) categorised small business operators’ perspectives on roles and responsibilities with respect to health-related behaviour of employees. These perspectives ranged on a continuum from “coming down hard” to “leaving it up to the workers” as discussed in Section 2.1.2 above. Within her sample population, Eakin found that the “leaving it up to the workers” approach was the most common. This was observed among the fishers and MVR operators in particular, with them preferring to allow individual workers to decide whether or not to wear PFD’s or air-supplied RPE.

Eakin (op. cit) relates the “leave it up to the workers” approach to operators not believing that they have control or legitimate authority over the health and safety behaviours of their employees; this belief being influenced by social relationships with employees. Vickers et al. (2003) and Walters and Lamm (2003) comment of the relationships that small business operators have with their employees and support Eakin’s “leave it up to the workers” approach in reporting that health and safety issues are often treated as an individual rather than corporate responsibility. Within the case studies this emerged and seemed particularly pronounced among operators whose family members were employees. Vickers et al. (2003) point out that it may be harder for managers in small businesses to discipline staff because of their close relationship with staff and a further factor may be the difficulty and expense of recruiting replacement staff. The limited number of spray painters available for employment and the fear of losing a good painter was clearly a factor that influenced the MVR operators’ preparedness to enforce the use of air supplied RPE.

Conversely, as Vickers et al. (2003) suggest, the close nature of the relationships can be a positive attribute with respect to the business operator wishing to protect their employees and that a paternalistic concern for the workforce may be reinforced by family involvement in the business. More than half (53%) of the respondents to the Vickers et al. (op. cit.) survey indicated that their motivation for adopting improvement measures had been a desire by management to protect their workforce and/or reduce risk. Among the MVR operators interviewed by telephone, 97% (n=29) indicated a similar motivation when they either agreed or strongly agreed that “For health and safety alone, a spray booth is worth the investment”.

5.2.2. Small business and OHS information

Elliott and Shanahan (1995) reported that small business operators work in an “information vacuum” and David Caple and Associates (1996) reported that many small businesses act on the basis of personal experience and information obtained through personal contacts, many of whom do not have credible OHS knowledge. Briggs and Crumbie (2000) found that a verbal rather than written culture predominates in small business and this has been linked to the lower percentage of small businesses that take action on OHS as a result of mail shots (9%) rather than from face-to-face contact such as seminars (47%) and inspections (43%) (Vickers et al., 2003). The telephone survey of MVR operators found that 60% relied on their industry association (VACC) for information about OHS and anecdotally many reported that they did not read unsolicited information received by mail. However, the population was drawn from VACC members and sources used by operators having no affiliation remains unknown.

The telephone survey also found that 53% of MVR operators relied on paint suppliers for OHS information about paint and painting while 67% did not appear to be aware that the use of two-pack paint may expose painters to the risk of asthma. Briggs and Crumbie (2000) found that, despite respondents working with chemicals that all had well documented detrimental effects, about two thirds (64%) of users thought that the chemicals they used posed little or no risk and only 8% indicated that they thought that there was a high risk. As Topping et al. (1998) report, a lack of information not only influences the likelihood that an employer will control risk, but it also influences the *level* of control that will be applied. It is concluded that the "arms-length tools" (e.g. electronic media, radio and television, mail shots and leaflet campaigns) (Walters, 2001) that have previously been employed to reach the target groups that were the subject of this research, have not made them aware of the respective risks they face nor instilled within them attitudes that lead to appropriate types and levels of risk control.

In regard to the use of traditional "arms-length tools" and in support of social marketing as an approach to intervention, Andreasen (1995 p.150) contrasts educators with social marketers. He suggests:

> "…the former will often inundate the target with information that the sources think is important. The latter will start by listening to targets and adjust messages to align with what is important to those targets, in a language that is appropriate, through vehicles that they will pay attention to. The social marketer typically measures success at this stage through assessment of knowledge, values and attitudes and resists the temptation to measure tangibles such as numbers of brochures distributed".

5.3. Social Marketing

5.3.1. The social marketing process

Andreasen (1995) suggests that recognition that the target audience has the primary role in the social marketing process is central to the success of social marketing, sets social marketing apart from commercial marketing and is a mind-set that the social marketer needs to adopt. As such, the social marketer must recognise that the target audience is in control of the marketing transaction and the marketing is therefore not organisation-centred. Organisation-centred social marketing results from a belief that the product (or desired behaviour) being marketed is superior or inherently good and therefore is a product that the targets will naturally wish to adopt. Organisation-centred also results from a belief that the targets are the problem and their failure to adopt the desired behaviour or product is a result of a character flaw. Acknowledging these fundamental characteristics of social marketing were essential to the research and the recognition of the potential for there being no demand or negative demand (Kotler et al., 2001) for the products (enforcement of PFD use, enforcement of air supplied RPE use and purchase and use of trowel boxes and fail safe panel lifters) that underpinned the investigations within each case study.

Of particular benefit to the intervention was the formative research phase of the social marketing process that aimed to gain “a richer understanding of the customer” (Andreasen, 1995 p.139). The structured approach to formative research that is proposed by Andreasen (1985; 1995) not only yielded ethnographic information but also information that was central to an understanding of the knowledge, practice, attitudes and beliefs (KAPB) of the targets. Thus the key information about knowledge of sensitisation and asthma and attitudes towards wearing of PFD’s at all times when at sea versus when crossing a bar, working in-shore or during rough weather became clearly apparent. While it may be preferable for fishers to wear PFD’s at all times, such a rule may lead to rejection of any use and thus a higher level of protection may be afforded if the skippers are empowered to enforce the wearing of PFD’s at times when their risk assessment has deemed it necessary for PFD’s to be donned. This is analogous to the percentage time worn theory of Else (Else, 1975) as applied to the use of personal hearing protection and extended to other forms of personal protective equipment (Else, 1981). The social marketing process thus gave an insight to the targets' risk perception rather than relying on the marketer's risk perception; it provided a contrast between the subjective risk assessment of the marketer and the subjective risk assessment of the target; the assessment by the latter being informed by their understanding of the context and nature of the risk. Peattie and Peattie (2003) point out in their critique of social marketing that it can overcome the shortcomings of predominantly educational approaches to influencing behaviour. They suggest:

> "Such approaches tended to be 'expert led', with an emphasis on the expertise of those who understood why and how public behaviour, for at least a certain sections of the population, needed to change…It was the message and the expertise behind it that dominated the agenda, not the nature, needs and likely responses of the target audience." (p.366)

The questions that were developed for use during the formative research phase within each case study were similar. Given the conclusion that the formative research process derived valuable information about the targets' knowledge, attitudes, knowledge, attitudes, beliefs and practices (KAPB (Andreasen, 1995)) it is possible that the list of questions might be developed into a template for use in subsequent studies.

Further, the formative research *process* caused reflection on the product that was being marketed. The product was, in each of the three case studies, a behaviour i.e. the enforcement of the use of a device that would reduce risk to the user. While social marketing has been used within the OHS discipline previously, the product has been behaviour to be adopted *by an individual exposed to a risk*, for example the use of personal hearing protection in noisy work environments (Lusk et al., 1997; Lusk et al., 1994; Melamed et al., 1996; Stephenson & Stephenson, Undated)[12] or healthy behaviours at home and work (Guidotti et al., 2000; Guidotti et al., 1996; Guidotti et al., 1997) or individual action in regard to control of wood dust (Brosseau et al., 2002; Lazovich et al., 2002) or adoption of a protective behaviour such as avoidance of structural collapse among fire fighters (Welbourne & Booth-Butterfield, 2005). This research focussed on

[12] This MS PowerPoint presentation does note specifically refer to "Social Marketing" but uses the health belief model within a social marketing framework

behaviour of *decision-makers* having responsibility for the health and safety of others and is thus unique.

The application of social marketing to influence the behaviour of decision-makers presented a challenge in determining exactly what, in social marketing terms, the "product" was. In the case of individual behaviour the desired behaviour is relatively apparent, e.g. 100% use of a personal hearing protection device while in a noisy environment or use of air-line supplied RPE at all times when spraying two-pack paint. However, in the case of the behaviour to be exhibited by the decision-maker, the process of deciding exactly what that behaviour may be exhibited as, was challenging and at the outset there was a tendency to describe and thus assess the decision-makers' behaviour in terms of employee behaviour e.g. measuring how many of a MVR operator's painters are wearing air-line supplied RPE at all times when spraying two-pack paint. The anchoring of a precise, concise and definitive term to describe the desired behaviour of the decision-maker was essential to the formative research as well as the segmentation of the target population and categorisation against the TTM (discussed below).

In addition, the formative research process causes reflection on the targets' attitudes towards the product. Of particular value was reflection on attitudes towards the benefits of the product, which caused the researcher (the social marketer) to review the evidence that supports the contention that the product is indeed of benefit i.e. reduces risk. While a strong evidence-base was found to support the use of air-supplied RPE while spray painting and PFD's while on-board a commercial fishing vessel, there was no evidence-base to support the contention that trowel boxes reduced risk. The absence of an evidence-base to support trowel box use caused the researcher to, as it were, be thrown out of the upward strategic social marketing cycle and undertake empirical research to establish an evidence-base that would either support or deny support for the marketing of the devices.

OHS change and risk controls are, in this author's experience and as suggested by Robson et al. (2001), frequently introduced without adequate reference to an evidence-base that supports them being employed. This may, at least in part, be explained by the very limited funds available within Australia, as well as in some other countries, to support the conduct of developmental and empirical research (Wigglesworth, 2001a, 2001b) that may build evidence in regard to what risk controls are successful. However, many occupational health and safety (OHS) interventions are undertaken without a strong evidence base (Schulte et al., 2003), and practitioners may be tempted to adopt risk controls because they appear intuitively obvious (Robson et al., op. cit.). OHS practitioners do not regularly search for an evidentiary base before applying risk controls (Robson et al., op. cit.) and this is linked to the relative immaturity of the OHS Profession and the freedom of unqualified OHS practitioners to practise in Australia (Cowley, 2005a, 2005c). Thus the employment of a social marketing framework may offer triggers that will stimulate practitioners to question the efficacy of a risk control and seek greater evidence of its efficacy before its introduction.

5.3.2. Stage of change

One part of the formative research process involved the assessment of the targets' readiness for change against Prochaska and Velicer's (1997b) Transtheoretical Model (TTM). Gielen and Sleet (2003 p.66) suggest, "the selection of the most appropriate theory is situation-specific and depends on the specific audience, the setting and the characteristics of the behaviour to be changed." The TTM was chosen after reviewing the various stages of change models. It was concluded that the model represented a useful simplification and refinement of many of the principles of other stages of change models; lent itself well to the social marketing process; and was consistent with Rogers' Innovation-Decision Process. The latter was considered important as a process that would drive the adoption of the desired behaviour beyond the case study groups. As Whitelaw (2005 p.253) comments in a critical review of the TTM, "it appeared to have an intuitive attractiveness."

The change theories that are the basis for the TTM assume that people weigh the expected benefits of a precaution against its costs and adopt the precaution if the balance appears favourable (Weinstein, 1988 p.358). Marshall and Biddle (2001) identify a strength of the model being that it treats behaviour change as a dynamic rather than "all or nothing" phenomenon (p.229). Prochaska et al. (1997 op. cit. p.40) refer to the individual's assessment of pros and cons as "Decisional Balance" and suggests that the balance must change as an individual moves through the stages of change. Their research shows that generally the cons of changing are higher than the pros for people in precontemplation and the pros increase between precontemplation and contemplation. The process of eliciting the subjects' perceived pros and cons in regard to the enforcement of air-supplied RPE and PFD's during the case study research was useful in regard to gaining further insight to the costs and benefits and matters that are important to the subjects i.e. gaining an insight to beliefs.

Central to moving targets through the stages is the recognition that individuals act on the basis of beliefs (Andreasen, 1995). The most important set of beliefs in this context are beliefs about the positive and negative consequences of the behaviour; about what others expect; and about the targets' perceived ability to carry out the action, i.e. self efficacy.

In the discussion of past experience Kunreuther et al. (1985) point out that adoption of protective activities differ from consumption goods because the rewards may not be apparent or immediate. Rewards are received only when a particular state of nature occurs (e.g. an accident). Weinstein (1988) discusses this issue in the context of cost versus benefit of adoption of a precaution. He suggests that costs are usually certain whereas the benefits are more hypothetical. Where the risk is chronic and the effects on the person and the organisation may be remote in time, creating demand is particularly difficult as the price is likely to appear high relative to the perceived benefits. Kunreuther, Sanderson, and Vetschera (1985) identify that people are often willing to protect themselves against risks which will have a moderate frequency of occurrence even though the potential loss is small. On the other hand, they are often reluctant to protect themselves against low probability events with high losses. This was apparent in regard to the MVR operators and the fishers who respectively are unlikely to see a case of sensitisation or a drowning among their own employees even though the incidence of severe events such as these are significant for the community as a whole. The purchase, supervision and maintenance of a PFD, air-supplied respirator, trowel box or fail safe panel lifter are unlikely to be recognised as investments that have yielded a return where the absence of an injury or the continued health of a worker are the result.

Stages of change models have been very widely used in public health interventions and to some extent used within OHS interventions (see for example Guidotti et al., 2000; Guidotti et al., 1996; Guidotti et al., 1997; Stephenson & Stephenson, Undated), but all have focussed on the behaviour of the risk-exposed individual rather than decision-maker behaviour. As discussed in regard to describing the desired behaviour at program establishment time, identifying the characteristics that categorise an individual against any one stage of change is challenging. Flow charts were designed to use in determining the stage of change of a subject and during the design process there was a tendency to address the behaviour of the decision-makers' employees rather than that of the decision-makers themselves. The flow charts could only be completed once the precise statement of the desired behaviour had been anchored, i.e. the characteristics of the decision-maker that might be identifiable at each stage of change were derived from the statement of the desired behaviour.

Having developed the flow charts as tools for applying the TTM, the application process was straightforward. The fishers' case study demonstrated that the skippers could be very simply categorised in regard to their preparedness to enforce the use of PFD's. In accord with the outcomes of the formative research, and supported by the literature regarding imposition of authority on employees (see for example Eakin, 1992; Lamm, 1999) and the decision making processes of commercial fishers (Brooks, 2004), application of the TTM yielded expected results in regard to the majority of fishers being at Precontemplation stage.

Similarly, the tool used to assess the readiness for change of the MVR operators was very useful and yielded results as expected before the intervention. After the MVR meetings and interactions between opinion leaders and followers, the tool became very useful as a lead indicator in the evaluation of the intervention and was able to demonstrate what appeared to be a shift in attitude among the case study population such that a greater proportion of MVR operators were categorised in the Maintenance stage of change. The sample population was, however, small and was further reduced by the loss of one subject owing to the closure of his business, and the statistical confidence in the shift is low (Chi Squared Test $p=0.12$).

Brug (2005 p.247) critically reviewed the TTM and reports, "…stage progression within the early stages of change is important to prove the likelihood of subsequent changes in behavior. In terms of evaluation of health promotion interventions, stage progression can be viewed as an intermediate outcome of success." However, McKellar (2005) and Conner (2005) in their critical reviews of the TTM remind users of the model that allocation of subjects to a particular stage is subjective and, in the absence of an agreed system may threaten validity of evaluations.

In their report of an intervention among bricklayers in which subjects were encouraged to adopt innovations that reduced physical workload, De Jong et al. (2003) began to address factors that will inform the development of more objective categorisation of subjects against the stages of change. They identified subjects to whom the work procedure was new and therefore an innovation in accord with Rogers' definition (Rogers, 1995). The degree of adoption of the innovation was determined by the number of hours per day a working method was used. Thus they were able to develop a scale of usage against the TTM that may be applied to subsequent adopters to categorise their stage of change. It is suggested that this perhaps offers a starting point for advancing an objective process of categorisation.

Thus it would appear that the TTM does represent a useful tool for use in the evaluation of interventions (Kidd, Reed, Weaver, Westneat, & Rayens, 2003) and was it possible to use it in this case for the assessment of change in reported *decision-maker* behaviour.

5.3.3. Opinion Leaders

The role of opinion leaders was discussed in detail in Section 2.2.4.3.2. Particularly in regard to MVR operators and the potential for sensitisation, recognition that people often acquire their notion of risk seriousness directly from acquaintances (Kunreuther et al., 1985; Weinstein, 1988) and that sometimes people rely on the behaviour and opinions of others to guide their own actions, attempts were made within the case study to identify opinion leaders and engage them in the communication process. The identification of opinion leaders was simply through self-reports, reports of case study population members, advice from a representative of the VACC and construction of a network diagram, the latter being particularly useful. However, it was noted that these processes as advocated by Andreasen (1995) as low cost and simple did not yield nominations from all subjects. Anecdotally it was evident that all VACC member MVR operators within each of the two cities communicated with most other operators in their respective city and sometimes with operators in the other city, even if only at a social level. However, operators were reluctant to acknowledge such interactions and it became apparent to the researcher that this typically stemmed from either a sense that they would be admitting to some level of weakness if it appeared that they sought advice from others or that they believed they may be betraying some confidence if they identified another operator with whom they interacted. It is possible that the questions used to elicit information about opinion leaders were too blunt as an instrument or that having identified the potential for such problems, expenditure of greater time with respondents was necessary to gain their confidence. However, at the MVR operator meetings it was clear that there was a level of respect for the opinion leaders and the evaluation suggests that they did influence followers. It was also observed that the opinion leaders did derive social capital through the social relations within the social structure and conversations with the opinion leaders suggested that the motivation was generalised reciprocity (Glenane-Antoniadis et al., 2003). As suggested by Glenane-Antoniadis et al. (op. cit.) this is not to suggest that network benefits are the only reason that individuals participate, but "rather, that social capital theory can provide some insight." (p.334)

It is possible that employment of opinion leaders may multiply up the effort of those wishing to increase the adoption of an innovation. For example, the identification and engagement of opinion leaders by an OHS authority for the communication of risk control messages may be more cost effective than attempting to visit every workplace within an industry group. While the identification, engagement and education of the opinion leader may be time consuming, the widespread influence may be cost-effective and also overcome some of the resistance to the imposition of authority commonly presented to workplace inspectors by small businesses.

In conclusion it would appear that the social marketing model was extremely useful as a framework for undertaking intervention research and, when used in concert with a stages of change model, naturally offered the opportunity for evaluation. The parallels between the approaches to social marketing and action research meant that the social marketing model lent itself very well to an OHS intervention; action research being a methodology that has much to offer to OHS practitioners and having the potential to become the foundation stone of OHS practitioner research (Runnalls & Cowley, 2004).

5.4. Implications for intervention

5.4.1. Social marketing versus education and enforcement

In Section 2.2 various intervention options were discussed, including the application of education, marketing or law and various combinations of these to influence public health behaviours as proposed by Rothschild (1999). Rothschild (op. cit.) discussed targets of a social intervention being prone, resistant or unable to adopt a desired behaviour and drew an analogy with the assessment of the “motivation, opportunity and ability” (MOA) of targets, undertaken by commercial marketers. A matrix that summarises this was presented in Table 1. Based on this matrix, Rothschild argued that when MOA are all present, education is sufficient to manage behaviour. When opportunity is lacking but the target is motivated and able to adopt the desired behaviour, marketing may be sufficient to introduce a product or service that will enable to target adopt the behaviour. Similarly, if only ability is missing, education and/or marketing may be sufficient. If there is ability and opportunity but motivation is lacking then law is proposed for consideration. When opportunity is also missing, marketing is suggested. If ability and motivation are lacking education and marketing are suggested.

Binney et al. (2003), reviewed Rothchild’s matrix in regard to the development of a social marketing campaign to encourage land holders in Australia to control rabbits and refined the definitions of motivation, opportunity and ability. They suggest (p.390) that motivation is defined in general as “consumers’ desire or readiness to process information about a brand during reception of advertising material”; that opportunity “occurs in the social marketing context when the consumer is not limited in their desire to act by factors in their external environment such as time money and outside controls”; and “Ability refers to consumers’ skill or proficiency at solving problems or their knowledge of how to act" and "…the capabilities and resources available to the consumers to behave . Consequently, ability relates to an internal skill set whereas opportunity reflects external environmental factors."

The formative research undertaken within the case studies collected information that may be correlated with Rothschild's MOA (op. cit.) and overlayed on Table 1 as shown in Table 39. The MVR operators and the fishers were *motivated* in regard to safety and welfare of their employees; many subjects in both groups acknowledging this among their freely listed pros of the desired behaviour. Before the intervention, among the MVR operators in Ballarat and Bendigo, 17 (57%) of the 30 pros listed when asked "What do you think are the advantages of enforcing the use of airline supplied RPE", related to the health of the worker. Among the fishers, 34 (67%) of the 51 pros listed when asked "What do you think are the advantages of enforcing the use of PFD's", related directly to the safety of the worker. Members of both groups had the *opportunity* to enforce the use of the respective devices, given supervisory roles and presence in the workplace. However, the MVR operators and fishers lacked the *ability* for, at the same time, similar and dissimilar reasons. In regard to the fishers, the literature would suggest they did not believe they had legitimate authority i.e. were empowered, and the research would suggest that they underestimated the risk associated with crew falling overboard and also did not believe that the PFD's available at the time met their needs. In regard to the MVR operators they did not believe they were empowered and were reluctant to enforce the use of air-supplied RPE for fear of losing their painter. There was an underestimation of risk and lack of knowledge about sensitisation and there were also some misconceptions regarding the interference with visibility associated with the use of full-face RPE.

Table 39 Application of education, marketing and law to case study subjects (after Rothschild, 1999)

Motivation	**Yes**		**No**	
Opportunity	**Yes**	**No**	**Yes**	**No**
Ability **Yes**	1 Prone to behave *education*	2 Unable to behave *marketing*	3 Resistant to behave *law*	4 Resistant to behave *marketing, law*
No	5 **Fishers & MVR operators:** Unable to behave *education, marketing*	6 Unable to behave *education, marketing*	7 Resistant to behave *education, marketing, law*	8 Resistant to behave *education, marketing, law*

Thus it would appear that, with the case study subjects having motivation and opportunity but lacking ability, the use of *social marketing* and education were appropriate for use with these subjects. The MOA analogy drawn by Rothschild (op. cit.) is therefore considered valid and is a useful "litmus-test" at the outset of an intervention of this nature. This conclusion is consistent with that of Binney et al. (2003) who concluded, "This framework does appear to provide a useful diagnostic tool in understanding the social marketing context and the application of the marketing tactics implicit in the Rothschild MOA framework." (p.400)

Thus the approach employed within this research and explained by Rothschild (op. cit.) employs strategies that overcome some of the difficulties associated with reliance upon voluntarism as an intervention. Gunningham & Johnstone (1999) suggested that voluntarism underpins the self-regulatory approaches that prevail in our community. However, the success of voluntarism relies upon employers having an interest in minimising work hazards. Ignorance is a major impediment to this and often employers do not have an interest because the financial costs of accidents and disease are, in many situations, less than preventing them. Social marketing uses tools to gain insight to the perceptions of the targets regarding the behaviour desired by the marketer. It addresses the ignorance of targets regarding the hazard and broadens the understanding of risk beyond just the financial. The result is that targets have a greater understanding of both the benefits of adopting the desired behaviour and the consequences of remaining inactive.

5.4.2. Social marketing as an intervention framework

Runnalls and Cowley (2004 p.50) have argued that "successful, evaluated, scientific research is necessary to build an evidence base that can be effectively, efficiently utilised by practitioners to drive improvement in OHS performance." In accord with the discussion above, they suggest (op. cit. p.50):

> "… that practitioners need a methodology that allows them to successfully manage problems that do not have black and white answers; a methodology that facilitates the negotiation of "risk" perceptions and the making of value judgements; a methodology which facilitates the development and implementation of responsible management of hazards posed by new technology; and a methodology to help them resolve problems of increasing complexity, involving large, diffusely defined systems. It is proposed that action research is such a methodology."

Carr and Kemmis (1986 p.165) suggest "action research is the research method of preference whenever a social practice is the focus of the research activity", and that it has two essential aims: to *improve* and *involve*. Stringer (1996) suggests that action research seeks to engage subjects as equal and full participants in the research process. Other important features of action research include a social practice in need of improvement; a spiralling research methodology consisting of cycles of planning, acting, observing and reflecting; systematic and self-critical implementation of each research phase; involvement of practitioners through each stage of the research process; and collaborative control of the research process (Carr & Kemmis, 1986).

OHS interventions such as those that are the focus of this thesis were addressing a social practice. A comparison was drawn in Section 3.2.2 between strategic social marketing and action research (see Table 6 Comparison of strategic social marketing and Action

Research) and between action research and participative OHS processes that include a focus on worker consultation. The close parallels between the social marketing and action research methodologies meant that, within this research, they were complementary. Action research observes and collects information about real-life problems and phenomena. Social marketing employs action research methods to learn about real-life problems and to inform the strategies that will be used during a subsequent intervention. The growing use of action research and its participatory nature means that it is naturally fits within social marketing-OHS interventions and it is suggested that social marketing becomes a legitimate OHS intervention tool.

Andreasen (2003) suggest that social marketing has reached a stage of “early maturity” (p.297), supported by, among other things, several text books dealing with the subject, a journal devoted to the discipline, annual conferences, a Social Marketing Institute, and a book treating social marketing ethics. In addition there are many agencies using the framework for interventions. He proposes that social marketers now need to “market social marketing” (p.298) to increase its use and as such, it needs to become a brand in the marketplace of social change approaches (Andreasen, 2002).

In regard to marketing the social marketing brand, Andreasen (2002) identifies competition at several levels. One of these is intervention and he identifies three levels in this regard; intervention at the individual behaviour level; intervention that will bring about change at community level through the modification of social norms; and intervention at the institutional level such that laws, technology and public policies are influenced. He suggests, “To the extent that social marketing is perceived as an individual level-intervention, increased prominence of this level would benefit the field’s growth” (p.5). Further he suggests, “…it is important to realize that a social marketing approach can also apply to bringing about behavior changes in other key players whose cooperative actions are needed to make programs successful.” (p.8)

5.4.3. Social marketing and intervention evaluation

Viner (1991) and Hale et al. (1986) have argued that OHS practitioners have an obligation to contribute to the development of knowledge. Robson et al. (2001), however, suggest that there is insufficient evaluation of OHS interventions and thus lack of contribution to an evidence base regarding the efficacy of interventions. The social marketing and action research cyclic processes naturally engage the researcher in reflection on the intervention process and thus encourage evaluation. Thus Andreason's model for strategic social marketing was useful in respect of the peripatetic process that begins in the marketing organisation, moves in to the market to listen before returning to the organisation to plan and so forth, as illustrated in Andreason's reviewed model of strategic social marketing shown at Figure 9. A stages of change model as an element of a social marketing framework was particularly useful as a tool for evaluation of the impact of an intervention.

Day and Sherrard in their report to the Rural Industries Research and Development Corporation (RIRDC), "Guidelines for evaluation of safety programs for the agricultural industry" (Sherrard & Day, 2001), suggest that evaluation of a safety program consists of four distinct stages integrated with the program at the planning phase and continuing until after completion of the program. Each of the elements of the development and implementation of the program plan has a corresponding level of evaluation and the similarities to and application within the social marketing cycles is evident. The first stage is *Formative* evaluation that ensures that procedures, activities, and materials will work as planned. Where possible as outlined above pilot testing of procedures, activities, and materials for feasibility, acceptability and high and consistent quality will be undertaken. The second stage is *Process* evaluation that determines whether the program has been implemented or delivered as planned by measuring program reach to the target group, participant satisfaction, implementation of activities, performance of materials and other components, and ongoing quality assurance. These measures relate to assessing satisfactory progress in the implementation of the program strategies. Sherrard and Day (2001) point out that it is not uncommon to find that the program delivery changes over time so that materials and activities are no longer the same as at the beginning of a program. The third stage is *Impact* evaluation that involves the assessment of immediate program effects on risk factors for the health and safety problem in question i.e. any change in knowledge attitudes and skills of the target group, level of injury hazards, the environment, and relevant policy indicate the immediate effect of the program. The fourth stage is *Outcome* evaluation that involves the assessment of longer term effects of a program on the program goal. The program goal may be defined as reduction of injury mortality and morbidity. This level of evaluation is rarely available to individual intervention projects and outcomes are generally measured by agencies such as workers compensation insurers in the longer term.

Day and Sherrard's (op. cit.) stages of evaluation lend themselves very well to intervention research of the type described in this thesis as well as to the evaluation of a social marketing intervention. The formative and process evaluation stages are driven by the stages within the action research and the strategic social marketing spirals (Andreasen, 2002; Carr & Kemmis, 1986). The TTM offers an opportunity to focus on and evaluate the impact of an intervention through the measurement of the proportion of a population that has moved to another stage of readiness for change.

In conclusion, it is argued here that social marketing offers not only a framework for intervention but also a strategy that parallels action research. The latter is increasingly recognised as a legitimate research tool that may be used to build the evidence base in regard to successful workplace-based interventions. Social research may be evaluated using a formative-process-impact-outcome model which in turn lends itself very well to the social marketing framework. The important lead indicator in the form of *impact* evaluation may be reviewed through the use of a stages of change model to estimate the proportions of target populations that are at each stage. Thus the social marketing framework becomes a holistic intervention tool that provides; insights to the targets regarding their perceptions of desired behaviour and the risk control measure being marketed; it provides an intervention framework; it provides an evaluation tool; and of particular importance to contemporary OHS practise, it involves consultative processes.

6. Conclusion

The research hypothesis and research questions are detailed Section 2.4. The research hypothesis was:

> "The social marketing model, currently used in other disciplines is transferable to the OHS discipline for the purposes of increasing the rate of adoption of OHS risk controls within small businesses."

The aim of the research was to apply relevant elements of a social marketing model to case study groups of small business operators to assess capacity of the model to increase the adoption of OHS risk control measures. This was done to varying degrees across three cases studies; within the fishers' case study, the formative research process was applied and the TTM used to assess the targets' readiness for change; within the plasterers' case study the formative research process was applied and this led to the conduct of empirical research to find evidence to support or deny support for the proposed intervention; within the MVR case study the formative research process was applied, an intervention strategy designed, the intervention tested and its success evaluated using pre-intervention and post-intervention application of the TTM.

A number of commonalities were identified between subjects within each case study and the characteristics observed were consistent with those reported in the literature. Few businesses that participated in the research had formal arrangements for managing OHS and interactions with inspectors were infrequent. There was a lack of recognition of an OHS problem and business operators generally perceived their workplace as being low risk. In general, business operators understood the concept of workplace health and safety primarily in terms of personal behaviour of employees and referred to worker carelessness and use of personal protective equipment when asked about OHS and risk control. While the motivation for adopting OHS improvement measures was, in general, a desire by management to protect their workforce, the "leaving it up to the workers" perspective was common.

Small businesses were found to require incentives or assistance to encourage the adoption of technological OHS risk controls. However, they have limited access to OHS information and evidence that might persuade them about the need for risk control measures. "Arms-length tools" have not been highly successful in reaching the target groups and have not made them aware of the respective risks they face nor instilled within them attitudes that lead to appropriate types and levels of risk control. Subjects within each of the three case studies did not appear to present lack of funding as a significant barrier to adoption of risk controls. In accord with the literature, the subjects appeared reluctant to protect themselves against low probability events with high losses. The purchase, supervision and maintenance of physical devices such as those that represented risk controls in this research were unlikely to be recognised as investments that would yield a return where the absence of an injury or the continued health of a worker are the result.

The TTM was a useful means of categorising small business *decision-maker* behaviour and was successfully employed to assess readiness for change of individuals and therefore the messages that are needed to unfreeze behaviour. It was found that marketing messages are dependent upon the outcomes of the social marketing formative research process and are therefore case-specific. The listening processes at the heart of the social marketing process set it apart from commercial marketing and force the marketer to listen to the subjective assessment of risk as perceived by targets. It also forces the questioning of the evidence base that supports the suitability and efficacy of the proposed intervention.

The identifying the characteristics that categorise an individual against any one stage of change were derived from the statement of the desired behaviour. The process of establishing the precise and concise definition of this desired behaviour was challenging but particularly important for the development of tools to use in undertaking the assessment. The process of eliciting the subjects' perceived pros and cons in regard to the adoption of the desired behaviour to assess decisional balance was also useful in regard to gaining further insight to the costs and benefits and other matters that are important to the subjects. The model represented a useful simplification and refinement of many of the principles of other stages of change models and lent itself well to the social marketing process. A stages of change model, such as the TTM, also provides a tool for evaluation of the impact of an intervention.

Oral communications and industry associations are important in regard to helping small business operators find out about OHS risk control innovations. Social networks were identified among MVR operators and the construction of a network diagram was of particular value. This assisted with the identification of opinion leaders among MVR operators although the approach used may need refinement to increase its usefulness in the small business sector. It appears that the intervention that included the employment of opinion leaders among the case study population of MVR operators had some effect in regard to the adoption of the desired behaviour and it was also observed that the opinion leaders did derive social capital through the social relations within the social structure and conversations with the opinion leaders suggested that the motivation was generalised reciprocity.

Opinion leaders multiply up the effort of those wishing to increase the adoption of an innovation and engagement of opinion leaders by an OHS authority for the communication of risk control messages may be more cost effective than attempting to visit every workplace within an industry group.

Thus, although social marketing is not in the general repertoire of OHS interventions, the model employed was extremely useful as a framework for undertaking intervention research and, when used in concert with a stages of change model, naturally offered the opportunity for evaluation. Application to people who have the responsibility for the health and safety of others was unique.

The parallels between the approaches to social marketing and action research meant that the social marketing model lent itself very well to an OHS intervention; action research being a methodology that has much to offer to OHS practitioners and having the potential to become the foundation stone of OHS practitioner research.

7. Further Work

The research reported here was case study based and exploratory in nature. The encouraging findings in regard to the use of the social marketing processes and the Transtheoretical Model of behaviour change (TTM) as a tool for assessing both readiness of change and the success of an intervention suggest that further work should be undertaken to verify and refine the techniques and tools.

It is suggested that the work is reproduced and evaluated within a larger sample population of small business operators. For example, developments in the safety management systems for use by commercial fishing vessel operators means that it would be timely to apply the model to all commercial fishers within the Victorian fleet such that the adoption of the PFD usage element of those plans is increased. Additional evaluation within a population of small business operators whose sector spans both regional and metropolitan areas would be beneficial. Within such an evaluation, the refinement of the processes for opinion leader identification within small business groupings is necessary. Assessment of the value of targeted visits by OHS authority inspectors to opinion leader's workplaces would be useful.

The questions that were developed for use during the formative research phase within during each case study within this research were similar. Given the conclusion that the formative research process derived valuable information about the targets' knowledge, attitudes, knowledge, attitudes, beliefs and practices (KAPB (Andreasen, 1995)) it is possible that the list of questions might be developed into a template for use in subsequent OHS intervention studies.

In addition in accord with suggestions made by Andreasen (2003) regarding the development and increased application of social marketing as a model, closer examination of the nuances of the TTM in regard to the adoption of OHS decision maker behaviour would be useful. As Andreasen (op. cit.) suggests, it is not clear that all behaviours are alike; starting something is different to stopping something and starting or stopping something involving others is different again. Having initiated change within subjects, examination of the strategies that keep targets in the maintenance stage is necessary. Development of scales or other measures that enable more objective processes of categorisation of subjects against the TTM would increase the model ease and value of use.

As social marketing is used to a greater extent in regard to decision-makers in OHS, consideration of ethical implications are necessary in regard to segmentation (Andreasen, 2003). For example, inclusion of wealthy business targets within a target population may reduce the amount of funding that is available to support activity among less wealthy targets.

In regard to larger businesses there is large body of literature addressing organisational change literature and many different change models are proposed. No reference to the application of the TTM to decision-makers within large organisations has been found although models that reflect similarities have been developed. For example, Maxfield et al. (1999) propose a model of organisational change that refers to four stages; (i) inaction, which is characterised by a lack of knowledge about a recommended policy, or a perception that the policy is irrelevant to the organisation or overly costly or problematic; (ii) advocacy, in which individuals act as internal advocates for adoption of the policy or practice; (iii) consensus, in which decision-makers in the organisation have achieved a high level of consensus on the issue and will move to adopt a policy or practice; and (iv) maintenance, in which the policy or practice is maintained in place and organisational systems for assigning personnel, allocating resources and enforcement of the policy are applied. Thus the model refers to decision-makers but focuses on organisational characteristics. The parallels with the TTM are evident and thus exploration of TTM as a model for organisational change that addresses the *behaviours of individual decision-makers* and the role of opinion leaders in facilitating change would be of interest. Schulte et al. (2003) refer to the Maxfield et al. (1999) model in regard to dissemination of OHS information and suggest that the targeting of appropriate information can be improved with reference to such models. Indeed, Andreasen (2003) has made reference to the potential for senior managers in organisations to employ the talents of their marketers to influence the behaviours of others *within* the organisation.

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OH&S in Small Business: Influencing the Decision Makers

The application of a social marketing model to increase the uptake of OHS risk control measures by small business

Appendices

Stephen Cowley

B.Sc. Hons (OHS) (Aston). M.Sc. (Occ.Hyg) (Lond), G.Cert (Ed) (Ballarat) FSIA

July 2006

TABLE OF CONTENTS

Appendix 1: Reported OHS Intervention Research

Table 40 Annotated bibliography: Reported OHS intervention research

Citation	Focus	Comment
(Eakin, 1992)	Leaving it up to the workers: sociological perspective on the management of health and safety in small workplaces	Qualitative analysis of 53 interviews with small business operators. Discusses implications for interventions
(Spickett & Howell, 1992)	Hazardous substances management in small business	Identifies issues that need to be further investigated before developing interventions.
(Bellows & Rudolph, 1993)	The Initial Impact of a Workplace Lead-Poisoning Prevention Project	Reports intervention project involving 275 radiator service companies in California. Identifies weaknesses of regulatory approaches and the success of an approach that used trade associations, the supply chain, etc.
(Elliott & Shanahan, 1995)	Development Research for a Community Education Campaign	Reports qualitative research that collected information on OHS awareness, current attitudes and information needs in order to plan a community education media campaign.
(Goldenhar & Schulte, 1996)	Methodological Issues for Intervention Research	Reviews existing literature relating to OHS interventions
(Gressel, 1996)	An Engineer's Perspective of the Intervention Research Workshop	Recommends that a marketing model be developed for use in interventions.
(LaMontagne & Needleman, 1996)	Overcoming Practical Challenges in Intervention Research	Identifies challenges of intervention research and offers generalized approaches to overcome them.
(Lipsey, 1996)	Key Issues in Intervention Research: A Program Evaluation Perspective	Summarises the lessons learnt from program evaluation research that might inform intervention research.
(David Caple & Associates, 1996)	Identification of the most effective methods for disseminating known solutions across industries.	Reports a survey of over 400 small businesses regarding information access and use. Concludes that mass circulation of printed materials is not viable and recommends future research to understand networking of small businesses.
(Needleman & Needleman, 1996)	Qualitative Methods for Intervention Research	Offers guidance in undertaking qualitative intervention research.
(Leviton & Sheehy, 1996)	Encouraging Small Businesses to Adopt Effective Technologies to Prevent Exposure to Health Hazards	Using radiator repair shops and control technology for reducing worker lead exposures in the shops as an example, the paper recommends the use of behavioral theories such as the Transtheoretical Model and the Rogers Diffusion of Innovations in intervention design.
(Mayhew & Gibson, 1996)	Self-employed builders: factors which influence the probability of work-related injury and illness	Reports the findings of interviews of 500 builders across Queensland and the implications for interventions.
(Mayhew, 1997a)	Barriers To Implementation Of Known OHS Solutions In Small Business	Reports interviews with 248 owner/managers of small businesses in Queensland. It found that the provision of OHS legislative and preventive OHS information/advice supply did not work and recommends factors to be considered in intervention design
(Mayhew, 1997b)	Self-employed builders in Australia and the United Kingdom: a comparison of OHS outcomes and regulatory compliance.	Reports data collected from 500 Australian and 100 UK builders in the small scale housing industry regarding factors that influence legislative compliance.
(Mayhew, 1997c)	Small business occupational health and safety information provision	Reports weaknesses of traditional approaches to reaching small business and identifies factors to consider in intervention design.

Table 40 continued…

Citation	Focus	Comment
(Jones, 1997)	Partnering for Workplace Safety in Small Business	Reports NIOSH approaches to intervening in small businesses in the USA.
(Zwerling et al., 1997)	Design and Conduct of Occupational Injury Intervention Studies: A review of Evaluation Strategies	Reviews literature on the design, conduct and evaluation of OHS interventions.
(Holmes et al., 1997)	Occupational Injury Risk in a Blue Collar, Small Business Industry: Implications for Prevention	Examined the perceptions of risk among the employees and employers of the painting industry in Australia. An intervention model is developed that proposes 4 stages that accommodates the different risk perceptions of employers and employees.
(Howell et al., 1998)	The management of hazardous substances in small business in Western Australia	Examined awareness and understanding of hazardous substance issues and suggests strategies that might inform the development of interventions.
(Rakel, Gerrard, Piggott, & Crick, 1998)	Evaluating Contact Techniques: Assessing the Impact of a Regulator's Intervention on the Health and Safety Performance of Small and Medium-Sized Businesses	Reports an evaluation methodology for assessing the effectiveness of seminars and mass mailing of information to small businesses.
(Holmes et al., 1998)	Meanings of Risk Control in Occupational Health and Safety Among Employers and Employees	Reports a study of risk perceptions and understandings of OHS among small Australian businesses and identifies factors that should be considered in intervention design.
(Holmes et al., 1999)	An Exploratory Study of Meanings of Risk Control for Long Term and Acute Effect Occupational Health and Safety Risks in Small Business Construction Firms	Identifies barriers to the adoption of risk control and recommends that the meanings of “risk” need to be addressed.
(Shannon et al., 1999)	Methodological criteria for evaluating occupational safety intervention research	Offers a method for evaluating intervention research reported in the literature.
(Goldenhar et al., 1999)	Concerns of the Dry-Cleaning Industry: A Qualitative Investigation of Labor and Management.	Explored the perceptions of small business operators and suggests that the findings will be used to develop interventions.
(Lamm, 1999)	Occupational Health and Safety in Australian Small Business: What can be done to reduce the lack of awareness and raise the level of compliance in Australian small business?	Reviews the perceptions of OHS among small business operators and barriers to adoption of OHS controls, and recommends alternative approaches to intervening in small business.
(Mayhew, 1999)	The impact of an intensive mailed OHS information campaign on small business cabinetmakers	Evaluated the impact of an intensive campaign that mailed OHS information to small business and found that it had minimal effect.
(Jones, 1999)	NIOSH Control Technology and Intervention Efforts for Small Business	Summarises the lessons learnt from the NIOSH approach to small business interventions.
(Briggs & Crumbie, 2000)	Characteristics of people working with chemical products in small firms	Reports 521 interviews with small businesses across the UK and identifies a range of factors to consider in communicating with small businesses about chemicals.

Table 40 continued…

Citation	Focus	Comment
(Rigby & Lawlor, 2001)	Health and Safety in Small Firms with Particular Reference to Spain	Presents information on a study that examined the role of external agencies in improving the health and safety performance of SME in Spain and concludes there is unlikely to be one best model for reaching small business.
(European Agency for Safety and Health at Work, 2001)	Health and Safety Campaigning - Getting the message across	Reviews and summarises a range of health and safety campaigns.
(National Occupational Health and Safety Commission, 2001a)	Evaluating the Rotary Speakers' Pilot Project	Reports a trial delivery of OHS information and advice directly to small business operators using Rotary Clubs whose members largely come from the small business environment.

Appendix 2: Commercial Fishing Case Study: Pre & Post-Trial Survey Forms

Vessel Name	
PFD Nº	

PFD Evaluation Sheet : Pre-Trial Information

Information to be collected from the skipper prior to trial

Number of crew			
Type of Fishing	☐ Rock Lobster ☐ Abalone ☐ Line ☐ Squid	☐ Seine Netting ☐ Mesh Netting ☐ Shark	☐ DW Trawling ☐ Scallop ☐ Wrasse
Type of PFD tested			
Contact name			
Phone			
To be tested by			
Does the skipper currently wear a PFD at sea?	☐ Often	☐ Sometimes	☐ Never
What type of PFD is available on the vessel at present?			

How do you feel about the following statements?

Read the statement to the skipper and tick the box.

If the skipper does not use a PFD, ask what he **thinks** *it might be like.*

	Strongly Disagree	Disagree	Agree	Strongly Agree
You do not need to use a PFD at sea	☐	☐	☐	☐
Crew are unlikely to fall overboard.	☐	☐	☐	☐
A PFD is too hard to look after	☐	☐	☐	☐
A PFD gets in the way	☐	☐	☐	☐
A PFD wastes time	☐	☐	☐	☐
A PFD is uncomfortable	☐	☐	☐	☐
You should wear a PFD when it is rough at sea	☐	☐	☐	☐
You should wear a PFD when working in-shore	☐	☐	☐	☐
You should wear a PFD when crossing a bar	☐	☐	☐	☐
A PFD should really be worn whenever on deck at sea	☐	☐	☐	☐
A PFD is not worth the money	☐	☐	☐	☐
A PFD wouldn't save me if I fell overboard	☐	☐	☐	☐
I prefer my crew to wear PFD's	☐	☐	☐	☐

Assess the stage the participant is at
Ask the skipper the question and tick the "yes" or" no" box.

	Yes	**No**	
Do you think it is necessary to use a PFD on deck?	☐	☐	**Go to Q10a**
Are PFD's available for crew on board?	☐	☐	**Go to Q10a**
Are PFD's sometimes used on deck?	☐	☐	**Go to Q10a**
Are PFD's always used:			
• When Crossing a bar?	☐	☐	**Go to Q10a**
• During rough weather?	☐	☐	
• During in-shore operations?	☐	☐	
Do you instruct crew to use a PFD?	☐	☐	**Go to Q10a**
Is use of a PFD a condition of work on the vessel?	☐	☐	**Go to Q10a**
Do you monitor use of PFD's by your crew?	☐	☐	**Go to Q10a**

Would you feel comfortable enforcing the use of suitable PFD's by crew when crossing a bar, during rough weather and during in-shore operations?

<u>Yes</u> ☐ **No** ☐

What do you think would be/are the advantages of enforcing the use of PFD's by crew while on deck? *(list as many as possible)*

____
____
____
____
____

What do you think would be/are the <u>dis</u>advantages of enforcing the use of PFD's by crew while on deck? *(list as many as possible)*

____

____

____

____

____

In the *<u>community at large</u>*, what is the main cause of work related injuries and illnesses? What are the second and third most important causes of work related injuries and illnesses?

(Put a "1" against the main cause and a "2" and "3" against the second and third causes)

☐ *Lack of training & Education?*

☐ *Pressure or stress?*

☐ *Worker being careless?*

☐ *Dangerous equipment and procedures?*

☐ *Lack of supervision?*

☐ *Boring, repetitive work?*

☐ *Alcohol or drugs?*

☐ *Dangerous chemicals or substances?*

What is the most important prevention measure for work related injuries and illnesses? What are the second and third most important prevention measure for work related injuries and illnesses?

(Put a "1" against the most important and a "2" and "3" against the second and third most important)

☐ *Education & awareness about health & safety?*

☐ *Training on safe work practices?*

☐ *Safe procedures and systems of work?*

☐ *Employee consultation and involvement?*

☐ *Safe equipment?*

☐ *Stronger enforcement of regulations?*

☐ *Regulations clearer and easier to understand?*

What proportion of injuries and illnesses could be prevented?

(Tick one box)

☐ *Nearly all?*

☐ *More than half?*

☐ *About half?*

☐ *Less than half?*

☐ *Hardly any?*

- Thank you -

Vessel Name	
PFD Nº	

PFD Evaluation Sheet: Post-Trial Information

Information to be collected from the wearer after the trial

Name of person who tested PFD					
Did you need to inflate the PFD?	☐ Yes		☐ No		
If yes	**Ease of Operation**	**Manual**	☐ Poor	☐ Good	☐ Excellent
		Automatic	☐ Poor	☐ Good	☐ Excellent
Ease of Care and Maintenance	**Inflation System**	☐ Poor	☐ Good	☐ Excellent	
	Shell	☐ Poor	☐ Good	☐ Excellent	
General comfort	☐ Poor	☐ Good	☐ Excellent		
Wearing comfort	☐ Poor	☐ Good	☐ Excellent		
I would wear this PFD on deck:	☐ Never	☐ If Rough	☐ All of the Time		
Type of preferred inflation	☐ Manual	☐ Automatic			
I would wear a crotch strap	☐ Yes	☐ No			
What I liked about this PFD					
What I didn't like about this PFD					
Other					
Would you be interested in attaching an EPIRB to a PFD?	☐ Yes	☐ No			
If an EPIRB could be attached, would you purchase one?	☐ Yes	☐ No			

How do you feel about the following statements?

Read the statement to the wearer and tick the box

	Strongly Disagree	Disagree	Agree	Strongly Agree
You should wear a PFD when it is rough at sea	☐	☐	☐	☐
You should wear a PFD when working in-shore	☐	☐	☐	☐
You should wear a PFD when crossing a bar	☐	☐	☐	☐
A PFD should really be worn whenever on deck at sea	☐	☐	☐	☐
This PFD is easy to look after	☐	☐	☐	☐
This PFD is comfortable	☐	☐	☐	☐
This PFD gets in the way	☐	☐	☐	☐
This PFD is easy to wear and remove	☐	☐	☐	☐
This PFD is good value for money	☐	☐	☐	☐
This PFD would save me if I fell overboard	☐	☐	☐	☐
I would wear this PFD when it is rough at sea	☐	☐	☐	☐
I would wear this PFD when working in-shore	☐	☐	☐	☐
I would wear this PFD when crossing a bar	☐	☐	☐	☐
I would wear a PFD whenever on deck at sea	☐	☐	☐	☐

- Thank you -

Vessel Name	
PFD Nº	

PFD Evaluation Sheet: Trial Information

Information to be recorded by wearer during trial

Please fill in date(s) and hours that the PFD is worn continuously and tick the appropriate box for the weather and sea conditions

Dates PFD worn	Hours PFD worn continuously	Weather cold	Weather warm	Weather hot	Sea calm	Sea moderate	Sea rough

- Thank you -

Appendix 3: Commercial Fishing Case Study Results

This section contains the tabulated and, where appropriate, graphed data collected during the commercial fishing case study. Where figures contain the initials “SD”, “D”, “A” and “SA” these refer to the respondents’ attitudes to statements that were “Strongly Disagree”, “Disagree”, “Agree” and “Strongly Agree” respectively.

Details of trials and respondents

Table 41 Distribution of participating vessels

Port	Frequency	%
Portland	21	44%
Lakes Entrance	23	48%
Queenscliff	4	8%
Total	**48**	**100%**

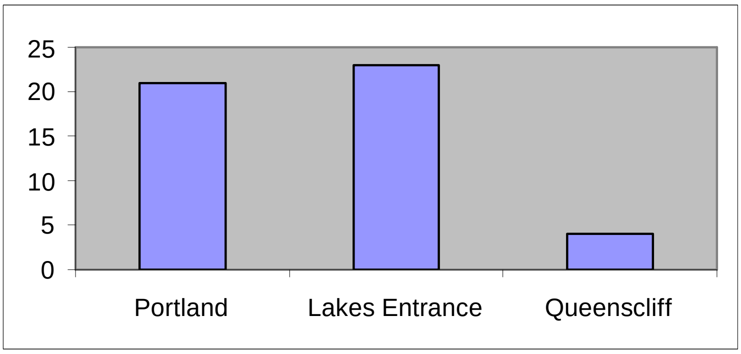


Figure 80 Distribution of participating vessels

Table 42 Number of trials at each port

Port	Frequency	%
Portland	34	25
Lakes Entrance	43	31
Queenscliff	23	17
Total	**100**	**73**

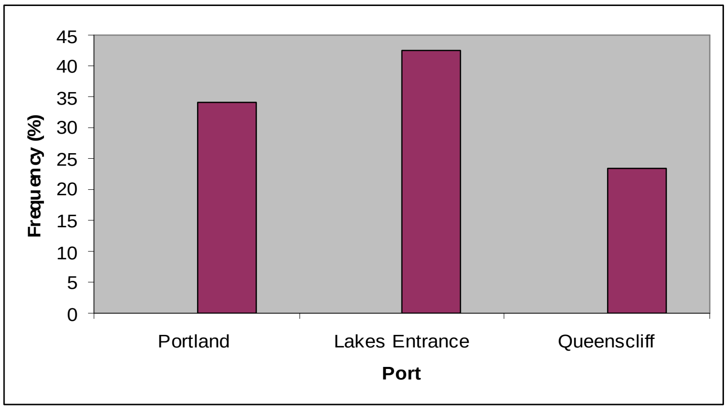


Figure 81 Number of trials at each port

Table 43 Wearer during trial

	Frequency	%
Skipper	30	41
Crew	35	48
Unknown	8	11
Total	**73**	**100**

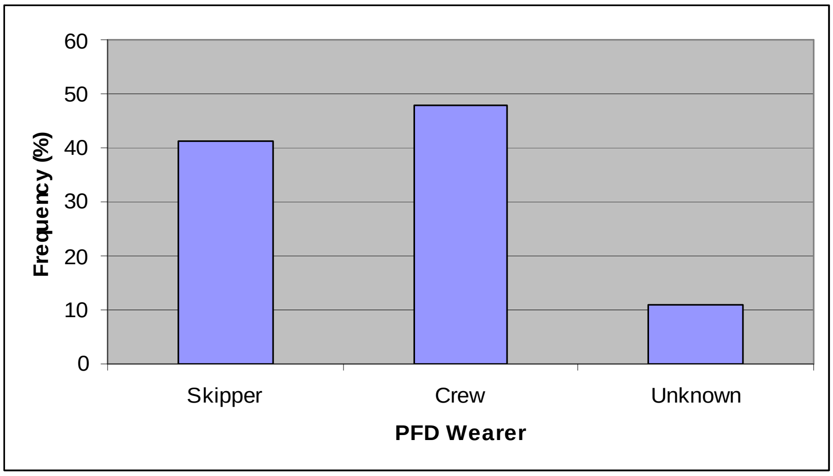


Figure 82 Wearer during trial

Table 44 Fishing Types Represented by the vessels in the trials

	Frequency	%
Rock Lobster	20	42
Prawn Trawling	2	4
Abalone	1	2
Line	1	2
Squid	1	2
Seine Netting	9	19
Mesh Netting	7	15
DW Trawling	5	10
Missing	2	4
Total	**48**	**100**

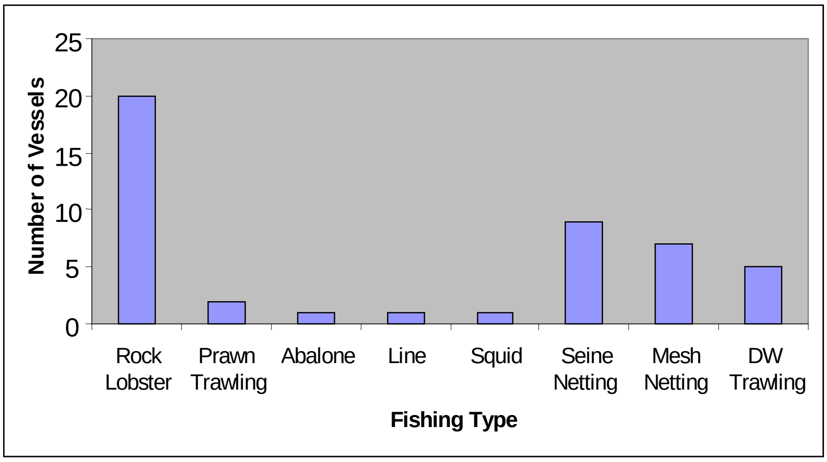


Figure 83 Fishing Types Represented by the vessels in the trials

Table 45 Fishing Types Represented in the trials

	Frequency	%
Rock Lobster	23	32
Prawn Trawling	4	6
Abalone	2	3
Line	1	1
Squid	2	3
Seine Netting	12	16
Mesh Netting	7	10
DW Trawling	20	27
Missing	2	3
Total	**73**	**100**

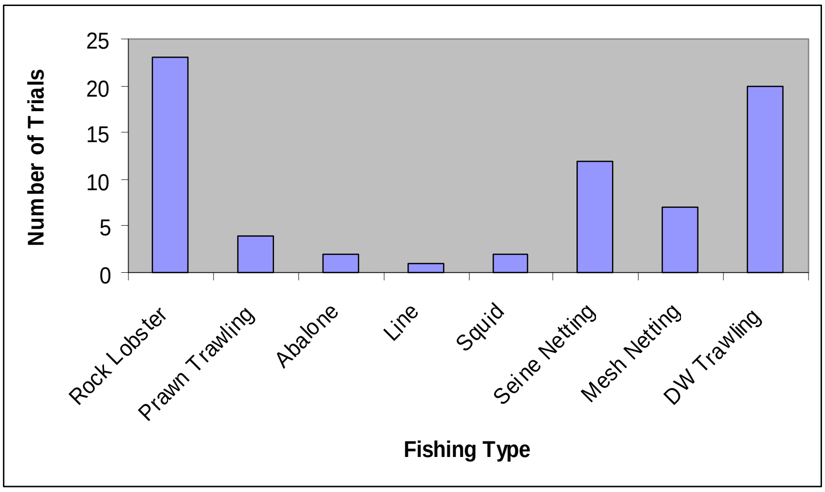


Figure 84 Fishing Types Represented in the trials

Table 46 Type of fishing undertaken by participating vessels

	Portland	Lakes Entrance	Queenscliff	Total
Rock Lobster	16	4		20
Prawn Trawling		2		2
Abalone		1		1
Line	1			1
Squid		1		1
Seine Netting		7	2	9
Mesh Netting	1	5	1	7
DW Trawling	2	3		5
Missing		1	1	2
Total	**20**	**24**	**4**	**48**

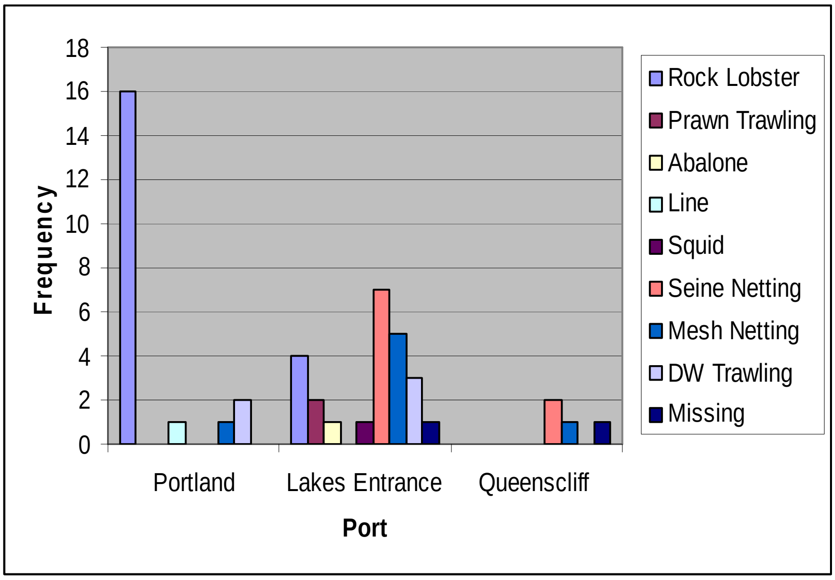


Figure 85 Type of fishing undertaken by participating vessels

Table 47 Number of crew among participating vessels

Number of Crew	Frequency	%
1	7	15
2	6	13
3	5	10
4	3	6
Missing	27	56
Total	**48**	**100**

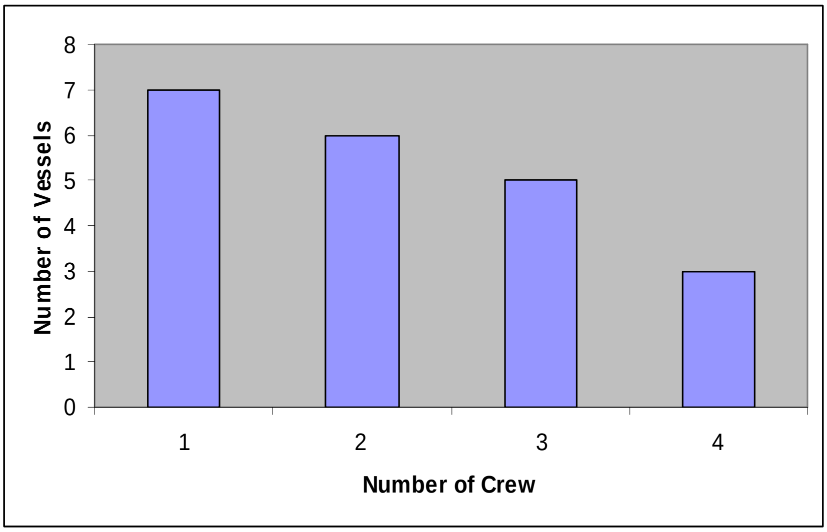


Figure 86 Number of crew among participating vessels

Table 48 Type of PFD in Current Use

	Frequency	%
Coastal	3	6
M.S.V.	1	2
Mullion	2	4
Solas	3	6
Standard	1	2
Stormy S	12	25
Survey	1	2
None	15	31
Unknown	10	21
Total	**48**	**100**

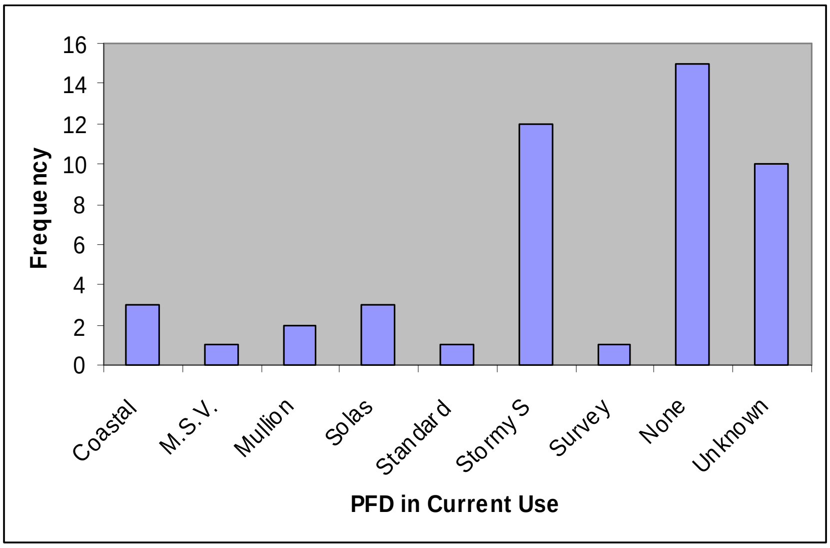


Figure 87 Type of PFD in Current Use

Table 49 Main cause of work related injuries and illnesses

	Frequency	%
Lack of training & education	8	21
Pressure or stress	5	13
Worker being careless	18	46
Dangerous equipment & procedures	4	10
Lack of supervision	1	3
Alcohol or drugs	2	5
Dangerous chemicals or substances	1	3
Total	**39**	**100**
Missing	9	
Total	**48**	

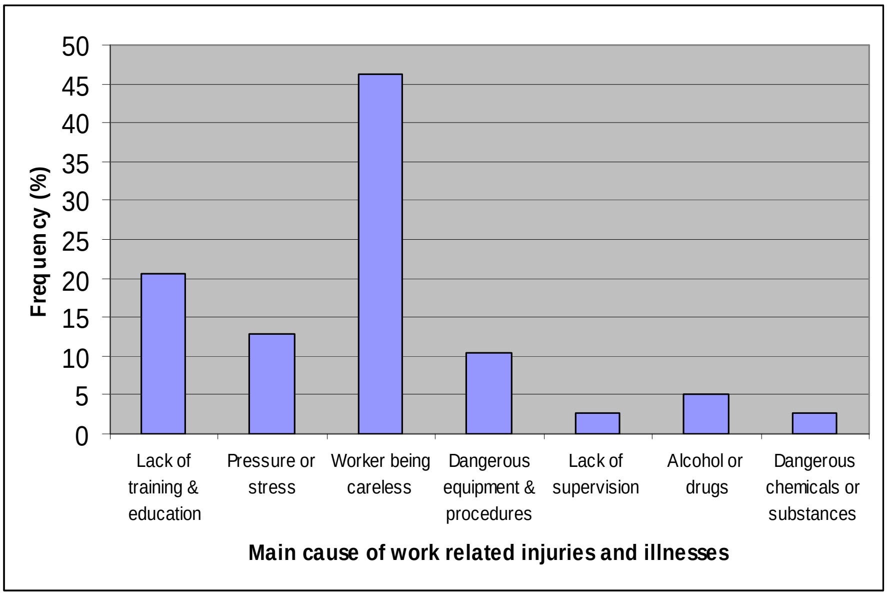


Figure 88 Main cause of work related injuries and illnesses

Table 50 Most important prevention measure for work related injuries and illnesses

	Frequency	%
Education & awareness about OHS	8	21
Training on safe work procedures	8	21
Safe procedures and systems of work	13	34
Employee consultation and involvement	3	8
Safe equipment	5	13
Regulations clearer and easier to understand	1	3
Total	**38**	**100**
Missing	10	
Total	**48**	

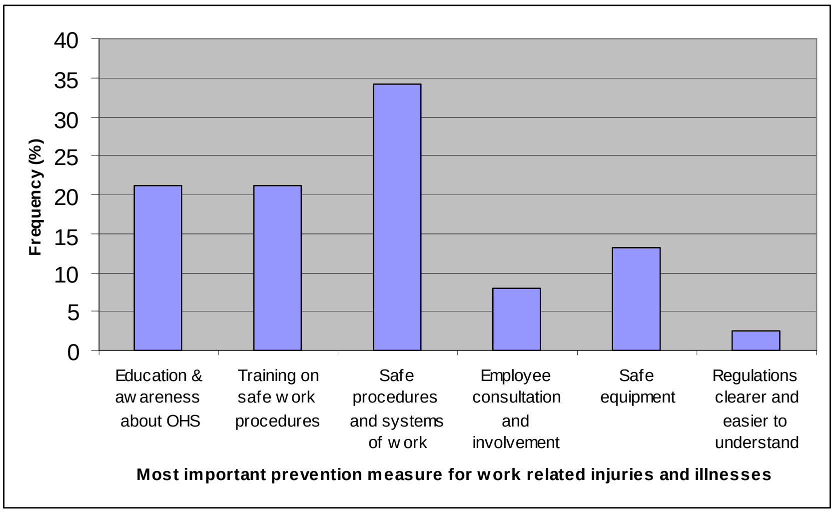


Figure 89 Most important prevention measure for work related injuries and illness

Table 51 Skippers' Current Use of PFDs

	Frequency	%
Often	6	13
Sometimes	6	13
Never	34	74
Total	**46**	**100**
Missing	2	
Total	**48**	

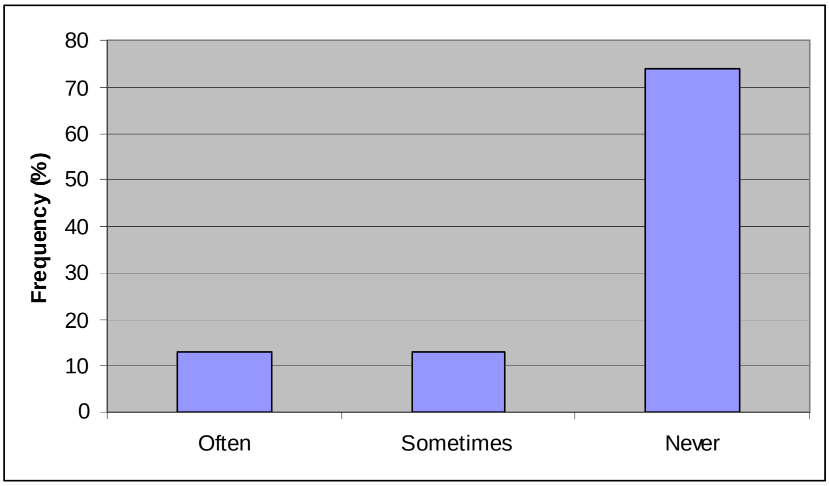


Figure 90 Skippers' Current Use of PFDs

Table 52 A PFD should really be worn whenever at sea

	Frequency	Valid Percent
SD	3	7
D	27	64
A	11	26
SA	1	2
Total	**42**	**100**
Missing	6	
Total	**48**	

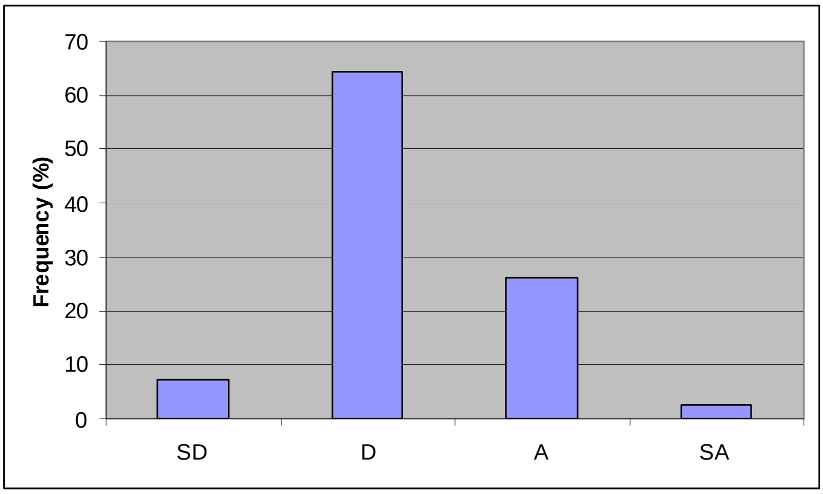


Figure 91 A PFD should really be worn whenever at sea

Table 53 You should wear a PFD whenever on deck at sea

	Frequency	%
SD	10	28
D	14	39
A	8	22
SA	4	11
Total	**36**	**100**
Missing	12	
Total	**48**	

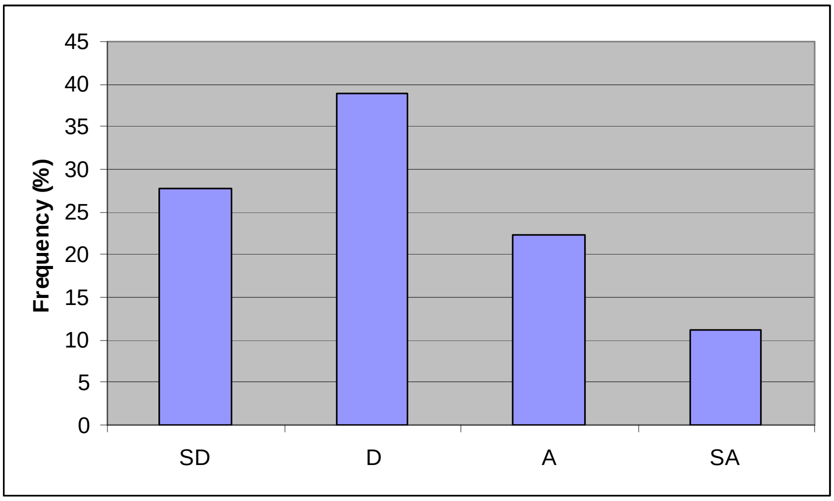


Figure 92 You should wear a PFD whenever on deck at sea

Table 54 You should wear a PFD when it is rough at sea

	Frequency	%
SD	0	0
D	6	40
A	8	53
SA	1	7
Total	**15**	**100**
Missing	33	
Total	**48**	

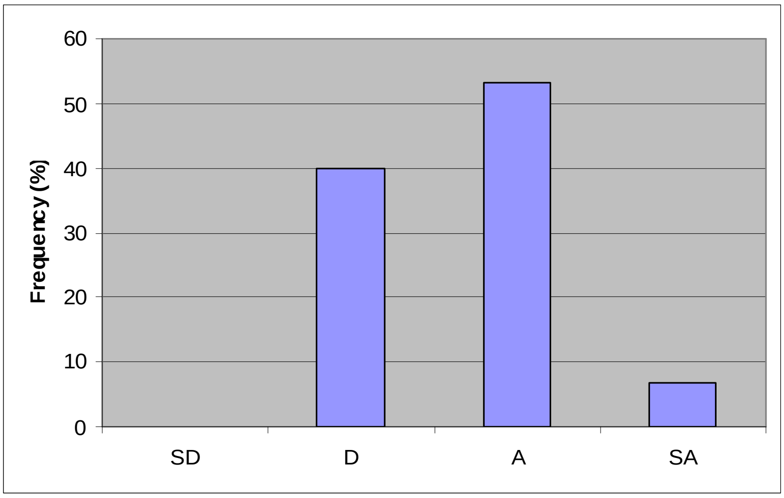


Figure 93 You should wear a PFD when it is rough at sea

Table 55 You should wear a PFD when working in-shore

	Frequency	%
D	6	40
A	8	53
SA	1	7
Total	**15**	**100**
Missing	33	
Total	**48**	

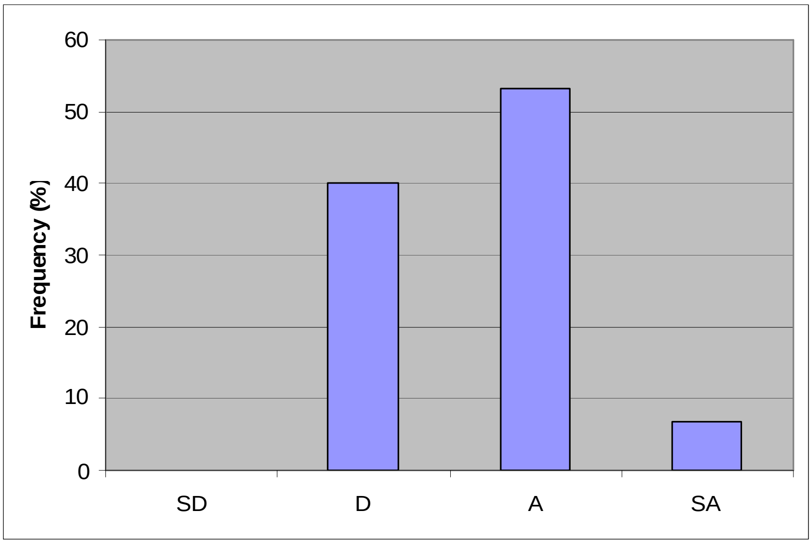


Figure 94 You should wear a PFD when working in-shore

Table 56 You should wear a PFD when crossing a bar

	Frequency	%
SD	0	0
D	6	40
A	8	53
SA	1	7
Total	**15**	**100**
Missing	33	
Total	**48**	

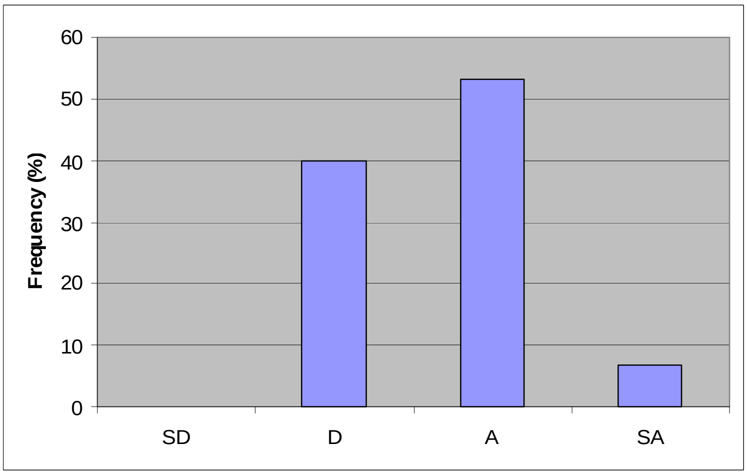


Figure 95 You should wear a PFD when crossing a bar

Table 57 You do not need to use a PFD at sea

	Frequency	%
SD	2	5
D	26	65
A	9	23
SA	3	8
Total	**40**	**100**
Missing	8	
Total	**48**	

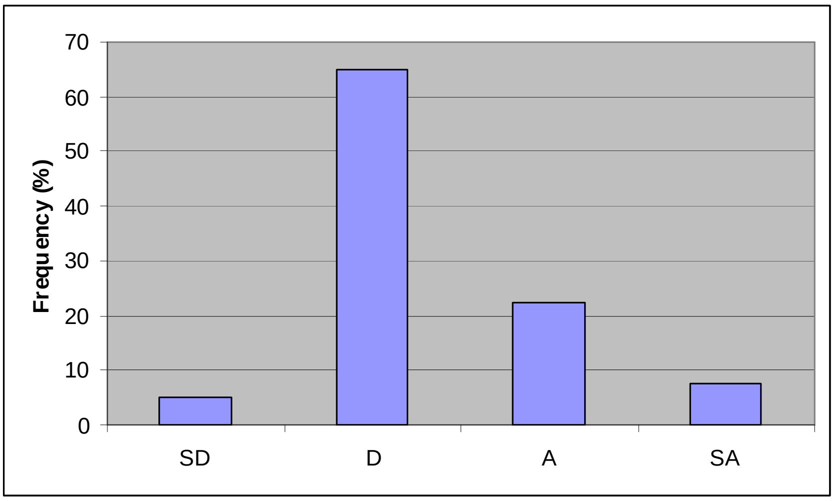


Figure 96 You do not need to use a PFD at sea

Table 58 Crew are unlikely to fall overboard

	Frequency	%
SD	6	15
D	18	44
A	13	32
SA	4	10
Total	**41**	**100**
Missing	7	
Total	**48**	

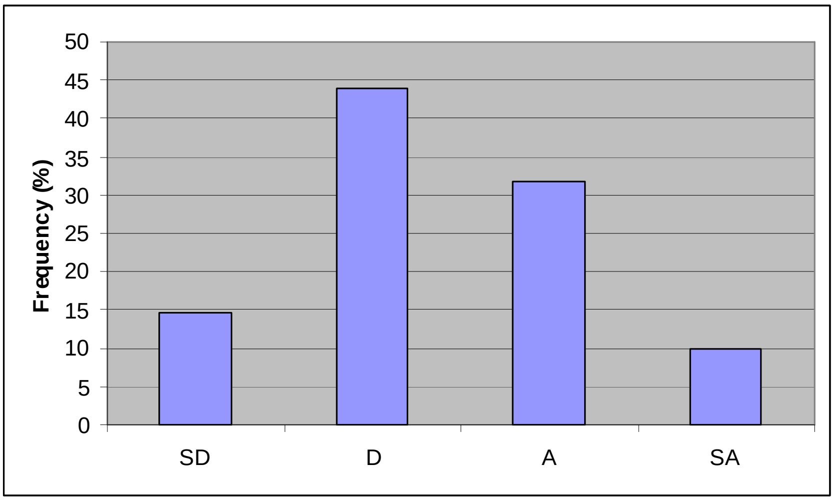


Figure 97 Crew are unlikely to fall overboard

Table 59 A PFD is too hard to look after

	Frequency	%
SD	1	3
D	25	66
A	8	21
SA	4	11
Total	**38**	**100**
Missing	10	
Total	**48**	

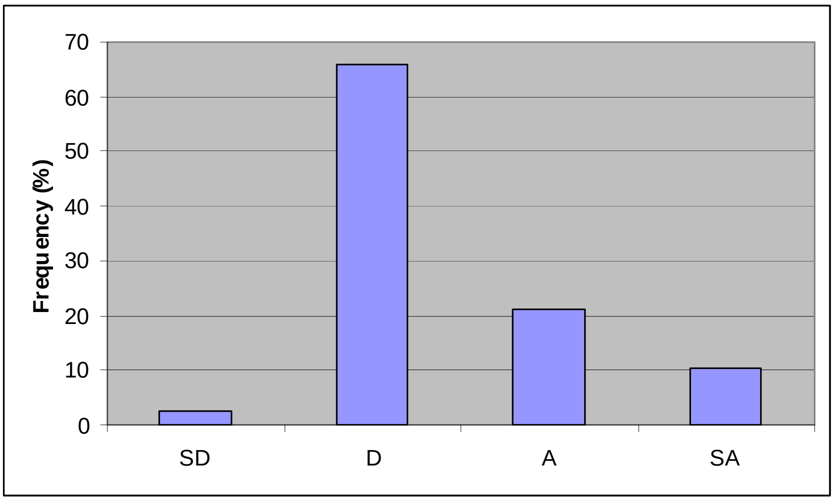


Figure 98 A PFD is too hard to look after

Table 60 A PFD gets in the way

	Frequency	%
SD	0	0
D	20	56
A	9	25
SA	7	19
Total	**36**	**100**
Missing	12	
Total	**48**	

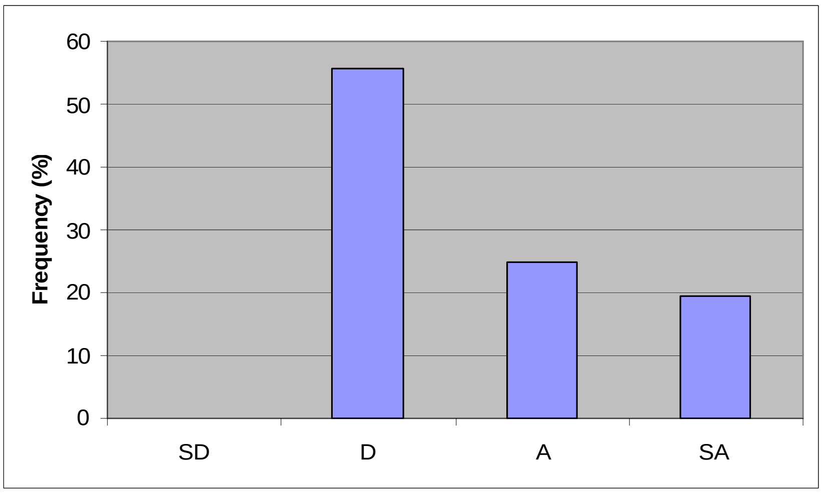


Figure 99 A PFD gets in the way

Table 61 A PFD wastes time

	Frequency	%
SD	3	7
D	29	71
A	7	17
SA	2	5
Total	**41**	**100**
Missing	7	
Total	**48**	

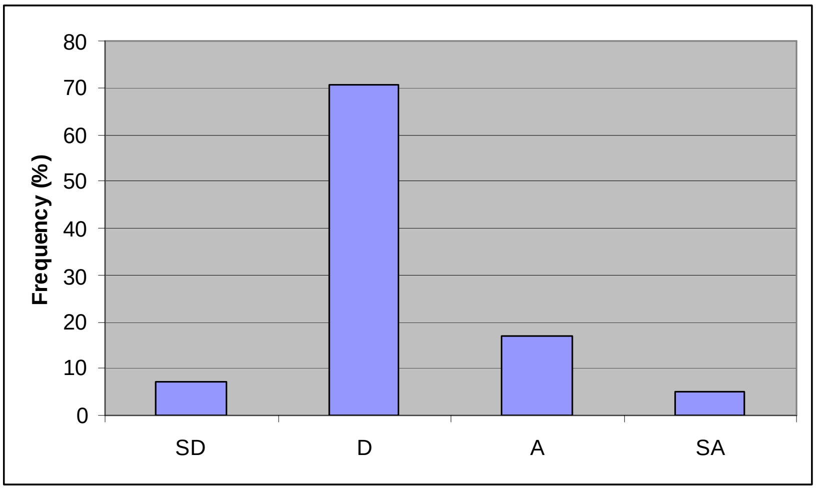


Figure 100 A PFD wastes time

Table 62 A PFD is uncomfortable

	Frequency	%
SD	0	0
D	17	49
A	15	43
SA	3	9
Total	**35**	**100**
Missing	13	
Total	**48**	

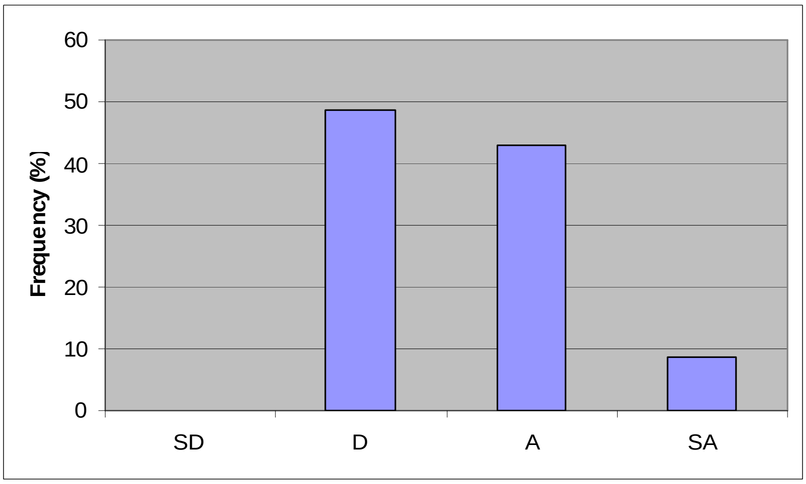


Figure 101 A PFD is uncomfortable

Table 63 A PFD is not worth the money

	Frequency	%
SD	5	12
D	29	71
A	6	15
SA	1	2
Total	**41**	**100**
Missing	7	
Total	**48**	

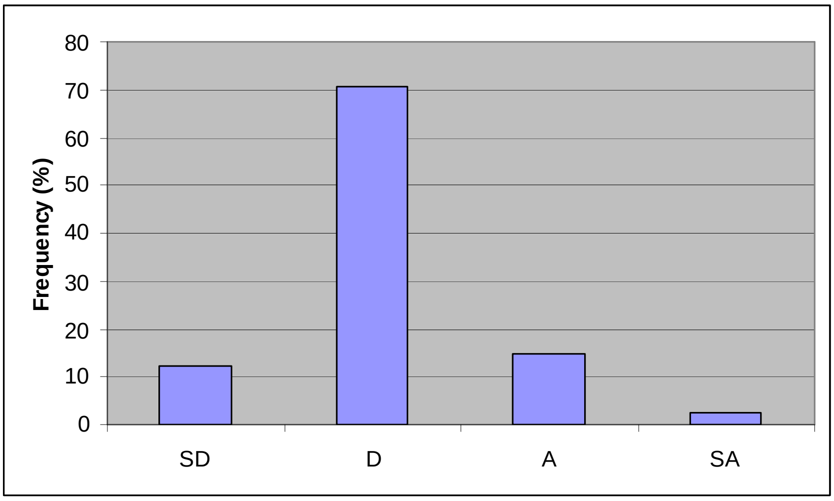


Figure 102 A PFD is not worth the money

Table 64 A PFD wouldn't save me if I fell overboard

	Frequency	%
SD	3	8
D	26	65
A	11	28
SA	0	0
Total	**40**	**100**
Missing	8	
Total	**48**	

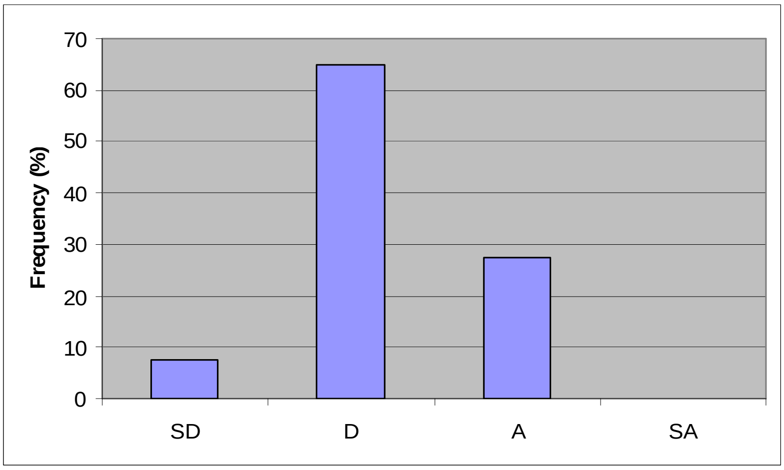


Figure 103 A PFD wouldn't save me if I fell overboard

Table 65 I prefer my crew to wear PFD's

	Frequency	%
SD	1	3
D	10	25
A	28	70
SA	1	3
Total	**40**	**100**
Missing	8	
Total	**48**	

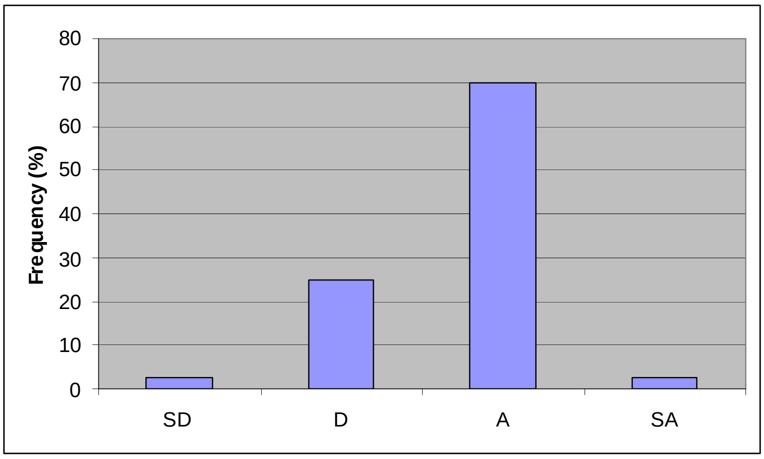


Figure 104 I prefer my crew to wear PFD's

Table 66 Stage of Change

Stage of Change	Frequency	%
Precontemplation	35	92
Contemplation	2	5
Early Action	1	3
Action	0	0
Maintenance	0	0
Total	**38**	**100**
Missing	10	
Total	**48**	

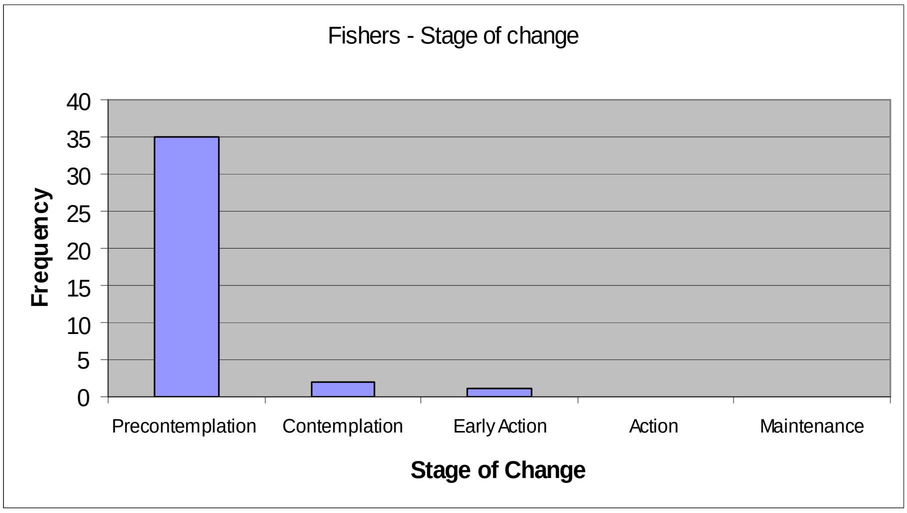


Figure 105 Stage of Change

Table 67 Would you feel comfortable enforcing the use of PFD's

	Frequency	%
Yes	16	70
No	7	30
Total	**23**	**100**
Missing	25	
Total	**48**	

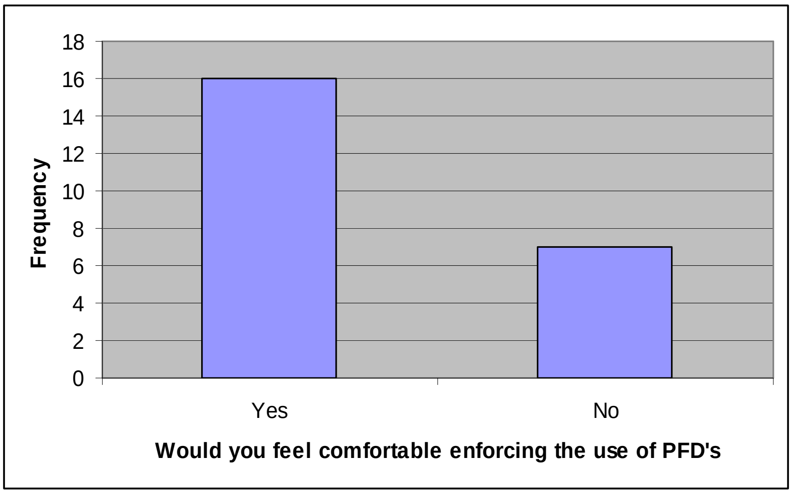


Figure 106 Would you feel comfortable enforcing the use of PFD's

Table 68 What do you think are the advantages of enforcing the use of PFD's

Comments	Frequency	%
Life saving/safety	34	67%
Peace of mind	8	16%
Easier to locate man overboard	3	6%
During rough weather	2	4%
Comfortable	1	2%
Useful with inexperienced crew	1	2%
Crew more confident	1	2%
Reduce liability	1	2%
Number of valid advantages listed	51	100%

Table 69 What do you think are the disadvantages of enforcing the use of PFD's

Comments	Frequency	%
Catching	20	27%
Restricted movement/bulky/awkward	12	16%
Hot in summer	11	15%
Uncomfortable	10	14%
Cost	3	4%
False sense of security	3	4%
Crew won't wear/arguments	3	4%
Gets dirty easy	2	3%
Puncture	2	3%
Chaffing	1	1%
Leave it to individual	1	1%
Only if improperly designed	1	1%
Part of work equipment	1	1%
Shoulder and back strain	1	1%
Weight	1	1%
Less efficient	1	1%
Maintenance	1	1%
Number of valid disadvantages listed	74	100%

The above tables represent the responses grouped by like meaning.

Table 70 Number of pros versus number of cons listed by respondents

Pros greater than Cons	13	30%
Pros same as Cons	9	21%
Cons greater than Pros	21	49%
Total number of valid responses	43	100%

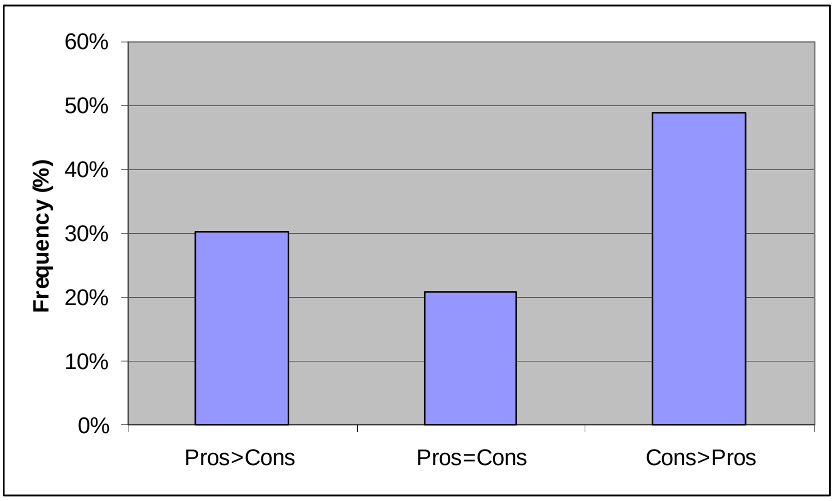
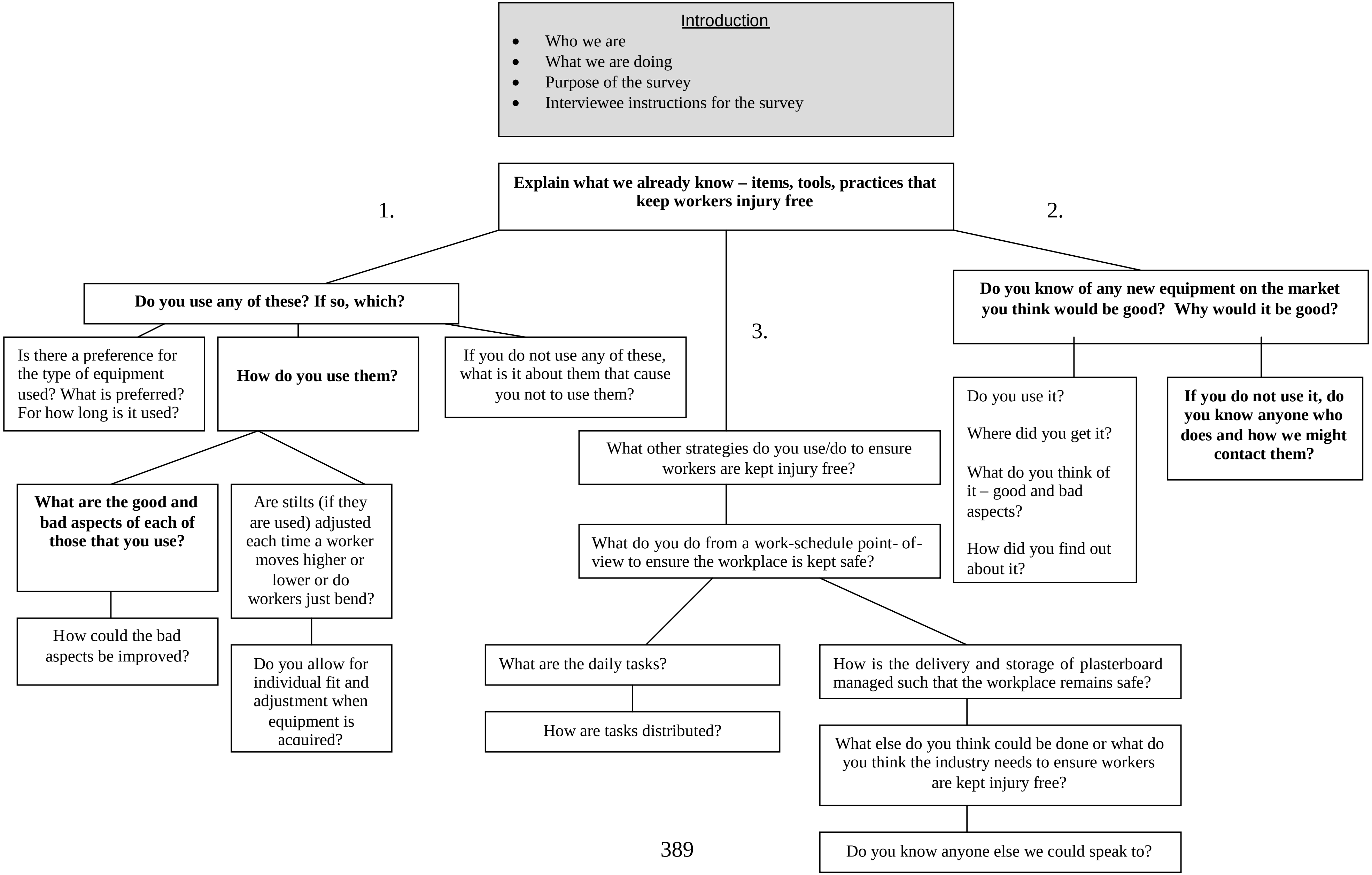


Figure 107 Number of pros versus number of cons listed by respondents

Appendix 4: Plaster Case Study - Industry Survey & Focus Group Questions



Plaster Case Study Focus Group Question Route

- Welcome & Introduction
- Opening Questions
    - How many years have you been involved in plastering?
    - Is your work residential or commercial?
    - Where do you get information about safety?
- Introductory Questions
    - What are the main safety problems that plasterers face?
    - What things have you seen or heard about that make plastering safer?
    - What things in particular increase the likelihood of being hurt?
- Transition questions
    - What have you heard about trowel boxes, panel lifters and stilts?
    - Have you used trowel boxes, panel lifters or stilts?
- Key Questions
    - Think back to when you have been using trowel boxes. How did it affect your work and how did you feel about your safety and the safety of others?
    - Think back to when you have been using stilts. How did it affect your work and how did you feel about your safety and the safety of others?
    - Think back to when you have been using panel lifters. How did it affect your work and how did you feel about your safety and the safety of others?
- Activity (moderator to list):
    - Trowel boxes
        - What things are good about trowel boxes when compared to hand trowelling?
        - What things are bad about trowel boxes when compared to hand trowelling?
    - Panel lifters
        - What things are good about panel lifters?
        - What things are bad about panel lifters?
    - Stilts
        - What things are good about stilts?
        - What things are bad about stilts?
- Ending Questions
- Moderator summarises.
- All things considered, do you think trowel box work is better than hand trowel work?
- All things considered, do you think panel lifters are worth using?
- All things considered, do you think stilts should be used?

Appendix 5: Plasterers' Trowel Box Assessment

Borg Perceived Exertion Scale

The following Perceived Exertion scale was used during the plasterer's trowel box quantitative risk assessment.

Rating	Word anchor
6	No exertion at all
7	Extremely light
8	
9	Very light
10	
11	
12	
13	Somewhat hard
14	
15	Hard (heavy)
16	
17	Very hard
18	
19	Extremely hard
20	Maximal exertion

(after Borg, 1998)

Results

The results of the perceived exertion assessment are shown in Table 71 and Figure 108.

Table 71 Perceived Exertion associated with three plastering techniques

	Perceived Exertion Rating		
Subject Code	Trowel Box	Hand Trowel: Stilts	Hand Trowel: Trestle
1	9	13	13
2	7	13	10
3	8	12	12
4	7	11	10
5	8	8	11
6	11	11	12
7	11	11	13
8	9	11	9

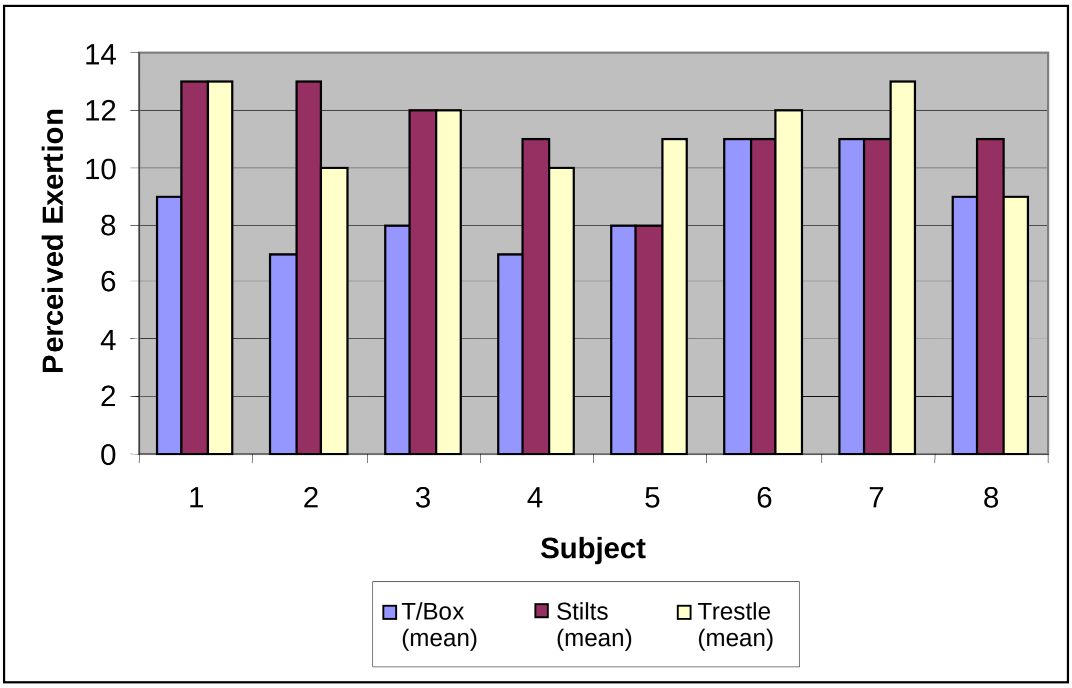


Figure 108 Perceived Exertion associated with three plastering techniques

Table 72 Trowel box assessment - subject height and handedness

Subject	Height	Handedness
1	1. 76 m	Right
2	1. 85 m	Right
3	1. 78 m	Right
4	1. 78 m	Right
5	1. 70 m	Right
6	1. 78 m	Right
7	1. 76 m	Right
8	1. 80 m	Right

**Plasterers' hand trowels and trowel boxes:
A comparative risk assessment**

The results presented in the following tables are raw data obtained for each subject. It should be noted here that all units are in degrees and that subjects 1 and 3 repeated their trials on a subsequent day to assess the reproducibility of the method used. Repeat subjects are denoted as 1r and 3r.

Empty cells in tables represent missing or bad data.

Abbreviations used in the tabular summaries are listed below:

- 1TB1= Subject no., technique type, trial number
- AV = Average
- TB = Trowel Box
- St = Hand trowel on stilts
- Tr = Hand trowel on trestles
- ShAV = Average shoulder angle
- ShMax = Maximum shoulder angle
- ShMin = Minimum shoulder angle
- LFlexAV = Average angle of lumbar lateral flexion
- LFlexMax = Maximum angle of lumbar lateral flexion
- LFlexMin = Minimum angle of lumbar lateral flexion
- CxExtAv = Average angle of cervical extension
- CxExtMax = Maximum angle of cervical extension (neck angle)
- CxExtMin = Minimum angle of cervical extension
- LxExtAv = Average angle of lumbar extension
- LxExtMax = Maximum angle of lumbar extension
- LxExtMin = Minimum angle of lumbar extension
- TBHanAv = Average trowel box handle angle
- TBHanMax = Maximum trowel box handle angle
- TBHanMin = Minimum trowel box handle angle

Subject 1

Table 73 Trowel Box

TRIAL	ShAv	ShMax	ShMin	LFlexAv	LFlexMax	LFlexMin	CxExtAv	CxExtMax	CxExtMin	LxExtAv	LxExtMax	LxExtMin	TBHanAv	TBHanMax	TBHanMin
1TB1	21.3	23.8	19.0	-18.2	-20.2	-16.2	87.1	94.4	82.2						
1TB2	40.9	84.7	13.1	-18.0	-19.6	-16.9	86.3	88.8	83.7	-6.5	-7.6	-5.1	35.9	37.0	35.0
1TB3	23.8	25.2	22.8	-18.0	-19.0	-16.3	87.2	91.1	82.9	-7.4	-9.1	-5.4	33.5	35.1	31.9
1TB4	20.1	22.0	18.8	-17.8	-19.2	-16.0	87.8	94.8	74.7	-6.7	-8.9	-3.8	35.3	37.5	33.3
1TB5	34.2	79.3	14.7	-20.4	-22.3	-17.8	91.5	95.6	87.7	-7.9	-9.2	-6.4	34.3	35.3	32.8
AV	28.1	47.0	17.7	-18.5	-20.1	-16.6	88.0	92.9	82.3	-7.1	-8.7	-5.2	34.8	36.2	33.3

Table 74 Hand trowel on stilts

TRIAL	ShAv	ShMax	ShMin	LFlexAv	LFlexMax	LFlexMin	CxExtAv	CxExtMax	CxExtMin	LxExtAv	LxExtMax	LxExtMin
1st1	13.1	15.6	8.6	-6.2	-11.0	-0.7						
1st2	16.6	21.4	8.4	-1.6	-6.1	-0.2	40.0	47.2	35.3	15.4	28.4	-0.3
1st3												
1st4	14.9	18.7	7.0	-3.5	-10.1	0.6	40.3	45.1	36.5	15.3	27.6	0.2
1st5	18.9	21.0	14.3	-3.6	-9.4	-1.5	38.0	45.2	33.2	18.2	30.4	3.2
AV	15.9	19.2	9.6	-3.7	-9.1	-0.5	39.4	45.8	35.0	16.3	28.8	1.0

Table 75 Hand trowel on trestles

TRIAL	ShAv	ShMax	ShMin	LFlexAv	LFlexMax	LFlexMin	CxExtAv	CxExtMax	CxExtMin	LxExtAv	LxExtMax	LxExtMin
1Tr1	22.0	26.1	14.4	-4.0	-7.8	-2.2	34.9	38.1	31.4	19.7	35.1	3.9
1Tr2	23.5	28.0	16.0	-4.7	-6.0	-2.9	34.7	40.2	31.3	20.5	35.0	2.5
1Tr3	21.9	26.2	14.5	-3.0	-4.8	-1.3	35.1	39.7	31.4	19.0	33.8	3.1
1Tr4	19.0	22.3	11.4	-3.6	-8.8	-2.0	34.6	39.8	31.0	15.6	31.1	-1.2
1Tr5	20.7	24.3	12.5	-3.9	-7.7	-2.1	30.4	36.5	24.7	20.9	34.1	3.2
AV	21.4	25.4	13.8	-3.8	-7.0	-2.1	34.0	38.9	30.0	19.2	33.8	2.3

Subject 2

Table 76 Trowel Box

TRIAL	ShAv	ShMax	ShMin	LFlexAv	LFlexMax	LFlexMin	CxExtAv	CxExtMax	CxExtMin	LxExtAv	LxExtMax	LxExtMin	TBHanAv	TBHanMax	TBHanMin
2TB1	24.5	25.7	23.4	-19.9	-21.3	-18.1	84.5	88.9	78.4	-6.8	-8.7	-4.8	43.3	44.9	40.9
2TB2	23.5	24.9	22.1	-14.7	-16.1	-12.1	81.9	86.3	78.5	-9.4	-11.1	-7.2	45.1	46.5	43.9
2TB3	21.6	23.3	19.1	-17.0	-18.4	-15.5	80.3	86.3	71.0	-11.3	-15.1	-6.6	45.0	46.4	43.9
2TB4	20.2	21.4	18.3	-14.1	-16.1	-11.7	74.3	78.8	68.4	-10.6	-12.5	-8.7	43.9	44.8	42.8
2TB5	20.2	22.3	17.7	-14.4	-15.5	-13.0	82.8		76.0	-7.1	-9.2	-5.4	42.5	45.2	40.7
AV	22.0	23.5	20.1	-16.0	-17.5	-14.1	80.8	85.1	74.5	-9.0	-11.3	-6.5	43.9	45.6	42.5

Table 77 Hand trowel on stilts

TRIAL	ShAv	ShMax	ShMin	LFlexAv	LFlexMax	LFlexMin	CxExtAv	CxExtMax	CxExtMin	LxExtAv	LxExtMax	LxExtMin
2st1	24.1	28.1	17.1	-15.1	-19.8	-11.5	35.4	41.9	29.9	-1.9	7.0	-7.0
2st2	26.1	32.1	7.7	-21.0	-23.5	-17.4	30.1	43.4	20.2	1.1	8.2	-7.9
2st3										1.9	8.1	-3.2
2st4										5.9	12.0	-1.1
2st5	22.3	28.6	6.7	-15.2	-16.9	-11.3	31.6	38.5	27.4	3.8	9.7	-1.5
AV	24.2	29.6	10.5	-17.1	-20.1	-13.4	32.3	41.2	25.8	2.2	9.0	-4.1

Table 78 Hand trowel on trestles

TRIAL	ShAv	ShMax	ShMin	LFlexAv	LFlexMax	LFlexMin	CxExtAv	CxExtMax	CxExtMin	LxExtAv	LxExtMax	LxExtMin
2Tr1	27.0	28.3	25.5	-15.5	-16.0	-15.1	32.4	38.5	24.4	2.7	4.6	-0.4
2Tr2	22.4	31.2	0.0	-17.3	-18.5	-15.1	30.7	38.0	24.5	6.1	15.3	1.6
2Tr3	23.5	31.0	11.2	-17.5	-20.4	-15.3	32.1	38.0	26.2	2.9	6.8	0.6
2Tr4	22.6	32.8	0.1	-20.3	-22.3	-17.7	29.7	33.4	24.6	7.0	14.6	2.1
2Tr5	20.3	25.5	7.7	-16.7	-18.0	-15.9	34.4	40.7	29.2	4.8	9.8	3.1
AV	23.2	29.8	8.9	-17.5	-19.0	-15.8	31.9	37.7	25.8	4.7	10.2	1.4

Subject 3

Table 79 Trowel Box

TRIAL	ShAv	ShMax	ShMin	LFlexAv	LFlexMax	LFlexMin	CxExtAv	CxExtMax	CxExtMin	LxExtAv	LxExtMax	LxExtMin	TBHanAv	TBHanMax	TBHanMin
3TB1	16.1	47.8	9.5	-9.2	-11.7	-6.5									
3TB2	10.0	11.9	8.0	-9.1	-11.4	-6.4	33.6	43.0	26.0	2.5	5.3	0.2	38.3	39.6	36.4
3TB3	24.7	43.3	6.9	-10.4	-11.5	-7.8	30.4	37.0	25.3	4.4	7.5	2.0	41.2	43.7	36.7
3TB4	14.6	49.9	7.4	-10.2	-12.0	-8.4	26.6	32.7	21.8	6.5	9.8	4.9	42.3	45.0	39.2
3TB5	23.4	49.7	8.2	-8.8	-10.5	-6.9	52.5	71.6	29.3	5.8	7.8	3.5	42.5	44.2	40.8
AV	17.8	40.5	8.0	-9.5	-11.4	-7.2	35.8	46.1	25.6	4.8	7.6	2.6	41.1	43.1	38.3

Table 80 Hand trowel on stilts

TRIAL	ShAv	ShMax	ShMin	LFlexAv	LFlexMax	LFlexMin	CxExtAv	CxExtMax	CxExtMin	LxExtAv	LxExtMax	LxExtMin
3st1	17.3	21.4	10.0	2.5	4.7	-1.9						
3st2	17.0	21.1	9.4	1.8	5.2	-4.6	58.9	63.1	54.1	18.5	34.4	1.0
3st3	17.9	22.5	9.8	3.1	6.2	-1.4	56.6	61.3	51.1	19.3	38.6	0.5
3st4	18.5	22.1	11.4	0.3	5.2	-8.5	56.4	61.7	47.9	20.5	35.5	1.2
3st5	16.4	21.0	8.4	0.2	5.2	-10.1	56.8	61.3	52.0	22.3	37.5	5.5
AV	17.4	21.6	9.8	1.6	5.3	-5.3	57.2	61.9	51.3	20.1	36.5	2.1

Table 81 Hand trowel on trestles

TRIAL	ShAv	ShMax	ShMin	LFlexAv	LFlexMax	LFlexMin	CxExtAv	CxExtMax	CxExtMin	LxExtAv	LxExtMax	LxExtMin
3Tr1	17.5	22.1	10.4	0.3	-5.4	3.9						
3Tr2	21.0	24.7	14.3	-1.1	-7.9	2.1	58.9	65.9	54.4	18.6	35.3	0.3
3Tr3	21.9	27.4	13.2	-0.9	-6.2	2.2	55.1	60.1	51.1	20.1	39.4	1.1
3Tr4	19.9	24.6	11.5	-0.9	-5.8	2.6	58.7	62.4	55.0	18.1	36.4	-2.1
3Tr5	20.4	28.2	7.8	1.2	-5.6	4.3	57.2	65.6	52.2	20.1	39.5	-2.0
AV	20.1	25.4	11.4	-0.3	-6.2	3.0	57.5	63.5	53.2	19.2	37.7	-0.7

Subject 4

Table 82 Trowel Box

TRIAL	ShAv	ShMax	ShMin	LFlexAv	LFlexMax	LFlexMin	CxExtAv	CxExtMax	CxExtMin	LxExtAv	LxExtMax	LxExtMin	TBHanAv	TBHanMax	TBHanMin
4TB1	12.6	14.6	9.8	-9.5	-12.0	-6.3	31.5	35.4	27.5	-6.5	-9.2	-3.3	51.8	54.5	49.3
4TB2	8.3	9.7	7.2	-8.7	-10.3	-6.9	27.5	32.7	21.7	-5.0	-6.7	-2.7	60.8	62.2	59.2
4TB3	7.1	10.2	4.8	-4.8	-8.0	-2.5	24.8	31.5	18.1	-8.2	-12.3	-4.4	51.2	56.1	48.7
4TB4	6.8	10.1	4.2	-5.2	-8.6	-3.0	23.3	30.0	18.8	-7.7	-11.0	-3.9	53.6	56.0	51.3
4TB5	6.5	8.7	4.8	-7.4	-10.2	-4.2	29.9	32.8	26.7	-7.7	-9.4	-5.5	50.8	53.9	49.3
AV	8.3	10.6	6.2	-7.1	-9.8	-4.6	27.4	32.5	22.6	-7.0	-9.7	-4.0	53.6	56.6	51.6

Table 83 Hand trowel on stilts

TRIAL	ShAv	ShMax	ShMin	LFlexAv	LFlexMax	LFlexMin	CxExtAv	CxExtMax	CxExtMin	LxExtAv	LxExtMax	LxExtMin
4st1	12.7	16.0	8.9	-5.5	-9.0	-2.4	32.4	41.2	21.4	0.8	3.4	-1.1
4st2	14.5	18.0	5.6	-8.5	-11.5	-1.8	36.4	43.9	27.8	0.8	2.5	-0.7
4st3	13.9	20.2	5.0	-12.3	-16.6	-7.9	33.6	40.5	22.9	-1.2	-0.6	-2.3
4st4	14.4	19.6	4.5	-11.9	-14.8	-8.3	31.7	40.2	16.0	1.1	5.1	-2.4
4st5	9.8	15.2	0.1	-10.7	-14.8	-3.0	31.8	39.7	21.7	0.5	3.3	-1.7
AV	13.1	17.8	4.8	-9.8	-13.3	-4.7	33.2	41.1	22.0	0.4	2.8	-1.7

Table 84 Hand trowel on trestles

TRIAL	ShAv	ShMax	ShMin	LFlexAv	LFlexMax	LFlexMin	CxExtAv	CxExtMax	CxExtMin	LxExtAv	LxExtMax	LxExtMin
4Tr1	15.8	20.1	7.0	-4.7	-7.7	-1.0	39.2	46.6	26.0	-5.6	-10.0	-2.2
4Tr2	16.0	22.0	5.6	-5.2	-6.9	-2.4	43.3	49.5	31.6	-7.7	-11.5	-3.1
4Tr3	17.6	23.7	7.8	-6.1	-9.9	-1.0	41.6	46.8	32.9	-4.0	-5.4	-2.7
4Tr4	13.9	20.3	2.7	-7.0	-11.3	-2.7	42.5	46.7	33.5	-3.3	-4.8	-1.3
4Tr5	16.7	21.3	7.3	-8.4	-12.6	-4.5	42.5	48.6	32.7	-5.6	-6.4	-4.8
AV	16.0	21.4	6.1	-6.3	-9.7	-2.3	41.8	47.6	31.4	-5.2	-7.6	-2.8

Subject 5

Table 85 Trowel Box

TRIAL	ShAv	ShMax	ShMin	LFlexAv	LFlexMax	LFlexMin	CxExtAv	CxExtMax	CxExtMin	LxExtAv	LxExtMax	LxExtMin	TBHanAv	TBHanMax	TBHanMin
5TB1	47.1	92.0	28.1	-19.4	-21.1	-17.7	71.7	75.6	66.7	-2.4	-5.0	0.7	31.8	34.9	28.4
5TB2	26.8	31.0	23.7	-21.4	-23.0	-19.3	70.2	78.1	60.9	-1.8	-4.2	0.6	35.2	36.3	33.9
5TB3	29.0	31.1	27.1	-22.7	-24.5	-20.8	67.4	76.5	61.9	-5.1	-7.3	-3.6	35.1	36.3	33.9
5TB4	31.3	33.0	29.0	-20.0	-22.5	-18.7	66.2	71.0	53.3	-3.5	-6.2	-1.4	36.3	37.6	35.2
5TB5	26.5	28.9	24.6	-18.2	-21.5	-15.0	67.0	73.3	58.9	-1.6	-5.5	0.4	33.4	34.1	32.5
AV	32.1	43.2	26.5	-20.4	-22.5	-18.3	68.5	74.9	60.3	-2.9	-5.7	-0.7	34.4	35.8	32.8

Table 86 Hand trowel on stilts

TRIAL	ShAv	ShMax	ShMin	LFlexAv	LFlexMax	LFlexMin	CxExtAv	CxExtMax	CxExtMin	LxExtAv	LxExtMax	LxExtMin
5st1	25.1	28.3	20.6	-7.3	-18.0	1.5	45.6	53.7	38.5	25.8	34.6	13.1
5st2	24.6	27.8	21.2	2.2	-7.3	9.8	46.2	52.5	35.8	21.8	34.4	-0.1
5st3	31.3	35.1	28.2	-5.3	-11.3	6.1	46.1	54.6	39.2	24.7	35.2	0.6
5st4	29.4	33.3	26.4	-2.3	-11.0	3.3	46.4	56.0	41.0	24.9	34.9	7.5
5st5	30.0	35.4	26.3	-1.3	-12.5	7.9	45.4	54.1	40.4	25.6	34.0	7.9
AV	28.1	32.0	24.6	-2.8	-12.0	5.7	45.9	54.2	39.0	24.6	34.6	5.8

Table 87 Hand trowel on trestles

TRIAL	ShAv	ShMax	ShMin	LFlexAv	LFlexMax	LFlexMin	CxExtAv	CxExtMax	CxExtMin	LxExtAv	LxExtMax	LxExtMin
5Tr1	29.5	33.6	0.1	0.3	-13.2	33.6	44.6	51.6	38.8	24.5	37.5	11.4
5Tr2	29.9	31.8	28.0	-5.6	-24.1	3.1	40.5	43.9	34.9	26.5	39.1	9.0
5Tr3	31.8	34.5	27.5	-12.7	-22.3	0.5	37.9	43.9	33.3	30.8	41.6	11.1
5Tr4	30.4	33.5	26.4	-5.4	-18.6	3.6	35.4	45.7	23.4	25.8	36.9	10.2
5Tr5	28.7	31.4	23.5	-4.1	-21.4	3.5	40.1	47.1	27.3	29.7	43.8	15.5
AV	30.1	33.0	21.1	-5.5	-19.9	8.9	39.7	46.5	31.5	27.5	39.8	11.4

Subject 6

Table 88 Trowel Box

TRIAL	ShAv	ShMax	ShMin	LFlexAv	LFlexMax	LFlexMin	CxExtAv	CxExtMax	CxExtMin	LxExtAv	LxExtMax	LxExtMin	TBHanAv	TBHanMax	TBHanMin
6TB1	4.9	6.0	3.4	-2.0	-3.5	-0.2	43.7	46.7	40.2	7.8	9.8	4.4	38.9	40.5	37.5
6TB2	7.8	9.1	6.2	-4.5	-6.0	-2.8	42.9	47.6	38.4	5.7	7.0	4.3	38.0	40.0	36.7
6TB3	4.9	6.7	2.7	-3.1	-4.1	-2.6	47.4	51.7	43.1	3.1	5.8	1.4	37.7	38.8	35.8
6TB4	7.5	9.1	5.9	-2.3	-4.4	0.8	52.1	55.4	48.7	6.1	8.4	4.0	40.0	41.6	38.1
6TB5	3.0	4.5	1.9	-2.9	-4.0	-1.4	46.7	51.0	42.6	2.4	5.8	-0.5	37.1	38.3	36.2
AV	5.6	7.1	4.0	-3.0	-4.4	-1.3	46.6	50.5	42.6	5.0	7.3	2.7	38.3	39.9	36.8

Table 89 Hand trowel on stilts

TRIAL	ShAv	ShMax	ShMin	LFlexAv	LFlexMax	LFlexMin	CxExtAv	CxExtMax	CxExtMin	LxExtAv	LxExtMax	LxExtMin
6st1	17.1	22.2	14.3	1.3	-2.5	3.6	51.3	57.7	45.8	12.7	18.5	6.4
6st2	14.2	16.2	11.2	2.6	-1.5	5.0	49.7	57.8	43.3	11.6	19.2	5.1
6st3	15.4	19.1	11.6	1.1	-3.5	5.0	53.8	58.9	49.0	12.9	19.9	0.8
6st4	17.3	19.6	14.5	-4.7	-7.8	-0.6	58.9	72.0	49.6	24.9	28.1	19.4
6st5	16.2	19.1	13.3	-3.3	-6.5	-0.3	57.7	71.6	51.9	21.1	27.5	16.1
AV	16.0	19.2	13.0	-0.6	-4.4	2.5	54.3	63.6	47.9	16.6	22.6	9.5

Table 90 Hand trowel on trestles

TRIAL	ShAv	ShMax	ShMin	LFlexAv	LFlexMax	LFlexMin	CxExtAv	CxExtMax	CxExtMin	LxExtAv	LxExtMax	LxExtMin
6Tr1	14.7	15.8	13.2	0.9	-3.5	4.1	49.7	56.8	44.7	21.5	35.7	7.4
6Tr2	11.8	13.2	10.8	0.5	-8.1	4.1	49.1	53.1	45.1	22.4	36.8	13.3
6Tr3	13.7	15.8	10.7	0.7	-10.0	4.5	50.6	58.9	45.9	22.4	32.7	8.5
6Tr4	12.5	15.4	9.4	-0.3	-7.8	4.4	47.0	51.4	41.9	20.3	29.0	9.5
6Tr5	12.3	14.4	9.9	4.5	0.2	6.7	45.2	48.9	40.9	20.8	30.5	5.1
AV	13.0	14.9	10.8	1.3	-5.8	4.8	48.3	53.8	43.7	21.5	32.9	8.7

Subject 7

Table 91 Trowel Box

TRIAL	ShAv	ShMax	ShMin	LFlexAv	LFlexMax	LFlexMin	CxExtAv	CxExtMax	CxExtMin	LxExtAv	LxExtMax	LxExtMin	TBHanAv	TBHanMax	TBHanMin
7TB1	7.2	9.0	4.2	-7.6	-9.6	-4.4	24.3	31.6	18.9	3.8	5.3	1.8	53.3	54.3	52.2
7TB2	6.5	8.1	5.2	-6.0	-8.3	-4.2	24.5	31.1	17.3	4.3	6.4	1.7	52.1	53.8	51.1
7TB3	10.2	11.9	7.9	-8.7	-10.6	-6.3	27.1	34.2	20.3	2.6	4.8	1.0	53.8	55.4	51.6
7TB4	11.0	13.3	9.0	-7.3	-9.6	-3.7	24.8	34.4	15.9	2.0	3.7	-3.3	59.1	60.5	58.0
7TB5	10.8	12.4	9.6	-8.4	-11.4	-6.2	15.5	23.2	7.5	1.3	3.4	-1.5	55.3	56.2	54.5
AV	9.1	10.9	7.2	-7.6	-9.9	-5.0	23.2	30.9	16.0	2.8	4.7	-0.1	54.7	56.1	53.5

Table 92 Hand trowel on stilts

TRIAL	ShAv	ShMax	ShMin	LFlexAv	LFlexMax	LFlexMin	CxExtAv	CxExtMax	CxExtMin	LxExtAv	LxExtMax	LxExtMin
7st1	16.9	19.6	14.1	4.2	5.6	3.3	38.5	55.0	31.7	19.0	32.1	6.7
7st2	17.1	19.1	13.5	1.9	5.8	-10.3	31.7	38.8	26.7	18.5	33.8	1.9
7st3												
7st4	17.3	20.1	13.5	2.3	7.4	-7.3	33.6	42.9	29.6	21.9	38.3	3.7
7st5	17.1	19.6	13.1	3.0	8.3	-9.7	32.7	40.7	28.4	19.7	38.3	2.9
AV	17.1	19.6	13.6	2.9	6.8	-6.0	34.1	44.4	29.1	19.8	35.6	3.8

Table 93 Hand trowel on trestles

TRIAL	ShAv	ShMax	ShMin	LFlexAv	LFlexMax	LFlexMin	CxExtAv	CxExtMax	CxExtMin	LxExtAv	LxExtMax	LxExtMin
7Tr1	14.4	15.4	12.3	4.6	10.1	-5.7	32.0	42.9	26.7	22.2	40.1	7.3
7Tr2	16.3	18.2	12.9	5.1	10.2	-5.8	31.5	41.6	26.5	21.1	37.2	4.8
7Tr3	17.7	19.1	14.2	0.3	9.8	-12.8	22.6	34.0	19.0	24.8	39.3	7.3
7Tr4	17.9	21.2	13.1	4.0	7.8	-5.4	31.5	38.6	27.8	17.7	35.8	1.2
7Tr5	18.6	20.4	15.2	6.6	11.9	-6.0	27.7	38.1	23.8	20.3	38.1	3.1
AV	17.0	18.9	13.5	4.1	9.9	-7.1	29.1	39.0	24.7	21.2	38.1	4.7

Subject 8

Table 94 Trowel Box

TRIAL	ShAv	ShMax	ShMin	LFlexAv	LFlexMax	LFlexMin	CxExtAv	CxExtMax	CxExtMin	LxExtAv	LxExtMax	LxExtMin	TBHanAv	TBHanMax	TBHanMin
8TB1	26.0	28.0	24.2	-22.8	-24.8	-21.0	90.9	103.8	76.9	-8.4	-10.3	-5.6	42.5	44.1	40.7
8TB2	19.9	21.5	17.7	-15.7	-18.1	-13.2	88.8	104.0	76.4	-7.1	-8.8	-3.9	44.5	46.3	41.2
8TB3	23.0	25.3	21.0	-19.5	-21.9	-17.4	83.7	87.9	79.6	-8.7	-10.3	-6.6	53.3	57.6	50.1
8TB4	20.0	21.2	18.3	-20.2	-22.2	-16.9	84.6	93.0	78.1	-9.6	-12.6	-5.9	46.8	48.8	45.0
8TB5	19.3	20.4	18.5	-19.1	-21.9	-17.6	89.6	95.4	82.3	-9.2	-13.2	-6.8	40.3	41.3	39.1
AV	21.7	23.3	20.0	-19.5	-21.8	-17.2	87.5	96.8	78.7	-8.6	-11.0	-5.8	45.5	47.6	43.2

Table 95 Hand trowel on stilts

TRIAL	ShAv	ShMax	ShMin	LFlexAv	LFlexMax	LFlexMin	CxExtAv	CxExtMax	CxExtMin	LxExtAv	LxExtMax	LxExtMin
8st1	29.4	41.9	12.2	-10.7	-15.6	-6.4	25.6	33.2	17.6	-1.4	-16.5	8.5
8st2	33.4	40.1	21.5	-11.5	-13.6	-9.8	26.7	31.4	22.0	-2.7	-18.4	6.4
8st3	37.1	41.8	29.6	-12.4	-18.7	-9.1	23.5	31.0	18.8	-0.2	-18.1	10.2
8st4	42.2	45.5	37.7	-12.0	-14.9	-8.3	26.6	33.4	21.0	-2.1	-19.5	9.6
8st5	41.2	42.7	39.9	-12.2	-15.2	-6.2	26.7	30.0	22.3	-2.4	-16.6	8.0
AV	36.7	42.4	28.2	-11.8	-15.6	-7.9	25.8	31.8	20.4	-1.8	-17.8	8.5

Table 96 Hand trowel on trestles

TRIAL	ShAv	ShMax	ShMin	LFlexAv	LFlexMax	LFlexMin	CxExtAv	CxExtMax	CxExtMin	LxExtAv	LxExtMax	LxExtMin
8Tr1	33.7	43.3	20.4	-19.2	-20.6	-17.3	22.8	28.5	14.6	-1.6	-14.7	6.1
8Tr2	28.0	37.1	13.5	-17.0	-20.5	-12.2	20.8	27.0	12.8	1.9	-9.3	7.2
8Tr3	32.4	39.6	29.4	-16.8	-20.8	-11.9	19.1	28.4	7.4	1.0	-11.9	6.8
8Tr4	33.2	38.2	27.4	-17.2	-19.3	-14.0	22.4	27.3	17.4	-0.3	-12.0	5.4
8Tr5	36.4	41.3	32.6	-17.7	-18.9	-15.1	23.1	28.6	13.7	-3.6	-14.9	2.8
AV	32.7	39.9	24.7	-17.6	-20.0	-14.1	21.7	27.9	13.2	-0.5	-12.5	5.6

Intra-subject comparisons

For each subject, the mean body sector angles and the greatest and smallest maximum angles measured during the five trials using each technique were calculated and are presented in Figure 109, Figure 110, Figure 111, Figure 112 and Figure 113. In addition to the mean angles recorded being shown, the maximum angles recorded are also illustrated. The figures show the greatest maximum angle and the smallest maximum angle recorded during the 5 trials.

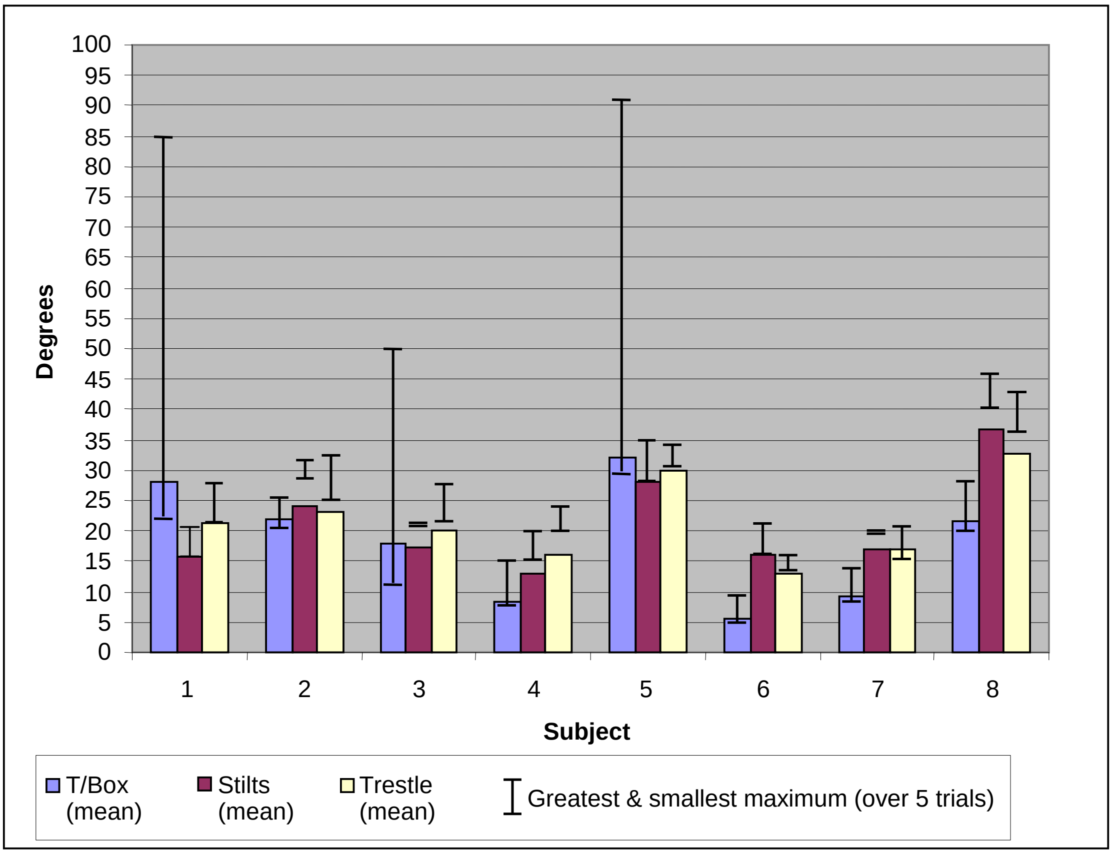


Figure 109 Shoulder rotation: mean and maxima within 5 trials

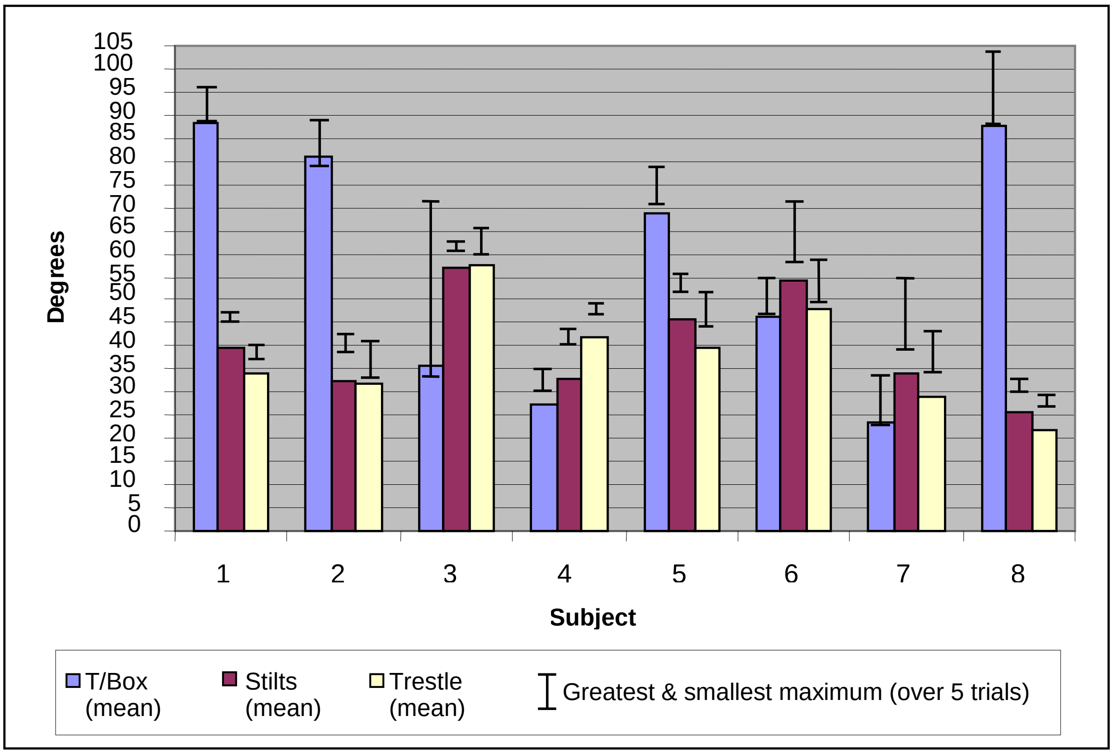


Figure 110 Neck inclination: mean and maxima within 5 trials

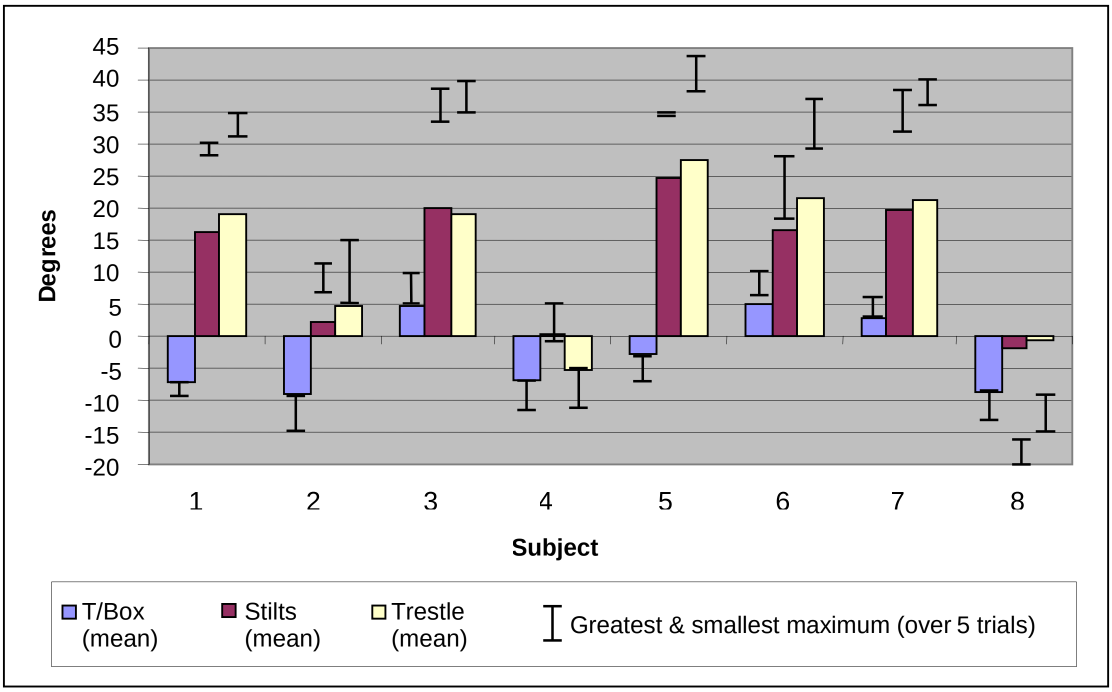


Figure 111 Lumbar extension: mean and maxima within 5 trials

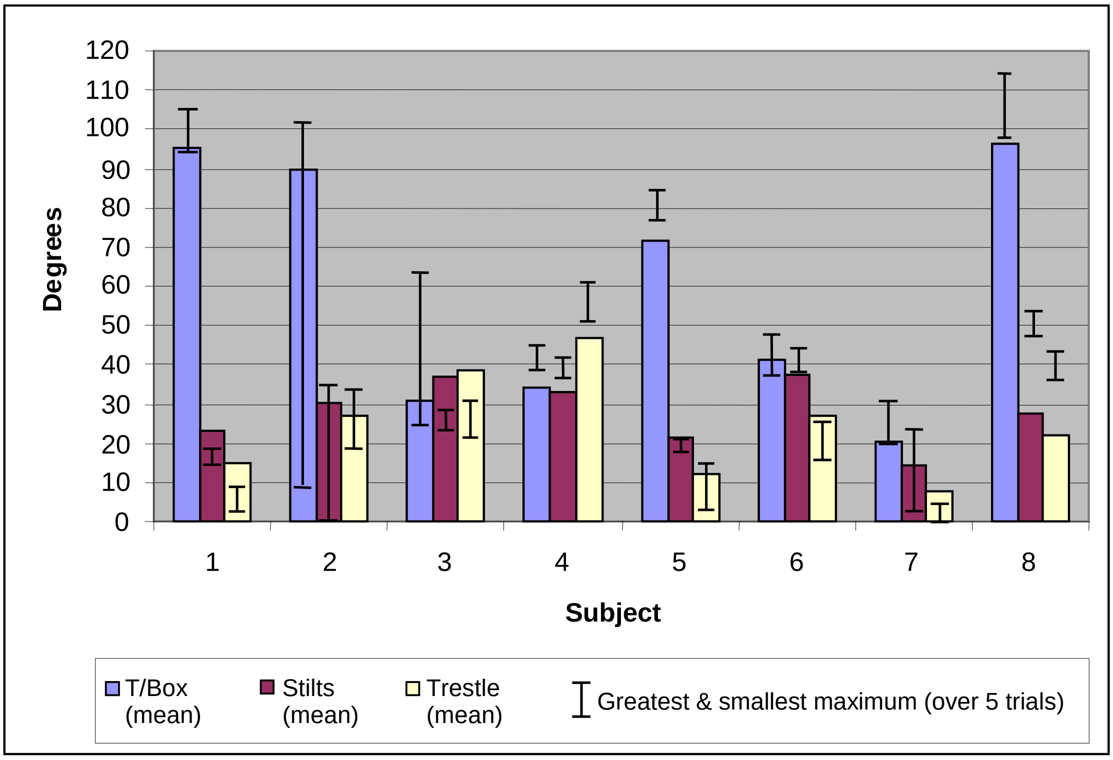


Figure 112 Neck extension: mean and maxima within 5 trials

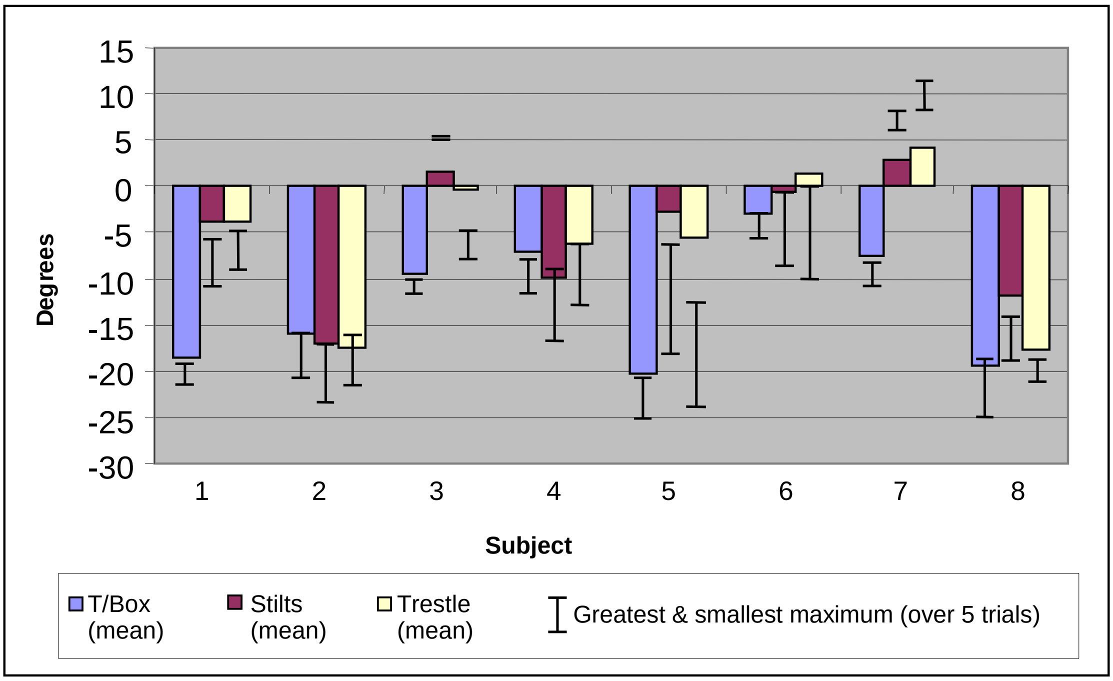


Figure 113 Lateral flexion: mean and maxima within 5 trials

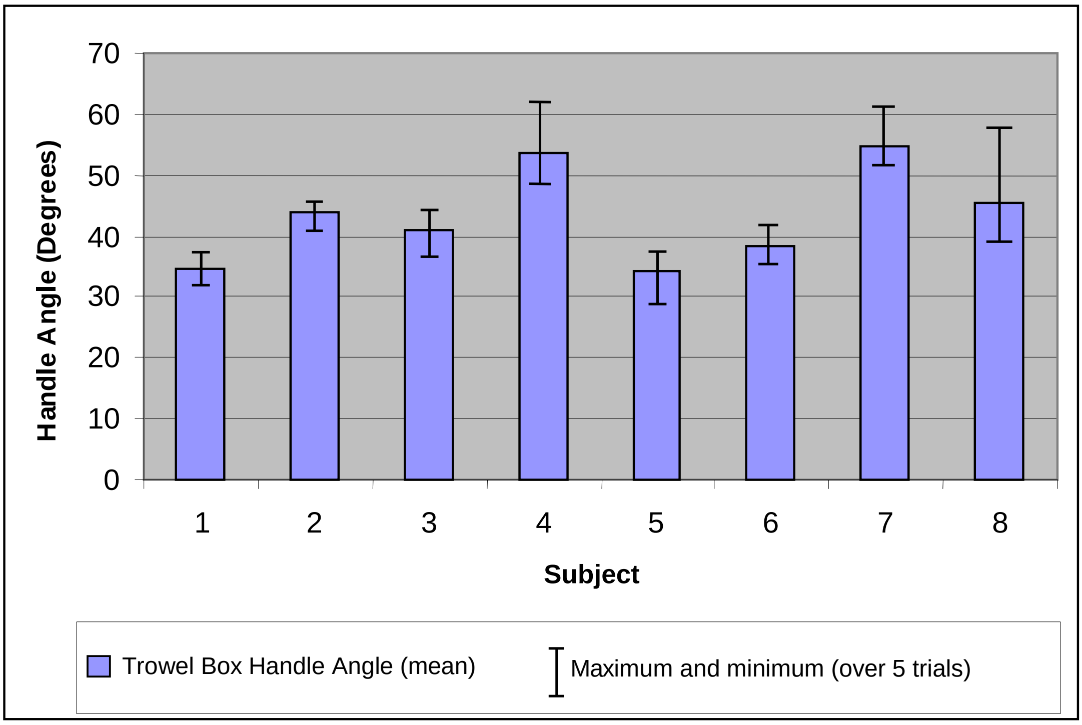


Figure 114 Trowel box handle angle: mean, maximum and minimum within 5 trials

Appendix 6: Plaster Case Study Solution Marketing Brochure

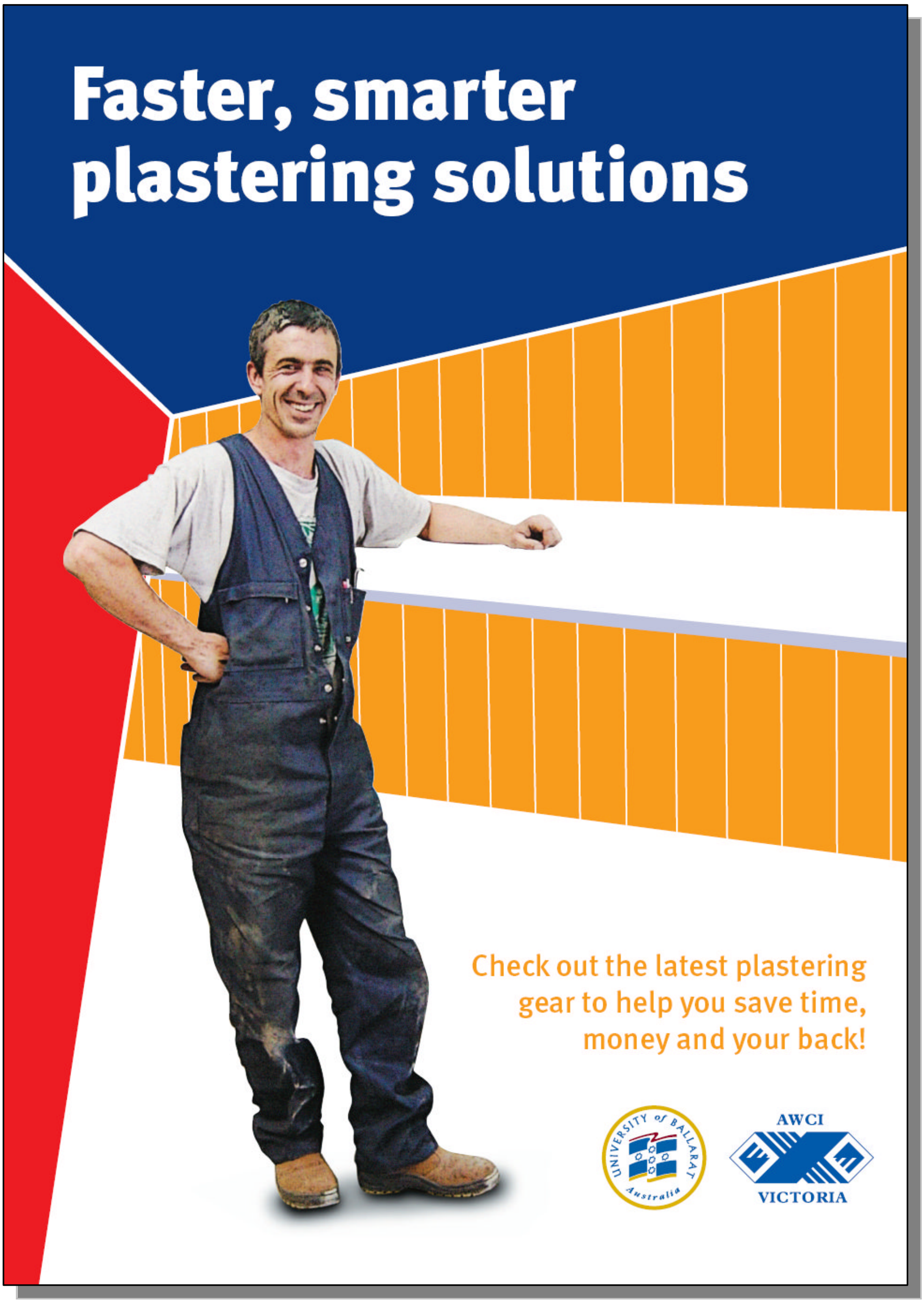


Figure 115 Brochure Front Page

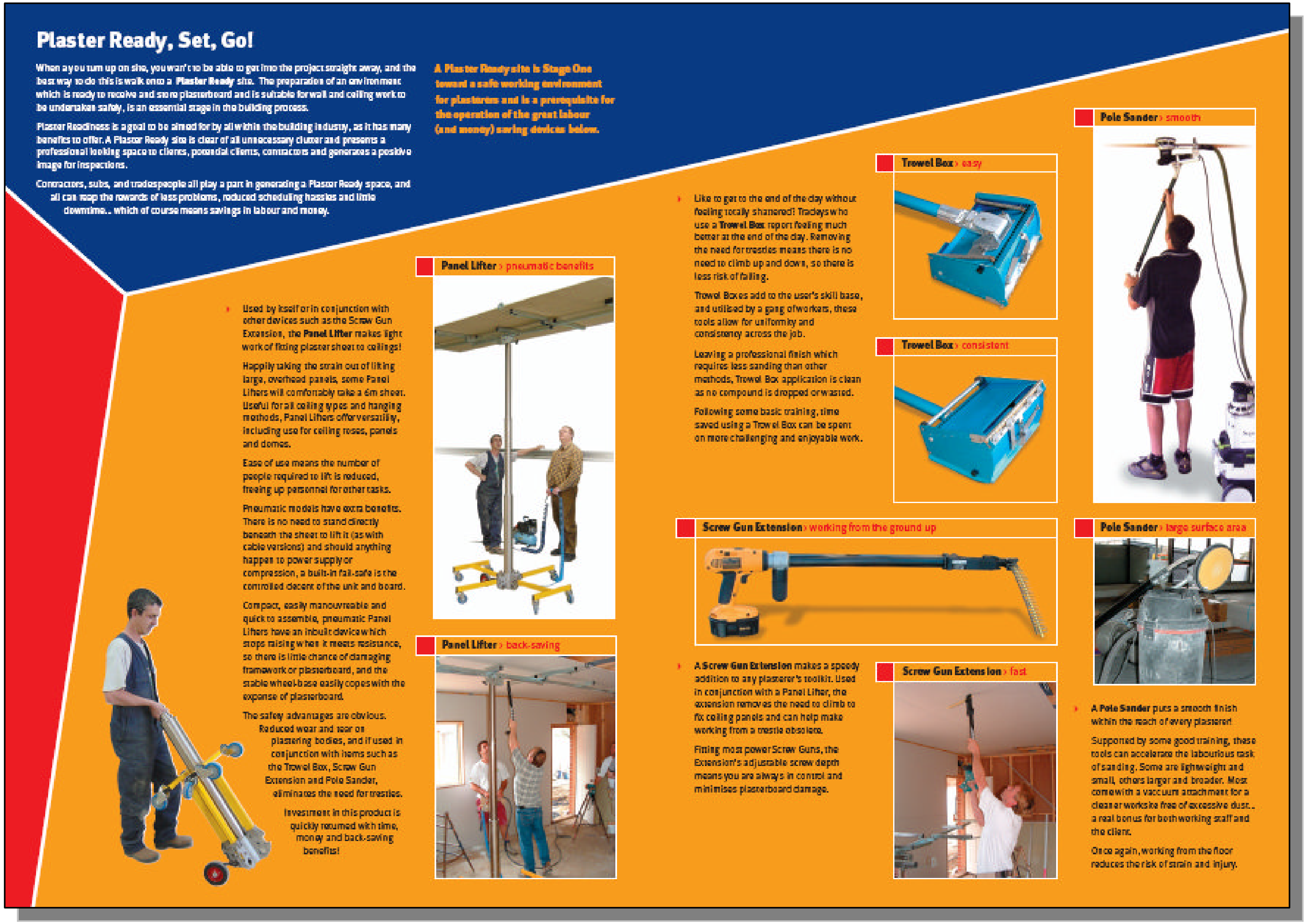
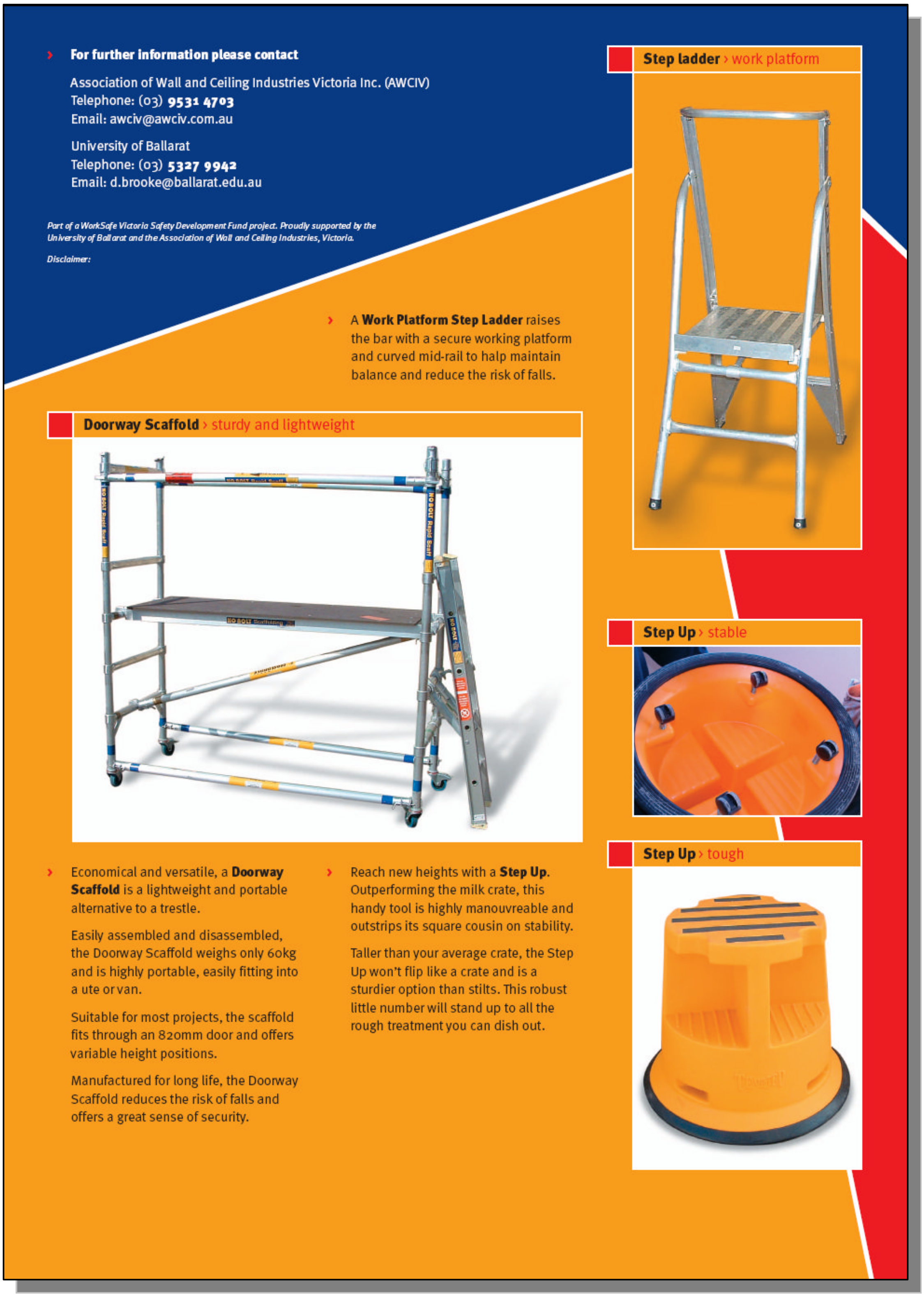


Figure 116 Brochure Inside Pages



› **For further information please contact**

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Part of a WorkSafe Victoria Safety Development Fund project. Proudly supported by the University of Ballarat and the Association of Wall and Ceiling Industries, Victoria.

Disclaimer:

Step ladder › work platform

› A **Work Platform Step Ladder** raises the bar with a secure working platform and curved mid-rail to halp maintain balance and reduce the risk of falls.

Doorway Scaffold › sturdy and lightweight

› Economical and versatile, a **Doorway Scaffold** is a lightweight and portable alternative to a trestle.

Easily assembled and disassembled, the Doorway Scaffold weighs only 60kg and is highly portable, easily fitting into a ute or van.

Suitable for most projects, the scaffold fits through an 820mm door and offers variable height positions.

Manufactured for long life, the Doorway Scaffold reduces the risk of falls and offers a great sense of security.

Step Up › stable

Step Up › tough

› Reach new heights with a **Step Up**. Outperforming the milk crate, this handy tool is highly manouvreable and outstrips its square cousin on stability.

Taller than your average crate, the Step Up won't flip like a crate and is a sturdier option than stilts. This robust little number will stand up to all the rough treatment you can dish out.

Figure 117 Brochure Back Page

Appendix 7: MVR Preliminary Visit Survey Sheets & Results

MVR Case Study Preliminary Visits Survey Sheet

Demographic data	
Ref Number	
How many employees do you have?	
How many employees spray paint?	
How old is your business?	
How long have you worked here?	
How much 2 pack paint do you use?	<10 litres/week >10 litres/week < 20 >20 litres/week
What is the nature of your work:	- Insurance % - Commercial….% - Private….%
OHS Information	
Which of the following do you obtain most of your OHS information from:	- WorkCover - VACC - VECCI or AIG - Suppliers - Other vehicle body repairers - Other….
How do you find out about the safety requirements of different paints?	
Do you always get an MSDS with your chemicals?	
Where do you get information about developments in paint and paint spraying?	

Opinion Leaders/Role Models	
Who do you know in your line of business who has good ideas about health and safety?	
Do you know who, in your line of business, is doing well in health and safety?	
Who do you know who has done particularly well in regard to chemicals in their business?	
Controls	
RPE	
Is personal respiratory protective equipment available?	Yes No
What type of personal respiratory protective equipment is available?	Air Line: Make……… PAPR Make……… Full face –ve Make……… Half Mask Make……… • Combination Filter • Organic Vapour Particulate Disposable
Is the respiratory protective equipment used when spraying 2 pack paints?	Always Sometimes Never What type:………?
RPE Condition	Good Fair Poor
RPE Storage	Good Fair Poor
Air line air supply	Filtered Monitored Conditioned

RPE Maintenance	Regular Occasional Never
Gloves	Yes No
Gloves type:	
Spray Booth	
Type	
Exhaust Location	
Is spray painting done in a spray booth?	Always Sometimes Never
If there is a spray booth:	How often is the air flow checked? • Frequently • Sometimes • Never
If there is a spray booth:	How often are filters cleaned? • Frequently • Sometimes • Never
How often is the fan checked and serviced?	Frequently Sometimes Never
How often are filters cleaned?	Frequently Sometimes Never

Storage	
Bunding	Yes No
Away from: • Moisture • Acids & Alkalis	Yes No Yes No
Fire precautions	Yes No
Spill facilities	Yes No
Signage	Yes No
Ignition sources	
Heat >2m	Yes No
Electrical >2m	Yes No
Mixing	
Designated	Yes No
Ignition sources	Electrical >2m Yes No
Heat >2m	Yes No

Signage	Good Fair Poor
Weighing	
Designated	Yes No
2m Clear	Yes No
Used as storage	Yes No
Containers kept closed	Yes No
Spill facilities (absorption material)	Yes No
Signage	Good Fair Poor
Fire extinguisher	Yes No
Handling	
Isocyanate spill procedure	Yes No
MSDS Available	Yes No
Oxygen available	Yes No
Eye wash	Yes No

Housekeeping	
Cleanliness	Good Fair Poor
Clean up facilities	Yes No
Solvent recycling facilities	Yes No

Preliminary Visits: Results

Five businesses in Metropolitan Melbourne and nine businesses in regional Victoria were surveyed. The number differed from the target as a result of business operator availability.

In the VACC membership database, three of these businesses were reported to employee 1-3 people. At the time of the visits, it was found that only one of these businesses employed less than 4 people. The size distribution of the businesses visited is shown in Table 97 and Figure 118. Thirteen of the 14 (93%) businesses visited employed more than 4 people.

Table 97 Number of Employees

	Frequency	Percent %
1-3	1	7.1
4-9	7	50
>10	6	42.9
Total	**14**	**100**

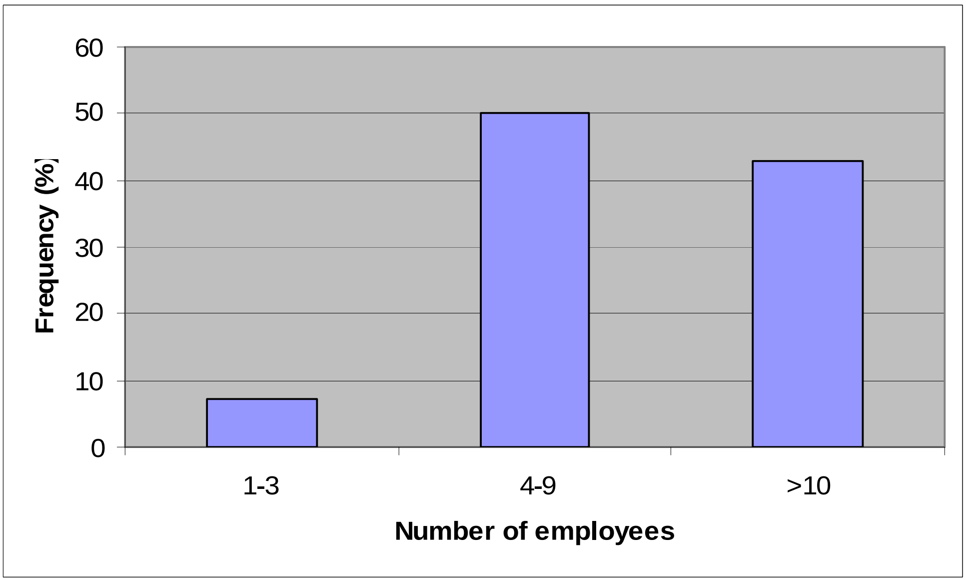


Figure 118 Number of employees

There was no clear correlation between the size of the businesses visited and the number of spray painters employed (see Table 98 and Figure 119). However, as one would expect, the smaller businesses employed the fewer painters.

Table 98 Number of spray painters

	Frequency	Percent %
1	3	21.4
2	3	21.4
3	2	14.3
4	4	28.6
5	2	14.3
Total	**14**	**100**

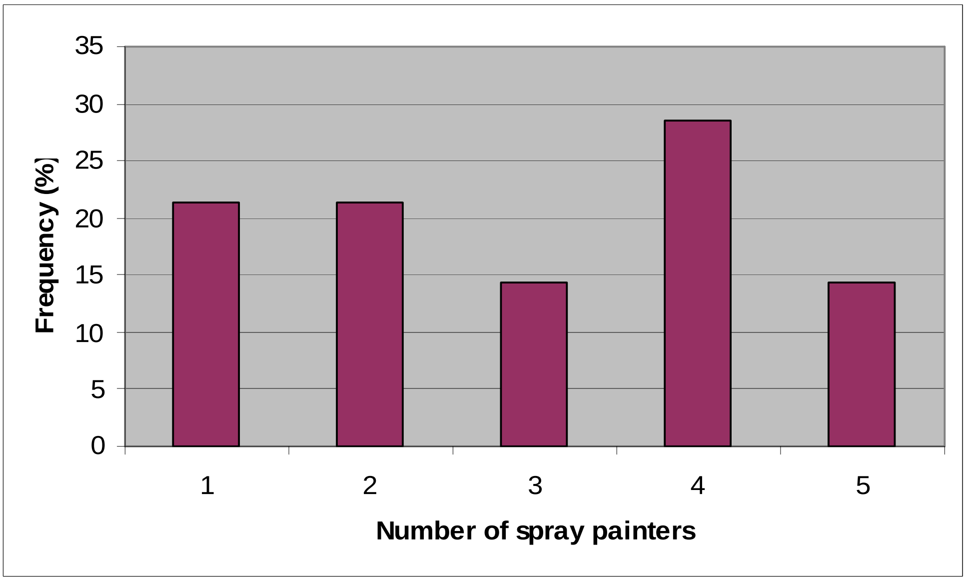


Figure 119 Number of spray painters

The majority of the businesses visited were older than 20 years as shown in Table 99 Age of Businessand Figure 120 Age of Business.

Table 99 Age of Business

	Frequency	Percent %
<5 years	1	7
6-20 year	2	14
>20 years	11	79
Total	**14**	**100**

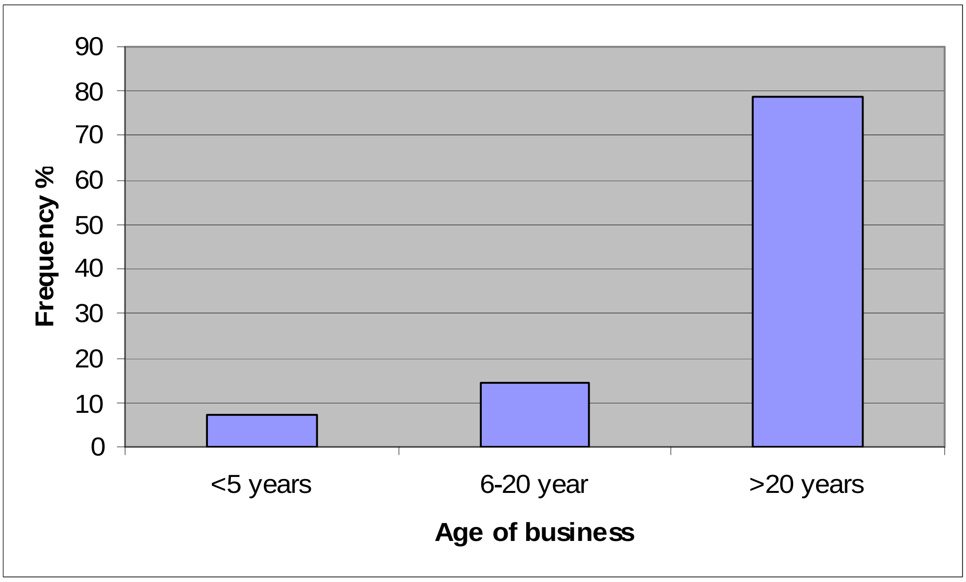


Figure 120 Age of Business

The majority (7) of the business operators interviewed had been involved in panel repair work for between 6 and 20 years and 6 of the operators had been involved in panel repair work for more than 20 years as shown in Table 100 Time involved in Body Repairand Figure 121 Time involved in body repair.

Table 100 Time involved in Body Repair

	Frequency	Percent %
<5 years	1	7
6-20 years	7	50
>20 years	6	43
Total	**14**	**100**

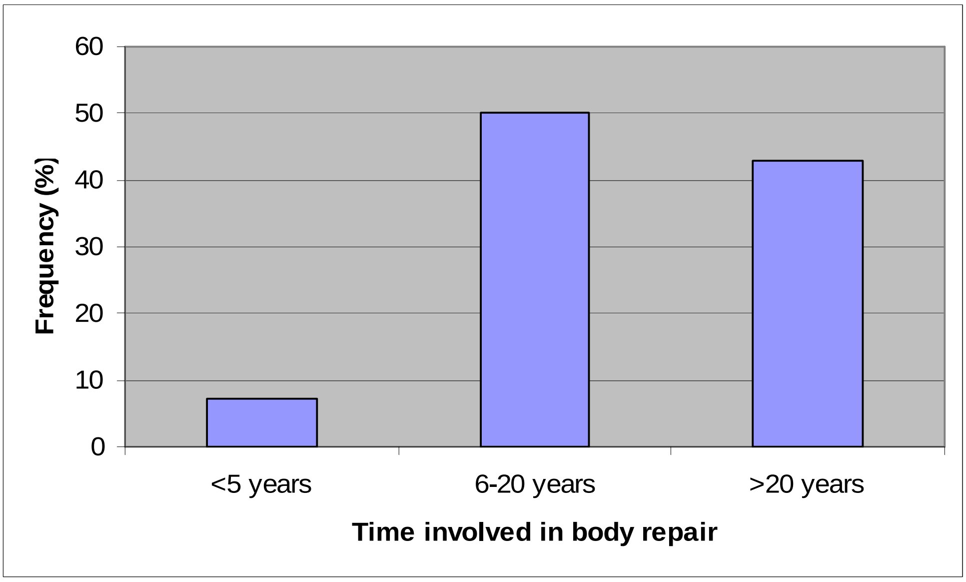


Figure 121 Time involved in body repair

As shown in Table 101 and Figure 122, most businesses visited (8 or 57%) used more than 10 litres but less than 20litres of two-pack paint each week.

Table 101 Volume of 2-pack paint used per week

	Frequency	Percent %
<10 litres	3	21
>10 litres - <20 litres	8	57
>20 litres	3	21.4
Total	**14**	**100**

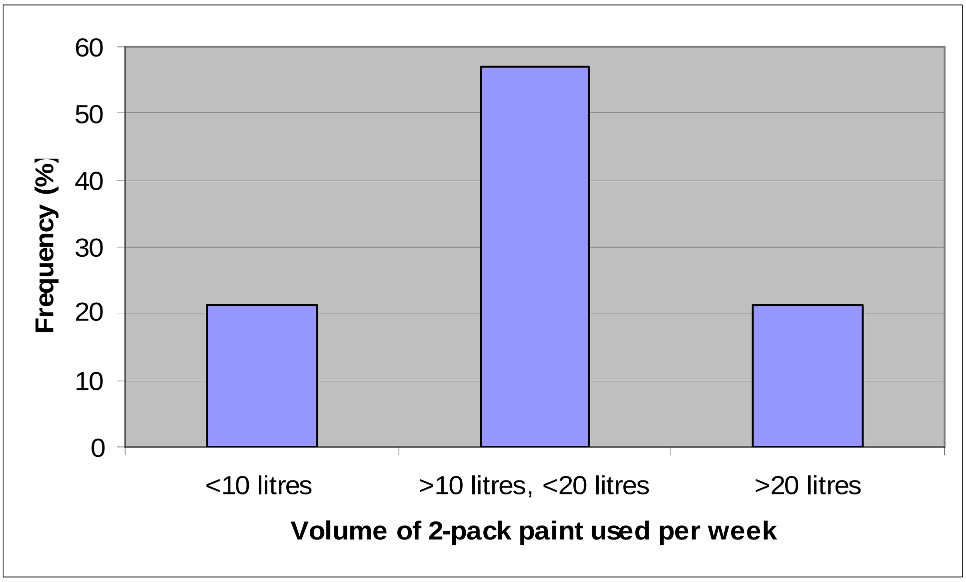


Figure 122 Volume of 2-pack paint used per week

As shown in Table 102 and Figure 123, only one business visited undertook mostly commercial work (spray painting of trucks), while the remainder undertook mostly insurance work i.e. motorcar panel repair.

Table 102 Type of Work

	Frequency	Percent %
Mostly Insurance	13	92.9
Mostly Commercial	1	7.1
Total	**14**	**100**

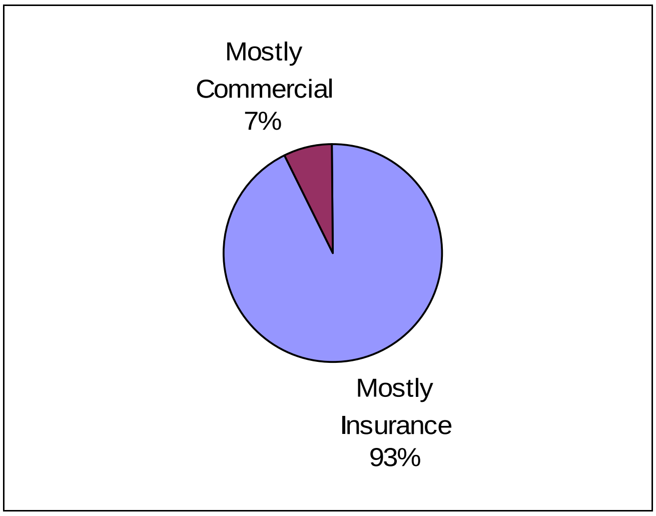


Figure 123 Type of Work

The majority of businesses (9 or 64%) reported that the VACC was their most important source of OHS information as shown in Table 103 and Figure 124. Only 1 business operator reported that other body repairers were an important source of information.

Table 103 Most Important source of general OHS Information

	Frequency	Percent %
WorkCover	4	29
VACC	9	64
Other body repairers	1	7
Total	**14**	**100**

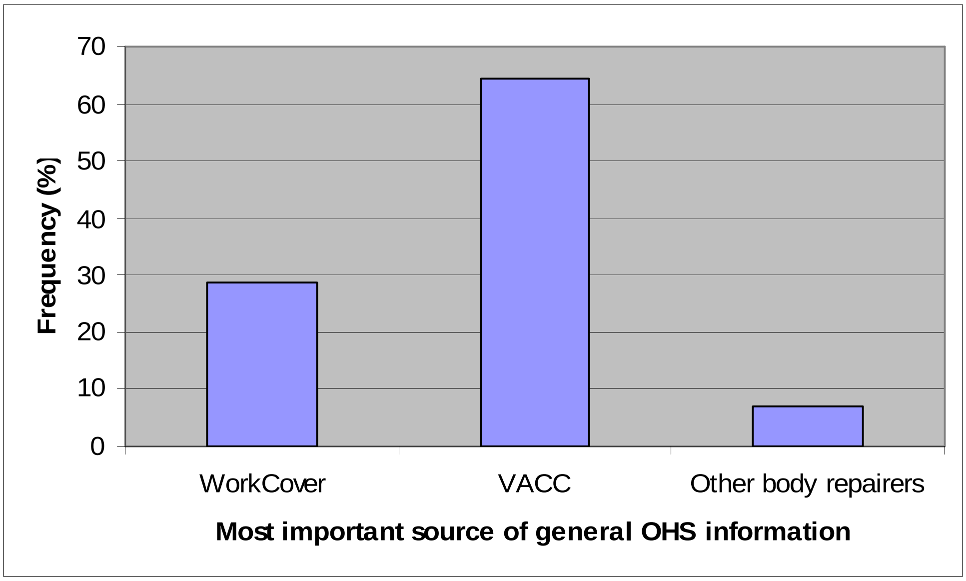


Figure 124 Most important source of general OHS information

The most important source of information about painting was reported to be paint suppliers as shown in Table 104 and Figure 125.

Table 104 Most important source of painting information

	Frequency	Percent %
VACC	1	7.1
Paint Suppliers	13	92.9
Total	**14**	**100**

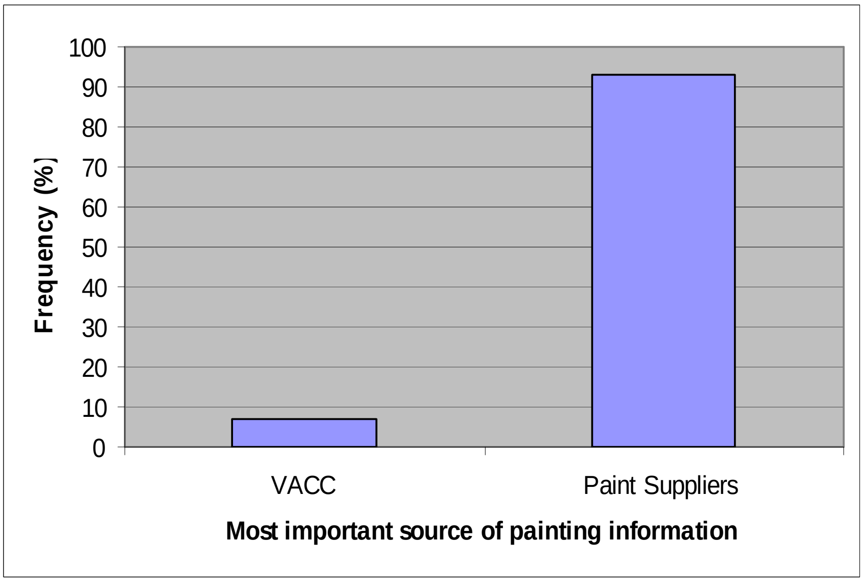


Figure 125 Most important source of painting information

All businesses reported that they always received material safety data sheets when they purchased chemicals.

As shown in Table 105 and Figure 126, only one business operator reported that they knew anyone in the panel repair business that had good ideas in relation to OHS.

Table 105 Do you know anyone with good OHS ideas?

	Frequency	Percent %
Yes	1	7
No	13	93
Total	**14**	**100**

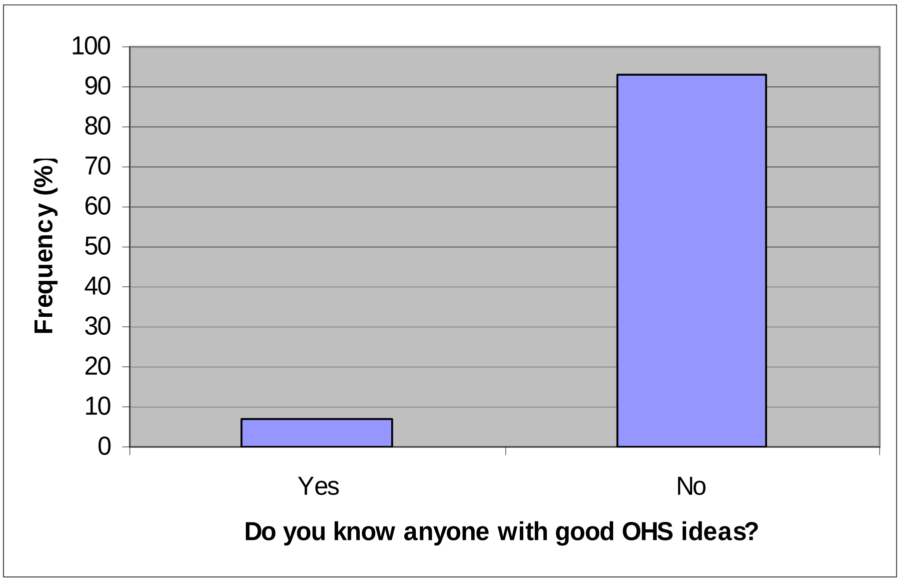


Figure 126 Do you know anyone with good OHS ideas?

As shown in Table 106 and Figure 127, only one business operator reported that they knew anyone in the panel repair business that doing well in regard to managing chemical safety

Table 106 Do you know anyone who is doing well in regard to Chemicals?

	Frequency	Percent %
Yes	1	7.1
No	13	92.9
Total	**14**	**100**

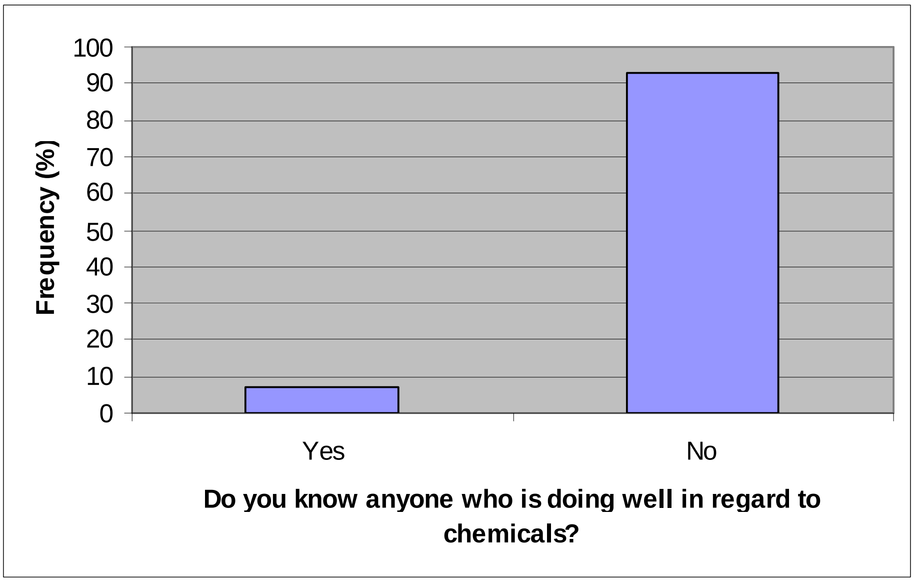


Figure 127 Do you know anyone who is doing well in regard to chemicals?

As shown in Table 107 and Figure 128, only one business operator reported that they knew anyone in the panel repair business that doing well in regard to managing OHS.

Table 107 Do you know anyone who is doing well in regard to OHS?

	Frequency	Percent %
Yes	1	7
No	13	93
Total	**14**	**100**

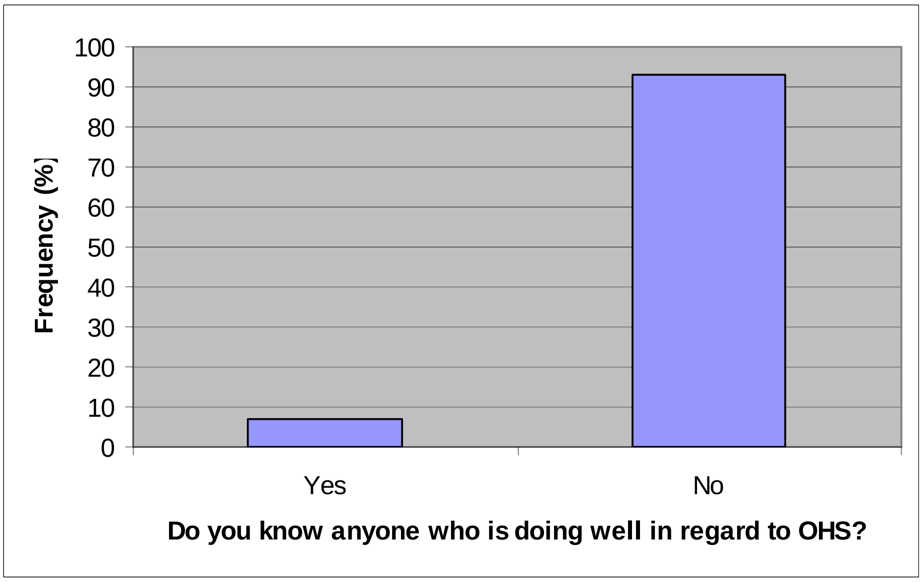


Figure 128 Do you know anyone who is doing well in regard to OHS?

All businesses made respiratory protection available. As shown in Table 108 and Figure 129, only one business did not make airline-supplied respiratory protection available i.e. 13 out of 14 (93%) of businesses made airline-supplied respiratory protection available.

Table 108 Availability of air supplied RPE

	Frequency	Percent %
Yes	13	93
No	1	7
Total	**14**	**100**

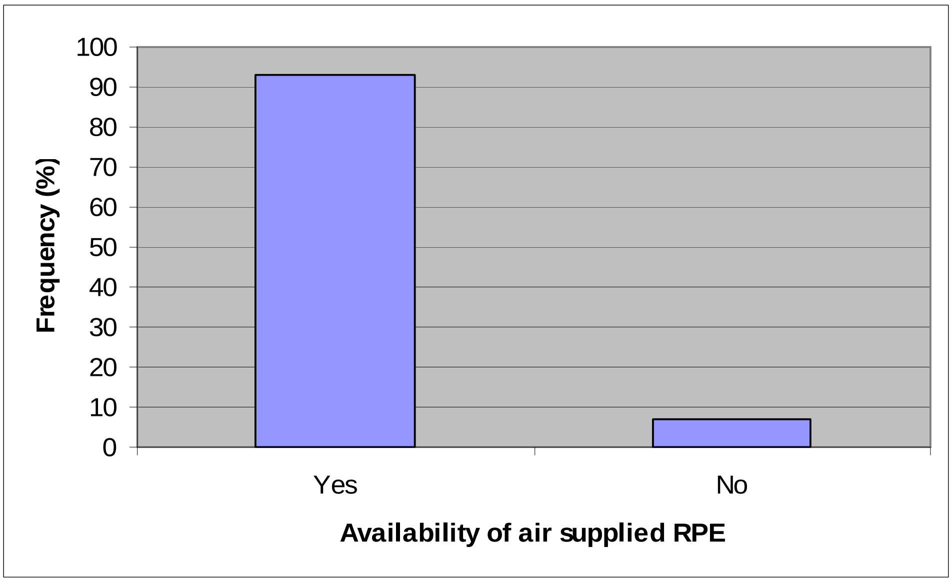


Figure 129 Availability of air supplied RPE

Only one business operator reported that respiratory protection is not always used when spraying two-pack paints, as shown in Table 109 and Figure 130.

Table 109 Use of RPE

	Frequency	Percent %
Always	13	93
Sometimes	1	7
Total	**14**	**100**

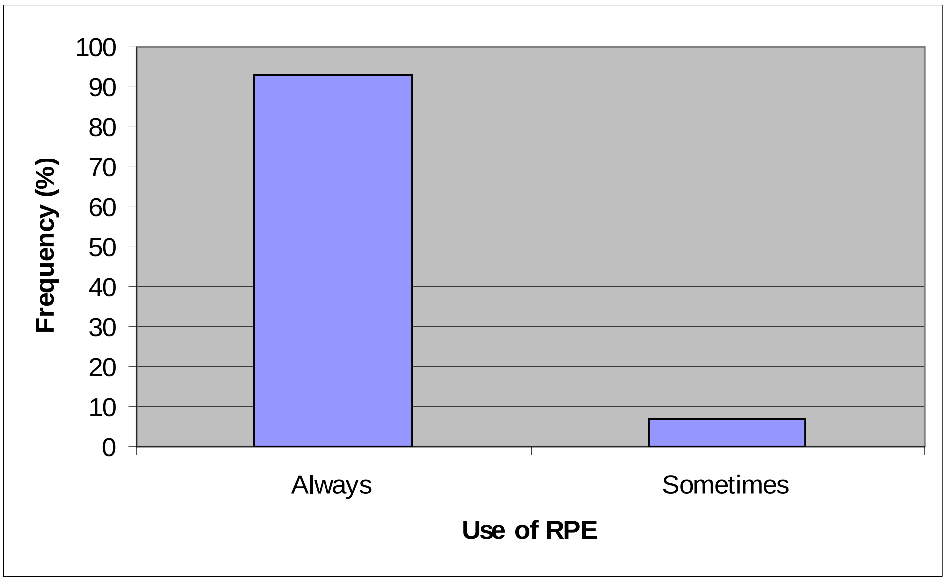


Figure 130 Use of RPE

As shown in Table 110 and Figure 131 the majority of businesses (10 or 71%) reported that airline-supplied respiratory protection is not always used while spraying two-pack paints. Only 4 businesses reported that airline-supplied respiratory protection is always used while spraying two-pack paints. Seven (50%) of businesses visited never use airline-supplied respiratory protection while spraying two-pack paints.

Table 110 Use of airline RPE

	Frequency	Percent %
Always	4	28.6
Sometimes	3	21.4
Never	7	50
Total	**14**	**100**

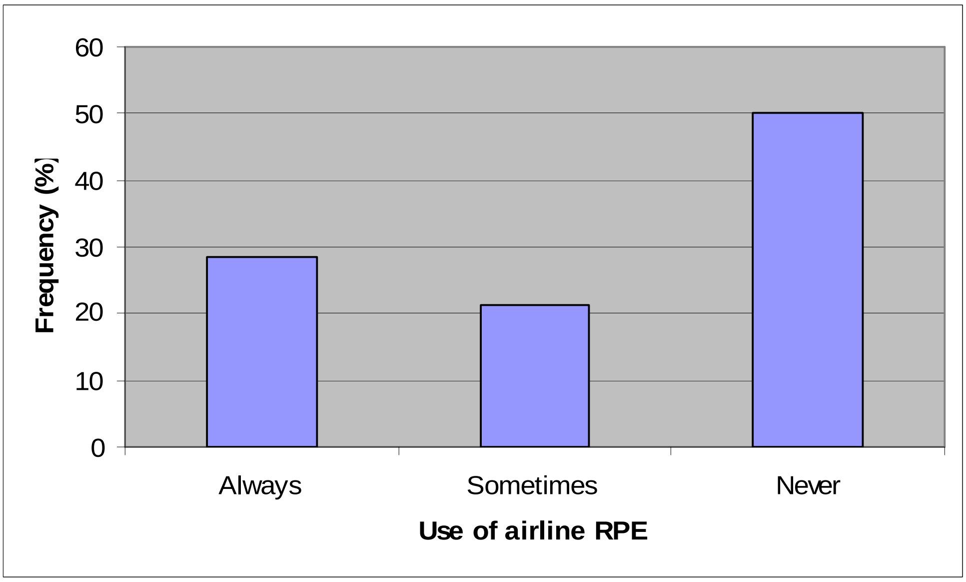


Figure 131 Use of airline RPE

The condition of respiratory protection at each of the businesses was assessed. As shown in Table 111 and Figure 132, at three of the businesses, the condition was assessed to be "poor", at three of the businesses it was assessed as "fair" and at seven (50%) it was assesses as "good".

Table 111 Condition of RPE

	Frequency	Percent %
Good	7	50
Fair	4	29
Poor	3	21
Total	**14**	**100**

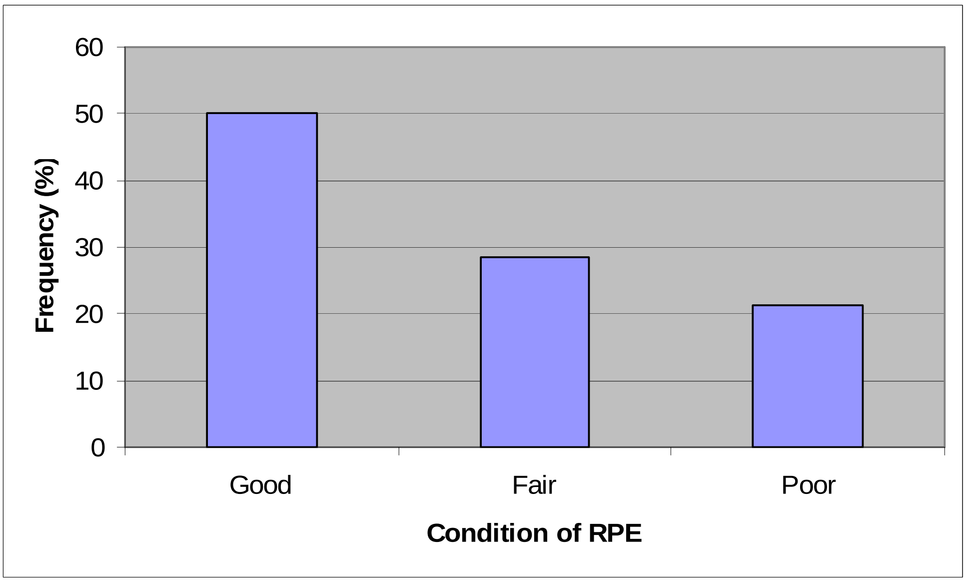


Figure 132 Condition of RPE

The condition, adequacy and suitability of storage facilities for respiratory protection at each of the businesses were assessed. As shown in Table 112 and Figure 133, at six of the businesses, the condition was assessed to be "satisfactory" and at eight (57%) of the businesses it was assessed as "unsatisfactory".

Table 112 Condition of RPE storage

	Frequency	Percent %
Satisfactory	6	42.9
Unsatisfactory	8	57.1
Total	**14**	**100**

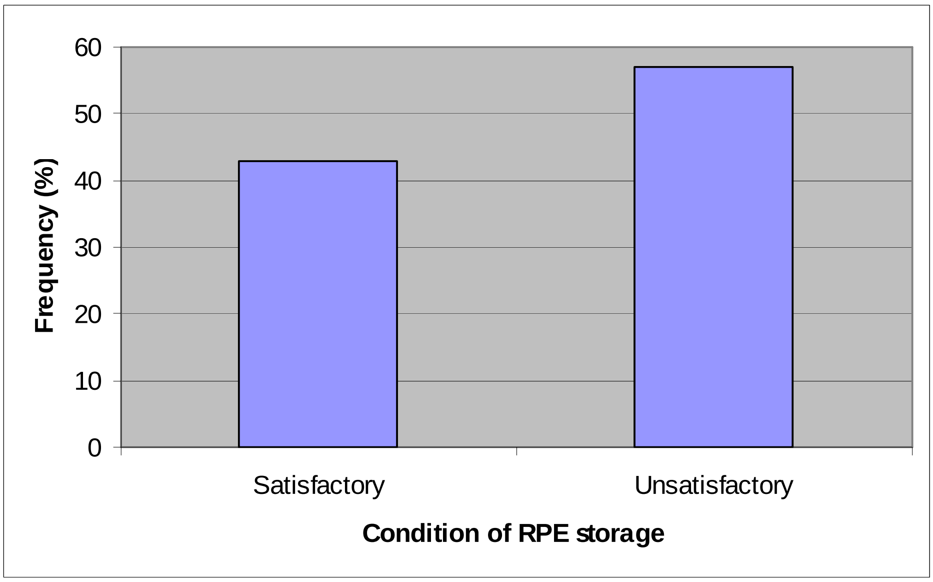


Figure 133 Condition of RPE storage

As shown in Table 113 and Figure 134, four businesses reported that they undertook "regular maintenance" of respiratory protective equipment. The majority of the businesses (64%) reported that they undertook "occasional maintenance". One business reported that it never undertook maintenance.

Table 113 Maintenance of RPE

	Frequency	Percent %
Regular	4	29
Occasional	9	64
Never	1	7
Total	**14**	**100**

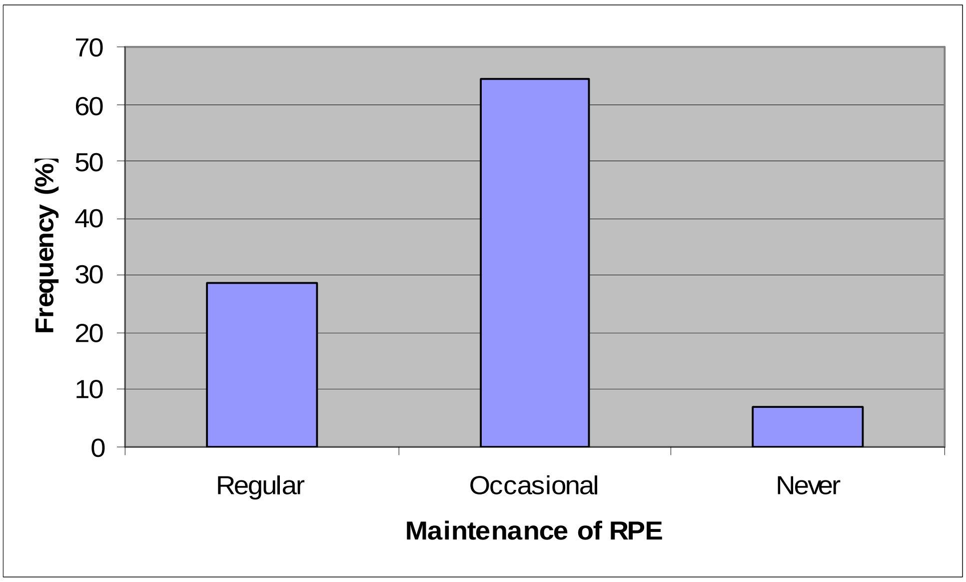


Figure 134 Maintenance of RPE

As shown in Table 114 and Figure 135, four (29%) businesses use gloves when spraying two-pack paint. Nine (64%) businesses do not use gloves when spraying two-pack paint.

Table 114 Are gloves used?

	Frequency	Percent
Yes	4	29
No	9	64
Total	**13**	**93**

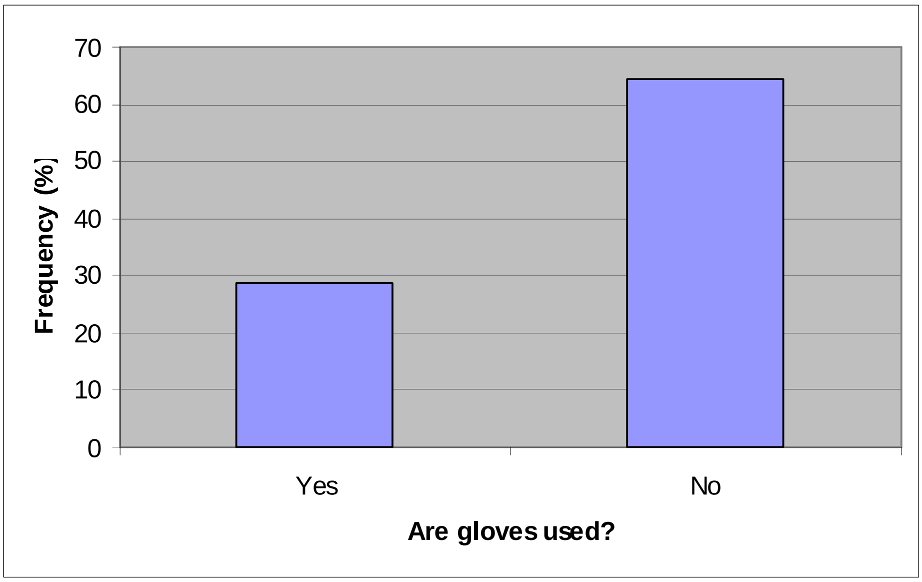


Figure 135 Are gloves used?

All businesses visited possessed spray booths on-site. As shown in Table 115and Figure 136, nine (64%) of businesses reported that spray painting was always done inside the spray booth. Five (36%) of businesses reported that two-pack paints were sometimes sprayed outside the spray booth.

Table 115 Is painting done in a booth?

	Frequency	Percent %
Always	9	64
Sometimes	5	36
Total	**14**	**100**

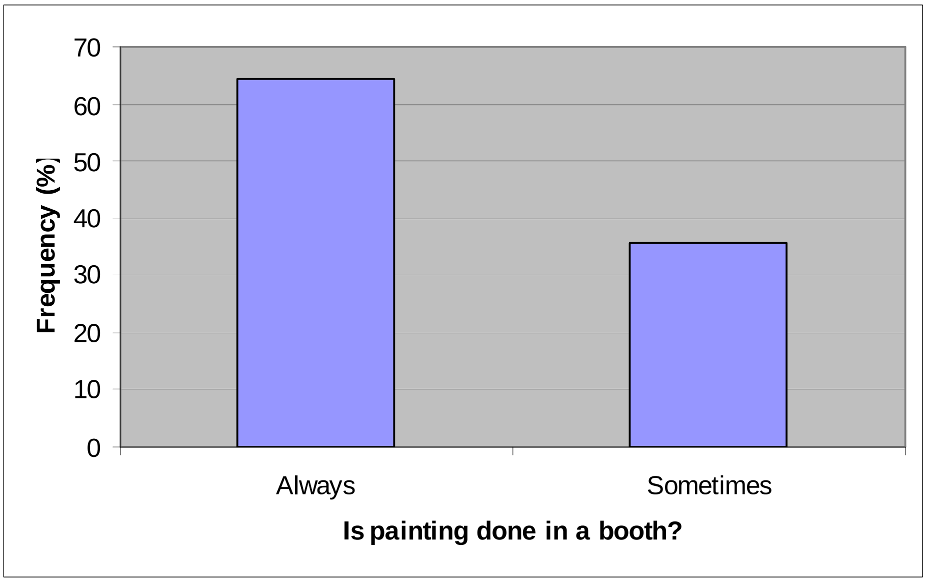


Figure 136 Is painting done in a booth?

As shown in Table 116 and Figure 137, the majority (10 or 71%) of businesses reported that they never quantitatively assessed the performance of their spray booth in terms of airflow. Only 4 (28%) businesses reported that they did measure the airflow in their spray booths.

Table 116 Frequency of booth airflow check

	Frequency	Percent %
More than once/year	3	21.4
Less than once/year	1	7.1
Never	10	71.4
Total	**14**	**100**

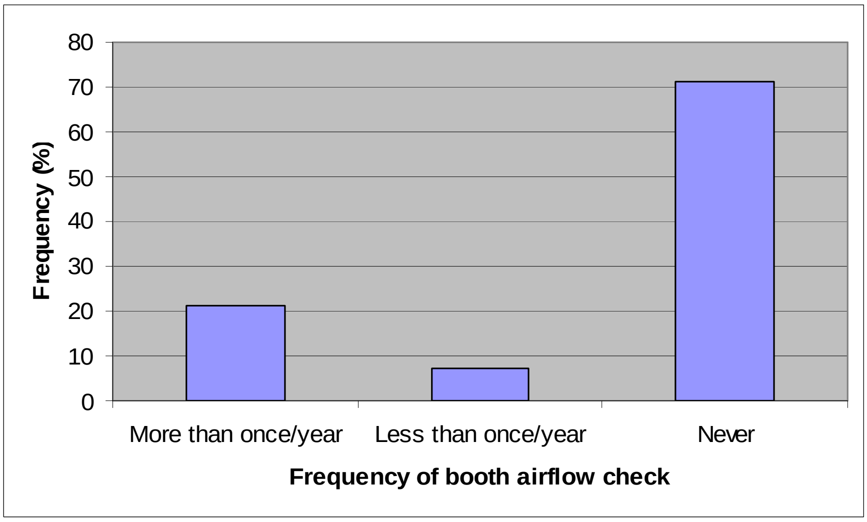


Figure 137 Frequency of booth airflow check

As shown in Table 117 and Figure 138, all businesses reported that they undertake maintenance on their spray booth filters. Seven (50%) reported that they undertook maintenance at least every six months.

Table 117 Frequency of booth filter maintenance

	Frequency	Percent %
At least every six months	7	50
Once per year	5	36
Once every few years	2	14
Total	**14**	**100**

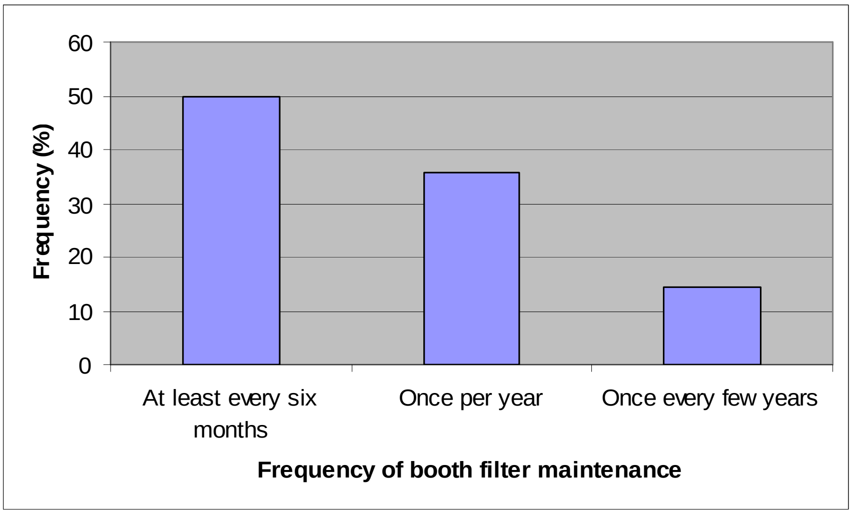


Figure 138 Frequency of booth filter maintenance

Paint storage, weighing and mixing facilities were inspected during each visit. As shown in Table 118 and Figure 139 half (7) of the businesses visited had a bunded paint storage area.

Table 118 Is storage equipped with bunding?

	Frequency	Percent %
Yes	7	50
No	7	50
Total	**14**	**100**

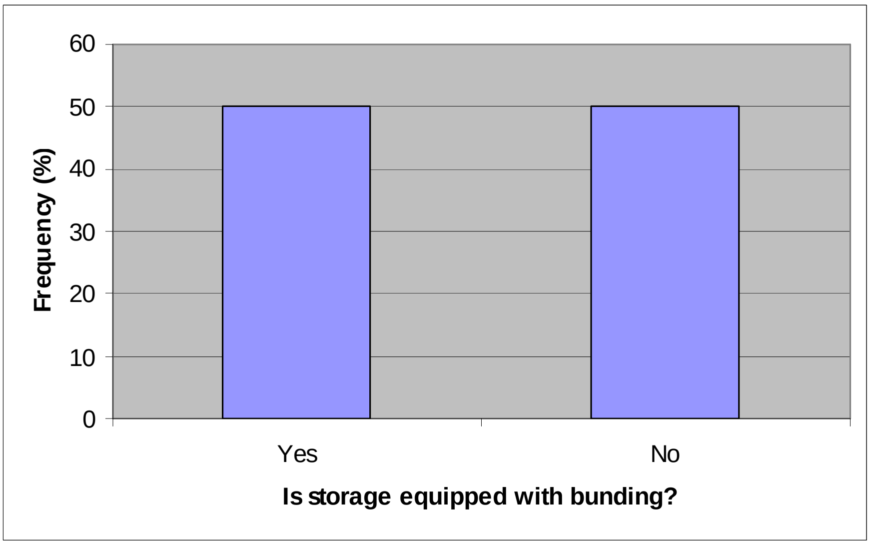


Figure 139 Is storage equipped with bunding?

As shown in Table 119 and Figure 140 the majority (13 or 93%) of the businesses visited had a paint storage area kept free of a source of moisture.

Table 119 Is paint stored away from moisture?

	Frequency	Percent %
Yes	13	92.9
No	1	7.1
Total	**14**	**100**

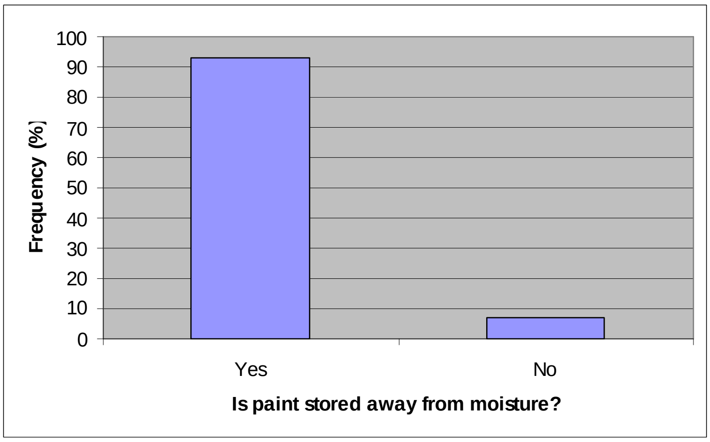


Figure 140 Is paint stored away from moisture?

As shown in Table 120 and Figure 141 the majority (12 or 86%) of the businesses visited had a paint storage area kept free of a source of alkali materials. Only one facility contained some alkali materials.

Table 120 Is paint stored away from alkalis?

	Frequency	Percent %
Yes	12	86
No	1	7
Total	**13**	**93**
Missing	1	7

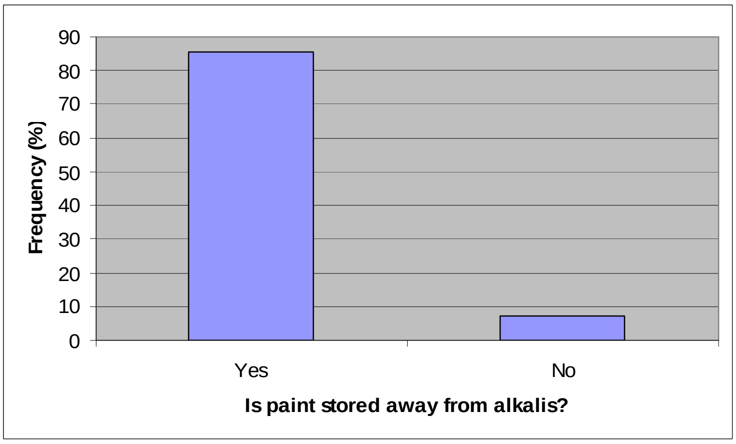


Figure 141 Is paint stored away from alkalis?

As shown in Table 121 and Figure 142 the majority (11 or 79%) of the businesses visited had a paint storage equipped with a fire extinguisher or other fire fighting equipment. Three businesses (21%) did not have any fire fighting equipment near the or in the paint storage area.

Table 121 Is paint storage equipped with fire fighting equipment?

	Frequency	Percent %
Yes	11	79
No	3	21
Total	**14**	**100**

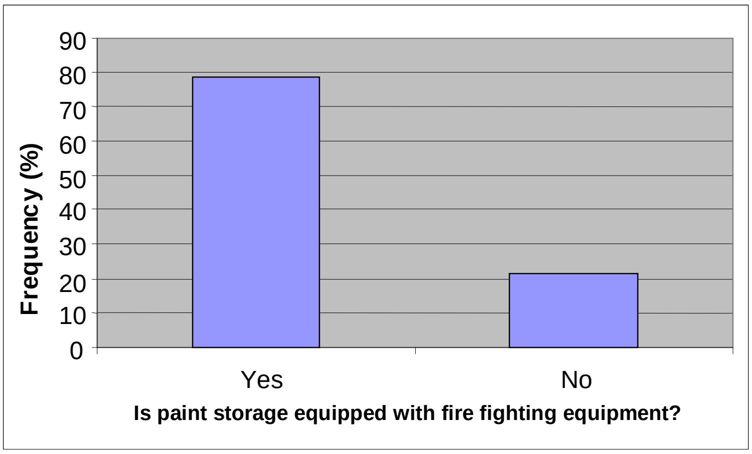


Figure 142 Is paint storage equipped with fire fighting equipment?

As shown in Table 122 and Figure 143, 4 (29%) of the businesses visited had a procedure and facilities to deal with a spill of isocyanates in the paint storage area.

Table 122 Are there paint spill facilities and procedures?

	Frequency	Percent %
Yes	4	29
No	10	71
Total	**14**	**100**

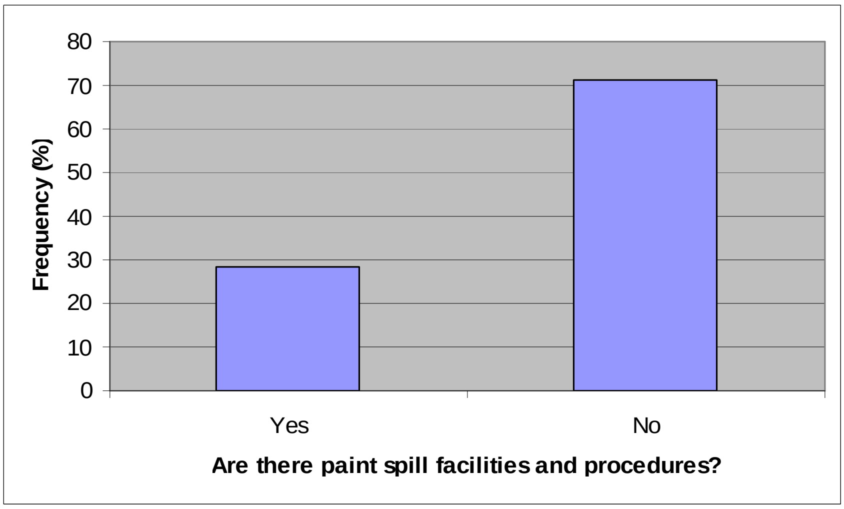


Figure 143 Are there paint facilities and procedures?

Signage regarding the materials stored in the paint store area was assessed. As shown in Table 123 and Figure 144, 2 (14%) of businesses had installed signage.

Table 123 Is the paint stored adequately signed?

	Frequency	Percent %
Yes	2	14
No	12	86
Total	**14**	**100**

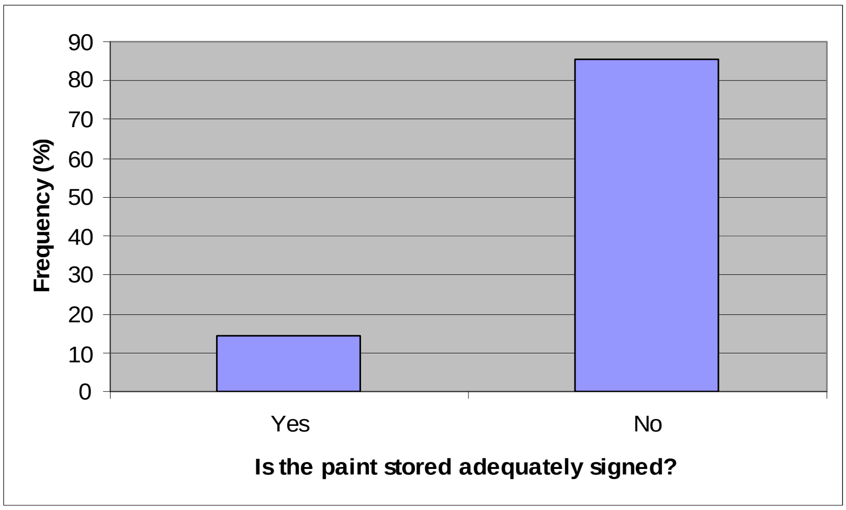


Figure 144 Is the paint stored adequately signed?

All businesses inspected had a paint storage area that was a distance of at least two metres from any heat source.

As shown in Table 124 and Figure 145, 7 (50%) of businesses inspected had a paint storage area that was a distance of at least two metres from any electrical source.

Table 124 Is paint storage at least 2m from any electrical source?

	Frequency	Percent %
Yes	7	50
No	7	50
Total	**14**	**100**

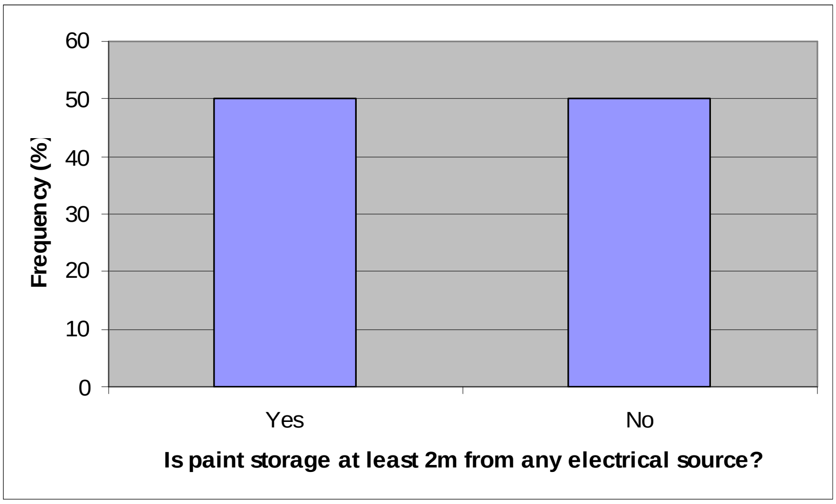


Figure 145 Is paint storage at least 2m from any electrical source?

As shown in Table 125 and Figure 146, 10 (71%) of the businesses inspected had a designated paint mixing area.

Table 125 Is there a designated paint mixing area?

	Frequency	Percent %
Yes	10	71
No	4	29
Total	**14**	**100**

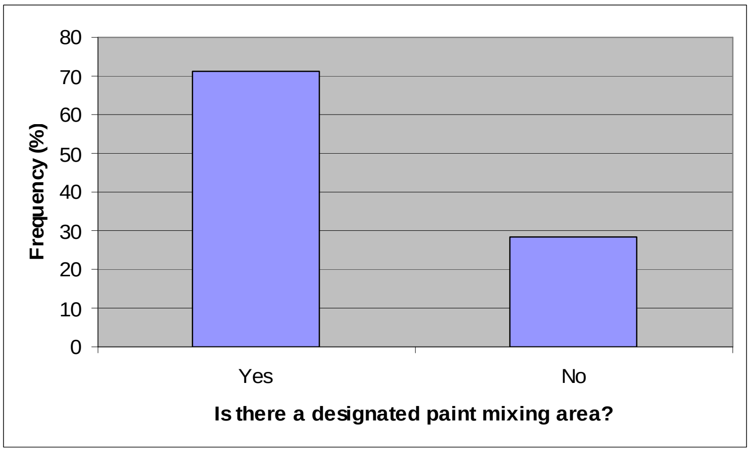


Figure 146 Is there a designated paint mixing area?

All businesses inspected had a paint mixing area that was a distance of at least two metres from any heat source. As shown in Table 126 and Figure 147, 4 (29%) of the businesses inspected had a paint mixing area that was a distance of at least two metres from any electrical source.

Table 126 Is paint mixing at least 2m from any electrical source?

	Frequency	Percent %
Yes	4	29
No	10	71
Total	**14**	**100**

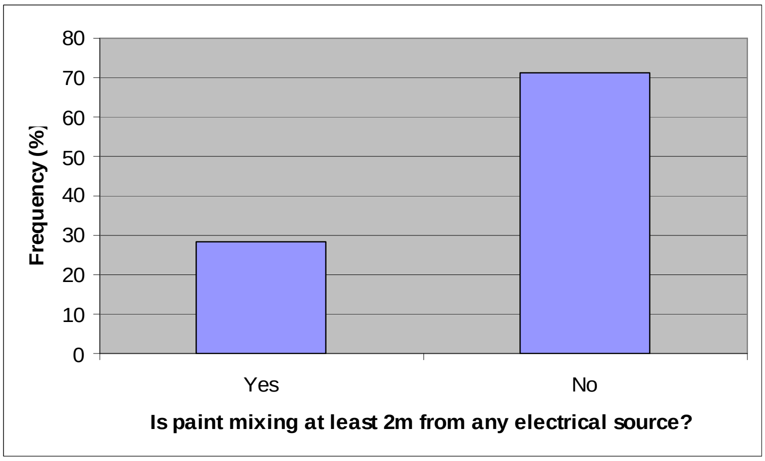


Figure 147 Is paint mixing at least 2m from any electrical source?

Signage regarding the materials handled in the paint mixing area was assessed. As shown in Table 127 and Figure 148, 11 (79%) of businesses had installed signage. Of these, the signage in 7 (50%) was considered to be poor.

Table 127 Adequacy of paint mixing area signage

	Frequency	Percent %
Good	0	0
Fair	4	29
Poor	7	50
Total	**11**	**79**
Missing	3	21

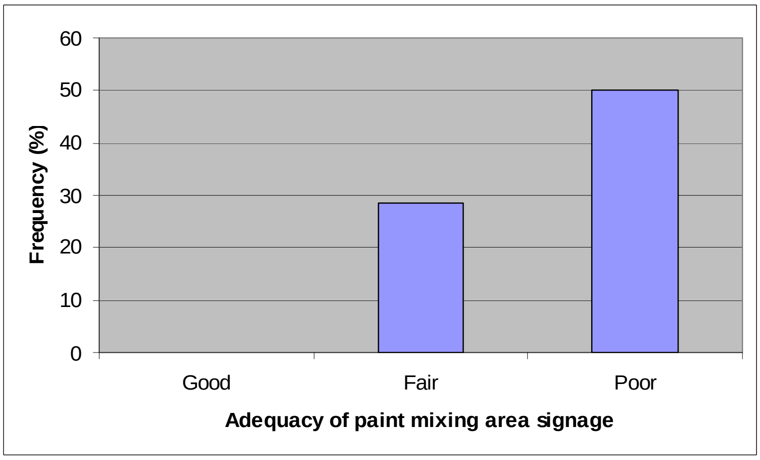


Figure 148 Adequacy of paint mixing area signage

As shown in Table 128 and Figure 149, 9 (64%) of the businesses inspected had a designated paint weighing area.

Table 128 Is weighing undertaken in a designated area?

	Frequency	Percent %
Yes	9	64
No	5	36
Total	**14**	**100**

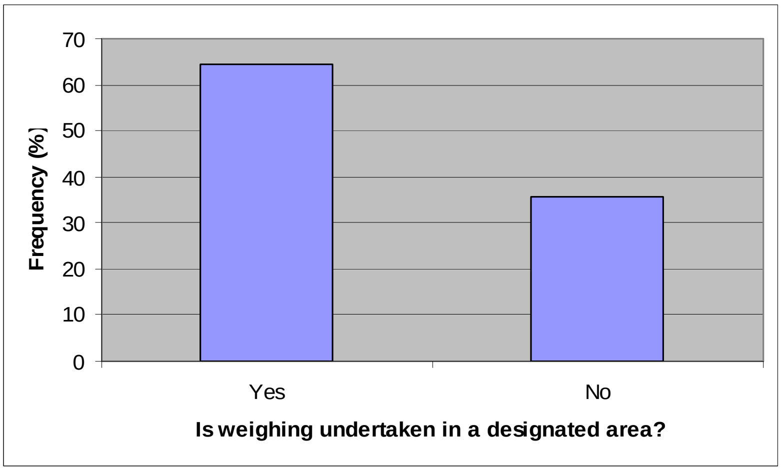


Figure 149 Is weighing undertaken in a designated area?

As shown in Table 129and Figure 150, 3 (21%) of businesses inspected had a paint weighing area that was within a clear area of at least two metres diameter.

Table 129 Does the paint weighing area have a clear area of at least two metres diameter?

	Frequency	Percent %
Yes	3	21.4
No	11	78.6
Total	**14**	**100**

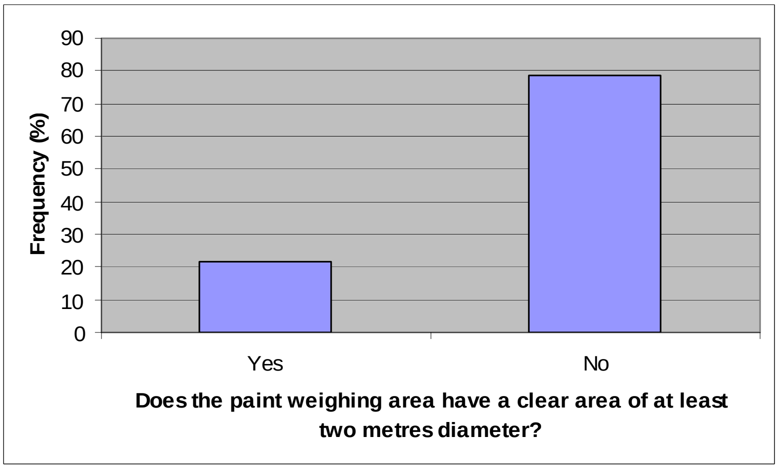


Figure 150 Does the paint weighing area have a clear area of at least two metres diameter?

As shown in Table 130 and Figure 151, 6 (43%) of businesses inspected stored paint in the paint weighing area.

Table 130 Is paint stored in the weighing area?

	Frequency	Percent %
Yes	6	43
No	8	57
Total	**14**	**100**

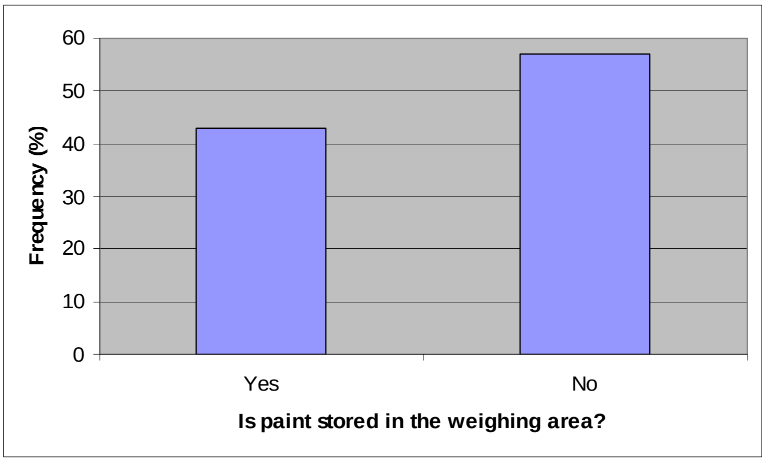


Figure 151 Is paint stored in the weighing area?

As shown in Table 131 and Figure 152, 13 (93%) of businesses inspected kept containers (paint, thinners, etc) in the weighing area closed while not in use.

Table 131 Are paint containers kept closed in weighing area?

	Frequency	Percent %
Yes	13	93
No	1	7
Total	**14**	**100**

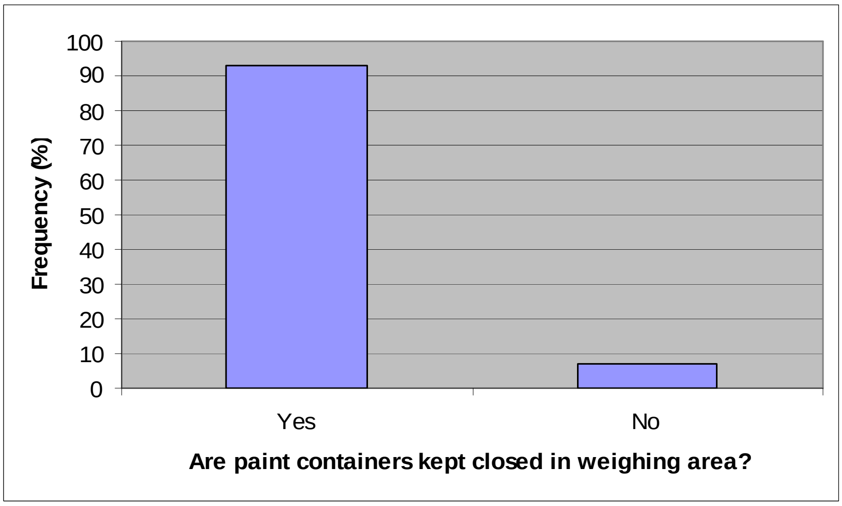


Figure 152 Are paint containers kept closed in weighing area?

As shown in Table 132 and Figure 153, 1 (7%) of the businesses visited had a procedure and facilities to deal with a spill of isocyanates in the paint weighing area.

Table 132 Are there isocyanate spill facilities in the weighing area?

	Frequency	Percent %
Yes	1	7
No	13	93
Total	**14**	**100**

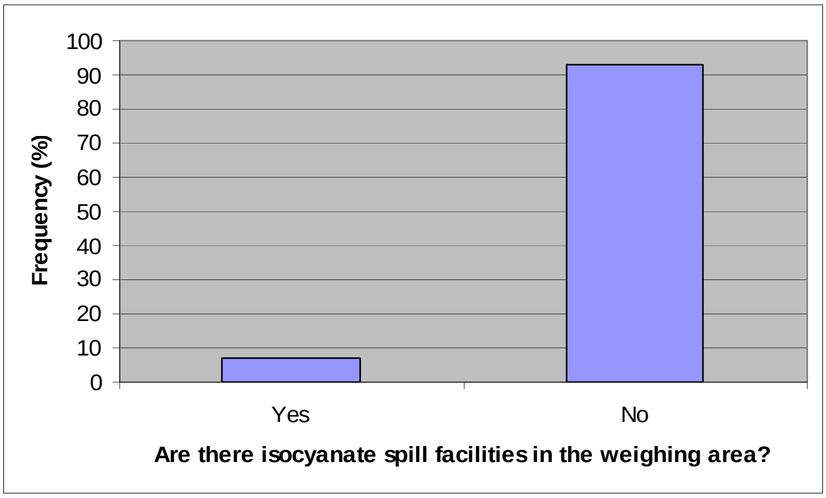


Figure 153 Are there isocyanate spill facilities in the weighing area?

Signage regarding the materials handled in the paint mixing area was assessed. As shown in Table 133 and Figure 154, 11 (79%) of businesses had installed signage. Of these, the signage in 7 (50%) was considered to be poor.

Table 133 Adequacy of signage in weighing area

	Frequency	Percent %
Fair	4	29
Poor	7	50
Total	**11**	**79**

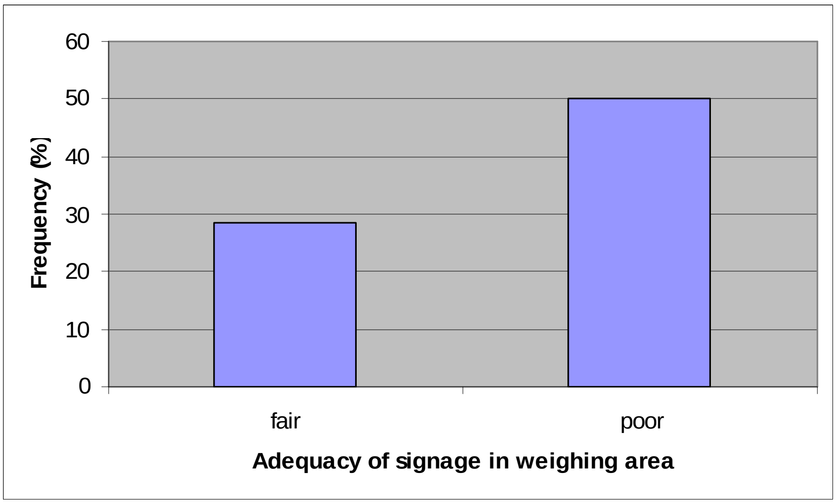


Figure 154 Adequacy of signage in weighing area

As shown in Table 134 and Figure 155, the majority (9 or 64%) of the businesses visited had fire extinguisher or other fire fighting equipment close to or in the paint weighing area. Five businesses (36%) did not have any fire fighting equipment.

Table 134 Are there fire fighting facilities in the weighing area?

	Frequency	Percent %
Yes	9	64
No	5	36
Total	**14**	**100**

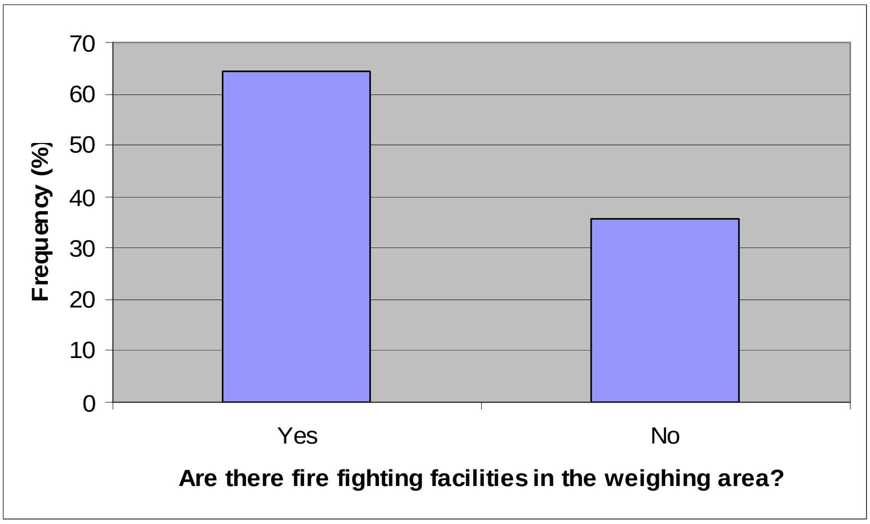


Figure 155 Are there fire fighting facilities in the weighing area?

As shown in Table 135 and Figure 156, 2 (14%) of the businesses visited had a procedure and facilities to deal with a spill of isocyanates during general handling.

Table 135 Is there an isocyanate spill procedure?

	Frequency	Percent %
Yes	2	14.3
No	12	85.7
Total	**14**	**100**

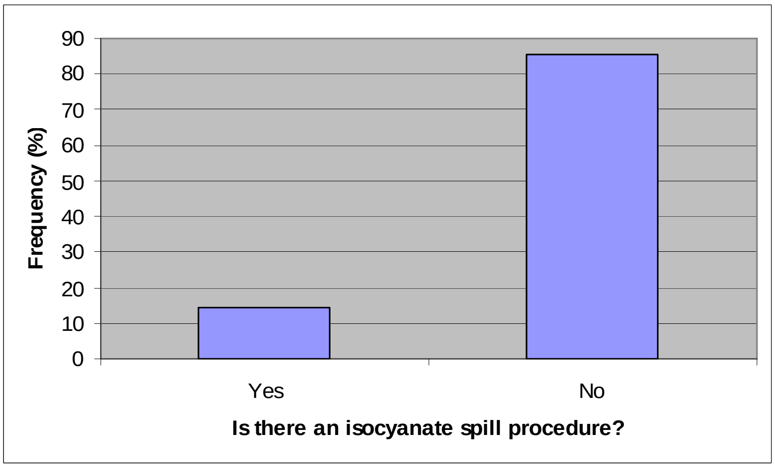


Figure 156 Is there an isocyanate spill procedure?

As shown in Table 136 and Figure 157 Availability of MSDS, 13 (93%) of the businesses visited were able to demonstrate the availability of MSDS.

Table 136 Availability of MSDS

	Frequency	Percent %
Yes	13	93
No	1	7
Total	**14**	**100**

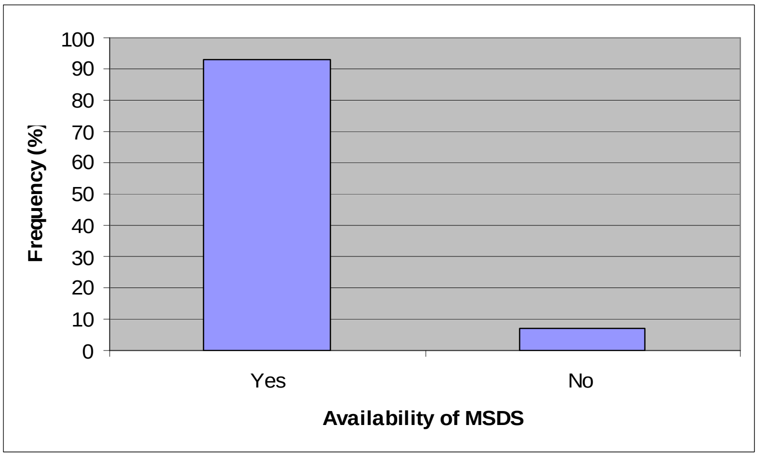


Figure 157 Availability of MSDS

None of the businesses visited had oxygen available for first aid purposes following an acute response to isocyanates exposure.

The general standard of housekeeping at the businesses visited was assessed. As shown in Table 137 and Figure 158, 6 (43%) of the businesses visited had a standard rated as "good", 6 (43%) had a standard rated as "fair" and 2 (14%) had a standard rated as "poor".

Table 137 Standard of housekeeping

	Frequency	Percent %
Good	6	43
Fair	6	43
Poor	2	14
Total	**14**	**100**

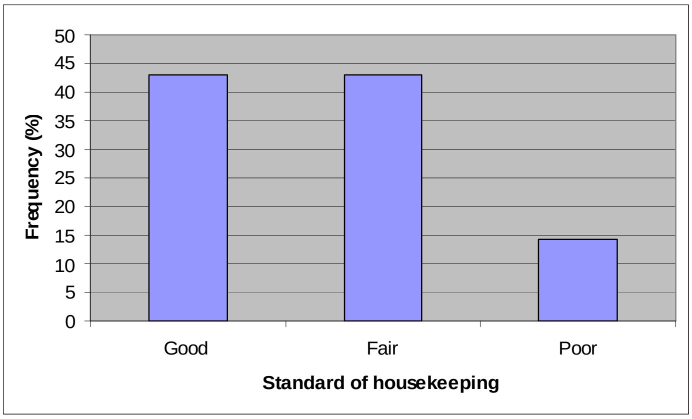


Figure 158 Standard of housekeeping

As shown in Table 138 and Figure 159, 4 (29%) of the businesses visited had designated facilities available for clean up of spray guns and personnel.

Table 138 Presence of cleanup facilities?

	Frequency	Percent %
Yes	4	29
No	9	64
Total	**13**	**93**
Missing	1	7

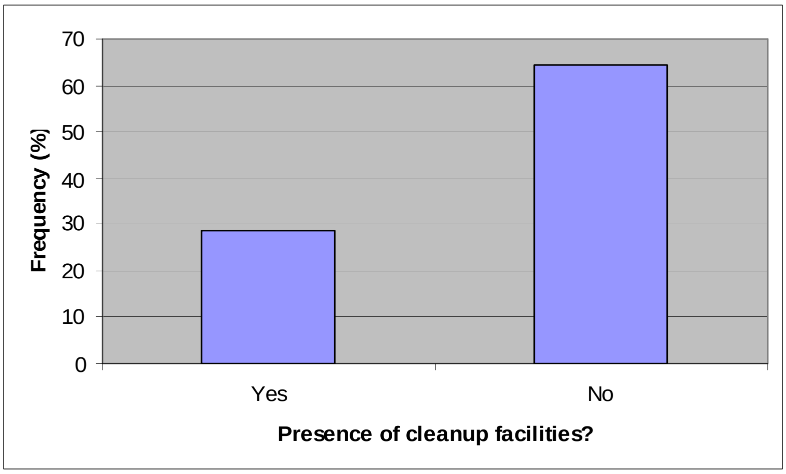


Figure 159 Presence of cleanup facilities?

Appendix 8: MVR Telephone Interviews

Telephone Interview Questionnaire

VACC Body Repair Division Health and Safety Survey

UNIVERSITY OF BALLARAT

Dear VACC Member

VIOSH-Australia (University of Ballarat) is conducting this survey on behalf of the Victorian Automobile Chamber of Commerce (VACC).

The purpose of this survey is to help improve Health and Safety in VACC member work places.

You will be telephoned so that we may get your answers to the questions in this questionnaire.

Who is being surveyed? You are part of a random sample of members of the Body Repair Division of the VACC.

Is this voluntary? **Yes.** Participation is voluntary.

Is this important? **Yes.** The information that you can provide is very important.

Is this confidential? **Yes.** All responses will be confidential. We will record your responses to the questions on coded response sheets. No responses will be linked to any one person or VACC member company.

How long will this take? The survey will take about 15 minutes to complete on the telephone.

When will I be telephoned? You will be telephoned to arrange a suitable time to later answer the questions over the telephone.

What if I need to ask a question? If you have any questions please contact either:

- VACC, Layla Yilmaz or Jim Reddy, 03 9829 1111
- University of Ballarat, Steve Cowley 03 5327 9160.

Part 1. You and Your Workplace

How many employees do you have?

☐ 1 1 - 3
☐ 2 4 - 9
☐ 3 More than 10

How many spray painters do you employ?

☐ 1 1
☐ 2 2
☐ 3 3
☐ 4 4
☐ 5 5
☐ 6 More than 5

What is mix of your business?

☐ 1 Mostly Insurance
☐ 2 Mostly Commercial (e.g. trucks)
☐ 3 Mostly Private

How old is the business?

☐ 1 Less than 5 years
☐ 2 6 – 20 years
☐ 3 More than 20 years

How long have you been involved in body repair work?

☐ 1 Less than 5 years
☐ 2 6 – 20 years
☐ 3 More than 20 years

What formal education do you have?

☐ 7 Nothing after school
☐ 8 TAFE Trade □ualification
☐ 9 TAFE Diploma
☐ 10 University Degree
☐ 11 Other...

If you did a TAFE course, did it include instruction on health and safety?

☐ 1 Yes
☐ 2 No

Part 2. Getting Health and Safety Information

Where have you seen or read anything about health and safety in the last year or so?

....

....

....

Do you have access to the internet?

☐ 1 Yes

☐ 2 No

Which of the following is the most important source of ***general health and safety*** information for you?

☐ 1 WorkCover *(now called WorkSafe Victoria)*

☐ 2 <u>**VACC**</u>

☐ 3 Paint suppliers

☐ 4 Other vehicle body repairers

☐ 5 Other..

Which of the following is the most important source of ***painting health and safety*** information for you?

☐ 1 WorkCover *(now called WorkSafe Victoria)*

☐ 2 <u>**VACC**</u>

☐ 3 Paint suppliers

☐ 4 Other vehicle body repairers

☐ 5 Other..

Do you always get material safety data sheets (MSDS) when you buy paint?

☐ 1 Yes

☐ 2 No

Have you learned anything about health and safety from any of the following in the last year or so:

☐ 18 Television

☐ 19 Newspapers and magazines

☐ 20 Pamphlets or newsletters?

☐ 21 Posters and signs?

☐ 22 Workmates or colleagues?

☐ 23 Supervisors or managers?

☐ 24 Training courses or seminars?

☐ 25 Radio?

☐ 26 Government bodies & organisations?

☐ 27 Professional or employer associations?

☐ 28 Internet?

If you had a health and safety problem would you go to any other vehicle body repairer for help?

☐ 1 Yes

☐ 2 No

If you had a spray painting or a business problem would you go to any other vehicle body repairer for help?

☐ 1 Yes

☐ 2 No

If you had any sort of health and safety problem who would you be most likely to go to?

☐ 1 WorkCover *(now called WorkSafe Victoria)*

☐ 2 **<u>VACC</u>**

☐ 3 Paint suppliers

☐ 4 An other vehicle body repairers

☐ 5 Other...

Part 3. Spray Painting in Your Business

Roughly how much 2-pack paint do you use each week?

☐ 1 Less than 10 litres per week

☐ 2 More than 10 litres per week but less than 20 litres per week

☐ 3 More than 20 litres per week

Do you have a spray booth?

☐ 1 Yes

☐ 2 No (if "**No"** go to ☐22)

Is spray painting done in the booth?

☐ 1 Always

☐ 2 **<u>Sometimes</u>**

☐ 3 Never

How often are the spray booth filters maintained?

☐ 1 At least once every six months

☐ 2 **<u>Once per year</u>**

☐ 3 Once every few years

☐ 4 Never

Is the airflow in the spray booth checked?

- ☐ 1 Every month
- ☐ 2 More than once each year
- ☐ 3 Less than once each year
- ☐ 4 Never

Are respirators (breathing masks) ***available*** for use by spray painters?

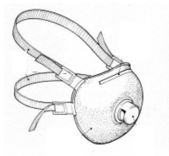
- ☐ 1 Yes
- ☐ 2 No

Are respirators (breathing masks) ***used*** when spray painting?

- ☐ 1 Always
- ☐ 2 Sometimes
- ☐ 3 Never

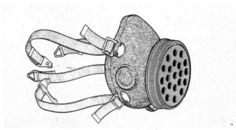
What type of respirators (breathing masks) are available for use by spray painters?

☐ 39 Disposable/Maintenance Free



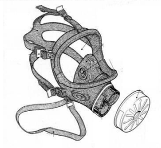
☐ 40 Half mask

(make………………….)



☐ 41 Full face with a filter

(make………………….)



☐ 42 Air supplied Full face

(make………………….)

☐ 43 Air supplied visor

(make………………….)

☐ 44 Air supplied hood

(make………………….)

If ***air supplied respirators*** *(e.g. either full-face, visor or hood type)* are available are they used when spray painting?

- ☐ 1 Always
- ☐ 2 **Sometimes**
- ☐ 3 Never

Part 4. What You Think About Health and safety

Please indicate how you feel about the following statements

	Strongly Disagree 1	Disagree 2	Neutral 3	Agree 4	Strongly Agree 5
Compared to all the other things that can go wrong, health and safety is a high priority	☐	☐	☐	☐	☐
I know where to get advice on workplace health and safety	☐	☐	☐	☐	☐
Injuries and ill health are a major problem for businesses of this size	☐	☐	☐	☐	☐
Only large amounts of 2-pack paint present a risk to people's health	☐	☐	☐	☐	☐
2-pack paints are safe these days	☐	☐	☐	☐	☐
Ill-health of my spray painters would be a problem for my business	☐	☐	☐	☐	☐
2-pack paints can cause asthma	☐	☐	☐	☐	☐
Respirators should be used at all times when handling 2-pack hardeners	☐	☐	☐	☐	☐
A respirator provides adequate protection when spraying 2-pack paints and a spray booth isn't really necessary	☐	☐	☐	☐	☐
Health and safety is not likely to be a problem here – the business is too small	☐	☐	☐	☐	☐
You do not need to use air-supplied respirators when spraying 2-pack paint	☐	☐	☐	☐	☐
A respirator is not necessary while weighing and mixing paint	☐	☐	☐	☐	☐
2-pack paints are not harmful if just splashed on the skin	☐	☐	☐	☐	☐
2-pack paints can cause lung damage	☐	☐	☐	☐	☐
Larger businesses face the real risks from health and safety	☐	☐	☐	☐	☐
*It is OK to use either a spray booth **or** a respirator while spraying 2-pack paints*	☐	☐	☐	☐	☐

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
An air supplied respirator should always be used when spraying 2-pack paints	☐	☐	☐	☐	☐
Gloves are unnecessary when spraying 2-pack paints	☐	☐	☐	☐	☐
I prefer my spray painters to use air line supplied respirators because I think it is better for them	☐	☐	☐	☐	☐
Airline-supplied respirators will save money in the long run	☐	☐	☐	☐	☐
It is OK to spray small amounts of 2-pack paint without a respirator	☐	☐	☐	☐	☐
*When spraying 2-pack paints a spray booth **and** a respirator should be used*	☐	☐	☐	☐	☐
You do not need air line supplied respirators when spraying 2-pack paints	☐	☐	☐	☐	☐
A respirator is not necessary while weighing and mixing paint	☐	☐	☐	☐	☐
An air line supplied respirator takes too long to put on	☐	☐	☐	☐	☐
2-pack paints are unlikely to hurt you	☐	☐	☐	☐	☐
I know how to test the fit of a respirator	☐	☐	☐	☐	☐
An air line supplied respirator is too much trouble when compared with other types of respirator	☐	☐	☐	☐	☐
Gloves are unnecessary when mixing 2-pack	☐	☐	☐	☐	☐
Even when doing a small spray job with 2-pack paint, a respirator should be used	☐	☐	☐	☐	☐
An air line supplied respirator is too expensive for my business given the amount of 2-pack spray paint we use	☐	☐	☐	☐	☐
An air line supplied respirator requires too much effort to keep it working properly	☐	☐	☐	☐	☐
Isocyanates can be harmful if they get on the skin	☐	☐	☐	☐	☐
For health and safety alone, a spray booth is worth the investment	☐	☐	☐	☐	☐
Painters prefer to use simple half-mask respirators when spray painting because they are easy to use.	☐	☐	☐	☐	☐
An airline-supplied respirator prevents you seeing properly	☐	☐	☐	☐	☐
I do not think it is necessary for spray painters to use air supplied respiratory protection	☐	☐	☐	☐	☐
Spray painters complain about the time it wastes if they wear air line respirators	☐	☐	☐	☐	☐
My spray painters choose for themselves whether to wear an air line supplied respirator	☐	☐	☐	☐	☐
An air line supplied respirator is not worth the money when a simple mask is sufficient for spraying	☐	☐	☐	☐	☐
It is OK to spray small amounts of 2-pack paints outside the spray booth	☐	☐	☐	☐	☐
A spray booth is not worth the money you have to spend to buy one	☐	☐	☐	☐	☐
A spray booth requires too much effort to keep it working properly	☐	☐	☐	☐	☐
Only the bigger businesses need spray booths	☐	☐	☐	☐	☐
Health and safety is not as important as other things like GST	☐	☐	☐	☐	☐

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Health and safety is not as important to businesses like mine as it is to larger ones	☐	☐	☐	☐	☐
Even when doing a small spray job with 2-pack paint, a spray booth should be used	☐	☐	☐	☐	☐
Respirators should be used at all times when handling 2-pack hardeners	☐	☐	☐	☐	☐
If any of my spray painters got sick because of the paint it would not be a major problem for my business	☐	☐	☐	☐	☐
Compared to large businesses, small businesses do not have many health and safety problems	☐	☐	☐	☐	☐
In this business health and safety is one of my biggest concerns	☐	☐	☐	☐	☐

What are the top three most important health and safety problems you are likely to face?

1 ……………………………………………………………………………………………………..

2 ……………………………………………………………………………………………………..

3 ……………………………………………………………………………………………………..

From the list below, in community at large, what is the main cause of work related injuries and illnesses? What are the second and third most important causes of work related injuries and illnesses?

☐ 1 *Lack of training & Education?*

☐ 2 *Pressure or stress?*

☐ 3 *Worker being careless?*

☐ 4 *Dangerous equipment and procedures?*

☐ 5 *Lack of supervision?*

☐ 6 *Boring, repetitive work?*

☐ 7 *Alcohol or drugs?*

☐ 8 *Dangerous chemicals or substances?*

What is the most important prevention measure for work related injuries and illnesses?

☐ 1 *Education & awareness about health & safety?*

☐ 2 *Training on safe work practices?*

☐ 3 *Safe procedures and systems of work?*

☐ 4 *Employee consultation and involvement?*

☐ 5 *Safe equipment?*

☐ 6 *Stronger enforcement of regulations?*

☐ 7 *Regulations clearer and easier to understand?*

What proportion of injuries and illnesses could be prevented?

- ☐ 1 *Nearly all?*
- ☐ 2 *More than half?*
- ☐ 3 *About half?*
- ☐ 4 *Less than half?*
- ☐ 5 *Hardly any?*

- Thank you -

Results

General Information about respondents

Of the thirty-eight businesses that agreed to participate and with which appointments were made, thirty businesses were surveyed. The eight businesses that did not participate either declined on the grounds of being too busy or failed to make themselves available at the appointed time.

As shown in table Table 139 and Figure 160, thirty (80%) were located in the suburbs of Melbourne, one (3%) was in Geelong and 5 (17%) were in regional areas.

Table 139 Business Location

	Frequency	Percent %
W.Suburbs	4	13
N.Suburbs	3	10
E.Suburbs	5	17
S.E.Suburbs	3	10
S.Suburbs	9	30
Geelong	1	3
Regional	5	17
Total	**30**	**100**

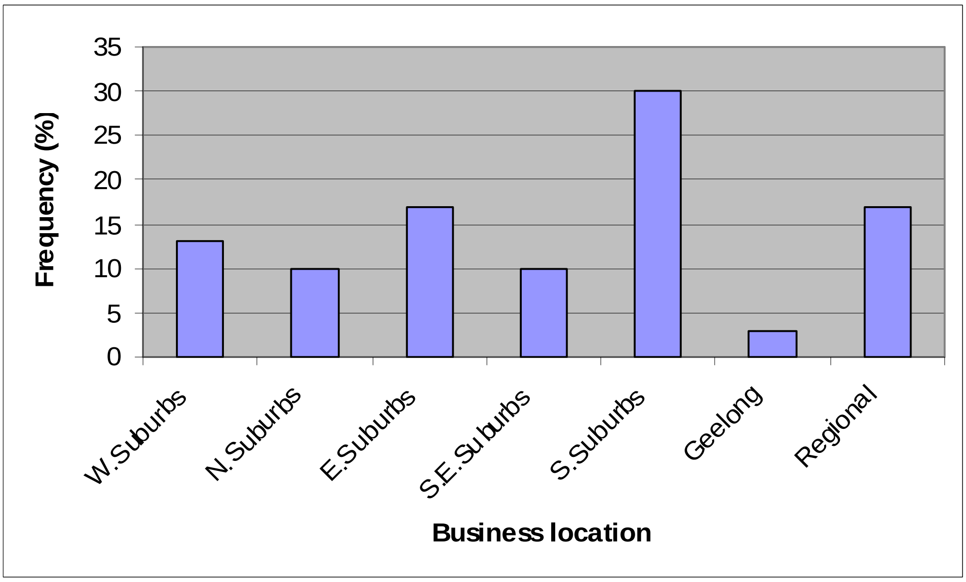


Figure 160 Business location

The size distribution of the businesses surveyed is shown in Table 140 and Figure 161 and Table 141 and Figure 162.

Table 140 Number of Employees

	Frequency	Percent %
01-Mar	7	23
04-Sep	12	40
>10	11	37
Total	**30**	**100**

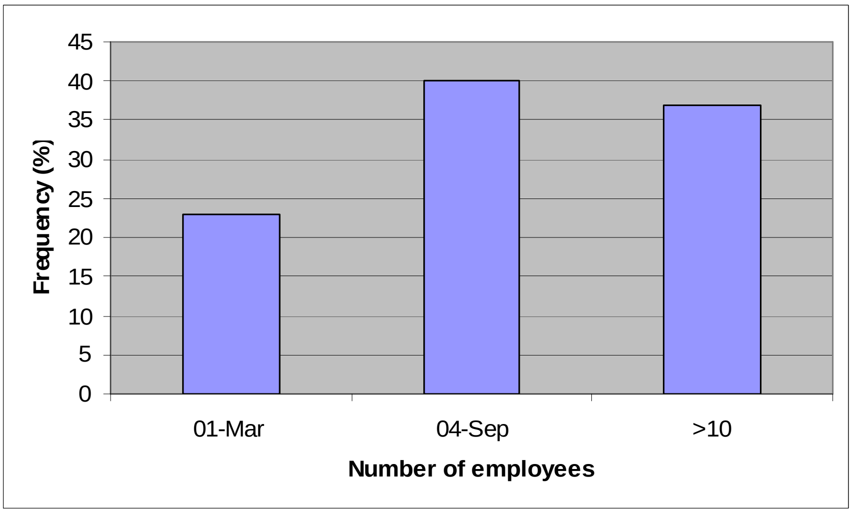


Figure 161 Number of Employeess

Table 141 Number of Spray painters

	Frequency	Percent %
1	10	33
2	11	37
3	5	17
5	2	7
>5	2	7
Total	**30**	**100**

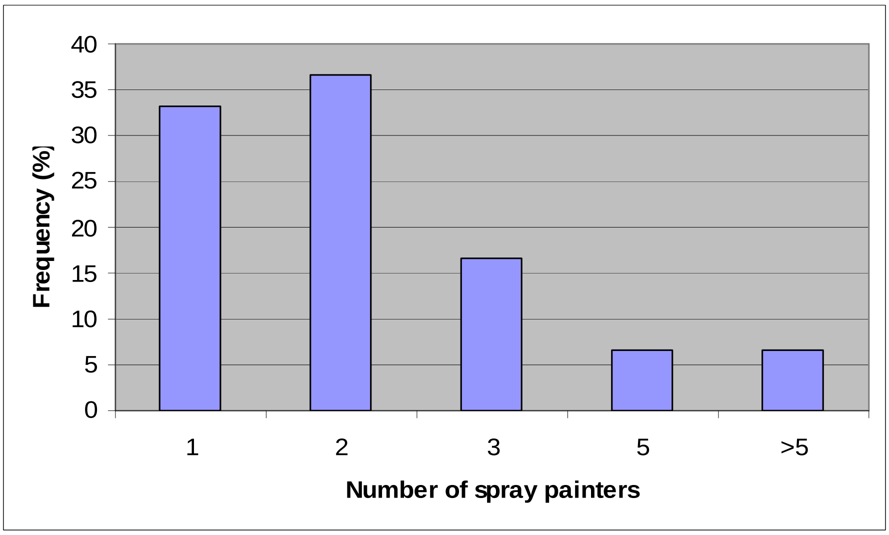


Figure 162 Number of spray painters

Twenty-eight (93%) of the businesses surveyed undertook mainly insurance-related body repair work. As shown in table 142 and figure 163, two businesses (7%) reported that they undertook more private work than insurance, this being speciality vehicle renovations.

Table 142 Type of work

	Frequency	Percent %
Mostly Insurance	28	93
Mostly Private	2	7
Total	**30**	**100**

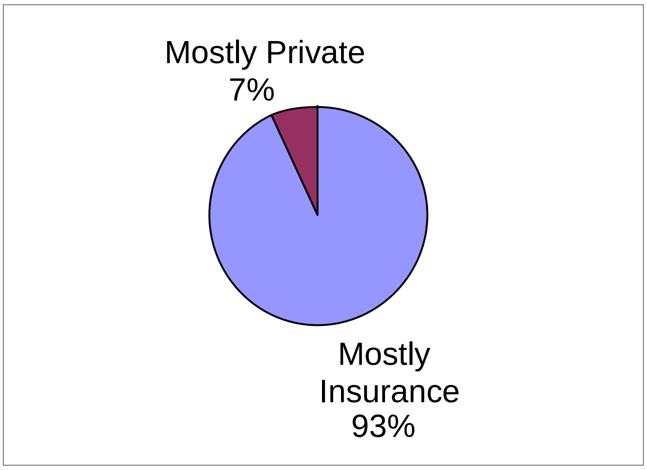


Figure 142 Type of business

The majority of the businesses visited were older than 20 years as shown in Table 143 and Figure 164

Table 143 Age of business

	Frequency	Percent %
6-20 years	13	43
>20 years	17	57
Total	**30**	**100**

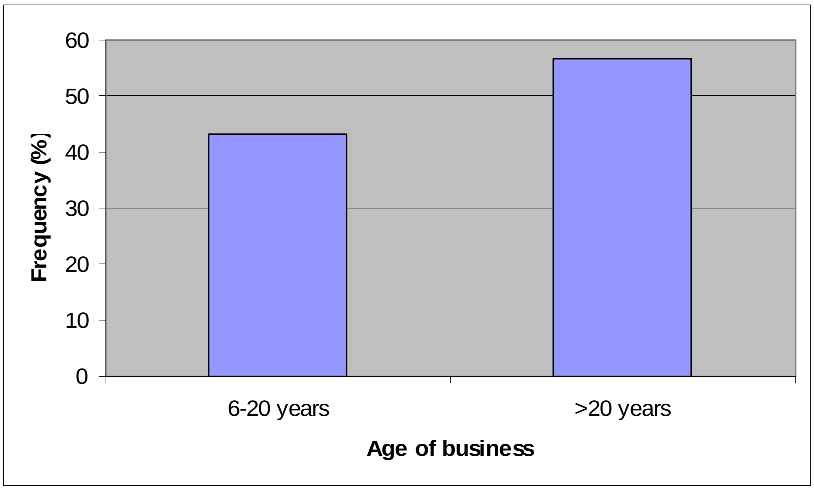


Figure 164 Age of Business

The majority (73%) of the business operators interviewed had been involved in panel repair work for more than 20 years as shown in Table 144 and Figure 165.

Table 144 Time involved in body repair

	Frequency	Percent %
<5 years	1	3
6-20 years	7	23
>20 years	22	73
Total	**30**	**100**

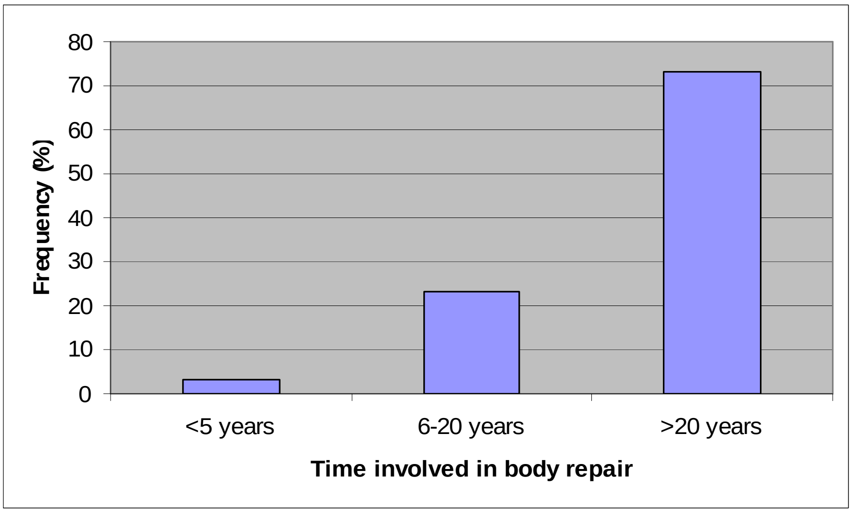


Figure 165 Time involved in body repair

The majority (73%) of the business operators interviewed had completed a TAFE trade qualification as shown in Table 145 and Figure 166. Three (10%) of respondents had completed a university degree.

Table 145 Level of formal education

	Frequency	Percent %
Nothing after school	4	13
TAFE Trade	22	73
TAFE Diploma	1	3
University Degree	3	10
Total	**30**	**100**

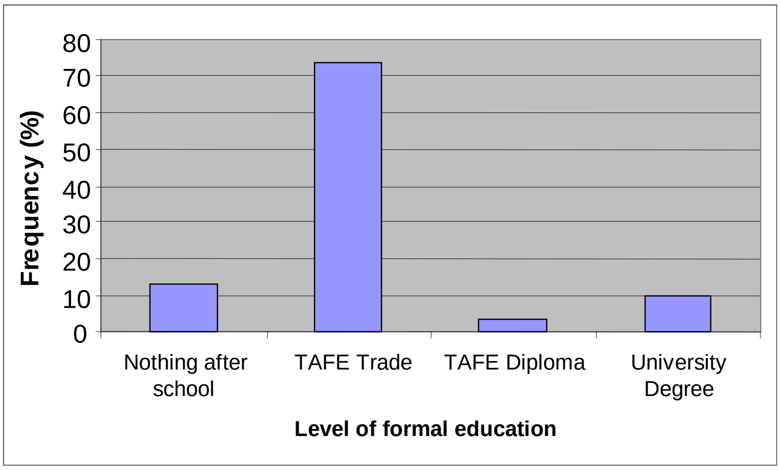


Figure 166 Level of formal education

Of those business operators who had completed a TAFE qualification only 7 (23%) recalled there being OHS instruction included in the curriculum as shown in Table 146 and Figure 167.

Table 146 Was OHS in the TAFE curriculum?

	Frequency	Percent %
Yes	7	23
No	17	57
Total	**24**	**80**
Missing	6	20

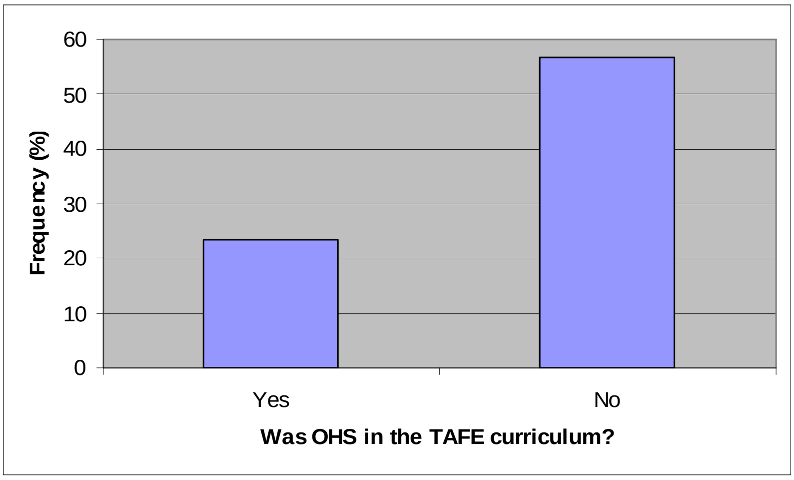


Figure 167 Was OHS in the TAFE Curriculum?

Sources of Information

As shown in Table 147 and Figure 168, the majority (70%) of the business operators interviewed recalled seeing something about OHS most recently in VACC materials.

Table 147 Where respondents had most recently seen or read about OHS

	Frequency	Percent %
VACC	21	70
TV	3	10
Amstad	1	3.3
Posters	1	3.3
Quality information	1	3.3
Trade Journal	1	3.3
Trade Magazine	1	3.3
WorkCover	1	3.3
Total	**30**	**100**

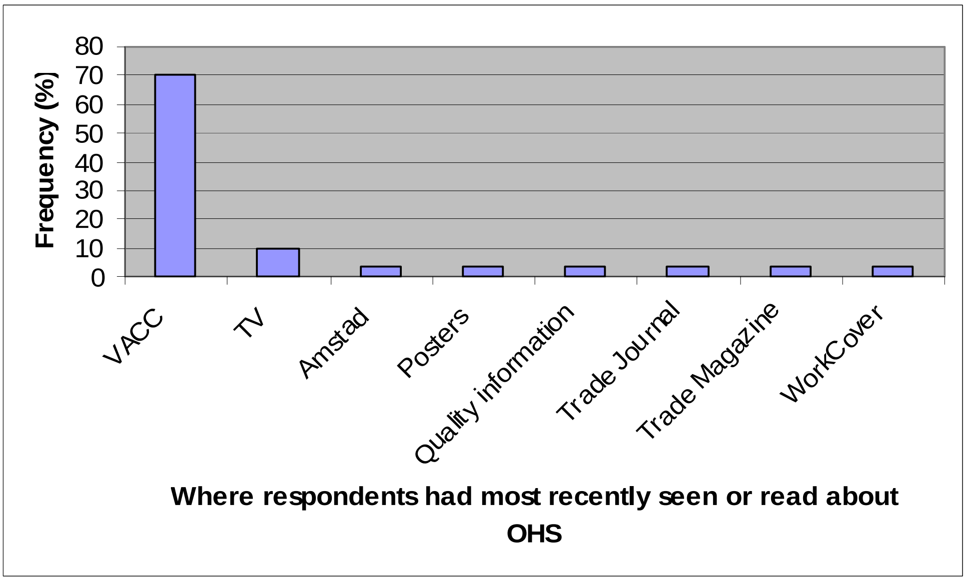


Figure 168 Where respondents had most recently seen or read about OHS

The majority (80%) of the business operators interviewed had access to the Internet as shown in Table 148 and Figure 169.

Table 148 Access to the internet

	Frequency	Percent %
Yes	24	80
No	6	20
Total	**30**	**100**

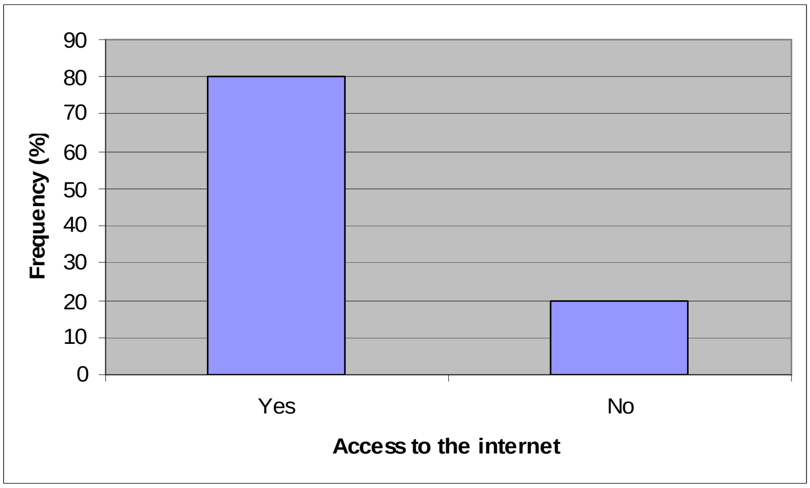


Figure 169 Access to the internet

Table 149 and Figure 170 show that the VACC is the most important source of *general* OHS information for the business operators while Table 150 and Figure 171 show that paint suppliers are the most important source of *painting* related OHS information, although VACC remains a significant source.

Table 149 Most important source of general OHS information

	Frequency	Percent %
WorkCover	9	30
VACC	18	60
Paint Suppliers	3	10
Total	**30**	**100**

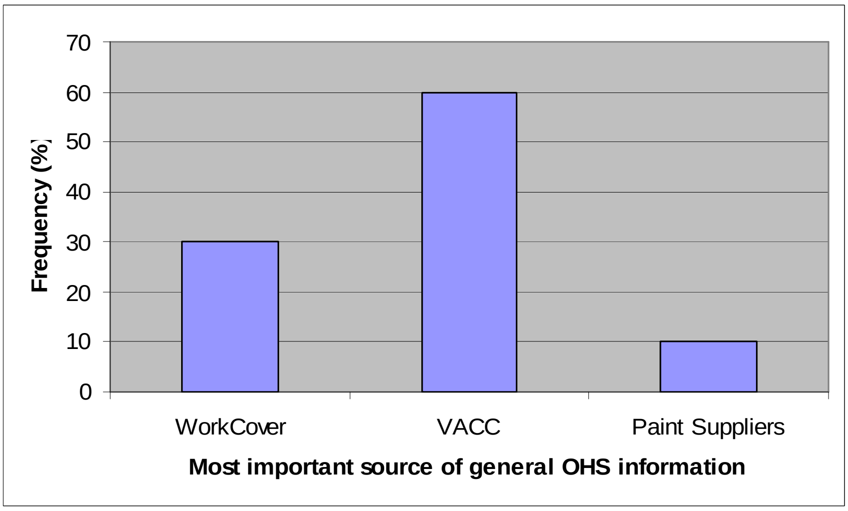


Figure 170 Most important source of general OHS information

Table 150 Most important source of painting information

	Frequency	Percent %
WorkCover	2	6.7
VACC	12	40
Paint Suppliers	16	53.3
Total	**30**	**100**

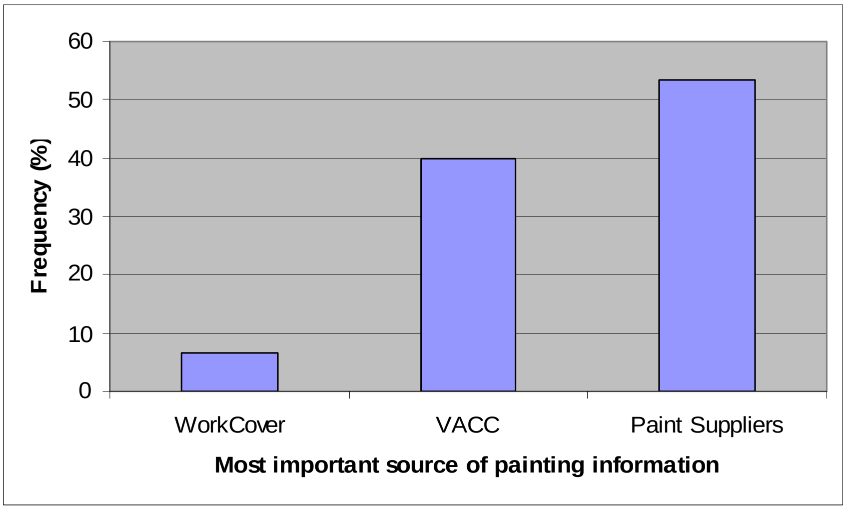


Figure 171 Most important source of painting information

Table 151 and Figure 172 show that less than half (47%) of respondents reported receiving an MSDS every time they purchased chemicals.

Table 151 Is an MSDS always received with chemical purchases?

	Frequency	Percent %
Yes	14	46.7
No	16	53.3
Total	**30**	**100**

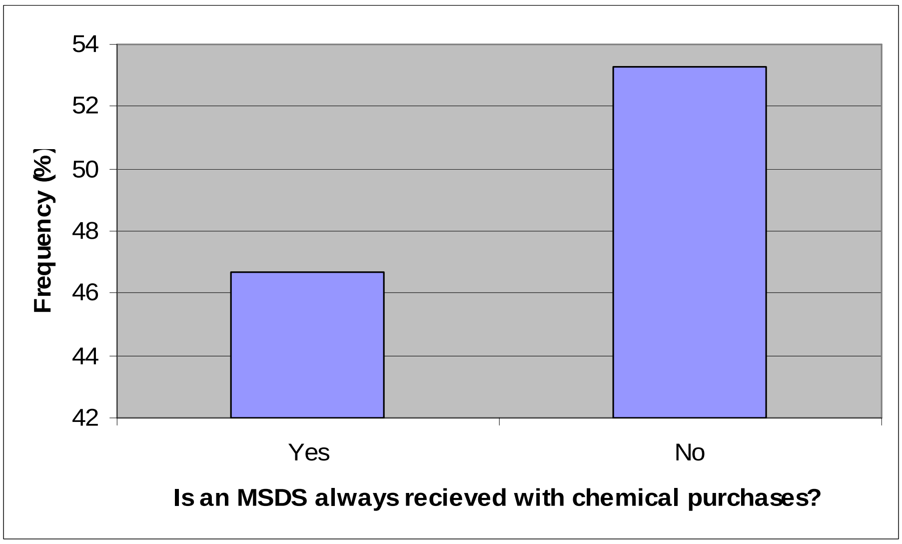


Figure 172 Is an MSDS always received with chemical purchases?

Table 152 and Figure 173 show the sources of OHS information that the business operators use. Professional bodies or employer associations are the most significant, in this case the respondents referred to the VACC. Similarly, the second most significant source (pamphlets and newsletters) also referred to VACC communiqués.

Table 152 Sources of OHS information

	Frequency	Percent%
Professional bodies or employer associations	24	63%
Pamphlets & newsletters	23	61%
Television	18	47%
Newspapers & magazines	18	47%
Posters & signs	18	47%
Government bodies & organisations	14	37%
Workmates or colleagues	12	32%
Radio	10	26%
Training courses or seminars	8	21%
Internet	2	5%
Supervisors or managers	1	3%

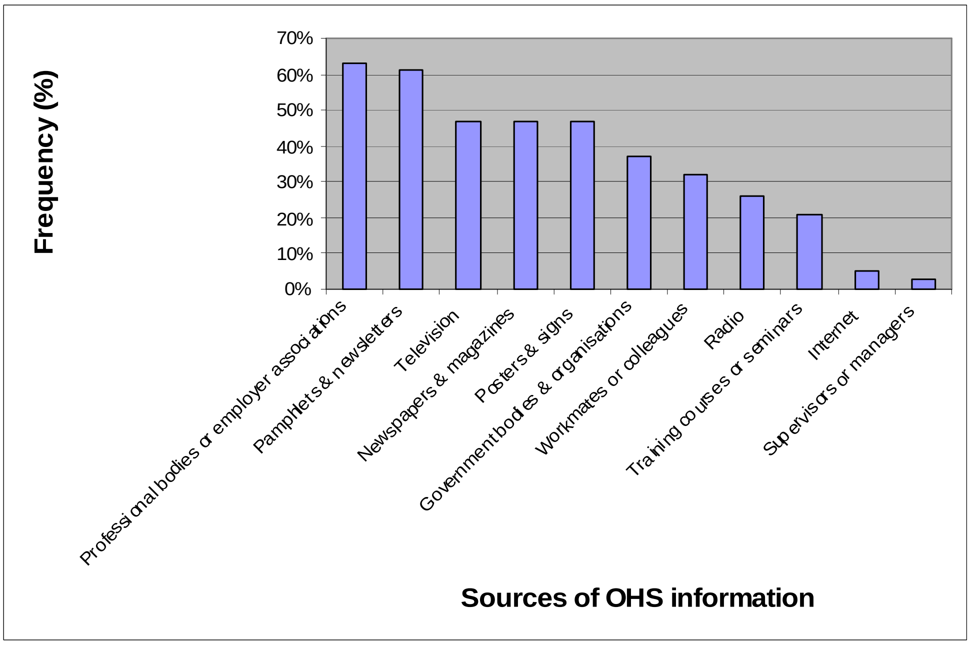


Figure 173 Sources of OHS information

Table 153 and Figure 174 show that 7 (23%) of the respondents would be likely to go to another body repairer for help in regard to an OHS issue.

Table 153 Would you go to another MVR for help regarding OHS?

	Frequency	Percent %
Yes	7	23
No	23	77
Total	**30**	**100**

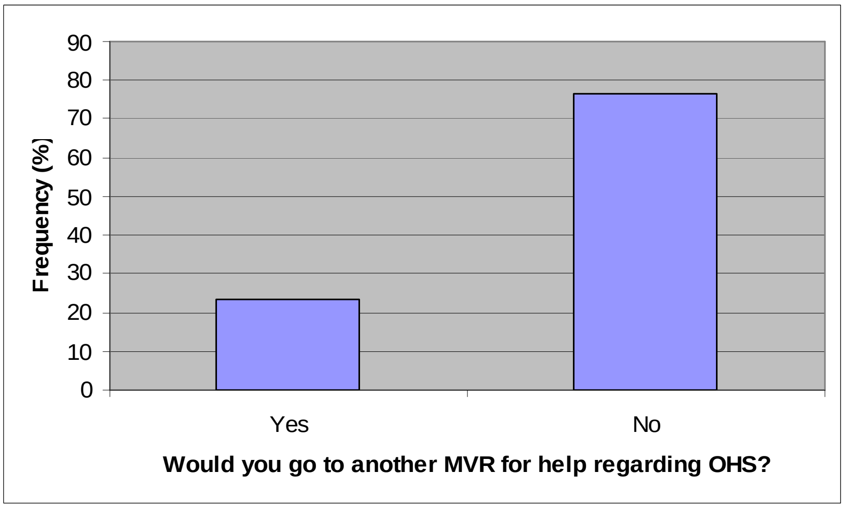


Figure 174 Would you go to another MVR for help regarding OHS?

Table 154 and Figure 175 show that 9 (30%) of the respondents would be likely to go to another body repairer for help in regard to a painting issue.

Table 154 Would you go to another MVR for help regarding painting?

	Frequency	Percent %
Yes	9	30
No	21	70
Total	**30**	**100**

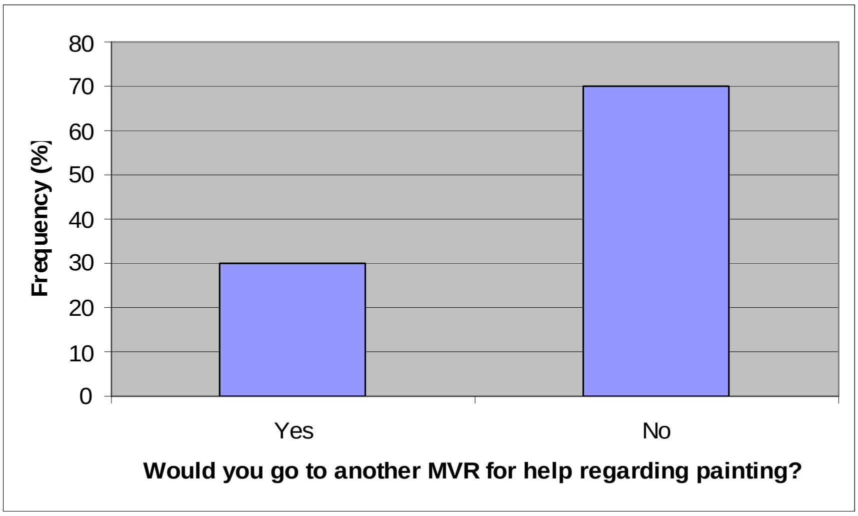


Figure 175 Would you go to another MVR for help regarding painting?

Table 155 and Figure 176 show that the VACC and WorkSafe Victoria are the most likely source of help for respondents in regard to an OHS issue.

Table 155 Most likely source of help regarding OHS

	Frequency	Percent %
WorkSafe Victoria	7	23
VACC	22	73
Paint Suppliers	1	3
Total	**30**	**100**

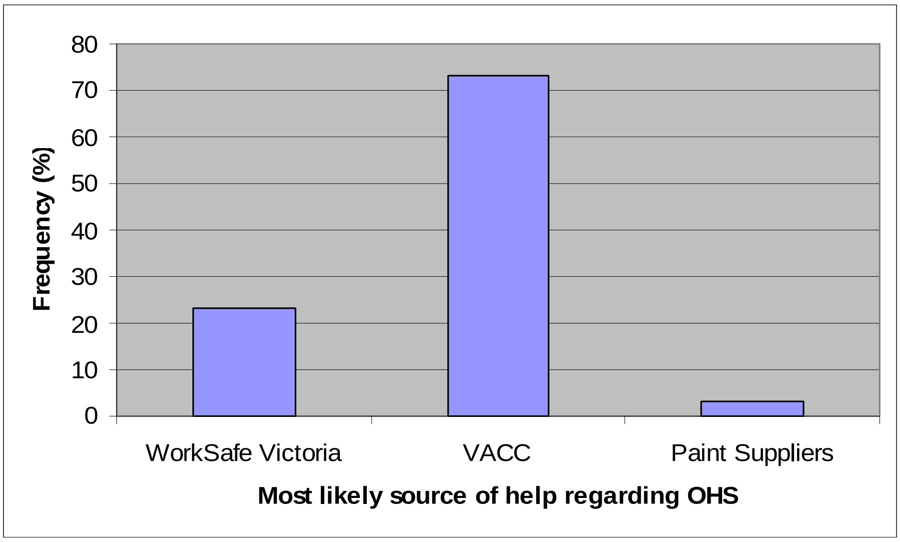


Figure 176 Most likely source of help regarding OHS

Participants were asked whether they knew where to get advice on health and safety. Participants were read a statement to which they responded with “strongly disagree”, “disagree”, “neutral”, “agree” or “strongly agree”. All participants either agreed or strongly agreed that knew where to get advice, as shown in Table 156 and Figure 177.

Table 156 I know where to get advice regarding OHS

	Frequency	Percent %
Agree	26	87
Strongly agree	4	13
Total	**30**	**100**

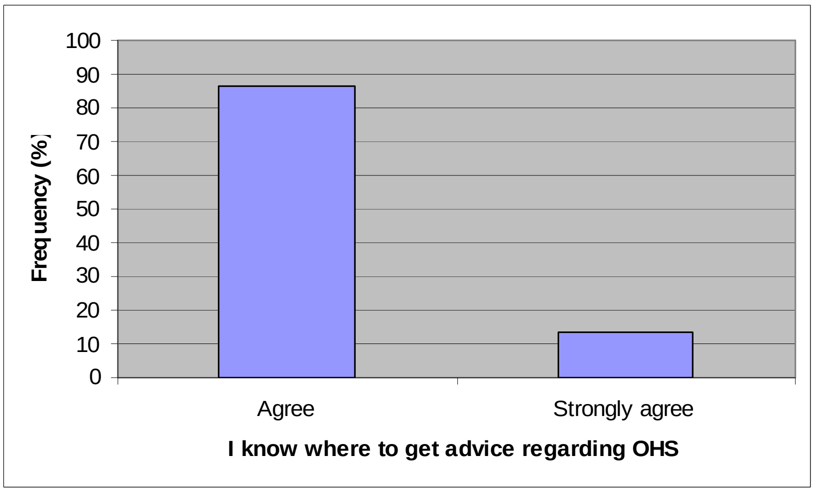


Figure 177 I know where to get advice regarding OHS

Attitudes and beliefs about OHS in general

Respondents were asked what were the three most important health and safety problems that they believed they were likely to experience in their business. The issues that were specified in the responses given are listed in Table 157.

Table 157 Top three OHS problems likely to be faced

Issue Specified	Frequency
Paint	7
Cuts	6
Slip, trip or fall	5
Dust & Fume	4
Eye	4
Burns	4
Carelessness	3
Fire	3
Workers not using safety equipment	2
Car falling	2
Noise	2
Manual handling	2
Dermatitis	1
Electricity	1
MSDS out of date	1
Product information	1
Sharp instruments	1
Plastic Filler	1
Drugs & alcohol	1

Respondents were asked to select from a list, what they believed was the main, cause of work related injuries and illness in the community in general. The responses given are listed in Table 158 and illustrated in Figure 178.

Table 158 Main cause of work related injuries and illness

	Frequency	Percent %
Lack of training & education	7	23
Pressure or stress	1	3
Worker being careless	17	57
Dangerous equipment & procedures	2	7
Dangerous chemicals or substances	3	10
Total	**30**	**100**

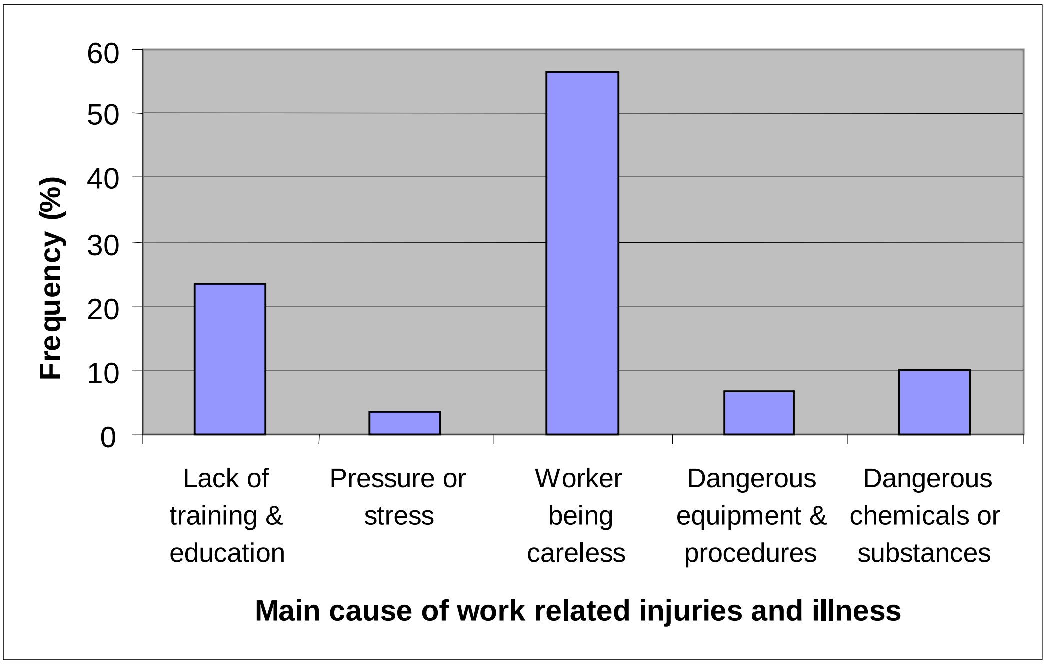


Figure 178 Main cause of work related injuries and illness

Respondents were asked to select from a list what they believed was the most important prevention measure for work related injuries and illness in the community in general. The responses given are listed in Table 159 and illustrated in Figure 179.

Table 159 Most important prevention measure for work related injuries and illnesses

	Frequency	Percent %
Education & awareness about OHS	14	47
Training on safe work procedures	6	20
Safe procedures and systems of work	2	7
Employee consultation and involvement	1	3
Safe equipment	3	10
Stronger enforcement of regulations	2	7
Regulations clearer and easier to understand	2	7
Total	**30**	**100**

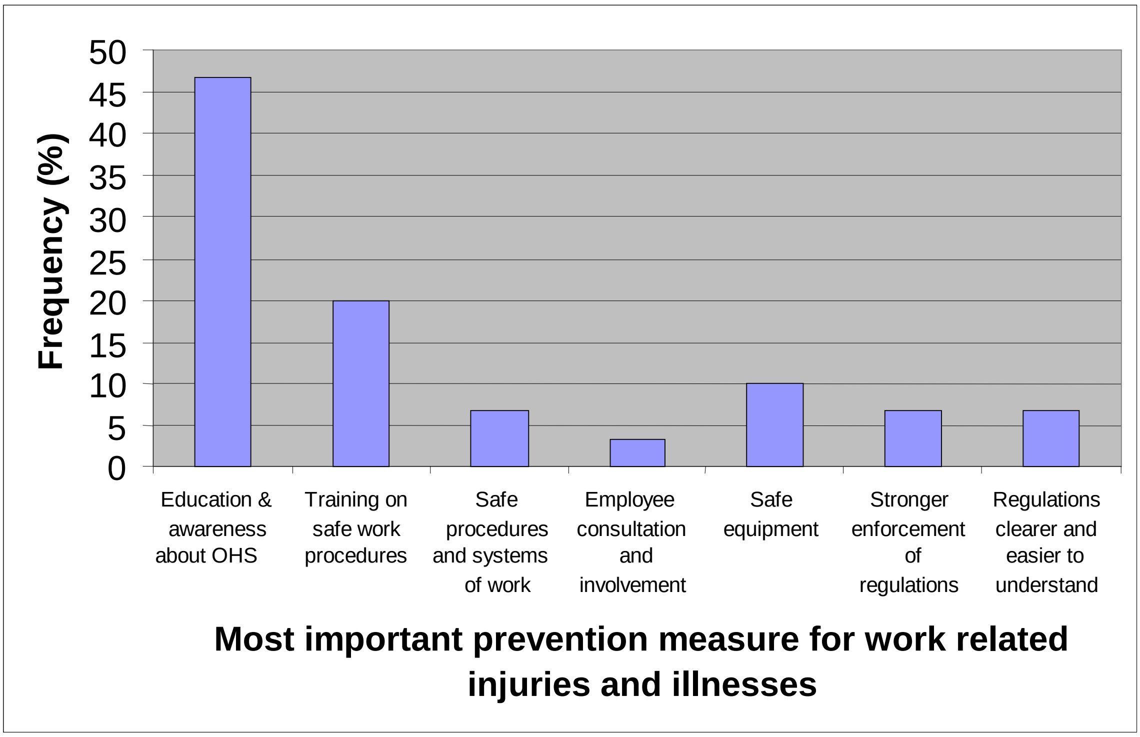


Figure 179 Most important prevention measure for work related injuries and illnesses

Respondents were asked to select from a list, what they believed was the proportion of work related injuries and illness in the community in general that could be prevented. The responses given are listed in Table 160 and illustrated in Figure 180.

Table 160 Proportion of injuries and illnesses that could be prevented

	Frequency	Percent %
Nearly all	15	50
More than half	7	23
About half	3	10
Less than half	3	10
Hardly any	2	7
Total	30	100

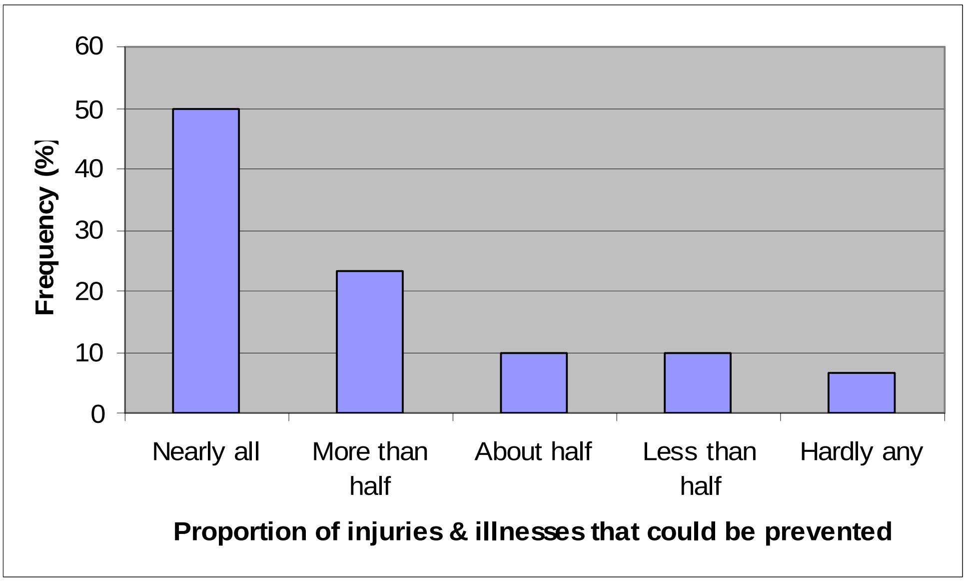


Figure 180 Proportion of injuries and illnesses that could be prevented

Beliefs about risk in small business

Participants were asked a series of questions to assess their attitudes and beliefs about the importance of OHS in their business. Participants were read a statement to which they responded with “strongly disagree”, “disagree”, “neutral”, “agree” or “strongly agree”.

The majority of respondents believed that health and safety is a high priority and one of their biggest concerns. The responses given are listed in Table 161, Table 162 and Table 163, illustrated in Figure 181 Compared to all the other things that can go wrong, health and safety is a high priority, Figure 182 Health and Safety is not as important as other things like GST and Figure 183 In this business health and safety is one of my biggest concerns.

Table 161 Compared to all the other things that can go wrong, health and safety is a high priority

	Frequency	Percent %
Neutral	1	3%
Agree	13	45%
Strongly agree	15	52%
Total	**29**	**100%**

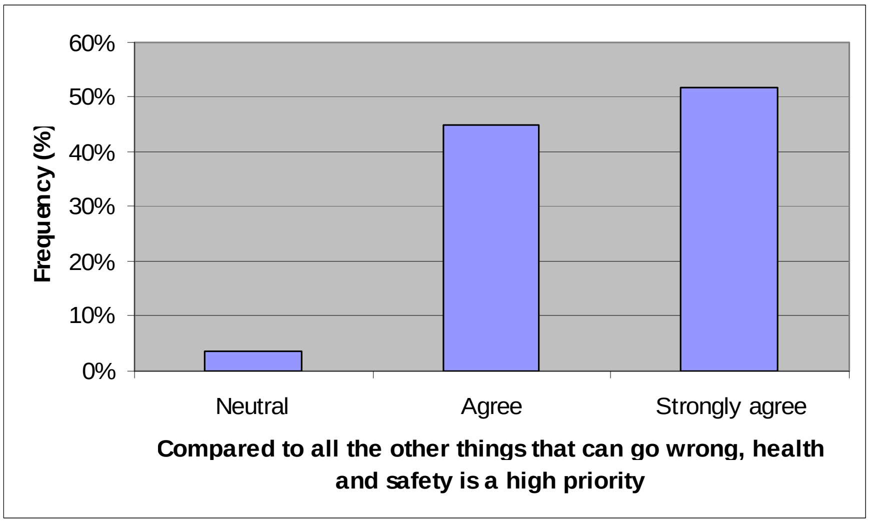


Figure 181 Compared to all the other things that can go wrong, health and safety is a high priority

Table 162 Health and Safety is not as important as other things like GST

	Frequency	Percent %
Strongly disagree	13	43
Disagree	15	50
Neutral	2	7
Total	**30**	**100**

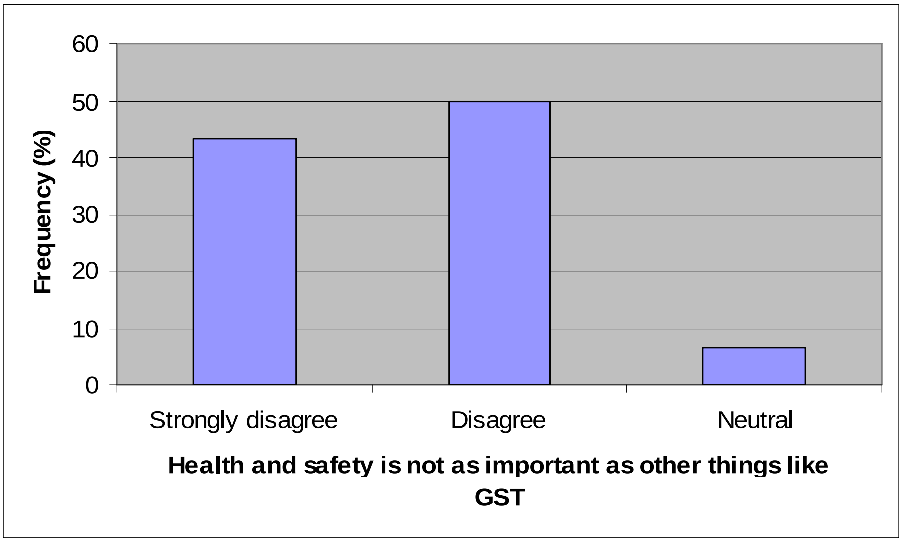


Figure 182 Health and Safety is not as important as other things like GST

Table 163 In this business health and safety is one of my biggest concerns

	Frequency	Percent %
Strongly disagree	2	7
Disagree	4	14
Neutral	3	10
Agree	13	45
Strongly agree	7	24
Total	**29**	**100**

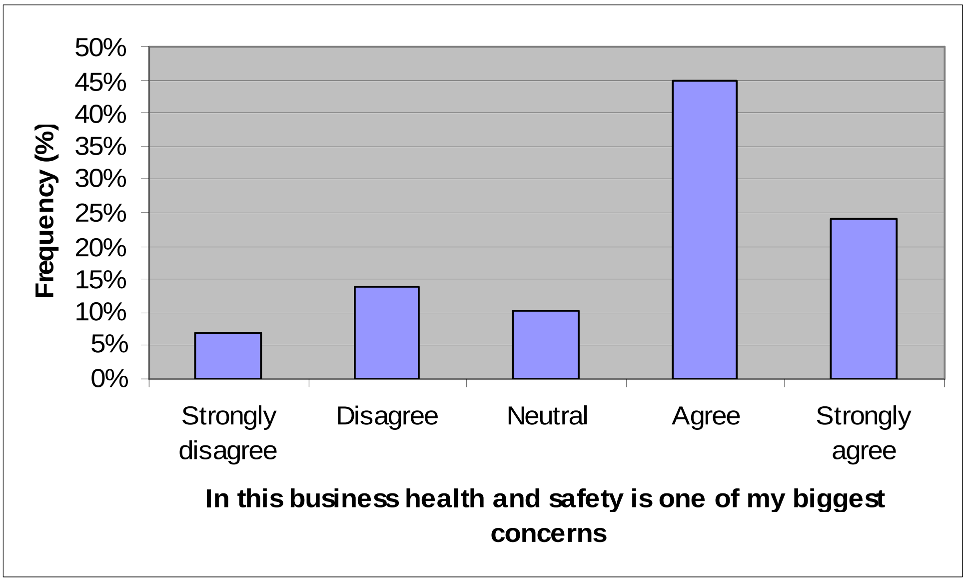


Figure 183 In this business health and safety is one of my biggest concerns

Table 164, Table 165, Table 166, Table 167 and Table 168, illustrated by Figure 184, Figure 185, Figure 186, Figure 187 and Figure 188 indicate that the majority of respondents believe that it is not only large businesses that face OHS problems and that OHS is significant as an issue for small businesses like theirs.

Table 164 Larger businesses face the real risks from health and safety

	Frequency	Percent %
Strongly disagree	4	13
Disagree	18	60
Neutral	2	7
Agree	6	20
Total	**30**	**100**

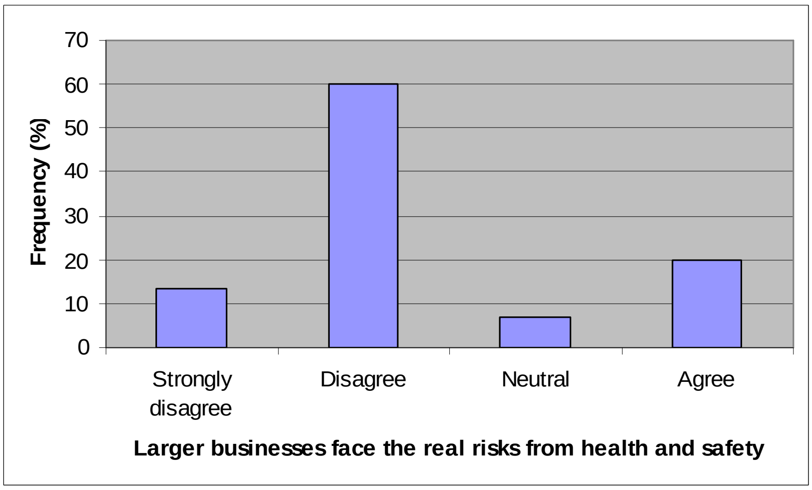


Figure 184 Larger businesses face the real risks from health and safety

Table 165 Health and Safety is not likely to be a problem here – the business is too small

	Frequency	Percent %
Strongly disagree	9	30
Disagree	17	57
Neutral	2	7
Agree	2	7
Total	**30**	**100**

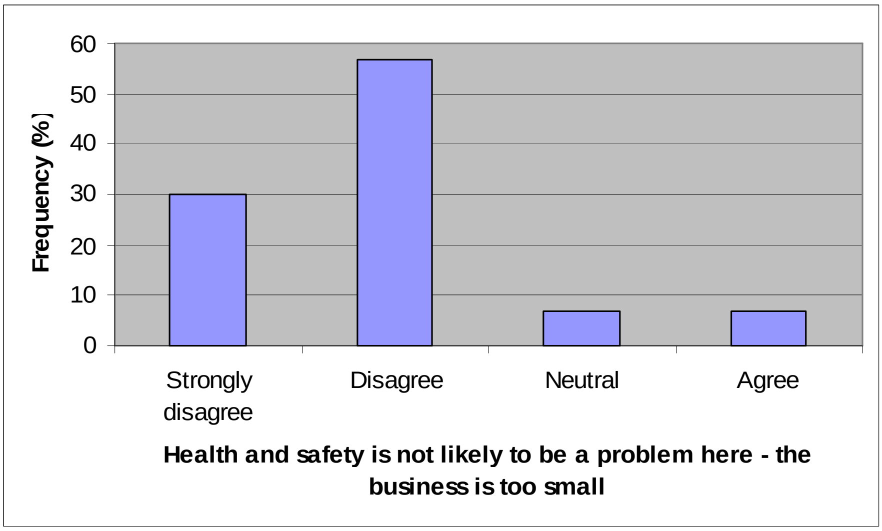


Figure 185 Health and Safety is not likely to be a problem here – the business is too small

Table 166 Health and safety is not as important to businesses like mine as it is to larger ones

	Frequency	Percent %
Strongly disagree	11	38%
Disagree	17	59%
Agree	1	3%
Total	**29**	**100%**

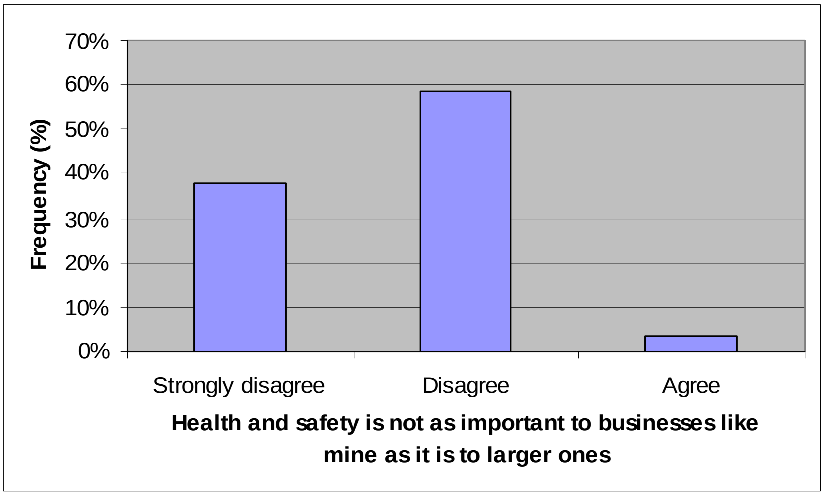


Figure 186 Health and safety is not as important to businesses like mine as it is to larger ones

Table 167 Injuries and ill health are a major problem for business of this size

	Frequency	Percent %
Strongly disagree	2	7
Disagree	17	57
Neutral	3	10
Agree	4	13
Strongly agree	4	13
Total	**30**	**100**

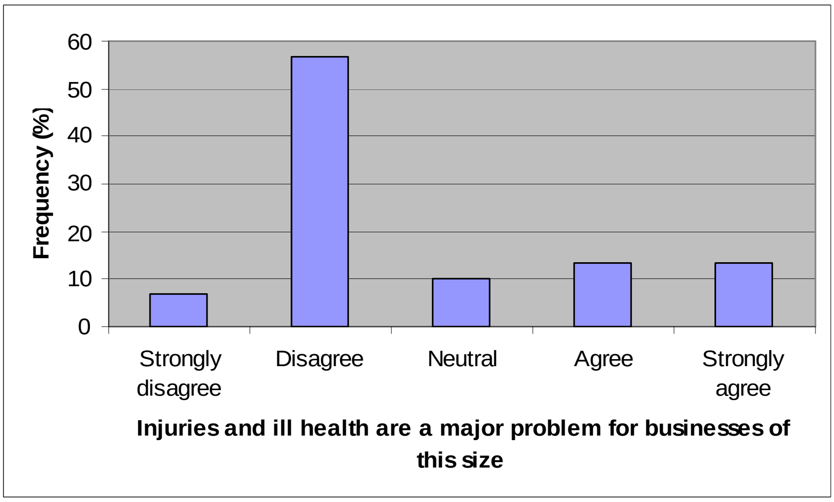


Figure 187 Injuries and ill health are a major problem for business of this size

Table 168 Compared to large businesses, small businesses do not have many health and safety problems

	Frequency	Percent %
Strongly disagree	7	24
Disagree	13	45
Neutral	6	21
Agree	3	10
Total	**29**	**100**

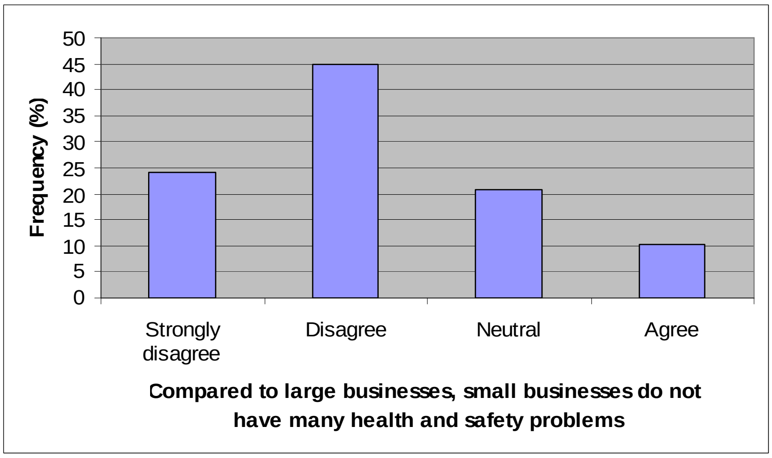


Figure 188 Compared to large businesses, small businesses do not have many health and safety problems

Table 169 and Table 170, illustrated by Figure 189 and Figure 190 show that the majority of respondents believed that ill-health of their spray painters would present them with a major business problem.

Table 169 If any of my spray painters got sick because of the paint it would not be a major problem for my business

	Frequency	Percent %
Strongly disagree	16	55
Disagree	9	31
Neutral	1	3
Agree	2	7
Strongly agree	1	3
Total	**29**	**100**

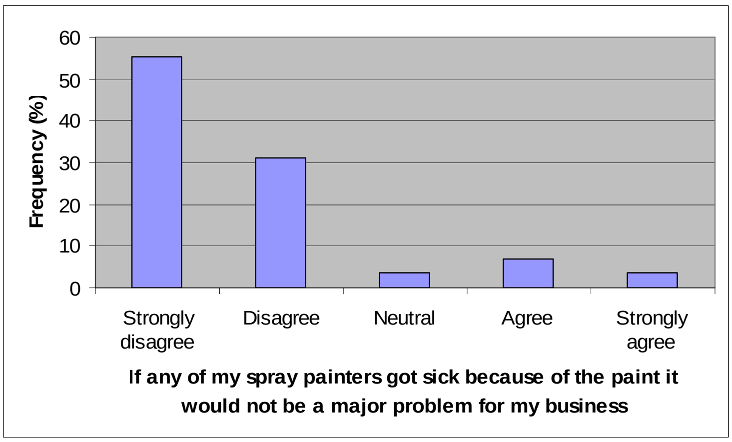


Figure 189 If any of my spray painters got sick because of the paint it would not be a major problem for my business

Table 170 Ill-health of my spray painters would be a problem for my business

	Frequency	Percent %
Disgree	4	13
Neutral	1	3
Agree	17	57
Strongly agree	8	27
Total	**30**	**100**

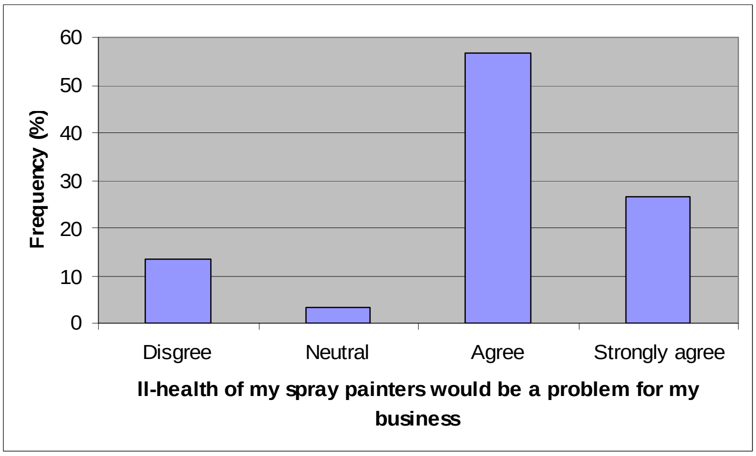


Figure 190 Ill-health of my spray painters would be a problem for my business

Spray painting facilities and practices

As shown in Table 171 and Figure 191, one-third of respondents used less than 10 litres of two-pack paint, one third used 10 litres but less than 20 litres and one third used more than 20 litres each week.

Table 171 Volume of 2-pack paint used per week

	Frequency	Percent %
<10 litres	10	33
>10 litres, <20 litres	10	33
>20 litres	10	33
Total	**30**	**100**

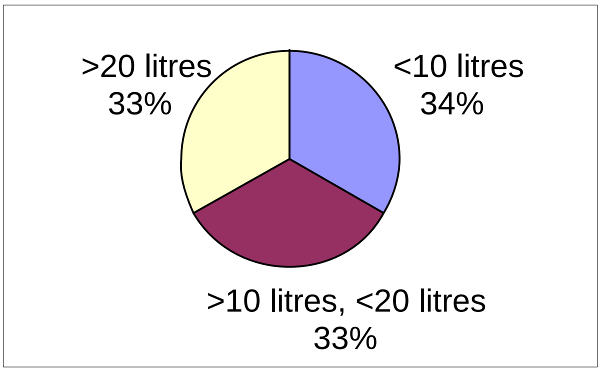


Figure 191 Volume of 2-pack paint used per week

All businesses surveyed possessed spray booths on-site.

As shown in Table 172 and Figure 192, 24 (80%) of businesses reported that spray painting was always done inside the spray booth. Six (20%) of businesses reported that two-pack paints were sometimes sprayed outside the spray booth.

Table 172 Use of a spray booth

	Frequency	Percent %
Always	24	80
Sometimes	6	20
Total	**30**	**100**

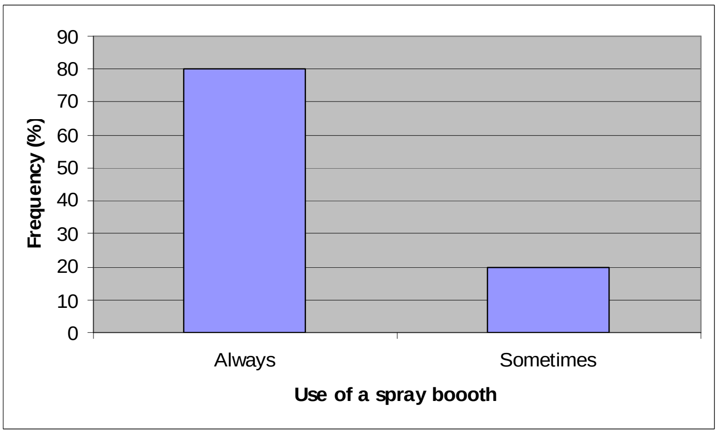


Figure 192 Use of spray booth

As shown in Table 173 and Figure 193, all businesses reported that they undertake maintenance on their spray booth filters. Twenty-one (70%) reported that they undertook maintenance at least every six months.

Table 173 Frequency of spray booth filter maintenance

	Frequency	Percent %
At least every six months	21	70
Once per year	6	20
Once every few years	3	10
Total	**30**	**100**

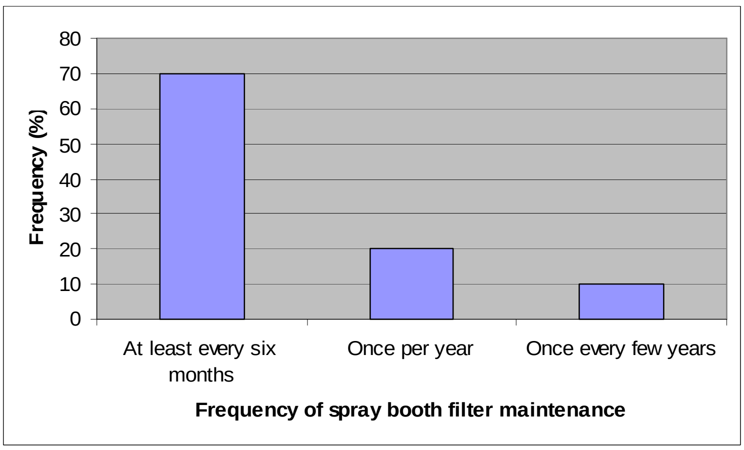


Figure 193 Frequency of spray booth filter maintenance

Table 174 and Figure 194 show that the majority (6 or 20%) of businesses reported that they never quantitatively assessed the performance of their spray booth in terms of airflow. Only 24 (80%) businesses reported that they did measure the airflow in their spray booths.

Table 174 Frequency of spray booth airflow check

	Frequency	Percent %
Monthly	4	13
More than once per year	17	57
<Once per year	3	10
Never	6	20
Total	**30**	**100**

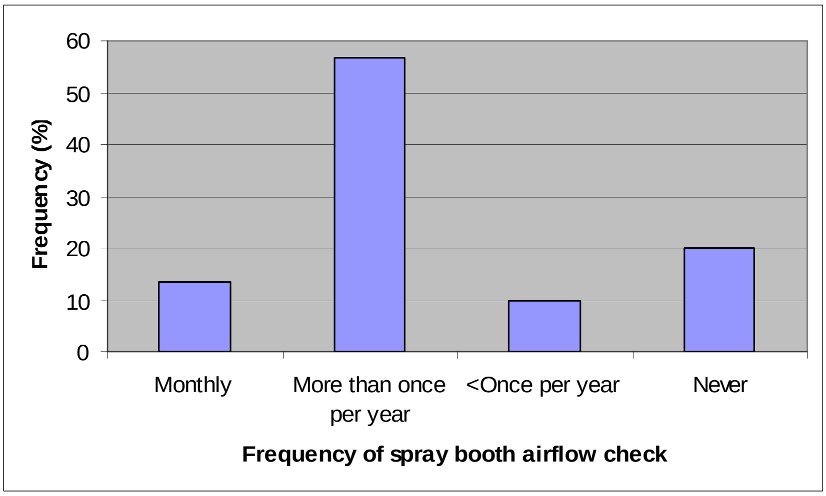


Figure 194 Frequency of spray booth airflow check

All of the businesses surveyed made respiratory protection available.

As shown in Table 175 and Figure 195 the majority (22 or 73%) of the businesses visited reported that respiratory protection was always used while spraying two-pack paints. Eight (27%) respondents reported that two-pack paints are sometimes sprayed without respiratory protection being used.

Table 175 Use of respiratory protection while spraying two-pack paint

	Frequency	Percent %
Always	22	73
Sometimes	8	27
Total	**30**	**100**

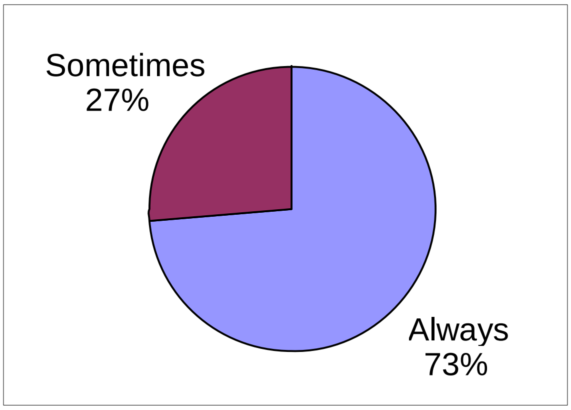


Figure 195 Use of respiratory protection while spraying two-pack paint

As shown in Table 176 and Figure 196 21 (70%) of the businesses surveyed made air supplied respiratory protection available.

Table 176 Availability of air supplied RPE

	Frequency	Percent %
Yes	21	70
No	9	30
Total	**30**	**100**

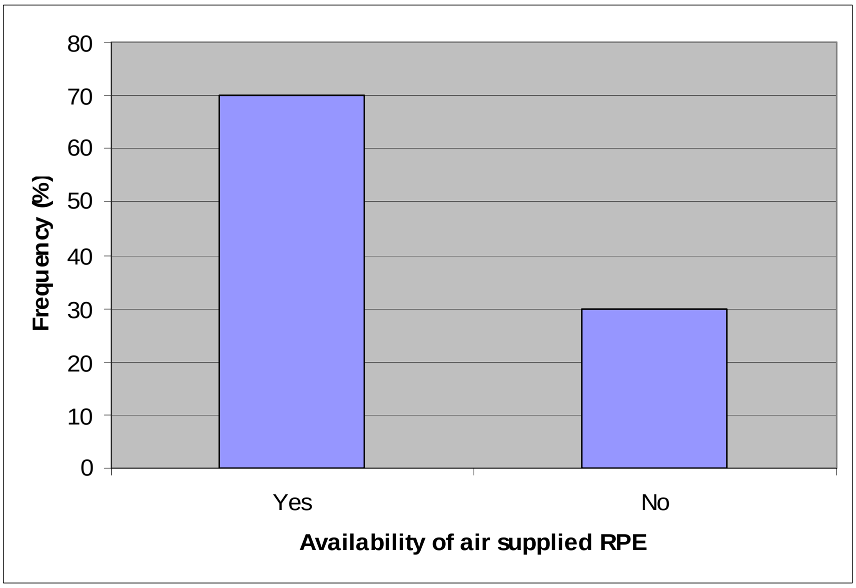


Figure 196 Availability of air supplied RPE

As shown in Table 177 and Figure 197, of the businesses which made airline-supplied respiratory protection available, the majority (12 or 60%) reported that airline-supplied respiratory protection is not always or is never used while spraying two-pack paints. Only 8 businesses reported that airline-supplied respiratory protection is always used while spraying two-pack paints. Two (10%) of businesses surveyed never use airline-supplied respiratory protection while spraying two-pack paints, even though it is available.

Table 177 Use of air supplied RPE

	Frequency	Percent %
Always	8	40
Sometimes	10	50
Never	2	10
Total	**20**	**100**

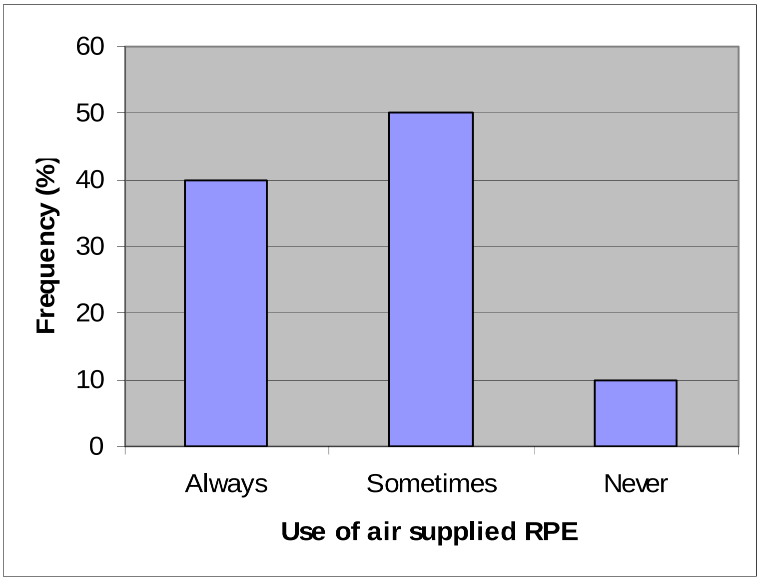


Figure 197 Use of air supplied RPE

Knowledge & attitudes about spray painting health risk

Participants were asked a series of questions to assess their knowledge about the health effects of exposure to isocyanates and two-pack paints. Participants were read a statement to which they responded with “strongly disagree”, “disagree”, “neutral”, “agree” or “strongly agree”.

Table 178 and Table 179, illustrated by Figure 198 and Figure 199 show that the majority (20 or 67%) of respondents agreed or strongly agreed with the statement that two-pack paints can cause lung damage, while the majority (17 or 57%) did not know (were neutral) that two-pack paints could cause asthma. Ten (33%) of the respondents agreed that two-pack paints could cause asthma.

Table 178 2-pack paint can cause lung damage

	Frequency	Percent %
Strongly disagree	0	0
Disagree	2	7
Neutral	8	27
Agree	14	47
Strongly agree	6	20
Total	**30**	**100**

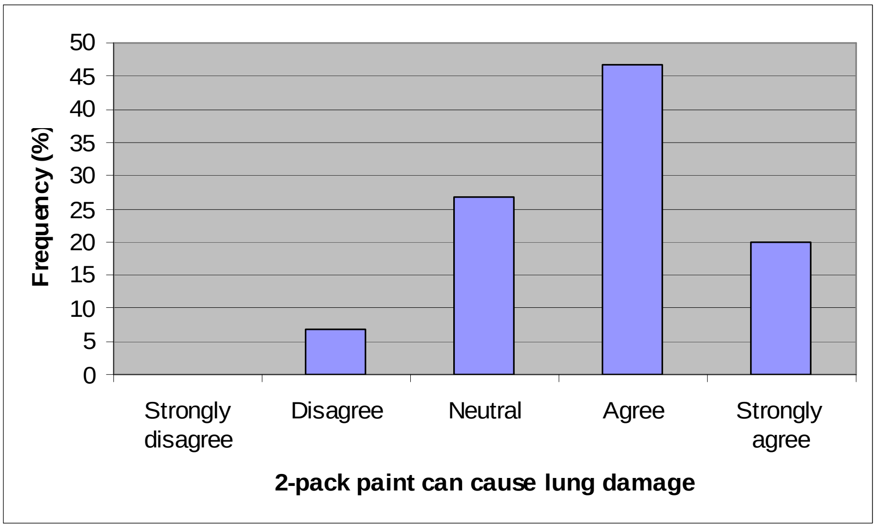


Figure 198 2-pack paint can cause lung damage

Table 179 2-pack paints can cause asthma

	Frequency	Percent %
Strongly disagree	1	3
Disagree	2	7
Neutral	17	57
Agree	9	30
Strongly agree	1	3
Total	**30**	**100**

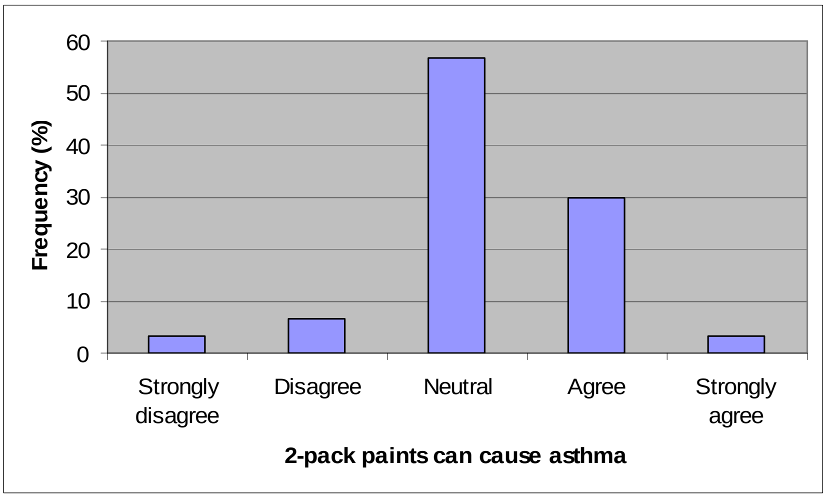


Figure 199 2-pack paints can cause asthma

Table 180 and Table 181 illustrated by Figure 200 and Figure 201 show that the majority (18 or 60%) of respondents disagreed or strongly disagreed with the statement that two-pack are safe these days, and the majority (24 or 80%) disagreed or strongly disagreed with the statement that two-pack paints are unlikely to hurt you. The distributions shown in Figure 198, Figure 200 and Figure 201 indicate strong inter-question reliability.

Table 180 2-pack paints are safe these days

	Frequency	Percent %
Strongly disagree	6	20
Disagree	12	40
Neutral	6	20
Agree	6	20
Strongly agree	0	0
Total	**30**	**100**

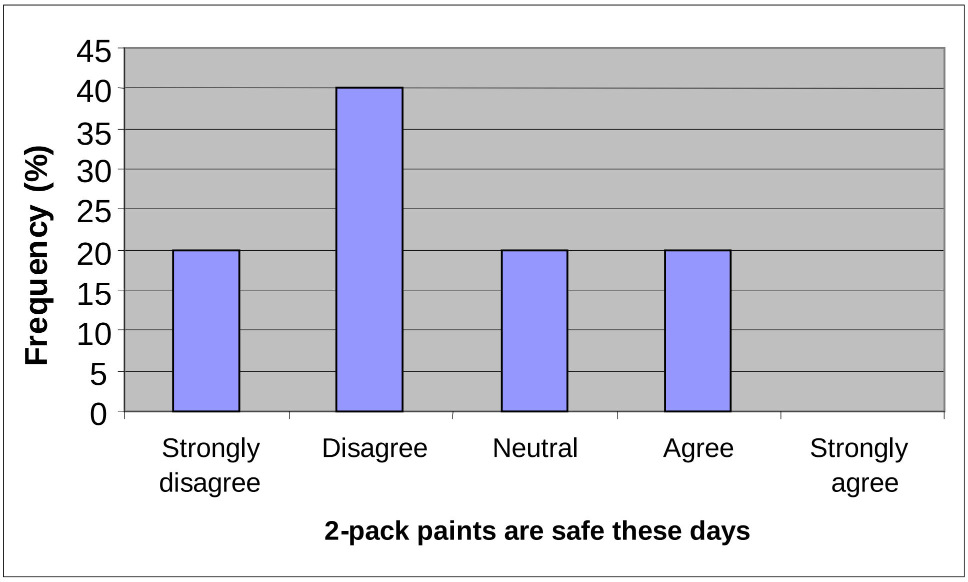


Figure 200 2-pack paints are safe these days

Table 181 2-pack paints are unlikely to hurt

	Frequency	Percent %
Strongly disagree	8	27
Disagree	16	53
Neutral	3	10
Agree	3	10
Strongly agree	0	0
Total	**30**	**100**

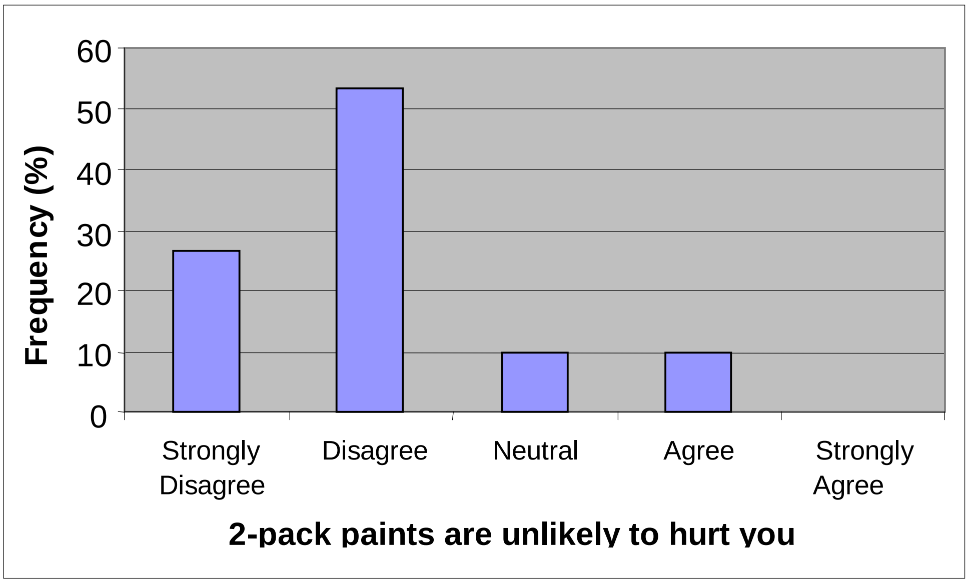


Figure 201 2-pack paints are unlikely to hurt

The majority (23 or 77%) of respondents disagreed or strongly disagreed with the statement that two-pack paints are not harmful if just splashed on the skin and, supporting this and indicating strong inter-question reliability, 24 (80%) respondents agreed with the statement that isocyanates can be harmful if they get on the skin.

Table 182 and Figure 202 show that the majority (20 or 66%) of respondents disagreed or strongly disagreed with the statement that "Gloves are unnecessary when spraying 2-pack paints" i.e. the majority of respondents recognise that gloves should be used while spraying two-pack paint. Only 6 respondents (20%) believed gloves are unnecessary.

Table 182 Gloves are unnecessary when spraying 2-pack paints

	Frequency	Percent %
Strongly disagree	4	13
Disagree	16	53
Neutral	4	13
Agree	6	20
Strongly agree	0	0
Total	**30**	**100**

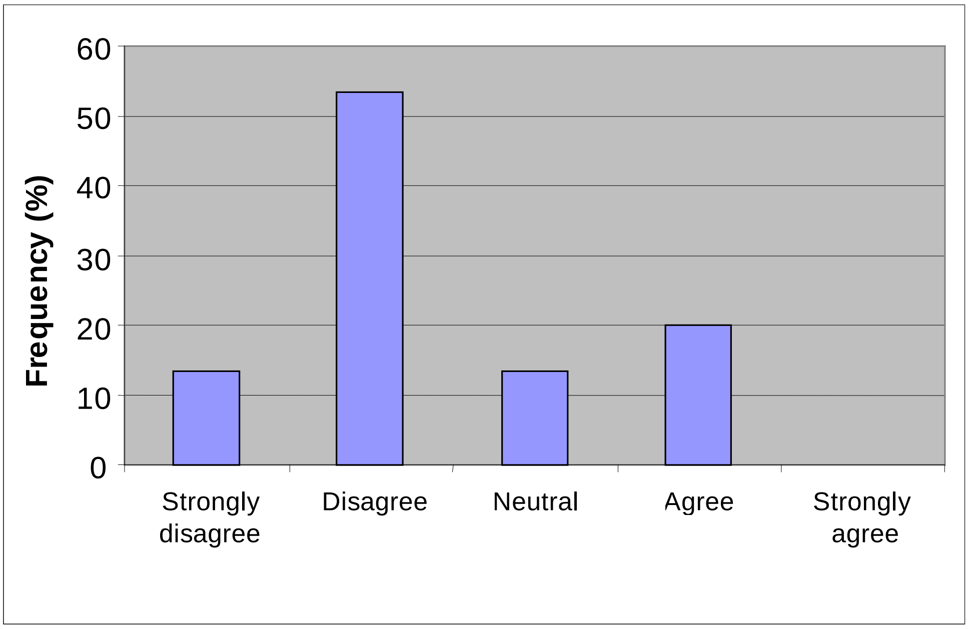


Figure 202 Gloves are unnecessary when spraying 2-pack paints

Table 183 and Figure 203 show that the 15 (50%) of respondents strongly disagreed or disagreed with the statement "Gloves are unnecessary when mixing 2-pack paint". However, 15 (50%) were either "neutral" or "disagreed" or "strongly disagreed", which suggests that there is less certainty among respondents regarding the necessity for gloves when mixing two-pack paints as compared to when spraying.

Table 183 Gloves are unnecessary when mixing 2-pack

	Frequency	Percent %
Strongly disagree	5	17
Disagree	10	33
Neutral	7	23
Agree	7	23
Strongly agree	1	3
Total	**30**	**100**

Figure 203 Gloves are unnecessary when mixing 2-pack

Attitudes about RPE & Spray Booths

Participants were asked a series of questions to assess their attitudes about the use of respiratory protection and spray booths while spraying and handling two-pack paints. Participants were read a statement to which they responded with “strongly disagree”, “disagree”, “neutral”, “agree” or “strongly agree”.

Table 184 and 185 illustrated by Figure 204 and Figure 205 show that the majority (28 or 94%) of respondents agreed or strongly agreed with the statement that a respirator *and* spray booth should be used when spraying two-pack paints and similar proportions (26 or 87%) rejected the suggestion (disagreed or strongly disagreed) that either a respirator *or* spray booth should be used when spraying two-pack paints. The results therefore indicate strong inter-question reliability.

Table 184 When spraying 2-pack paints a spray booth and a respirator should be used

	Frequency	Percent %
Strongly disagree	0	0
Agree	0	0
Neutral	1	3
Agree	20	69
Strongly agree	8	28
Total	**29**	**100**

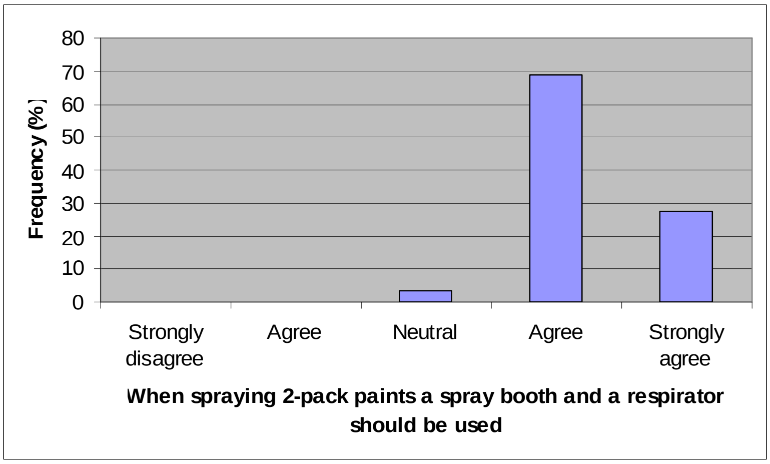


Figure 204 When spraying 2-pack paints a spray booth and a respirator should be used

Table 185 It is OK to use either a spray booth or a respirator while spraying 2-pack paints

	Frequency	Percent %
Strongly disagree	8	27
Disagree	18	60
Neutral	1	3
Agree	2	7
Strongly agree	1	3
Total	30	100

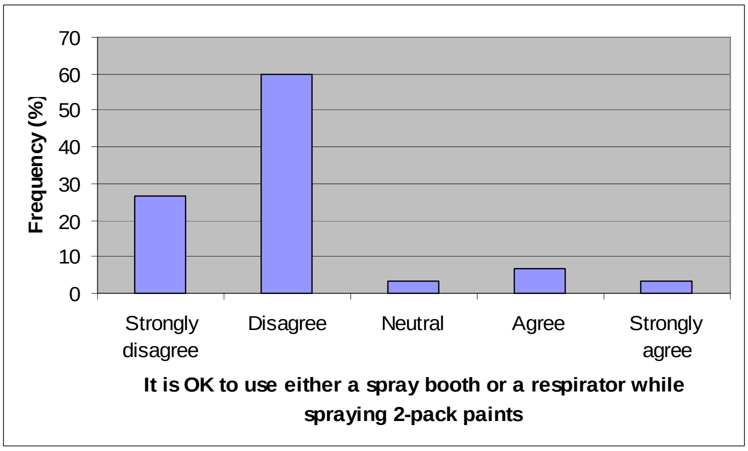


Figure 205 It is OK to use either a spray booth or a respirator while spraying 2-pack paints

Table 186 and Table 187 illustrated by Figure 206 and Figure 207 show that the majority (29 or 97%) of respondents disagreed or strongly disagreed with the statement that it is OK to spray small amounts of two-pack paint without a respirator and similar proportions (27 or 90%) agreed or strongly agreed that even when doing a small spray job with 2-pack paint, a respirator should be used. The results therefore indicate strong inter-question reliability.

Table 186 It is ok to spray small amounts of 2-pack paint without using a respirator

	Frequency	Percent %
Strongly disagree	5	17
Disagree	24	80
Neutral	1	3
Agree	0	0
Strongly agree	0	0
Total	**30**	**100**

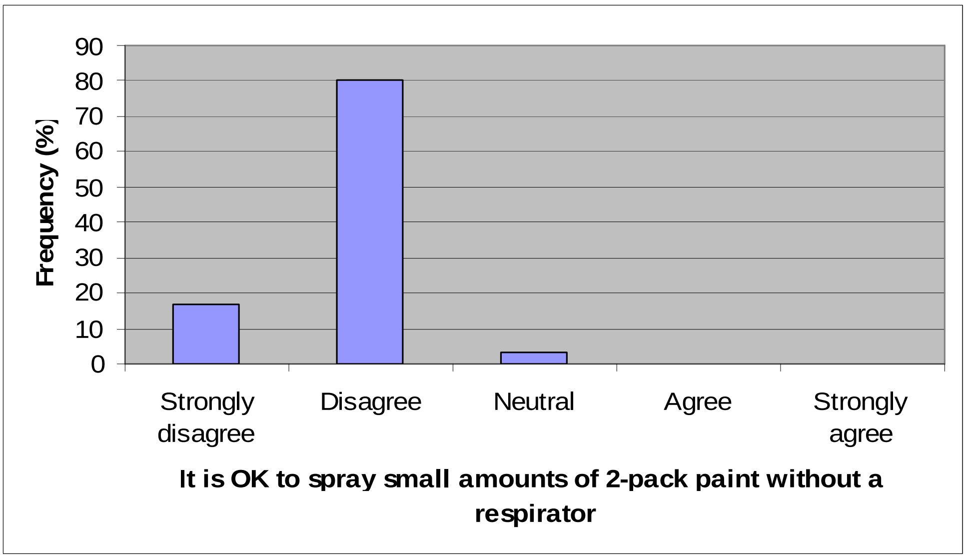


Figure 206 It is ok to spray small amounts of 2-pack paint without using a respirator

Table 187 Even when doing a small spray job with 2-pack paint a respirator should be used

	Frequency	Percent %
Strongly disagree	0	0
Disagree	0	0
Neutral	2	7
Agree	22	76
Strongly agree	5	17
Total	**29**	**100**

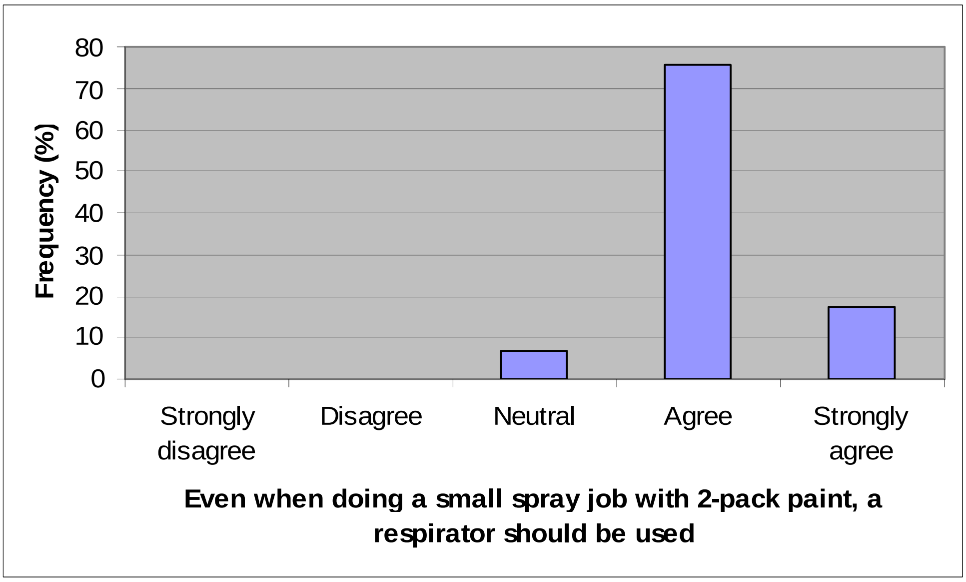


Figure 207 Even when doing a small spray job with 2-pack paint a respirator should be used

Table 188, Table 189, Table 190 and Table 19, illustrated by Figure 208, Figure 209, Figure 210 and Figure 211 show that there a range of beliefs about the need for airline-supplied respirators among respondents. There is however, an indication that the majority of respondents believe air-line supplied respirators should be used, with 53% (16) either disagreeing or strongly disagreeing with the statement that you do not need to use air-supplied respirators when spraying 2-pack paint, 50% (15) either disagreeing or strongly disagreeing with the statement that you do not need airline-supplied respirators when spraying 2-pack paints and 67% (20) either agreeing or strongly agreeing with the statement that an air-supplied respirator should always be used when spraying 2-pack paints. 19 (63%) either disagreeing or strongly disagreeing with the statement that they do not think it is necessary for spray painters to use air supplied respiratory protection.

Table 188 You do not need to use air supplied RPE when spraying 2-pack paint

	Frequency	Percent %
Strongly disagree	0	0
Disagree	7	23
Neutral	3	10
Agree	10	33
Strongly agree	10	33
Total	**30**	**100**

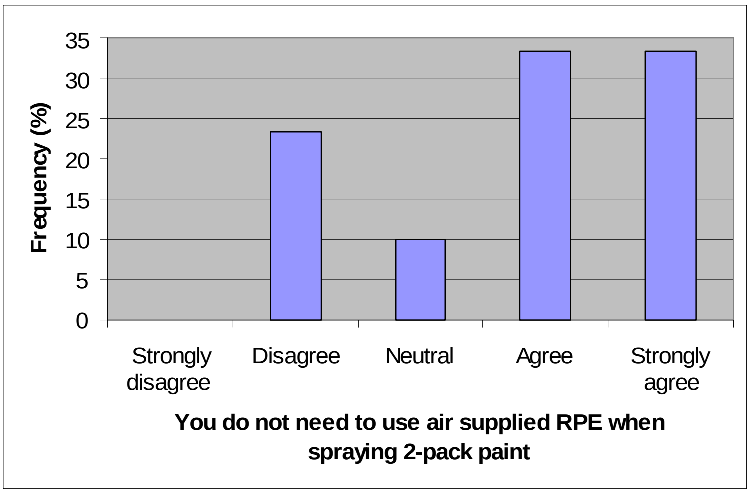


Figure 208 You do not need to use air supplied RPE when spraying 2-pack paint

Table 189 You do not need airline-supplied respirators when spraying 2-pack paints

	Frequency	Percent %
Strongly disagree	6	21
Disagree	9	31
Neutral	3	10
Agree	10	34
Strongly agree	1	3
Total	**29**	**100**

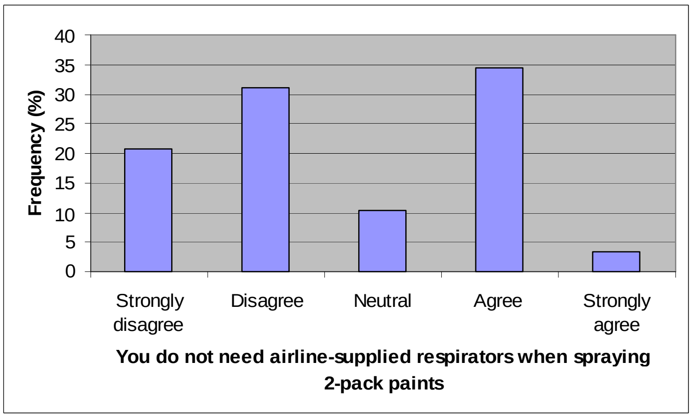


Figure 209 You do not need airline-supplied respirators when spraying 2-pack paints

Table 190 An air-supplied respirator should always be used when spraying 2-pack paints

	Frequency	Percent %
Strongly disagree	0	0
Disagree	7	23
Neutral	3	10
Agree	10	33
Strongly agree	10	33
Total	**30**	**100**

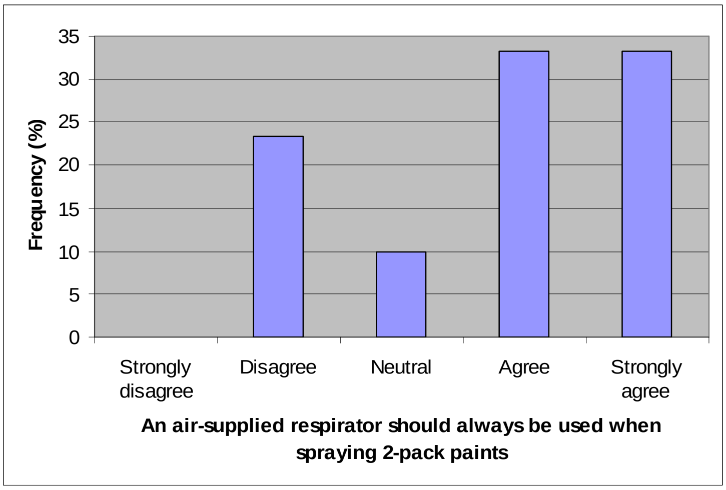


Figure 210 An air-supplied respirator should always be used when spraying 2-pack paints

Table 191 I do not think it is necessary for spray painters to use air supplied respiratory protection

	Frequency	Percent %
Strongly disagree	4	13
Disagree	15	50
Neutral	4	13
Agree	7	23
Strongly agree	0	0
Total	**30**	**100**

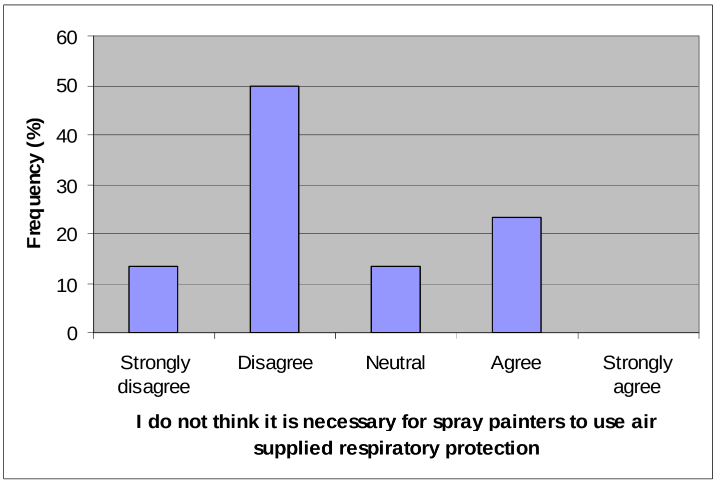


Figure 211 I do not think it is necessary for spray painters to use air supplied respiratory protection

Table 192 and Figure 212 suggest contradictory beliefs among respondents about the need for respirators while handing paints, showing that 112 (36%) either disagreed or strongly disagreed with the statement that "a respirator is not necessary while weighing ot mixing paint", while 13 (43%) agreed with the statement that "a respirator is not necessary while weighing or mixing paint." However, as shown in Table 193 and Figure 231, 27 (90%) either agreed or strongly agreed with the statement that "respirators should be used at all times when handling 2-pack hardeners." It is possible that the respondents differentiated between paints in general and 2-pack hardeners.

Table 192 A respirator is not necessary while weighing and mixing paint

	Frequency	Percent %
Strongly disagree	1	3
Disagree	10	33
Neutral	6	20
Agree	13	43
Strongly agree	0	0
Total	**30**	**100**

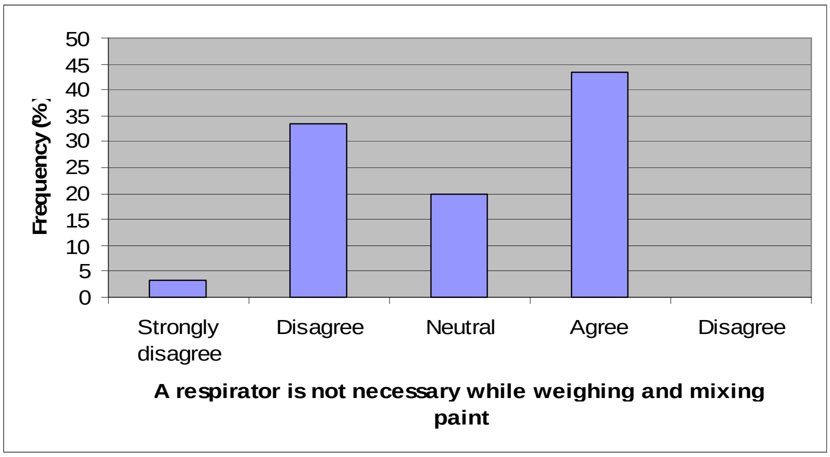


Figure 212 A respirator is not necessary while weighing and mixing paint

Table 193 Respirators should be used at all times when handling 2-pack hardeners

	Frequency	Percent %
Strongly disagree	0	0
Disagree	1	3
Neutral	2	7
Agree	9	30
Strongly agree	18	60
Total	**30**	**100**

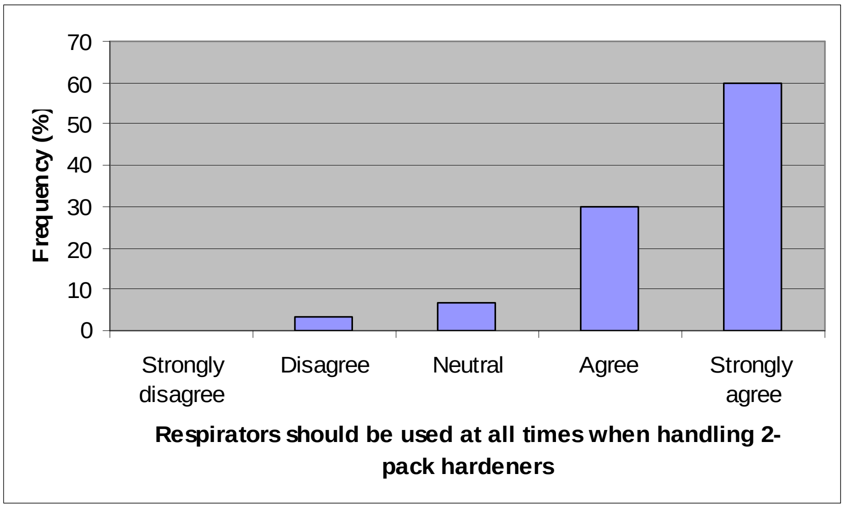


Figure 213 Respirators should be used at all times when handling 2-pack hardeners

Table 194 and Figure 214 indicate that the majority (20 or 67%) of respondents believe that they know how to test the fit of a respirator.

Table 194 "I know how to test the fit of a respirator"

	Frequency	Percent %
Strongly disagree	0	0
Disagree	4	14
Neutral	5	17
Agree	18	62
Strongly agree	2	7
Total	**29**	**100**

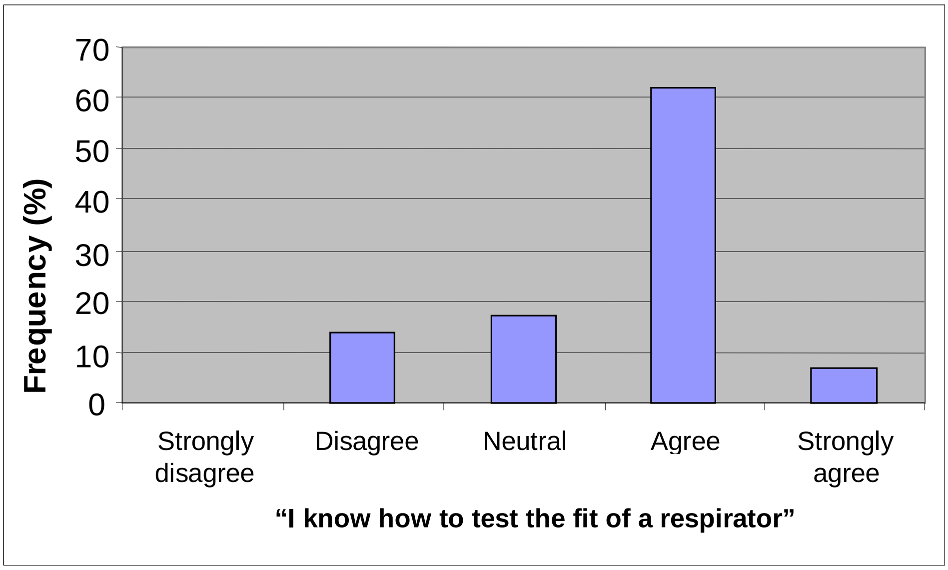


Figure 214 "I know how to test the fit of a respirator"

Table 195 and Figure 215 indicate that the majority (15 or 50%) of respondents agreed with the statement that an airline-supplied respirator prevents you seeing properly.

Table 195 An airline-respirator prevents you seeing properly

	Frequency	Percent %
Strongly disagree	0	0
Disagree	7	23
Neutral	8	27
Agree	14	47
Strongly agree	1	3
Total	**30**	**100**

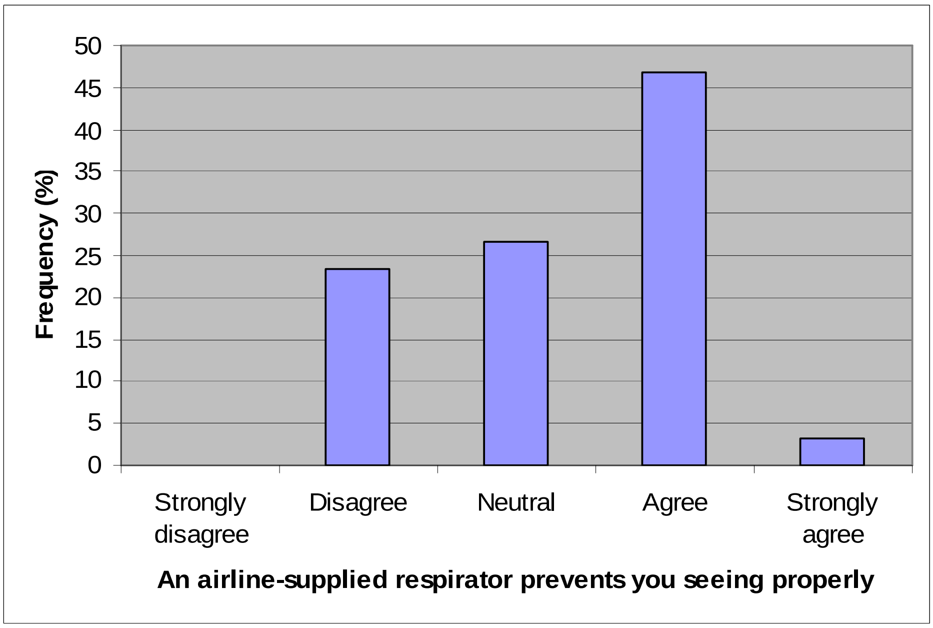


Figure 215 An airline-respirator prevents you seeing properly

Table 196 and and Table 197, illustrated by Figure 216 and Figure 217, indicate that the majority (25 or 83%) of respondents either disagreed or strongly disagreed with the statement that an airline-supplied respirator is too expensive for their business given the amount of two-pack spray paint they use, and 23 (77%) either disagreed or strongly disagreed with the statement that an airline-supplied respirator is not worth the money when a simple mask is sufficient for spraying.

Table 196 An airline-supplied respirator is too expensive for my business given the amount of 2-pack spray paint we use

	Frequency	Percent %
Strongly disagree	4	13
Disagree	21	70
Neutral	4	13
Agree	0	0
Strongly agree	1	3
Total	**30**	**100**

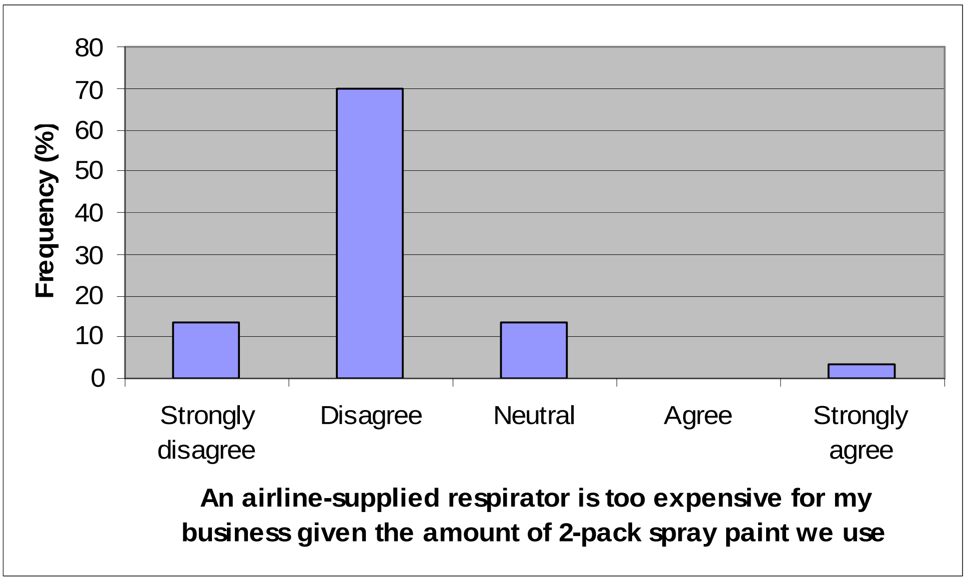


Figure 216 An airline-supplied respirator is too expensive for my business given the amount of 2-pack spray paint we use

Table 197 An airline-supplied respirator is not worth the money when a simple mask is sufficient for spraying

	Frequency	Percent %
Strongly disagree	7	23
Disagree	16	53
Neutral	6	20
Agree	1	3
Strongly agree	0	0
Total	**30**	**100**

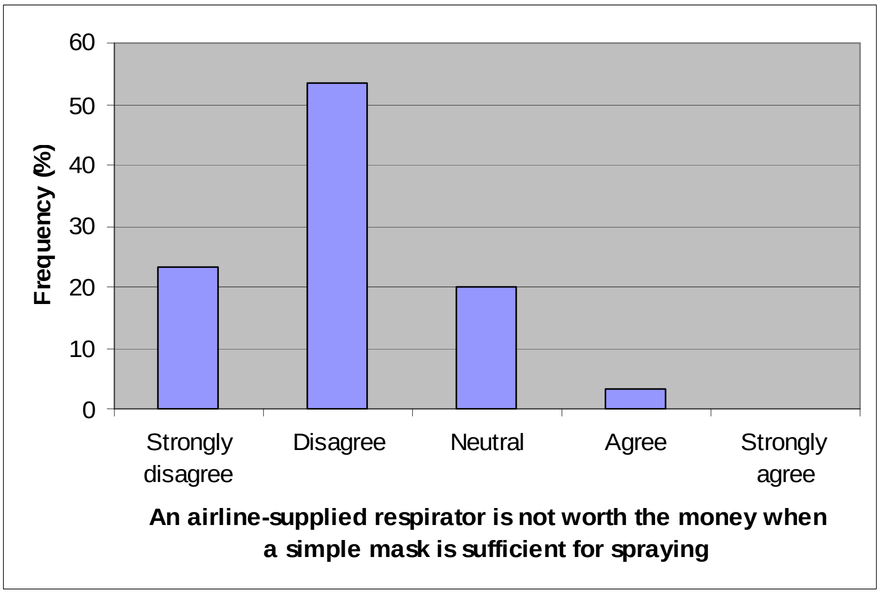


Figure 217 An airline-supplied respirator is not worth the money when a simple mask is sufficient for spraying

Table 198 and Figure 218 indicate that the majority (22 or 73%) of respondents prefer their spray painters to use airline-supplied respirators because they think it is better for them. However, Table 199 and Figure 219 indicate that the majority (18 or 60%) of respondents allow their spray painters choose for themselves whether to wear an airline-supplied respirator.

Table 198 I prefer my spray painters to use airline-supplied respirators because I think it is better for them

	Frequency	Percent %
Strongly disagree	0	0
Disagree	4	13
Neutral	4	13
Agree	15	50
Strongly agree	7	23
Total	**30**	**100**

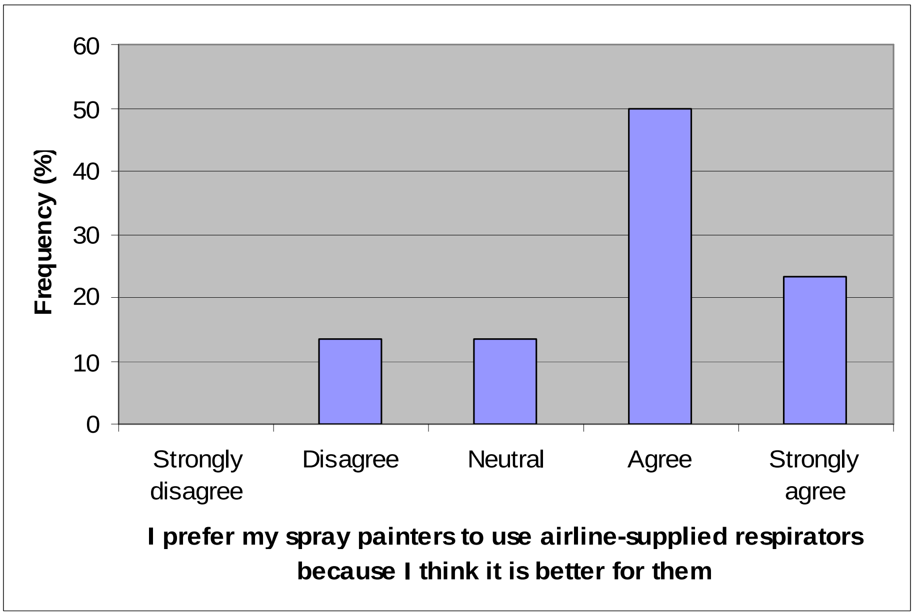


Figure 218 I prefer my spray painters to use airline-supplied respirators because I think it is better for them

Table 199 My spray painters choose for themselves whether to wear and airline-supplied respirator

	Frequency	Percent %
Strongly disagree	3	10
Disagree	7	23
Neutral	2	7
Agree	13	43
Strongly agree	5	17
Total	**30**	**100**

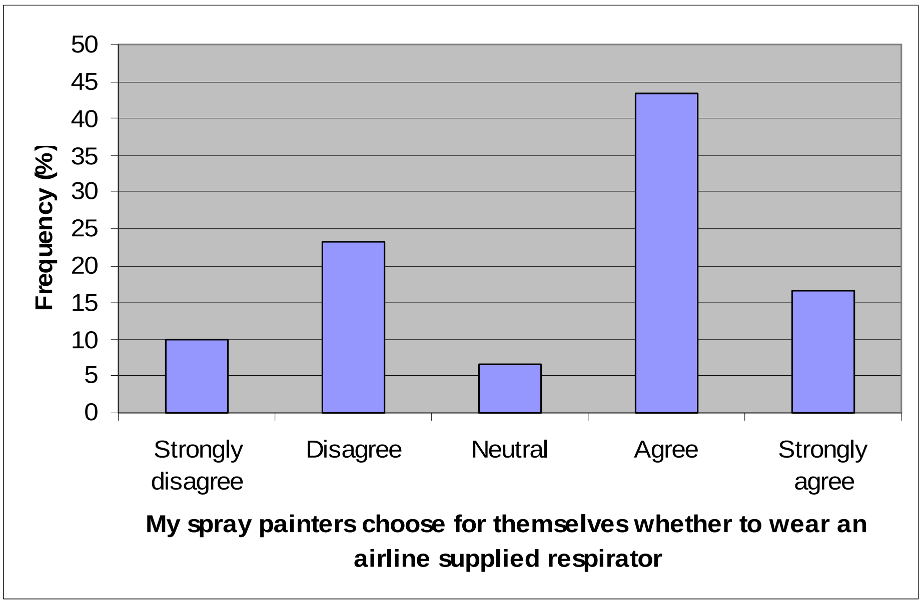


Figure 219 My spray painters choose for themselves whether to wear and airline-supplied respirator

Table 200 and Table 201 illustrated by igure 220 and Figure 221 and indicate that the majority (19 or 63%) of respondents disagree or strongly disagree that an air-line supplied respirator is too much trouble and that the majority (22 or 73%) of respondents disagree or strongly disagree airline-supplied respirator requires too much effort to keep it working properly.

Table 200 An airline-supplied respirator is too much trouble when compared with other types of respirators

	Frequency	Percent %
Strongly disagree	2	7
Disagree	17	57
Neutral	5	17
Agree	6	20
Strongly agree	0	0
Total	**30**	**100**

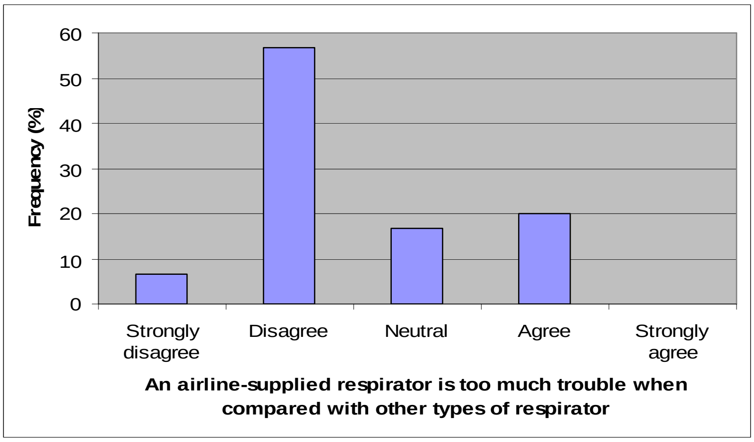


Figure 220 An airline-supplied respirator is too much trouble when compared with other types of respirators

Table 201 An airline-supplied respirator requires too much effort to keep it working properly

	Frequency	Percent %
Strongly disagree	4	13
Disagree	18	60
Neutral	6	20
Agree	2	7
Strongly agree	0	0
Total	**30**	**100**

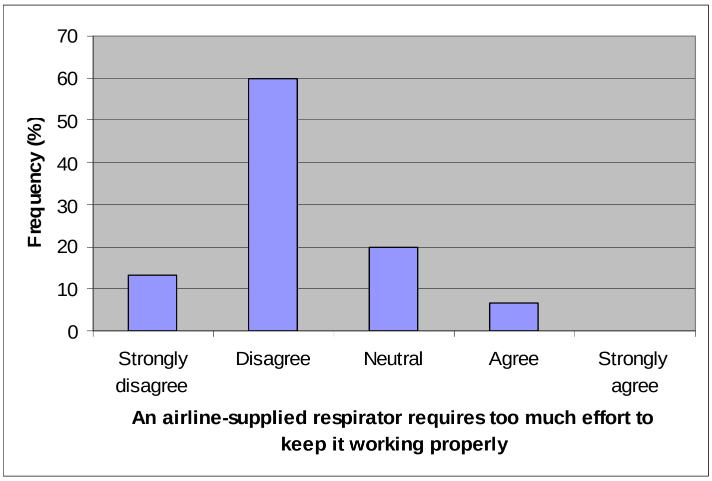


Figure 221 An airline-supplied respirator requires too much effort to keep it working properly

Table 202 and Figure 222 indicate that there is some dissatisfaction with airline-supplied respirators, with 12 (40%) of respondents agreeing that their painters complain about the time that airline-supplied respirators waste and 10 (33%) disagreeing that their painters complain. Eight (27%) of respondents were neutral in regard to this issue. However, 25 (83%) of respondents believed that their painters prefer to use a simple half mask respirator as shown in Table 203 and Figure 223.

Table 202 Spray painters complain about the time it wastes if the wear airline respirators

	Frequency	Percent %
Strongly disagree	0	0
Disagree	10	33
Neutral	8	27
Agree	12	40
Strongly agree	0	0
Total	**30**	**100**

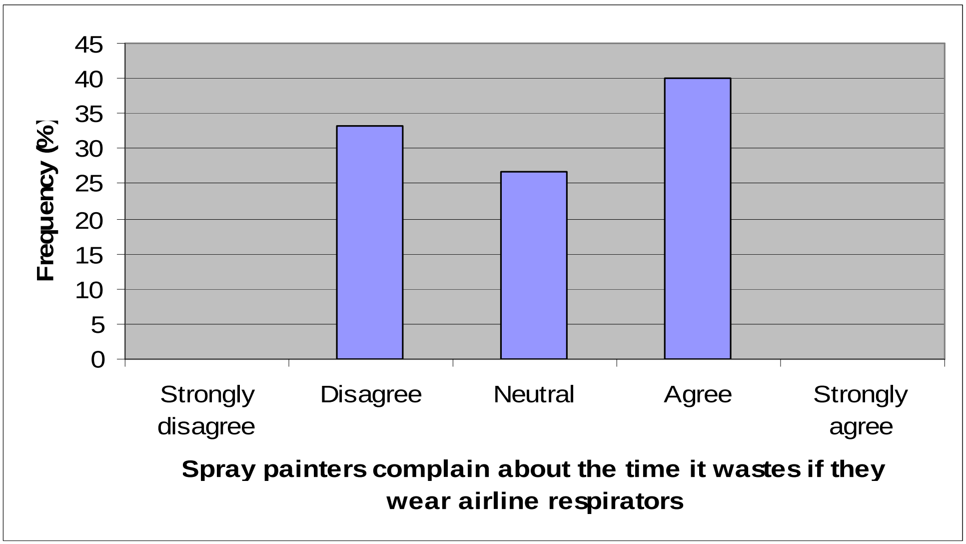


Figure 222 Spray painters complain about the time it wastes if the wear airline respirators

Table 203 Painters prefer to use simple half-mask respirators when spray painting because they are easy to use

	Frequency	Percent %
Strongly disagree	0	0
Disagree	3	10
Neutral	2	6.7
Agree	24	80
Strongly agree	1	3.3
Total	**30**	**100**

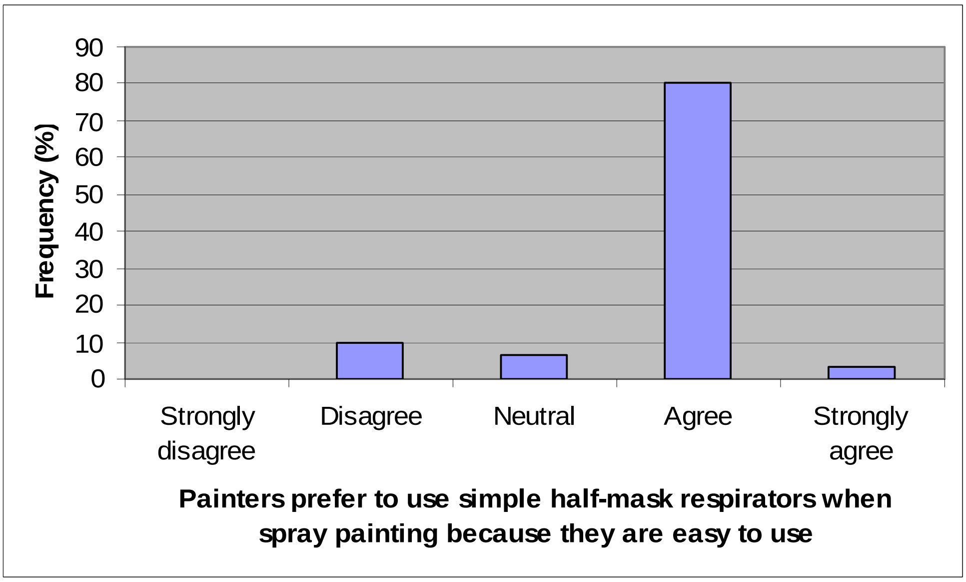


Figure 223 Painters prefer to use simple half-mask respirators when spray painting because they are easy to use

Table 204 and Figure 224 indicate that the majority (16 or 53%) of respondents agree or strongly agree that an air-line supplied respirator will save money in the long run.

Table 204 Airline-supplied respirators will save money in the long run

	Frequency	Percent%
Strongly disagree	0	0
Disagree	6	20
Neutral	8	27
Agree	13	43
Strongly agree	3	10
Total	**30**	**100**

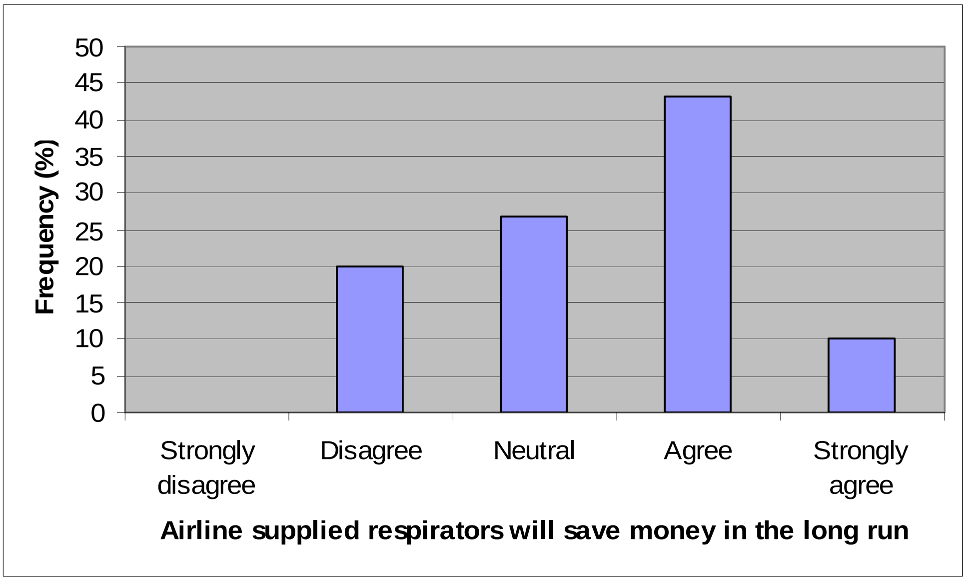


Figure 224 Airline-supplied respirators will save money in the long run

Table 205 and Figure 225 indicate that the majority (17 or 56%) of respondents disagree or strongly disagree that an air-line supplied respirator takes too long to put on.

Table 205 An airline-supplied respirator takes too long to put on

	Frequency	Percent %
Strongly disagree	1	3
Disagree	16	53
Neutral	8	27
Agree	4	13
Strongly agree	1	3
Total	**30**	**100**

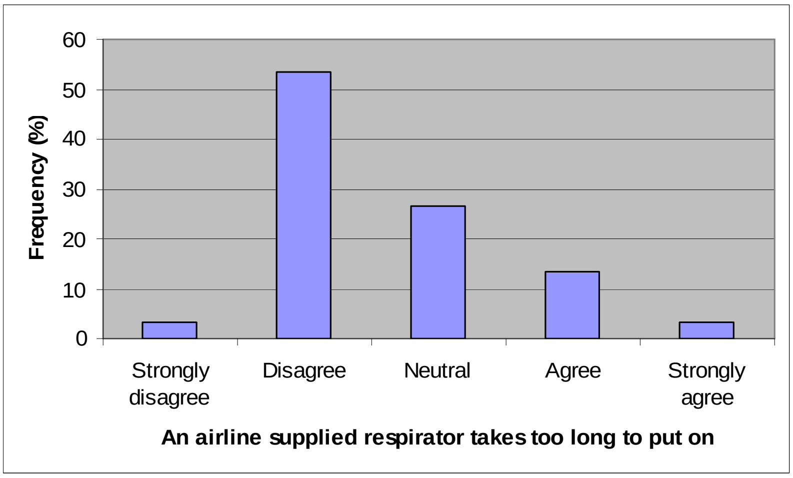


Figure 225 An airline-supplied respirator takes too long to put on

Table 206, Table 207 and Table 208, illustrated by Figure 226, Figure 227 and Figure 228, show that the majority (28 or 94%) of respondents disagreed or strongly disagreed with the statement that a respirator provides adequate protection when spraying 2-pack paints and a spray booth isn't really necessary while 22 (73%) agreed or strongly agreed that even when doing a small spray job with 2-pack paint, a spray booth should be used. Twenty-two (63%) either disagreed or strongly disagreed that with the statement that it is OK to spray small amounts of 2-pack paints outside the spray booth. The results support the earlier questions regarding the use of both a respirator and a spray booth but suggest that there is some acceptance of spraying outside a booth.

Table 206 A respirator provides adequate protection when spraying 2-pack paints and a spray booth isn't really necessary

	Frequency	Percent %
Strongly disagree	11	37
Disagree	17	57
Neutral		
Agree	2	7
Strongly agree	0	0
Total	**30**	**100**

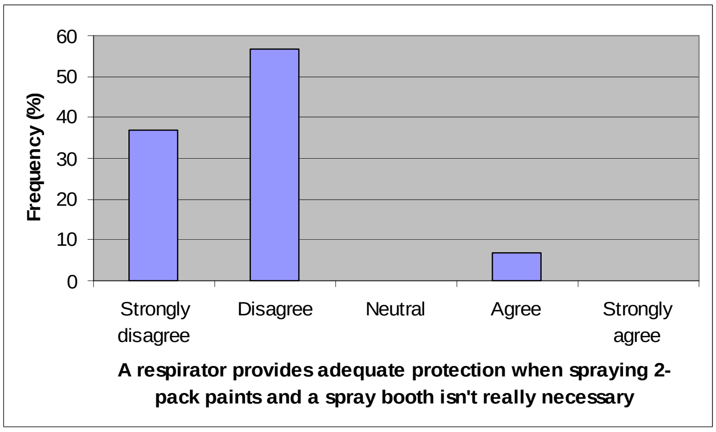


Figure 226 A respirator provides adequate protection when spraying 2-pack paints and a spray booth isn't really necessary

Table 207 Even when doing a small spray job with 2-pack paint, a spray booth should be used

	Frequency	Percent %
Strongly disagree	0	0
Disagree	6	21
Neutral	1	3
Agree	15	52
Strongly agree	7	24
Total	**29**	**100**

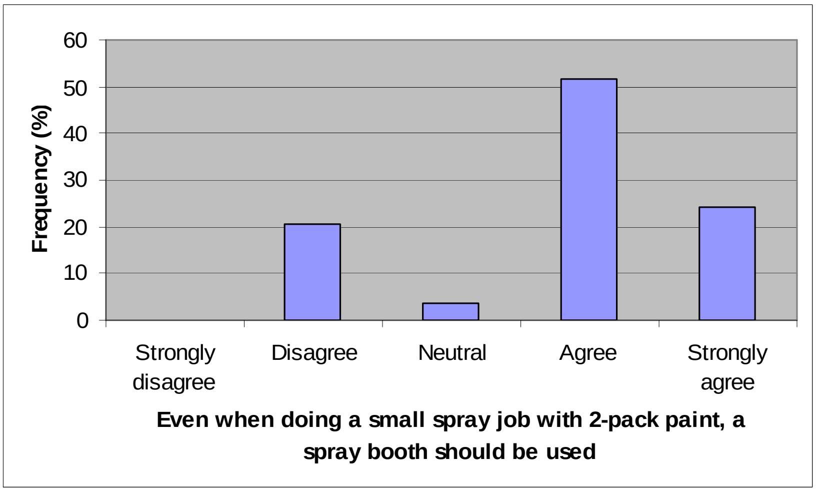


Figure 227 Even when doing a small spray job with 2-pack paint, a spray booth should be used

Table 208 It is OK to spray small amounts of 2-pack paints outside the spray booth

	Frequency	Percent %
Strongly disagree	4	14
Disagree	18	62
Neutral	2	7
Agree	5	17
Strongly agree	0	0
Total	**29**	**100**

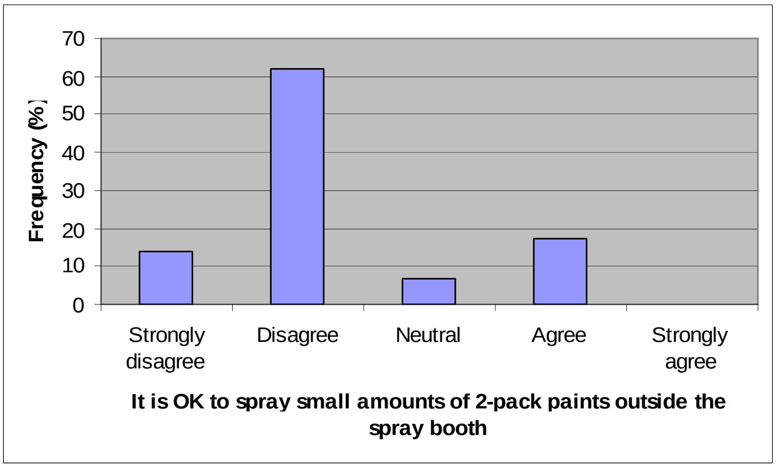


Figure 228 It is OK to spray small amounts of 2-pack paints outside the spray booth

Table 209 and Figure 229 indicate all respondents either disagreed or strongly disagreed that only bigger businesses need spray booths.

Table 209 Only the bigger businesses need spray booths

	Frequency	Percent %
Strongly disagree	10	34
Disagree	19	66
Neutral	0	0
Agree	0	0
Strongly agree	0	0
Total	**29**	**100**

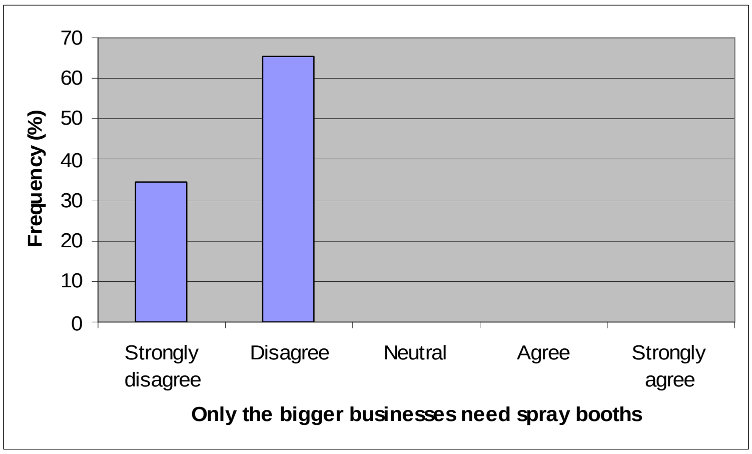


Figure 229 Only the bigger businesses need spray booths

Table 210 and Table 211, illustrated by Figure 230 and Figure 231 indicate that the majority of respondents believe that a spray booth is worth the investment.

Table 210 For health and safety alone, a spray booth is worth the investment

	Frequency	Percent %
Strongly disagree	0	0
Disagree	1	3
Neutral	0	0
Agree	11	37
Strongly agree	18	60
Total	**30**	**100**

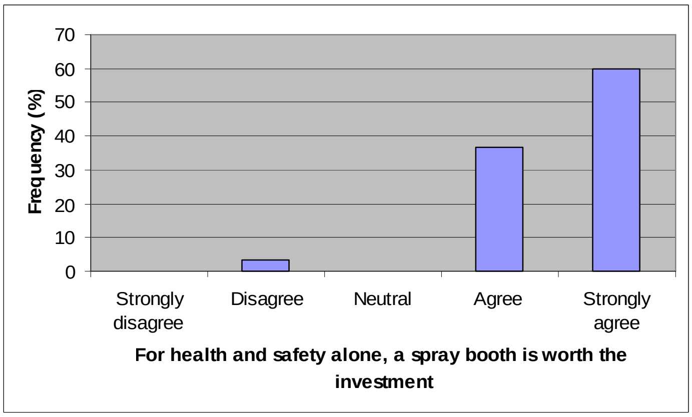


Figure 230 For health and safety alone, a spray booth is worth the investment

Table 211 A spray booth is not worth the money you have to spend to buy one

	Frequency	Percent %
Strongly disagree	9	31
Disagree	19	66
Neutral	0	0
Agree	1	3
Strongly agree	0	0
Total	**29**	**100**

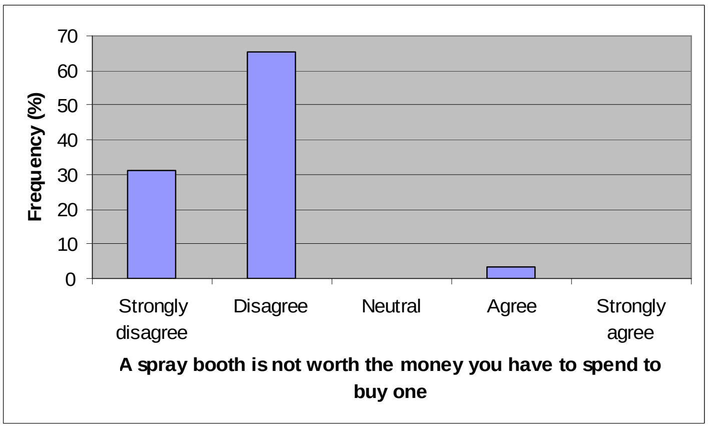


Figure 231 A spray booth is not worth the money you have to spend to buy one

Table 212 and Figure 232 indicate that the majority (27 or 90%) of respondents believe that a spray booth does not require too much effort to keep it working properly.

Table 212 A spray booth requires too much effort to keep it going properly

	Frequency	Percent %
Strongly disagree	7	24
Disagree	20	69
Neutral	1	3
Agree	1	3
Strongly agree	0	0
Total	**29**	**100**

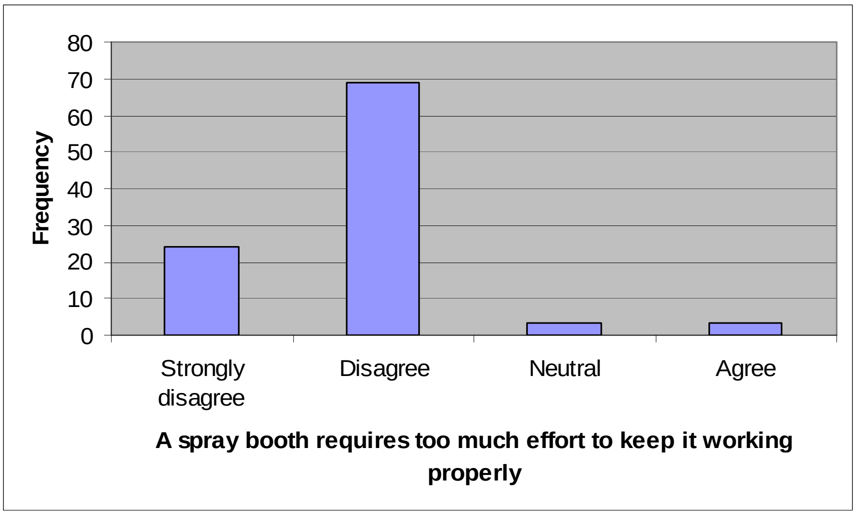


Figure 232 A spray booth requires too much effort to keep it going properly

Appendix 9: Review of WorkSafe Project 888 Spray Painting

There are 1,282 registered workplaces under the industry code F4865K, that identifies MVR operations. Therefore the visits represent direct contact with 38% of all registered workplaces where vehicle repair is undertaken. A number of workplaces were visited on several occasions. Multiple visits are likely to have followed the serving at one workplace of multiple compliance notices having varying compliance deadlines. Each deadline for compliance can result in a return visit by an inspector.

Of the 29 inspectors that completed workplace visits, 7 completed 69% and 3 completed 42%, as shown in Table 213. The maximum number of workplaces visited an inspector was 133 and the minimum was 1. The mean number of workplaces visited by an inspector was 32 (standard deviation 39.4) and the median 20. The very wide spread in the number of visits undertaken is to some extent explained by the allocation of a core group of three inspectors in each of the five inspectorate regions (three metropolitan and two regional) to focus on the completion of Project 888. Visits undertaken by inspectors outside these core groups are likely to have followed the receipt of Service Requests, i.e. request for a visit by an inspector received from a member of the public or employee of a workplace.

The frequency of use of the respective phrase codes is listed in Table 214.

Review of the text that accompanies the respective standard phrases used reveals that there is some difference in their interpretation either between inspectors or between visits and therefore use at different workplaces. For example Phrase Code "OHS-0356: Adequacy of hazardous substance controls" included a reference to ignition sources in the paint mixing area, which may have been more appropriately assigned DG-0119; Phrase code "DG-0139: Spraying near ignition source" included some references to storage & handling and decanting and cleaning near an ignition source, which have been better assigned code DG-0119. However, the majority of the text demonstrated what appears to be appropriate and relevant use of the respective phrases.

Table 213 Standard Phrase Use During Project 888

Spray painting checklist question	Phrase code	Phrase	Frequency of Use		
			Direction[13]	Verification & observation[14]	Total
1a	OHS-0350 OHS-0351	MSDS accessibility	63	20	83
1b	OHS-0353	Decanted hazardous substance labelling	1	0	1
2a	**OHS-0356**	Adequacy of hazardous substance controls	5	2	7
2a & 5b	OHS-0357	Maintaining hazardous Substance controls	36	5	41
2a	OHS-0466 DG-0139	Spraying near ignition source	8	0	8
2c	OHS-0463	Air filtration system for spray painting (breathing air not filtered)	97	20	117
	OHS-0464	Breathing air filter not working	12	0	12
	OHS-0467	Respiratory equipment when spraying with isocyanates (not airline)	39	30	69
2e	OHS-0359	Atmospheric monitoring	0	0	0
3b	DG-0119	Ignition source in hazardous area	122	8	130
3d	DG-0101 to DG-0107	Fire protection	0	1	1
5a	OHS-0362	Hazardous substances instruction & training	6	2	8
6a	OHS-0465	Health surveillance for isocyanates exposure	154	35	189
8a	OHS-0355 OHS-0503	Hazardous substance risk assessment requirements	15	8	23

[13] Includes direction, serving of improvement and prohibition notices and voluntary compliance
[14] Includes confirmation of compliance with notices and positive observations

Table 214 Number of visits by individual inspectors

Inspector	Number of Visits
1	1
2	26
3	20
4	2
5	71
6	24
7	3
8	1
9	1
10	63
11	5
12	27
13	53
14	133
15	2
16	7
17	2
18	44
19	40
20	124
21	3
22	15
23	20
24	3
25	28
26	58
27	129
28	1
29	9
	915

Phrase Code "OHS-0350 & OHS-0351:MSDS accessibility" was used to address matters relating to the absence of MSDS as well as accessibility in hard copy and electronic form. The number of directions served (n=63) is lower than might have been expected. However, this author's experience is that the paint supply companies are increasingly providing users with copies of MSDS stored on compact disk for loading on to personal computers located adjacent to paint mixing rooms.

Phrase Code "OHS-0353: Decanted hazardous substance labelling" refers to the requirement of the Hazardous Substances Regulations and Code of Practice (Victorian WorkCover Authority, 2000) and was used only once (n=1). This is perhaps surprising in terms of this author's observations during visits and the apparent ignorance of OHS legislative requirements but probably reflects the nature of an inspector's visit that is a snap shot in time, i.e. any workplace inspection will only reveal conditions and activities that are present and underway at that time.

The infrequency of use of Phrase Code "OHS-0356: Adequacy of hazardous substance controls" (n=5) that was used as a direction to address matters relating to spray booths, paint mixing areas and respirators contradicts this author's experience during workplace visits. However, Phrase Code "OHS-0357: Maintaining hazardous substance controls", used largely to address issues relating to spray booth maintenance, was used more frequently (n=36) and it is possible that these codes (OHS-0357 and OHS-0466/DG-0139) were considered by some inspectors to be mutually exclusive or to some extent collapsed together.

Phrase Code "OHS-0466/DG-0139: Spraying near ignition source" (n=8) is self-explanatory and is likely to reflect the spraying of paint near non-flame proof or poorly maintained lights.

Phrase Code "OHS-0463: Air filtration system for spray painting" (breathing air not filtered) was used (n=39) in reference to a number of matters that included air quality not monitored; air filtration inadequate; air intake in a poor position; and the results of air monitoring showing that the air is poor, having an unacceptably high oil or water content. 1 or 2 only texts included reference to the non-use of an air-supplied respirator, which is addressed by Phrase Code OHS-0467 discussed below. The difference between Phrase Code OHS-0463 and Phrase Code "OHS-0464: Breathing air filter not working" is unclear from the text provided. However, all Phrase Code OHS-0464 texts (n=12) related to air quality monitoring. Systems to verify air quality are specifically referred to.

The relatively high frequency of directions using the Phrase Codes relating to air quality (n=109) is significant given the importance of good air quality in encouraging the use of airline respiratory equipment. This author was unable to verify air quality monitoring during site visits given the need to access written records. Reliance upon MVR operators' self reports was abandoned early in the visits given the apparent contradictions between self-reports of air quality assessment and anecdotes. A comparison with the inspectors' data is therefore not possible.

Phrase Code "OHS-0467: Respiratory equipment when spraying with isocyanates" (n=39) addressed inadequate (non-airline) and non-use of RPE. The author's experience and industry surveys suggests that the inspectors may not have been given an accurate picture of air-supplied RPE usage. In a number of cases the absence of such equipment is unequivocal. However, the presence of equipment does not necessarily indicate use and during several workplace visits this author was informed that the airline equipment was indeed only taken out of its storage for the benefit of WorkSafe inspectors.

Interestingly, Phrase Code "OHS-0359: Atmospheric monitoring" did not appear in the list of phrases used (n=0) while the Hazardous Substances Regulations and Code of Practice (Victorian WorkCover Authority, 2000) require monitoring where a designated hazardous substance is used. This potentially reflects judicious use of the legislation by the inspectors, placing emphasis on improving risk control rather than monitoring. It is this author's assertion that there is undue emphasis in the occupational hygiene discipline on hazardous substance monitoring at the expense of risk control (Cowley, 1990, 1997, 2001) and in the context of small businesses the cost of monitoring can be prohibitive. Given the requirement that air-supplied RPE and spray booths and are used when spraying isocyanate-containing paints, the value of monitoring is questionable. Monitoring would simply reveal the air concentration of the isocyanates and confirm the need to use the aforementioned risk controls. The monitoring may reveal the need for booth maintenance and potentially could reveal the need for maintenance of the respiratory protection. However, an inspector's focus on the adequacy of booth and respiratory protection maintenance is likely to deliver the same outcome without the time and expense associated with monitoring.

Phrase Code "DG-0119 Ignition source in hazardous area was frequently used (n=122) and largely referred to paint mixing areas". This frequency supports this author's observations during workplace visits and is likely to reflect the number of computers and other electrical equipment positioned and used in the vicinity of work areas where decanting, weighing and mixing occur.

Phrase Codes "DG-0101 to DG-0107 Fire protection" were not used as directions (n=0) possibly reflecting the observations of this author that fire extinguishers are widely available and appropriately located. This is possibly a function of fire insurance arrangements and the widespread recognition of fire risk in community at large.

Phrase Code "OHS-0362 Hazardous substances instruction & training" (n=6) largely referred to training in use of RPE. This author's experience is at odds with that of the inspectors given that very few business operators understand that isocyanates are associated with asthma and therefore by implication, it is unlikely that adequate hazardous substances training has been provided in regard to isocyanate usage. Contrary to this it is arguable that young spray painters have received information about the risks of working with isocyanates during TAFE courses. However, this is likely to apply to only relatively young spray painters and in this author's experience, spray painters have not understood the nature of the risk related to asthma if the information has been provided.

Phrase Code "OHS-0465: Health surveillance for isocyanates exposure" addressed issues relating to the necessity for health surveillance where designated hazardous substances are in use (National Occupational Health & Safety Commission, 1994; Victoria, 1999; Victorian WorkCover Authority, 2000) and was, of the Phrase Codes requested for this review, most frequently used (n=154). Undoubtedly this high usage reflects the need in the workplaces visited but is perhaps surprisingly high in contrast with the directions for airborne contaminant monitoring. While health surveillance is to some extent a bench marking exercise and does little but identify exposures and damage that has occurred it potentially offers an opportunity to educate employees about isocyanate exposure and risk.

Phrase Codes "OHS-0355 and OHS-0503: Hazardous substance risk assessment requirements" addressed the completion of risk assessments relating to the use of isocyanates. There was surprisingly little use of this Phrase Code as a direction (n=15) given the anecdotal evidence that few operators have undertaken formal risk assessments. However, this author has been informed that risk assessments were de-emphasised in the training given to the core inspectors engaged in Project 888.

Conclusion

Thirty-eight percent (38%) of all registered workplaces where vehicle repair is undertaken were visited under the auspices of Project 888.

Based on the selection of Phrase Codes reviewed the inspectors appear have placed an emphasis on improving risk controls, particularly in regard to spray booths and respiratory protection. The data suggests that 28% of workplaces had, in some way, an inadequate supply of breathing air for respiratory protection and 11% did not have air-supplied respiratory protection available.

Appendix 10: MVR Targetted Intervention

Ballarat & Bendigo Targetted Visits Pre intervention Questionnaire

Part 1. The Body Repair Shop Operator and the Workplace

Reference Number: Bd-   -   Date: /   /

How many people does the body repair shop employ?

☐ 1 1 - 3
☐ 2 4 - 9
☐ 3 More than 10

How many spray painters are employed?

☐ 1 1
☐ 2 2
☐ 3 3
☐ 4 4
☐ 5 5
☐ 6 More than 5

What is mix of the business?

☐ 1 Mostly Insurance
☐ 2 Mostly Commercial (e.g. trucks)
☐ 3 Mostly Private

How old is the business?

☐ 1 Less than 5 years
☐ 2 5 – 20 years
☐ 3 More than 20 years

How long the operator been involved in body repair work?

☐ 1 Less than 5 years
☐ 2 6 – 20 years
☐ 3 More than 20 years

What formal education does the operator have?

☐ 7 Nothing after school
☐ 8 TAFE Trade qualification
☐ 9 TAFE Diploma
☐ 10 University Degree
☐ 11 Other..

If the operator did a TAFE course, did it include instruction on health and safety?

☐ 1 Yes
☐ 2 No

Part 2. Getting Health and Safety Information

Has the body repair shop been visited by WorkSafe in the last 12 months?

☐ 1 Yes

☐ 2 No

Do you have access to the internet?

☐ 1 Yes

☐ 2 No

Which of the following is the most important source of ***health and safety*** information for you?

☐ 1 WorkCover *(now called WorkSafe Victoria)*

☐ 2 **VACC**

☐ 3 Paint suppliers

☐ 4 Other vehicle body repairers

☐ 5 Other..

Have you received any information about spray painting safety from WorkSafe in the last 12 months?

☐ 1 Yes: If "yes" what specifically was the information?

☐ 2 No

Who's opinion do you value in the vehicle body repair business locally?

☐ 1 Name(s):

☐ 2 No one

Who's opinion do you value in regard to business in general locally?

☐ 1 Name(s):

☐ 2 No one

Do other people in the vehicle body repair business locally contact you?

☐ 1 Yes - Name(s):

☐ 2 No

When you speak with other body repair shop operators is it usually by:

☐ 18 Telephone?

☐ 19 Face to face?
Where:……………………………………………………………………………

☐ 20 Email?

☐ 21 Other?……………………………………………………………………….

Part 3. Spray Painting in the Business

Rougly how much 2-pack paint does the body repair shop use each week?

☐ 1 Less than 10 litres per week

☐ 2 More than 10 litres per week but less than 20 litres per week

☐ 3 More than 20 litres per week

Do you have a spray booth?

☐ 1 Yes

☐ 2 No (if "**No"** go to Q21)

Is spray painting done in the booth?

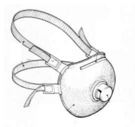
☐ 1 Always

☐ 2 **<u>Sometimes</u>**

☐ 3 Never

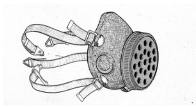
What type of respirators (breathing masks) are available for use by spray painters?

☐ 1 Disposable/Maintenance Free



☐ 2 Half mask

(make………………….)

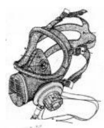


☐ 3 Full face with a filter

(make………………….)

☐ 4 Air supplied Full face

(make………………….)



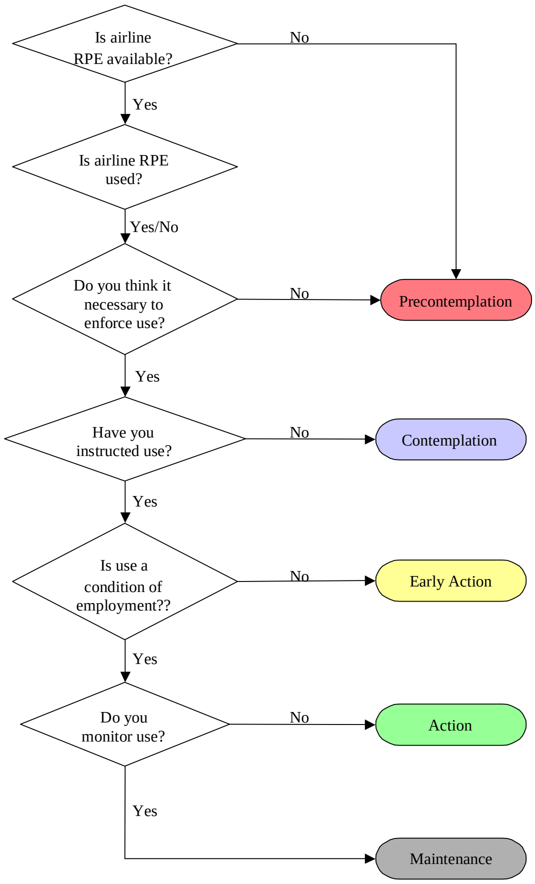
☐ 5 Air supplied visor

(make………………….)

☐ 6 Air supplied hood

(make………………….)

TTM



What do you think would be/are the advantages of enforcing the use of airline-supplied respirators by spray painters (list as many as possible)?

1 ____

2 ____

3 ____

4 ____

5 ____

What do you think would be/are the ***dis***advantages of enforcing the use of airline-supplied respirators by spray painters (list as many as possible)?

1 ____

2 ____

3 ____

4 ____

5 ____

Part 4. Opinions About Health and safety

How you feel about the following statements

	Strongly Disagree 1	Disagree 2	Neutral 3	Agree 4	Strongly Agree 5
2-pack paints are safe these days	☐	☐	☐	☐	☐
You do not need to use air-supplied respirators when spraying 2-pack paint	☐	☐	☐	☐	☐
2-pack paints are unlikely to hurt you.	☐	☐	☐	☐	☐
Even when doing a small spray job with 2-pack paint, a respirator should be used	☐	☐	☐	☐	☐
An air line supplied respirator is too much trouble when compared with other types of respirator	☐	☐	☐	☐	☐
Painters prefer to use simple half-mask respirators when spray painting because they are easy to use.	☐	☐	☐	☐	☐
An airline-supplied respirator prevents you seeing properly	☐	☐	☐	☐	☐
Spray painters complain about the time it wastes if they wear air line respirators	☐	☐	☐	☐	☐
I prefer my spray painters to use air line supplied respirators because I think it is better for them	☐	☐	☐	☐	☐
Airline-supplied respirators will save money in the long run	☐	☐	☐	☐	☐
It is OK to spray small amounts of 2-pack paint without a respirator	☐	☐	☐	☐	☐
I do not think it is necessary for spray painters to use air supplied respiratory protection	☐	☐	☐	☐	☐
It is OK to spray small amounts of 2-pack paints outside the spray booth	☐	☐	☐	☐	☐
2-pack paints can cause lung damage	☐	☐	☐	☐	☐
2-pack paints can cause asthma	☐	☐	☐	☐	☐

In the community at large, what is the main cause of work related injuries and illnesses? What are the second and third most important causes of work related injuries and illnesses?

☐ 1 *Lack of training & Education?*
☐ 2 *Pressure or stress?*
☐ 3 *Worker being careless?*
☐ 4 *Dangerous equipment and procedures?*
☐ 5 *Lack of supervision?*
☐ 6 *Boring, repetitive work?*
☐ 7 *Alcohol or drugs?*
☐ 8 *Dangerous chemicals or substances?*

What is the most important prevention measure for work related injuries and illnesses?
What are the second and third most important prevention measure for work related injuries and illnesses?

☐ 1 *Education & awareness about health & safety?*
☐ 2 *Training on safe work practices?*
☐ 3 *Safe procedures and systems of work?*
☐ 4 *Employee consultation and involvement?*
☐ 5 *Safe equipment?*
☐ 6 *Stronger enforcement of regulations?*
☐ 7 *Regulations clearer and easier to understand?*

What proportion of injuries and illnesses could be prevented?

☐ 1 *Nearly all?*
☐ 2 *More than half?*
☐ 3 *About half?*
☐ 4 *Less than half?*
☐ 5 *Hardly any?*

- Thank you -

MVR Pre-intervention Results

Table 215 Number if employees

	Frequency	Percent %
1-3	3	16
4-9	5	26
>10	11	58
Total	**19**	**100**

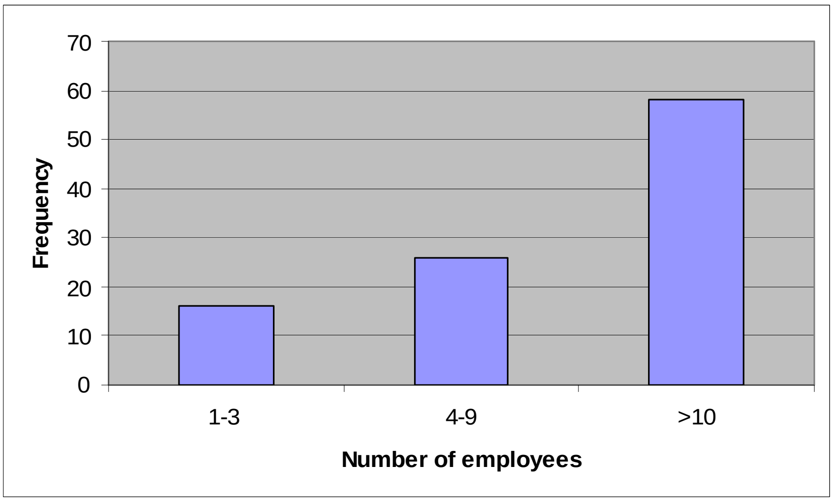


Figure 233 Number of employees

Table 216 Number of spray painters

	Frequency	Percent %
1	1	5
2	7	37
3	5	26
4	2	10
5	3	16
>5	1	5
Total	**19**	**100**

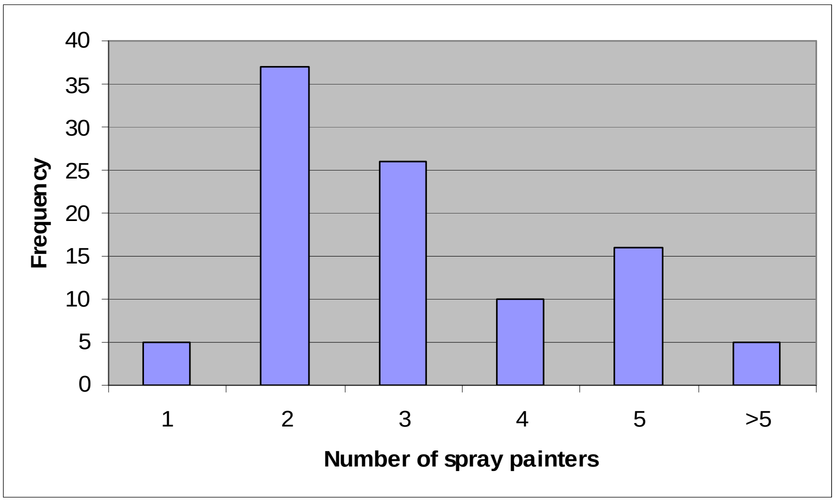


Figure 234 Number of spray painters

Table 217 Most important source of general OHS information

	Frequency	Percent %
WorkCover	3	16
VACC	15	80
Paint Suppliers	1	5
Total	**19**	**100**

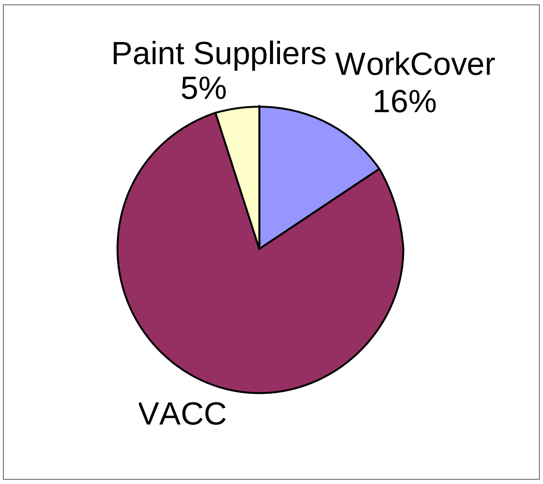


Figure 235 Most important source of general OHS information

Table 218 Main cause of work related injuries and illnesses

	Frequency	Percent %
Lack of training & education	8	42.1
Worker being careless	8	42.1
Dangerous equipment & procedures	2	10.5
Lack of supervision	1	5.3
Total	**19**	**100**

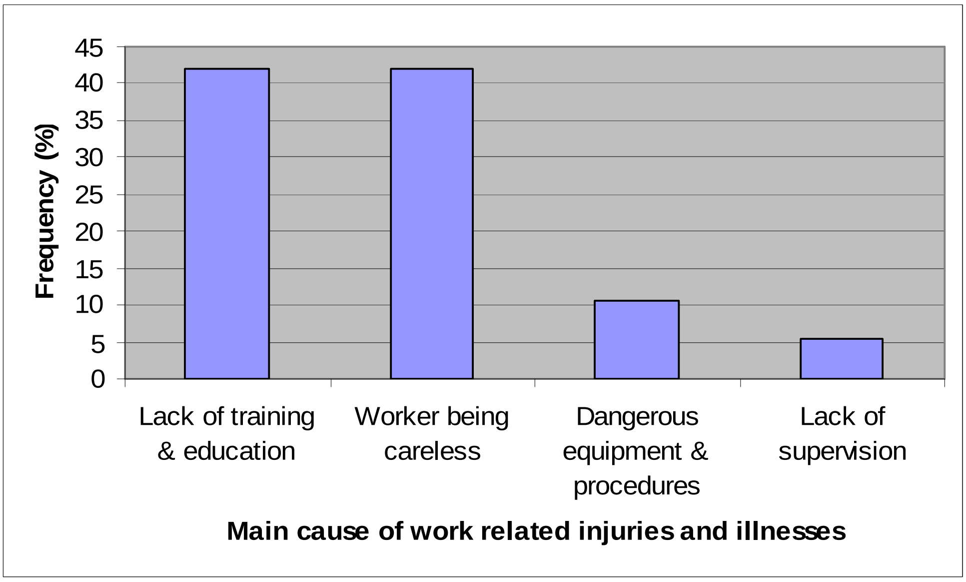


Figure 236 Main cause of work related injuries and illnesses

Table 219 Most important prevention measure for work related injuries and illnesses

	Frequency	Percent %
Education & awareness about OHS	7	37
Training on safe work procedures	5	26
Safe procedures and systems of work	1	5
Employee consultation and involvement	0	0
Safe equipment	3	16
Stronger enforcement of regulations	0	0
Regulations clearer and easier to understand	3	16
Total	**19**	**100**

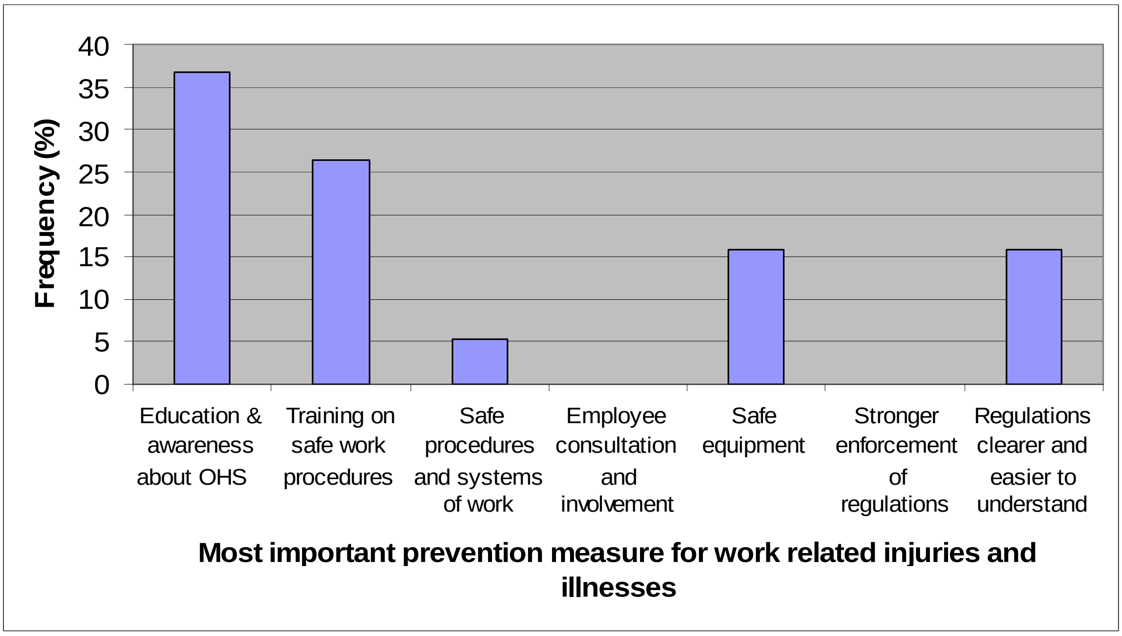


Figure 237 Most important prevention measure for work related injuries and illnesses

Table 220 Proportion of injuries and illnesses that could be prevented

	Frequency	Percent %
Nearly all	7	37
More than half	6	32
About half	4	21
Less than half	2	11
Hardly any	0	0
Total	**30**	**100**

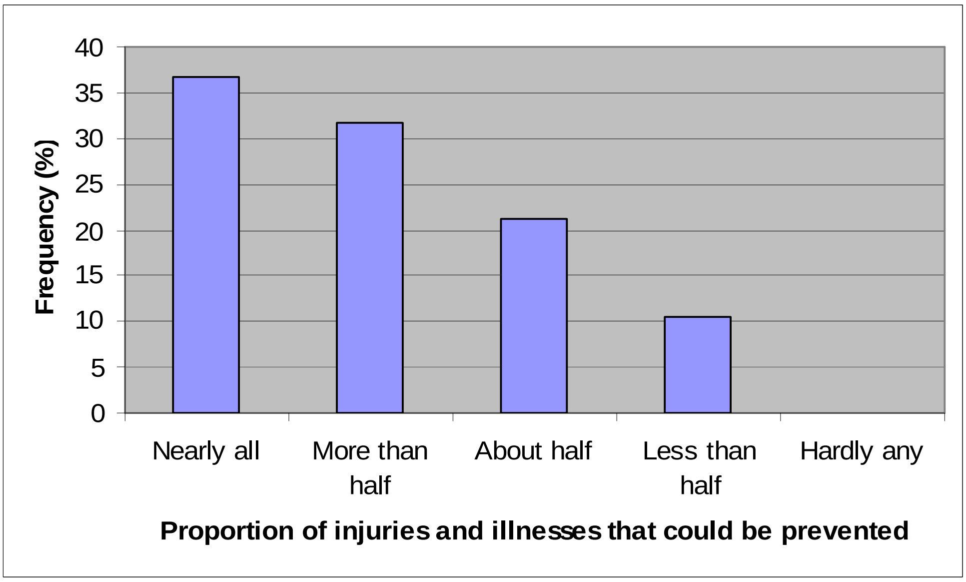


Figure 238 Proportion of injuries and illnesses that could be prevented

Table 221 Use of spray booth while spraying two-pack paint

	Frequency	Percent %
Always	7	37
Sometimes	12	63
Total	**19**	**100**

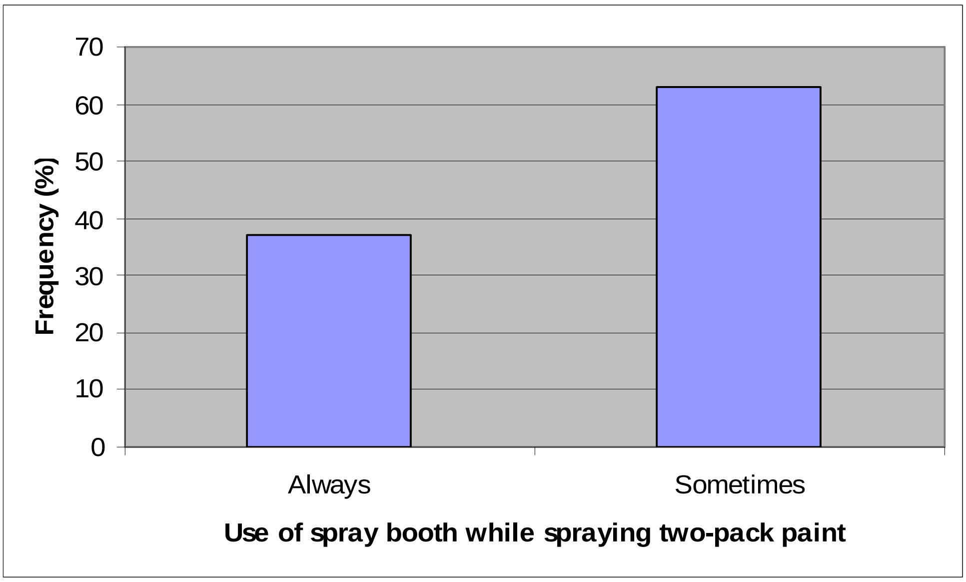


Figure 239 Use of spray booth while spraying two-pack paint

Table 222 Stage of Change

	Before Meeting	
	Frequency	Percent %
Precontemplation	6	32
Contemplation	3	16
Early Action	7	37
Action	0	0
Maintenance	3	16
Total	**19**	**100**

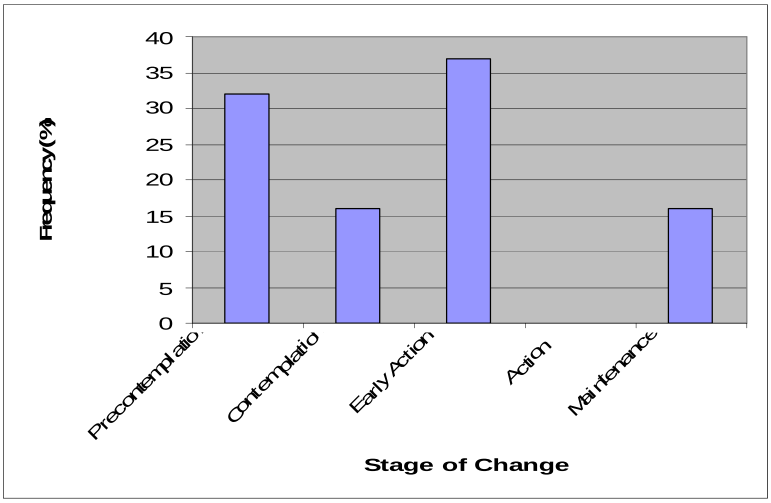


Figure 240 Stage of Change

Table 223 2-pack paints can cause lung damage

	Frequency	Percent %
Strongly disagree	**0**	**0**
Disagree	0	0
Neutral	3	16
Agree	13	68
Strongly agree	3	16
Total	**19**	**100**

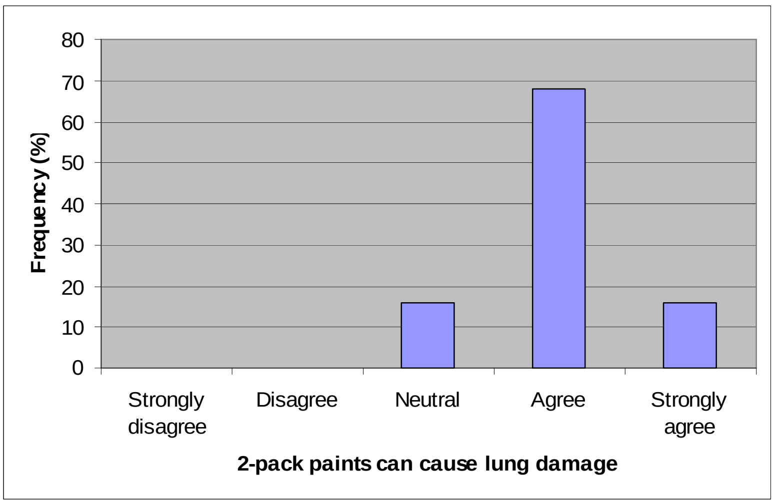


Figure 241 2-pack paints can cause lung damage

Table 224 2-pack paints can cause asthma – before MVR meetings

	Frequency	Percent %
Strongly disagree	0	0
Disagree	0	0
Neutral	10	53
Agree	9	47
Strongly agree	0	0
Total	**19**	**100**

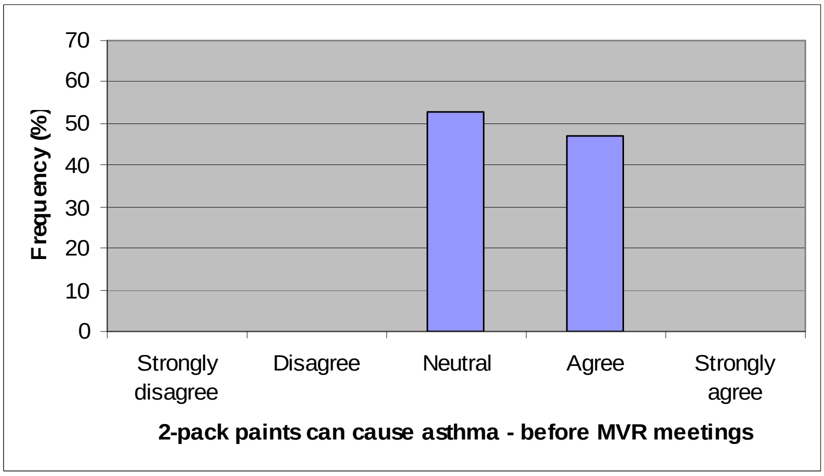


Figure 242 2-pack paints can cause asthma – before MVR meetings

Table 225 2-pack paints are safe these days – before MVR meetings

	Frequency	Percent %
Strongly disagree	6	32
Disagree	6	32
Neutral	2	10
Agree	5	26
Strongly agree	0	0
Total	**19**	**100**

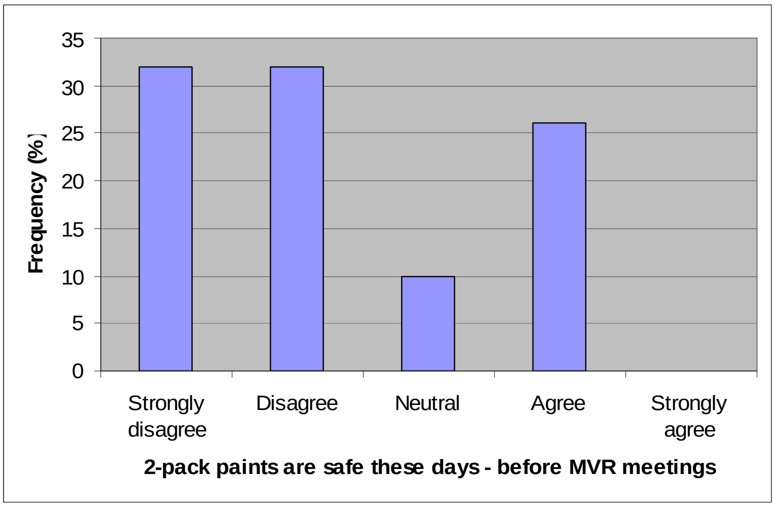


Figure 243 2-pack paints are safe these days – before MVR meetings

Table 226 2-pack paints are unlikely to hurt you – before MVR meetings

	Frequency	Percent %
Strongly disagree	5	26
Disagree	13	68
Neutral	0	0
Agree	1	5
Strongly agree	0	0
Total	**19**	**100**

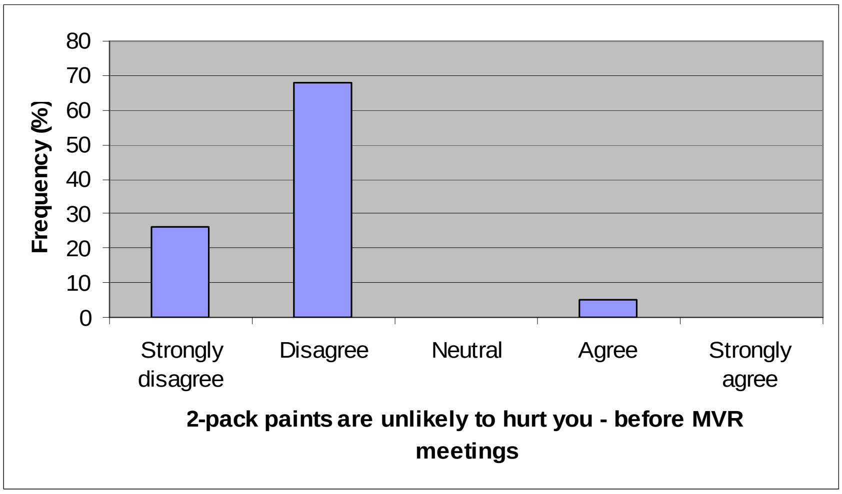


Figure 244 2-pack paints are unlikely to hurt you – before MVR meetings

Table 227 It is OK to spray small amounts of 2-pack paints without a respirator – before MVR meetings

	Frequency	Percent %
Strongly disagree	4	21
Disagree	14	74
Neutral	1	5
Agree	0	0
Strongly agree	0	0
Total	**19**	**100**

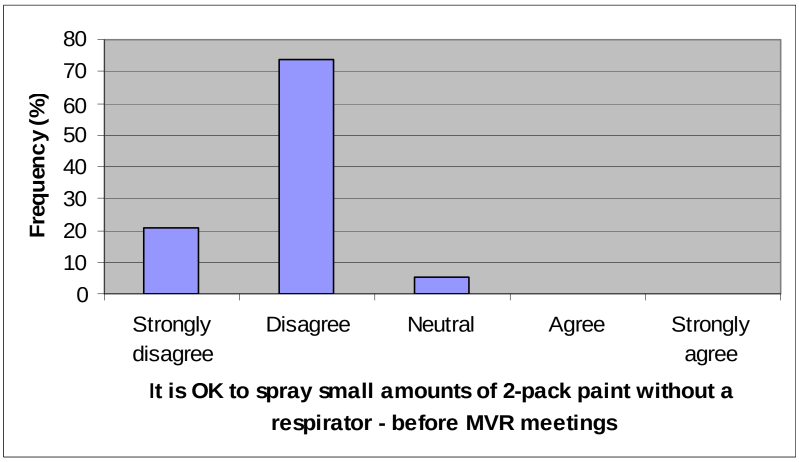


Figure 245 It is OK to spray small amounts of 2-pack paints without a respirator – before MVR meetings

Table 228 Even when doing a small spray job with 2-pack paint, a respirator should be used

	Frequency	Percent %
Strongly disagree	0	0
Disagree	1	5
Neutral	0	0
Agree	13	68
Strongly agree	5	26
Total	**19**	**100**

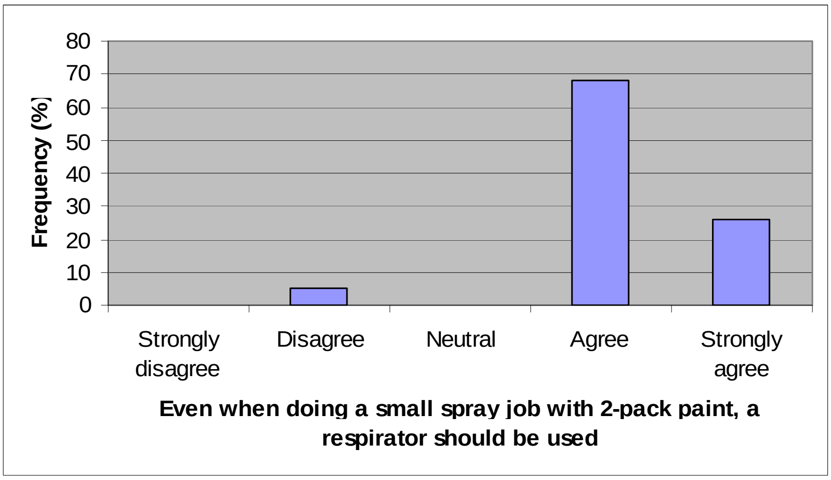


Figure 246 Even when doing a small spray job with 2-pack paint, a respirator should be used

Table 229 You do not need to use air-supplied respirators when spraying 2-pack paint – before MVR meetings

	Frequency	Percent %
Strongly disagree	5	26
Disagree	9	47
Neutral	2	10
Agree	3	16
Strongly agree	0	0
Total	**19**	**100**

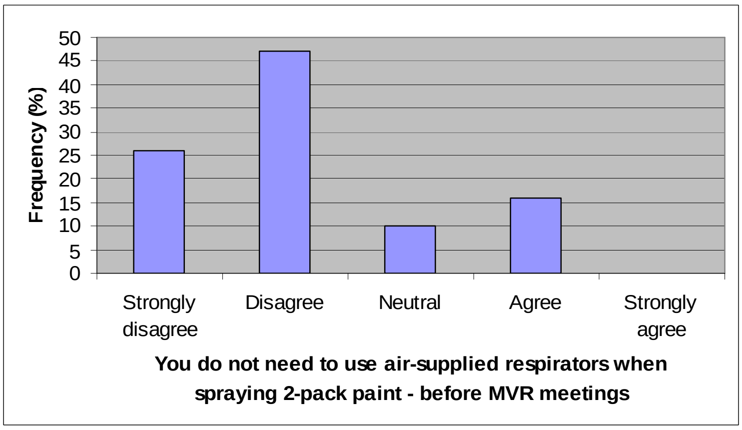


Figure 247 You do not need to use air-supplied respirators when spraying 2-pack paint – before MVR meetings

Table 230 I do not think it is necessary for spray painters to use air supplied respiratory protection

	Frequency	Percent %
Strongly disagree	3	16
Disagree	12	63
Neutral	2	10
Agree	2	10
Strongly agree	0	0
Total	**19**	**100**

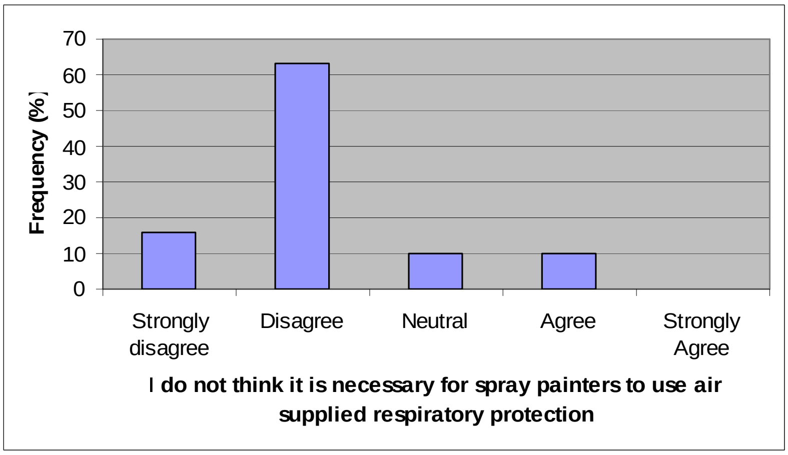


Figure 248 I do not think it is necessary for spray painters to use air supplied respiratory protection

Table 231 An airline-supplied respirator prevents you seeing properly

	Frequency	Percent %
Strongly disagree	0	0
Disagree	3	16
Neutral	2	10
Agree	13	68
Strongly agree	1	5
Total	**19**	**100**

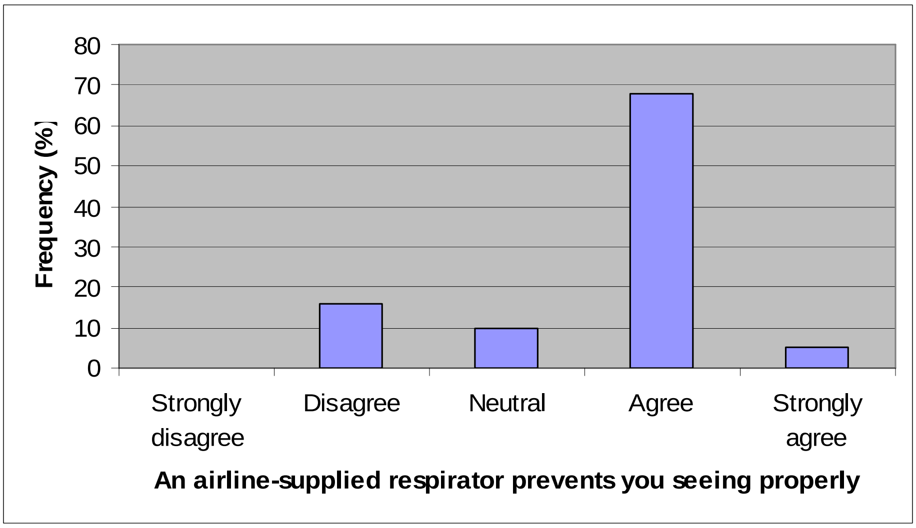


Figure 249 An airline-supplied respirator prevents you seeing properly

Table 232 I prefer my spray painters to use airline-supplied respirators because I think it is better for them

	Frequency	Percent %
Strongly disagree	0	0
Disagree	1	5
Neutral	1	5
Agree	10	53
Strongly agree	7	37
Total	**19**	**100**

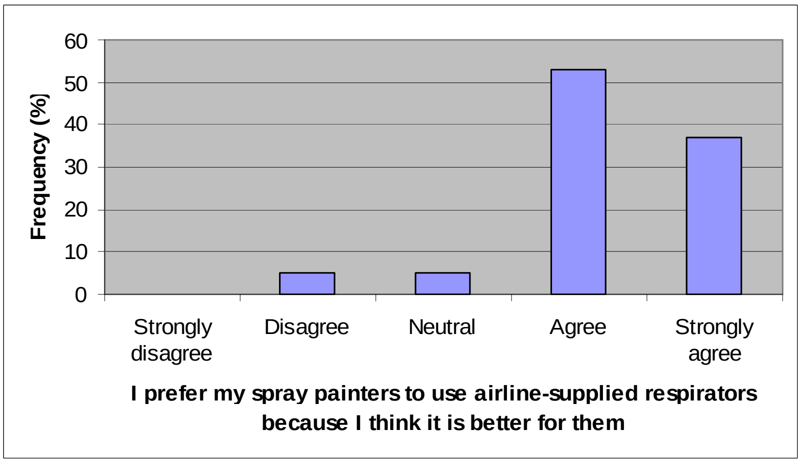


Figure 250 I prefer my spray painters to use airline-supplied respirators because I think it is better for them

Table 233 An airline-supplied respirator is too much trouble when compared with other types of respirators

	Frequency	Percent %
Strongly disagree	3	16
Disagree	5	26
Neutral	3	16
Agree	7	37
Strongly agree	1	5
Total	**19**	**100**

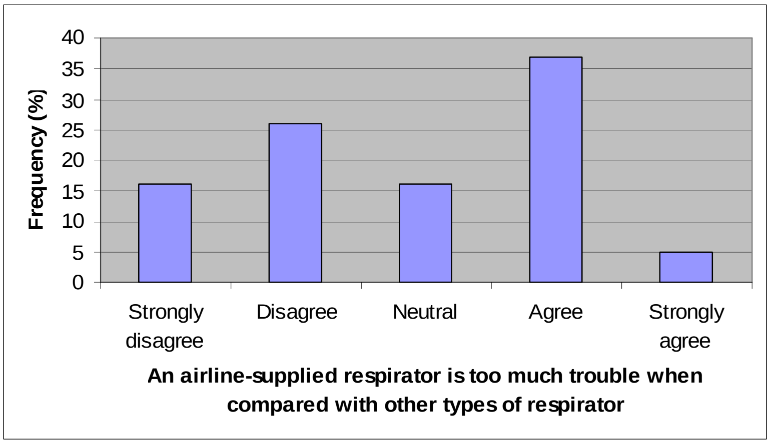


Figure 251 An airline-supplied respirator is too much trouble when compared with other types of respirators

Table 234 Spray painters complain about the time it wastes if they wear airline respirators

	Frequency	Percent %
Strongly disagree	0	0
Disagree	11	58
Neutral	2	10
Agree	6	32
Strongly agree	0	0
Total	**19**	**100**

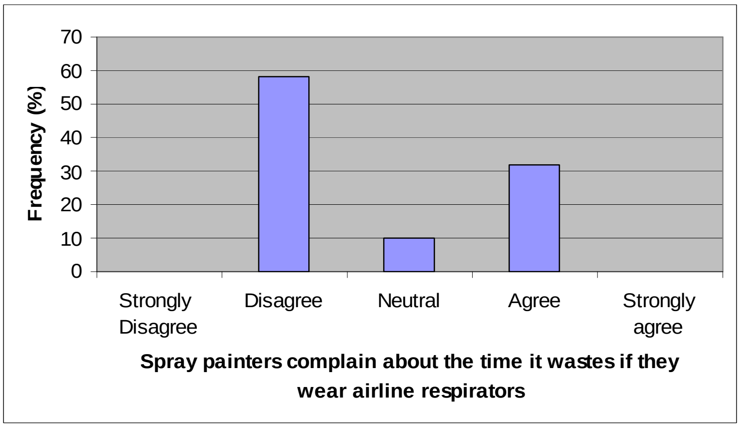


Figure 252 Spray painters complain about the time it wastes if they wear airline respirators

Table 235 Painters prefer to use simple half-mask respirators when spray painting because they are easy to use

	Frequency	Percent%
Strongly disagree	0	0
Disagree	1	5
Neutral	0	0
Agree	14	74
Strongly agree	4	21
Total	**19**	**100**

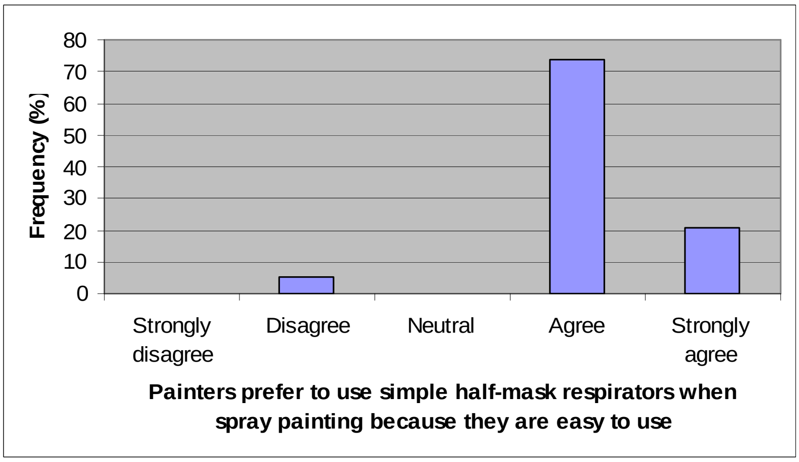


Figure 253 Painters prefer to use simple half-mask respirators when spray painting because they are easy to use

Table 236 Airline-supplied respirators will save money in the long run

	Frequency	Percent %
Strongly disagree	1	5
Disagree	4	21
Neutral	4	21
Agree	8	42
Strongly agree	2	10
Total	**19**	**100**

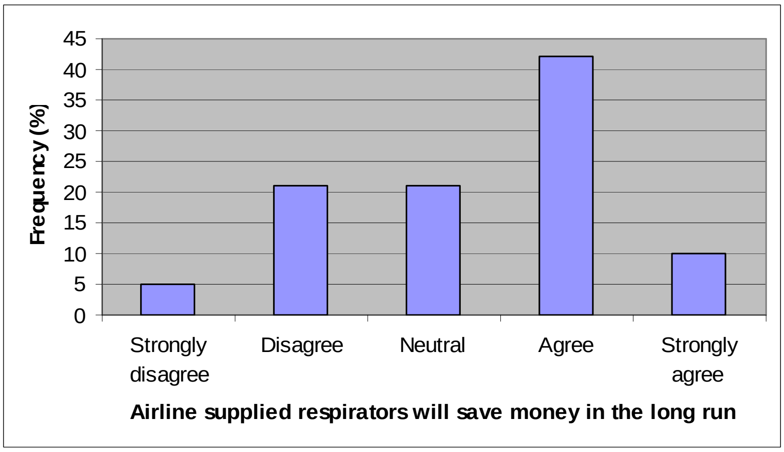


Figure 254 Airline-supplied respirators will save money in the long run

Table 237 It is OK to spray small amounts of 2-pack paints outside the spray booth

	Frequency	Percent %
Strongly disagree	3	16
Disagree	10	53
Neutral	1	5
Agree	5	26
Strongly agree	0	0
Total	**19**	**100**

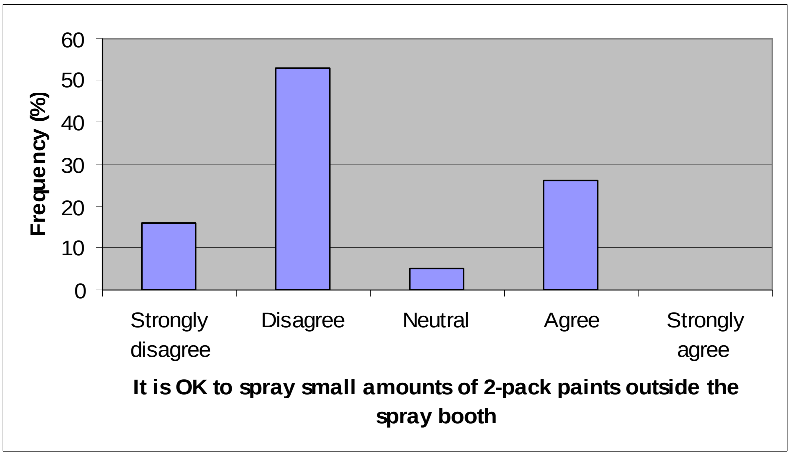


Figure 255 It is OK to spray small amounts of 2-pack paints outside the spray booth

Table 238 What do you think are the advantages of enforcing the use of airline-supplied RPE?

Health of worker	17	57%
Protect business	7	23%
Legal compliance	3	10%
Professionalism	2	7%
Morale	1	3%
	30	**100%**

Table 239 What do you think are the disadvantages of enforcing the use of airline-supplied RPE?

Comfort & awkwardness	9	32%
Visibility	6	21%
Lose employee	4	14%
Painting performance	2	7%
Up to worker	2	7%
Painters dislike	2	7%
Time	1	4%
Maintenance	1	4%
Sore throat	1	4%
	28	**100%**

Table 240 Ratio of pros to cons

Pros > Cons	**Pros = Cons**	**Pros<Cons**
6	2	10
33%	11%	56%

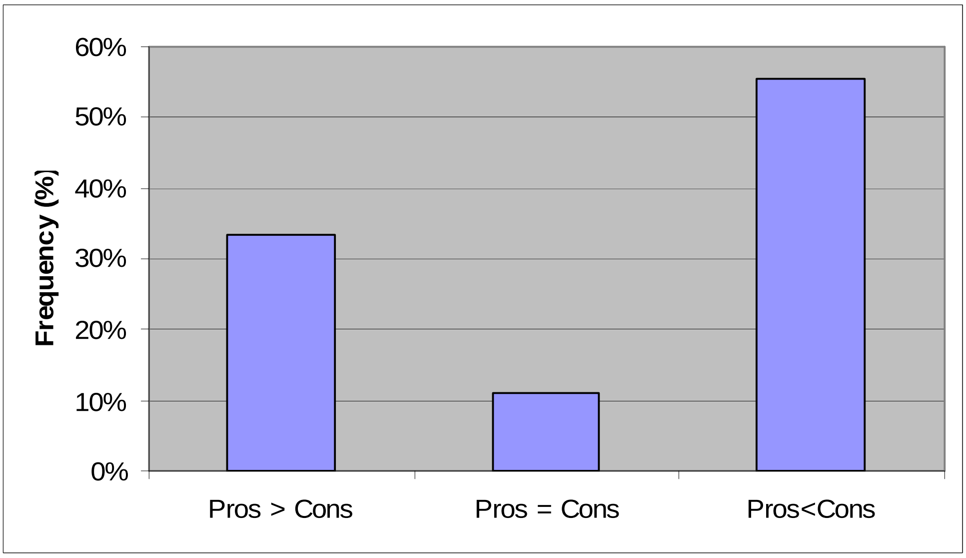


Figure 256 Ratio of pros to cons

Table 241 Stage of Change

	Before Meeting	
	Frequency	**Percent %**
Precontemplation	6	32
Contemplation	3	16
Early Action	7	37
Action	0	0
Maintenance	3	16
Total	**19**	**100**

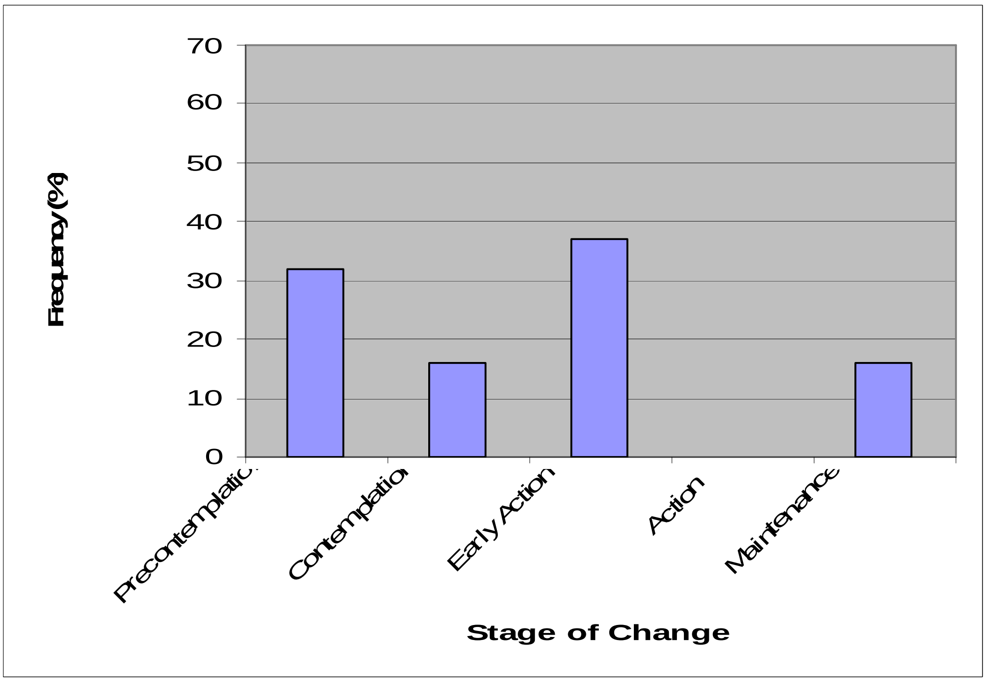


Figure 257 Stage of Change

Ballarat & Bendigo Targeted Visits

MVR Post Intervention Questionnaire

Reference Number: Bd- - Date: / /

Has the body repair shop been visited by WorkSafe since my last visit?

☐ 1 Yes
☐ 2 No

Have you received any information about spray painting safety from WorkSafe since my last visit?

☐ 1 Yes: If "yes" what specifically was the information?
☐ 2 No

Have you received the letter from Damian Cathcart about spray painting safety?

☐ 1 Yes
☐ 2 No

Have you read the letter from Damian Cathcart about spray painting safety?

☐ 1 Yes
☐ 2 No

Did you get a chance to read the information sheets about spray painting safety that came with the letter?

☐ 1 Yes
☐ 2 No

Did you get a chance to discuss the information sheets about spray painting safety with your painter(s)?

☐ 1 Yes
☐ 2 No

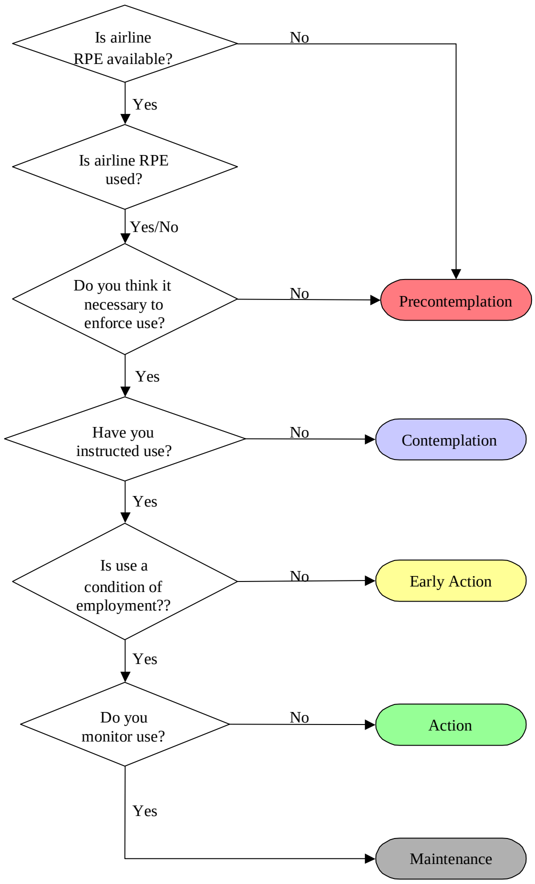
Because the information sheets came from another MVR were you more likely to read it?

☐ 1 Yes
☐ 2 No

If we were to send this information out to other MVR's, would it be more likely to influence them if it came this way (from another body repairer) or from:

☐ 1 WorkCover *(now called WorkSafe Victoria)*
☐ 2 **VACC**
☐ 3 Paint suppliers
☐ 4 Other...

TTM



What do you think would be/are the advantages of enforcing the use of airline-supplied respirators by spray painters (list as many as possible)?

1 ______________________________

2 ______________________________

3 ______________________________

4 ______________________________

5 ______________________________

What do you think would be/are the ***dis***advantages of enforcing the use of airline-supplied respirators by spray painters (list as many as possible)?

1 ______________________________

2 ______________________________

3 ______________________________

4 ______________________________

5 ______________________________

How you feel about the following statements

	Strongly Disagree 1	Disagree 2	Neutral 3	Agree 4	Strongly Agree 5
2-pack paints are safe these days	☐	☐	☐	☐	☐
You do not need to use air-supplied respirators when spraying 2-pack paint	☐	☐	☐	☐	☐
2-pack paints are unlikely to hurt you.	☐	☐	☐	☐	☐
Even when doing a small spray job with 2-pack paint, a respirator should be used	☐	☐	☐	☐	☐
I prefer my spray painters to use air line supplied respirators because I think it is better for them	☐	☐	☐	☐	☐
Airline-supplied respirators will save money in the long run	☐	☐	☐	☐	☐
It is OK to spray small amounts of 2-pack paint without a respirator	☐	☐	☐	☐	☐
I do not think it is necessary for spray painters to use air supplied respiratory protection	☐	☐	☐	☐	☐
It is OK to spray small amounts of 2-pack paints outside the spray booth	☐	☐	☐	☐	☐
2-pack paints can cause lung damage	☐	☐	☐	☐	☐
2-pack paints can cause asthma	☐	☐	☐	☐	☐

~ Thankyou ~

Table 242 2-pack paints can cause lung damage

	Frequency	Percent %
Strongly disagree	0	0
Disagree	0	0
Neutral	3	18
Agree	10	59
Strongly agree	4	23
Total	**17**	**100**

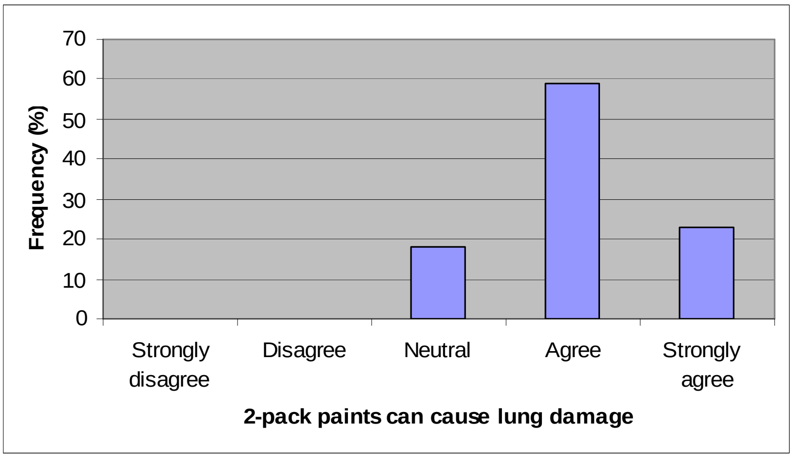


Figure 258 2-pack paints can cause lung damage

Table 243 2-pack paints can cause asthma – after MVR meetings

	Frequency	Percent %
Strongly disagree	0	0
Disagree	0	0
Neutral	4	23
Agree	10	59
Strongly agree	3	18
Total	**17**	**100**

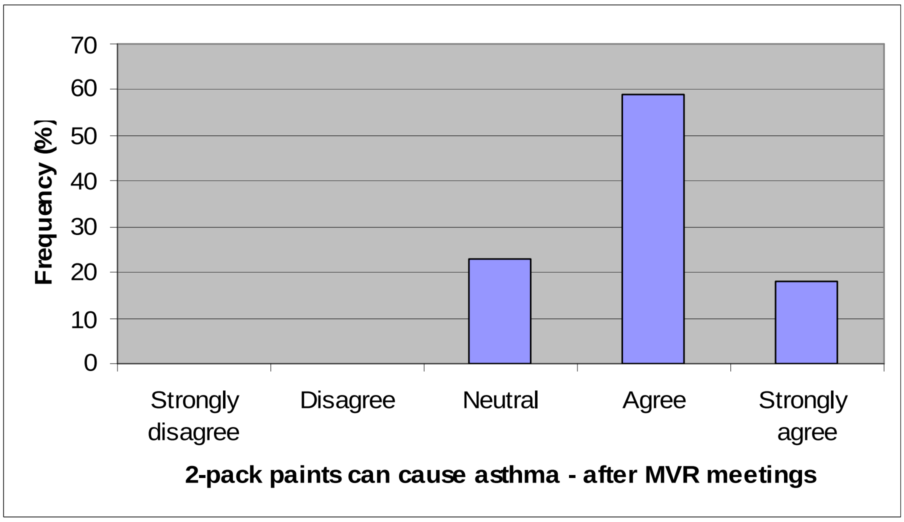


Figure 259 2-pack paints can cause asthma – after MVR meetings

Table 244 2-pack paints are safe these days

	Frequency	Percent %
Strongly disagree	3	18
Disagree	13	76
Neutral	0	0
Agree	1	6
Strongly agree	0	0
Total	**17**	**100**

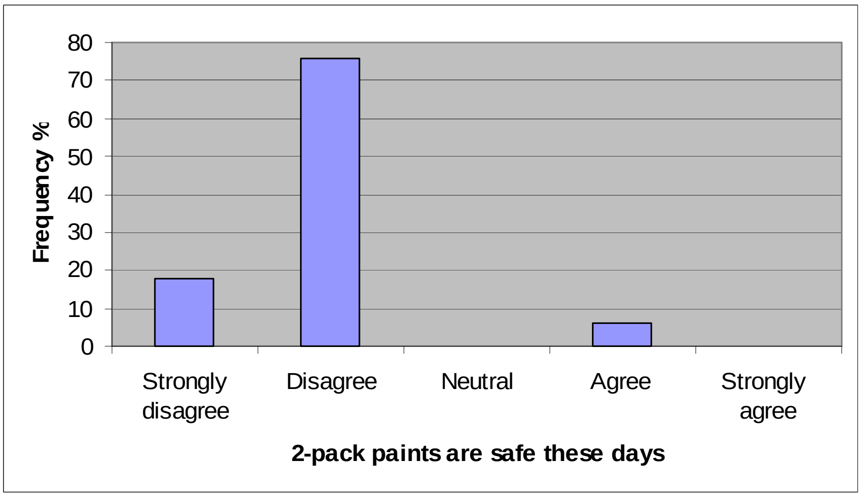


Figure 260 2-pack paints are safe these days

Table 245 2-pack paints are unlikely to hurt you – after MVR meetings

	Frequency	Percent %
Strongly disagree	6	35
Disagree	10	59
Neutral	1	6
Agree	0	0
Strongly agree	0	0
Total	**17**	**100**

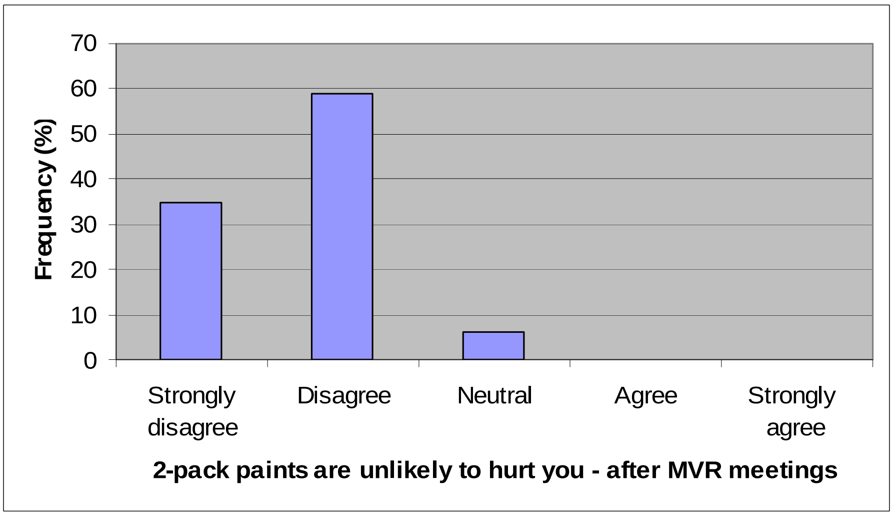


Figure 261 2-pack paints are unlikely to hurt you – after MVR meetings

Table 246 It is OK to spray small amounts of 2-pack paint without a respirator – after MVR meetings

	Frequency	Percent %
Strongly disagree	6	35
Disagree	10	59
Neutral	1	6
Agree	0	0
Strongly agree	0	0
Total	**17**	**100**

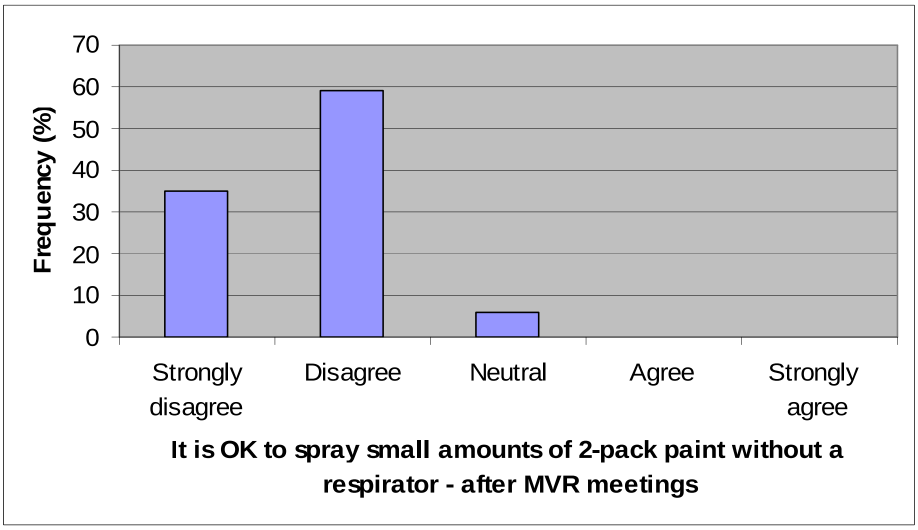


Figure 262 It is OK to spray small amounts of 2-pack paint without a respirator – after MVR meetings

Table 247 Even when doing a small spray job with 2-pack paint, a respirator should be used

	Frequency	Percent %
Strongly disagree	0	0
Disagree	0	0
Neutral	0	0
Agree	12	71
Strongly agree	5	29
Total	**17**	**100**

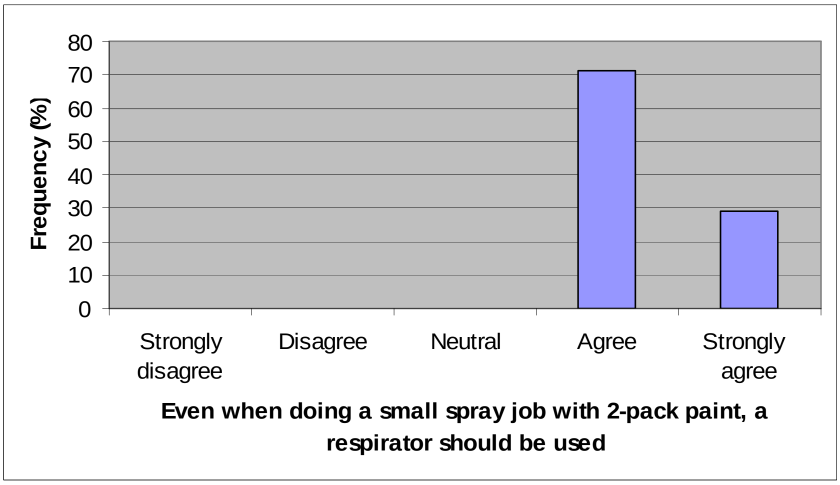


Figure 263 Even when doing a small spray job with 2-pack paint, a respirator should be used

Table 248 You do not need to use air-supplied respirators when spraying 2-pack paint – after MVR meetings

	Frequency	Percent %
Strongly disagree	11	64
Disagree	2	12
Neutral	1	6
Agree	3	18
Strongly agree	0	0
Total	**17**	**100**

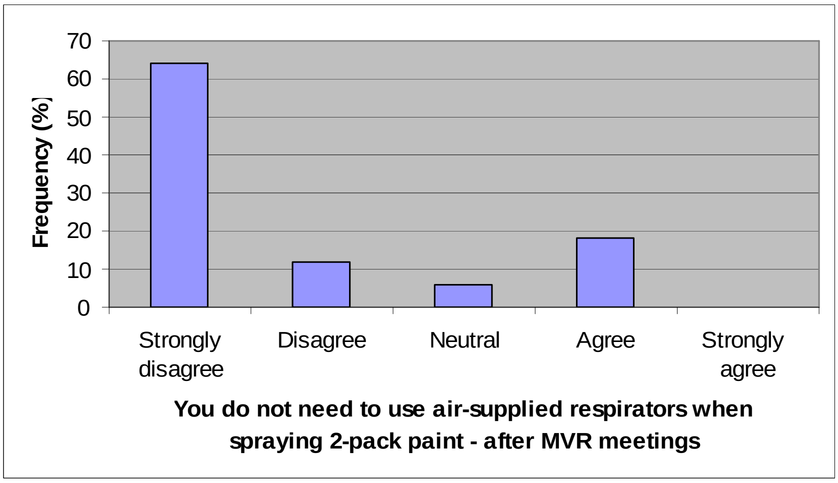


Figure 264 You do not need to use air-supplied respirators when spraying 2-pack paint – after MVR meetings

Table 249 I do not think it is necessary for spray painters to use air supplied respiratory protection

	Frequency	Percent %
Strongly disagree	8	47
Disagree	8	47
Neutral	1	6
Agree	0	0
Strongly agree	0	0
Total	**17**	**100**

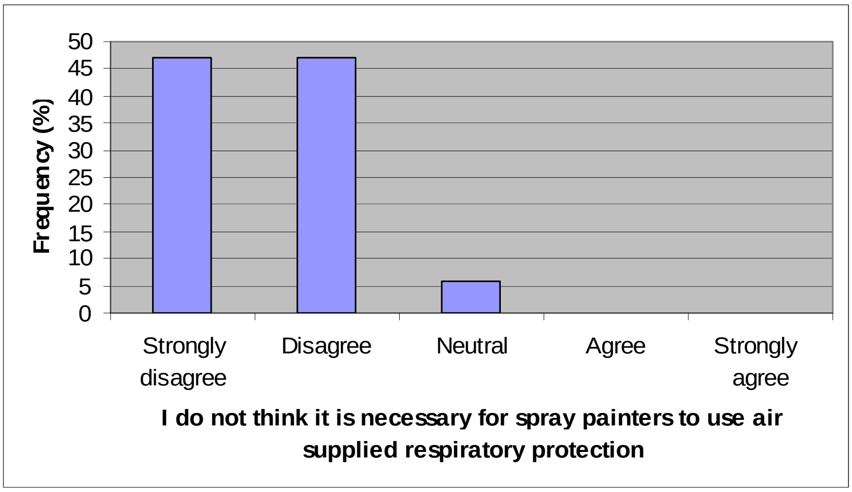


Figure 265 I do not think it is necessary for spray painters to use air supplied respiratory protection

Table 250 I prefer my spray painters to use airline-supplied respirators because I think it is better for them

	Frequency	Percent %
Strongly disagree	0	0
Disagree	0	0
Neutral	0	0
Agree	8	47
Strongly agree	9	53
Total	**17**	**100**

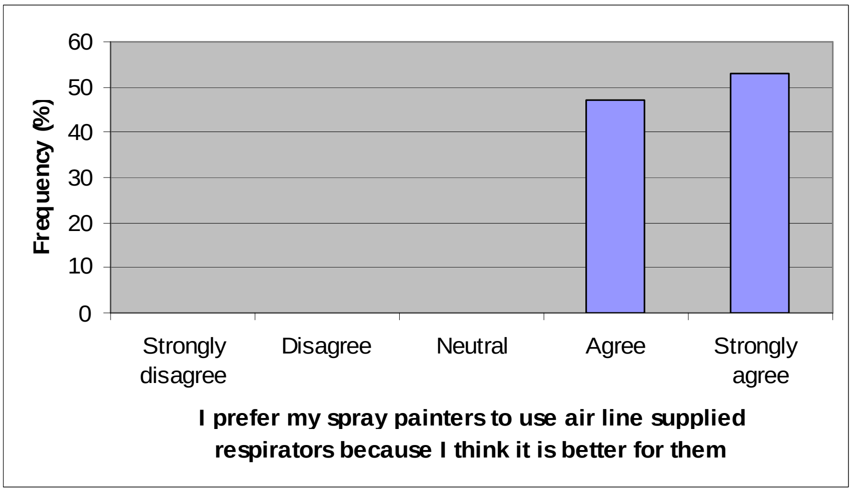


Figure 266 I prefer my spray painters to use airline-supplied respirators because I think it is better for them

Table 251 Airline-supplied respirators will save money in the long run

	Frequency	Percent %
Strongly disagree	0	0
Disagree	4	23
Neutral	2	12
Agree	7	41
Strongly agree	4	23
Total	**17**	**100**

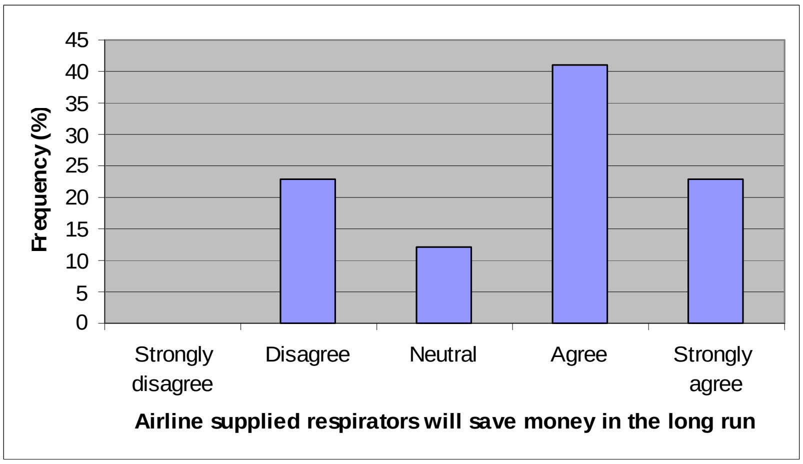


Figure 267 Airline-supplied respirators will save money in the long run

Table 252 It is OK to spray small amounts of 2-pack paints outside the spray booth

	Frequency	Percent %
Strongly disagree	2	12
Disagree	13	76
Neutral	1	6
Agree	1	6
Strongly agree	0	0
Total	**17**	**100**

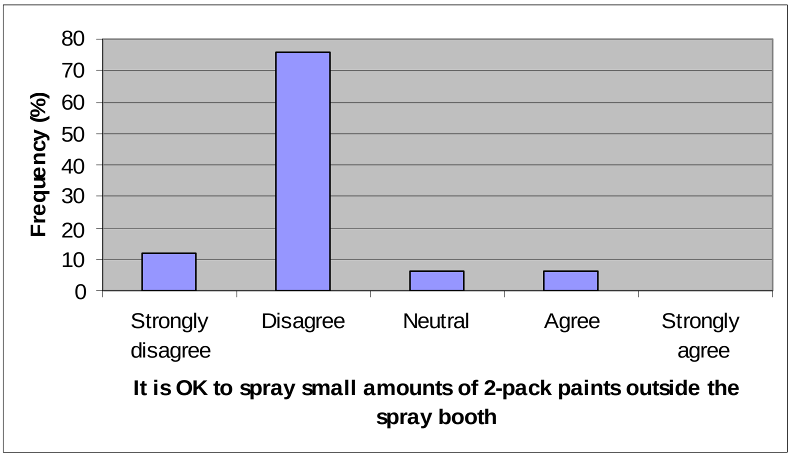


Figure 268 It is OK to spray small amounts of 2-pack paints outside the spray booth

Table 253 Stage of Change

	After Meeting	
	Frequency	Percent%
Precontemplation	3	18
Contemplation	1	6
Early Action	2	12
Action	0	0
Maintenance	11	65
Total	**17**	**100**

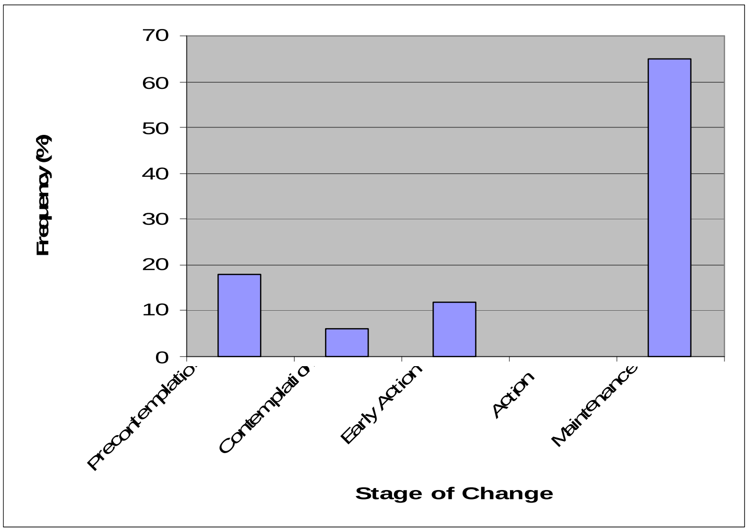


Figure 269 Stage of Change

Table 254 What do you think are the advantages of enforcing the use of airline-supplied RPE?

Health of worker	13	59%
Protect business	5	23%
Legal compliance	4	18%
Professionalism	0	0%
Morale	0	0%
	22	**100%**

Table 255 What do you think are the disadvantages of enforcing the use of airline-supplied RPE?

Comfort & awkwardness	7	64%
Visibility	3	27%
Lose employee	0	0%
Painting performance	0	0%
Up to worker	0	0%
Painters dislike	1	9%
Time	0	0%
Maintenance	0	0%
Sore throat	0	0%
	11	**100%**

Table 256 Ratio of pros to cons

Pros > Cons	Pros = Cons	Pros<Cons
10	1	4
67%	7%	27%

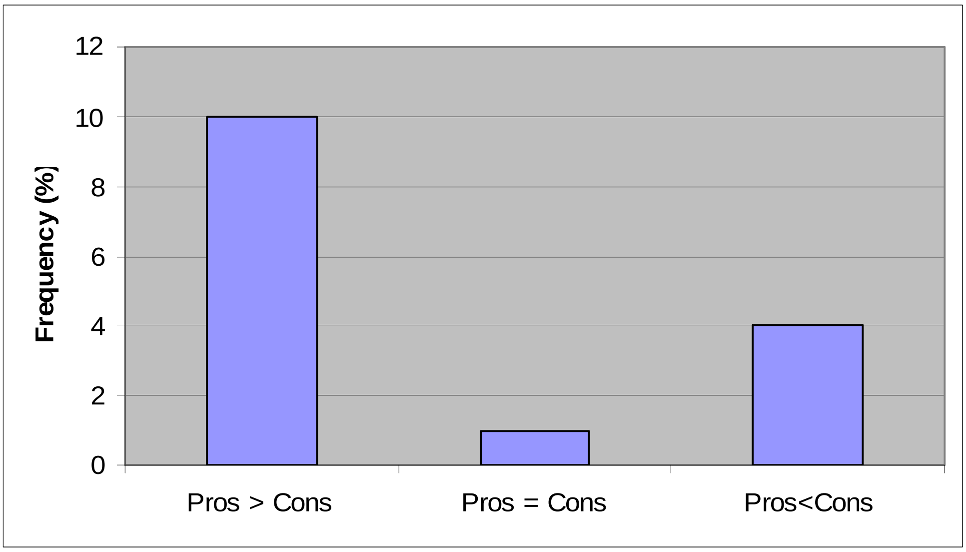


Figure 270 Ratio of pros to cons

Appendix 11: Spray painting and health information sheets

Painters' information sheet

Spray Painting & Your Health

Imagine pinching your nose closed and trying to breathe through a drinking straw. Now imagine trying to breathe through that straw while you were climbing a flight of stairs, kicking a footy, or just carrying your young child to bed. Imagine how hard it would be to get enough air.

That's what life is like for someone having an ***asthma attack.***

What has this got to do with me?

Two-pack spray paints contain chemicals called ***isocyanates*** and these are one of the most important causes of work-related ***asthma***. People who are exposed to too much isocyanate can become allergic to them i.e. they become ***sensitised***.

What does "being sensitised" mean?

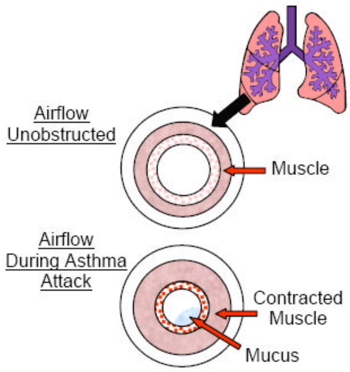
Sensitisation does not happen instantly. There have to be quite high levels of isocyanates in the air at work for it to happen. But once a person is sensitised, even ***minute amounts*** of isocyanates can lead to asthma attacks. Once someone has been sensitised it is likely that they will have to leave their job and find one that is away from spray painting.

A runny nose or sore eyes that you think may be linked to spraying may be the first signs that you are breathing too much isocyanate.

What is an asthma attack?

Asthma happens when sensitised people come into contact with a 'trigger', such as isocyanates. The muscles in their airways tighten and narrow. At the same time, the lining of the airways reddens and swells and mucus is produced. This leads to the wheezing, coughing and difficulty breathing that you may have seen in people with asthma.

Asthma attacks may occur immediately or they may be delayed for up to 12 hours after spray painting, so symptoms may occur away from work. Fatal cases have been reported but these are rare.



Spray Painting & Your Health cont...

How can I avoid being sensitised to isocyanates?

If spraying is done in an open shop, invisible spray will spread. There have been some cases of asthma among non-sprayers as a result of this. Others have occurred due to leaking booths. A good spray booth ventilated through filters to a safe place in the open air will protect other people in the workshop.

When you are inside the booth you should wear ***air-supplied masks*** that have a full-face or visor. Charcoal filters in a half-mask do not filter out the isocyanates and there have been several spray painters wearing half masks who have suffered asthma. One of the problems is that the charcoal takes away the paint smell and so you cannot tell that isocyanates are getting through to your lungs.

During spraying, isocyanates will fill the booth and can remain in the air for a long period. How long will depend on the type of spraying and the effectiveness of the ventilation in the booth but may be up to half an hour. You cannot see the clouds of isocyanates that remain in the booth.

So, to avoid being sensitised:

- Wear your air-supplied mask ***at all times*** in the booth when spraying and for up to half an hour afterwards.
- Make sure your mask is kept ***clean and well maintained.***
- ***Report a runny nose*** or sore eyes to your supervisor if you think that it may be linked to spraying.

For more information call you local WorkSafe office

To find out more about asthma go to www.hse.gov.uk/asthma

MVR Operators' Information sheet

You & Your Spray Painter's Health cont...

How can you prevent your painter being sensitised?

Obviously you want to protect you painter. Good painters are hard to come by and you want to avoid costly illness.

If spraying is done in an open shop, invisible spray will spread. There have been some cases of asthma among non-sprayers as a result of this. Others have occurred due to leaking booths. A good spray booth ventilated through filters to a safe place in the open air will protect other people in the workshop.

People inside the booth should wear air-supplied masks that have a full-face or visor. Charcoal filters in a half-mask do not filter out the isocyanates and there have been several spray painters wearing half masks who have suffered asthma. One of the problems is that the charcoal takes away the paint smell and so you cannot tell that isocyanates are getting through to your lungs.

During spraying, isocyanates will fill the booth and can remain in the air for a long period. How long will depend on the type of spraying and the effectiveness of the ventilation in the booth but may be up to half an hour. You cannot see the clouds of isocyanates that remain in the booth.

So, to protect your painter:

- Make sure your painter wears an ***air-supplied mask*** at all times in the booth when spraying and for up to half an hour afterwards.
- Make sure your painter keeps their mask ***clean and well maintained.*** You will need to provide a clean storage area. An airtight plastic container is useful to keep the mask.
- Make sure your painters understand that they should report a runny nose or sore eyes that they think is linked to spraying.

For more information call the VACC or your local WorkSafe office

To find out more about asthma go to www.hse.gov.uk/asthma

Op

You & Your Spray Painter's Health

Imagine pinching your nose closed and trying to breathe through a drinking straw. Now imagine trying to breathe through that straw while you were climbing a flight of stairs, kicking a footy, or just carrying your young child to bed. Imagine how hard it would be to get enough air.

That's what life is like for someone having an ***asthma attack.***

What has this got to do with me?

Two-pack spray paints contain chemicals called ***isocyanates*** and these are one of the most important causes of work-related ***asthma***. People who are exposed to too much isocyanate can become allergic to them i.e. they become ***sensitised***.

What does "being sensitised" mean?

Sensitisation does not happen instantly. There have to be quite high levels of isocyanates in the air at work for it to happen. But once a person is sensitised, even ***minute amounts*** of isocyanates can lead to asthma attacks. These are obviously distressing for the sufferer.

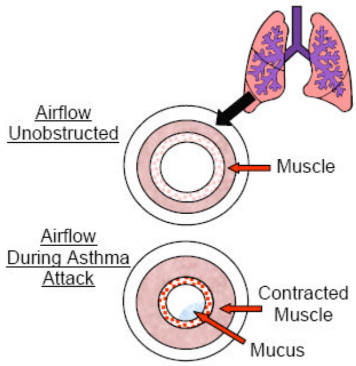
Once someone has been sensitised it is likely that they will have to leave their job and find one that is away from spray painting. ***This means losing your spray painter.*** This results in costs to you and reflects badly on the industry.

A runny nose or sore eyes that appear to be linked to spraying may be the first signs that your spray painter is breathing too much isocyanate and there is a risk of sensitisation. This means costs to you in sick leave and possibly a workers compensation claim.

What is an asthma attack?

Asthma happens when sensitised people come into contact with a 'trigger', such as isocyanates. The muscles in their airways tighten and narrow. At the same time, the lining of the airways reddens and swells and mucus is produced. This leads to the wheezing, coughing and difficulty breathing that you may have seen in people with asthma.

Asthma attacks may occur immediately or they may be delayed for up to 12 hours after spray painting, so symptoms may occur away from work. Fatal cases have been reported but these are rare.



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Appendix 12: Post MVR Meeting: Letters sent by opinion leaders

Letter sent to attendees

Spray Painting and Health

Dear XXX

A few weeks ago we attended an evening seminar about spray painting and health, run by the University of Ballarat.

The presenter told us about asthma and how common it is among spray painters. We discussed the risk of losing our spray painters as well as incurring the costs of sick leave and possibly a workers compensation claim if they do not wear an air-supplied mask ***at all times*** when spraying in the booth.

I was quite struck by the information about the suddenness of asthma after someone has been exposed to isocyanates and as business operators we risk immediate loss of our spray painters.
Asthma is obviously a problem that our industry faces. Good painters are hard to come by and while things are tight we cannot afford to lose the good ones. For the good of ***all our businesses*** and the industry as a whole we really need to make sure our painters use the air-supplied masks when spraying two pack paints.

I have discussed the issues with my painters and thought I would make contact to urge you to do the same if you haven't already. Preventing asthma among painters through the use of air-supplied masks will be good for all of us.

Regards

Signed: Opinion Leader

In association with University of Ballarat

Letter sent to non-attendees

Spray Painting and Health

Dear XXX

A few weeks ago I attended an evening seminar about spray painting and health, run by the University of Ballarat. I believe you were invited but were unable to attend.

The presenter told us about asthma and how common it is among spray painters. The two-pack spray paints contain chemicals called isocyanates, which are one of the most important causes of work-related asthma.

It seems that asthma can strike quite suddenly after a painter has been exposed to isocyanates and as business operators we risk immediate loss of our spray painters. In addition we may incur the costs associated with sick leave and possibly a workers compensation claim.

As a result, we talked about the importance of making sure painters wear an air-supplied mask ***at all times*** when spraying in the booth.

We were given some information sheets – one for us as business operators and one for discussion with the painter. I have enclosed copies of these and urge you to take 5 minutes to read them and discuss the content with your painter.

Asthma is obviously a problem that our industry faces. Good painters are hard to come by and while things are tight we cannot afford to lose the good ones. For the good of ***all our businesses*** and the industry as a whole we really need to make sure our painters use the air-supplied masks when spraying two pack paints.

Regards

Signed: Opinion Leader

In association with University of Ballarat

Appendix 13: Australian Paint Manufacturers' Association Guidance Note

GUIDANCE NOTE

PAINT HANDLING AREAS IN PANEL SHOPS

PAINT HANDLING AREAS IN PANEL SHOPS

PURPOSE

This guidance note has been prepared by the Australian Paint Manufacturers' Federation Inc. to assist panel shop operators in regard to the appropriate storage and handling of Dangerous Goods in Paint Handling Areas.

BACKGROUND

The safe handling of Dangerous Goods is regulated by State and Territory legislation. This legislation places an obligation on employers to store, handle and use Dangerous Goods in a safe manner, without risk to health.

Examples of equipment frequently found in Paint Mix Areas include non-intrinsically safe computers, weigh scales and microfiche readers. These are potential ignition sources for flammable vapours which are generated through normal activity in a Paint Mix Area. Without proper safeguards or controls, there is a risk of fire and/or explosion occurring.

Unsafe work practices such as smoking within areas where Dangerous Goods are stored or used places employees and plant at risk and should not be allowed. Use of mobile phones and other electronic equipment also poses the same risks as described above.

GENERAL RECOMMENDATIONS

The following recommendations are for quantities of paints/tinters below 1000 litres and thinners below 250 litres. Where either of these quantities are exceeded, refer to the Dangerous Goods legislation in your State to determine if additional duties are required.

1. **Designate** a "Paint Mix Area" similar to the one illustrated in Figure 1. This area should be well-ventilated and can either be a room or an open area in the panel shop. It would normally be used for preparation, decanting and clean-up operations. The area within **two metres** of these operations is classified as a **hazardous area**.

2. **Eliminate** all ignition sources from the designated "Paint Mix Area". Ignition sources include stoves, heaters, welders, power points, lights, switches, weigh scales, computers, microfiches, mechanical paint mixing racks, mobile phones etc. Ignition sources may either be moved outside the **hazardous area** (See Figure 1), or appropriate electrical wiring/equipment installed (Zone 2 Compliant).

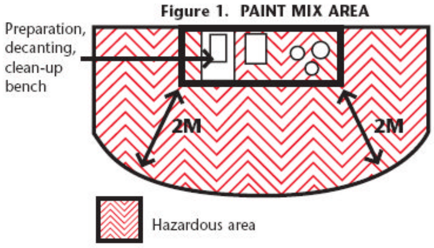
3. **Designate** a "Paint Weighing Area" dedicated to the weighing of paints/tinters as illustrated in Figure 2. Only that paint which is required for **immediate** use is to be brought into this area. Storage of paints/tinters, thinners and waste paints is **not** permitted in this area. Storage must be at least **two metres** away from all ignition sources.

PAINT HANDLING AREAS IN PANEL SHOPS

4. **Close** packages when they are not in use to reduce evaporation of solvents.
5. **Provide** information, instruction, training and supervision for employees on the hazards and safe handling requirements for the paints/tinters and thinners. Refer to the relevant material safety data sheets on the safe use of products.
6. **Provide** adequate spill absorption material for cleaning up of spills (refer to the material safety data sheet).
7. **Clean** up any spills immediately. Dispose of materials used in an appropriate manner.
8. **Post** appropriate signs around the designated Paint Mix Area. An example of a sign may include, "DANGER - FLAMMABLE LIQUIDS NO SMOKING OR IGNITION SOURCES IN THIS AREA"
9. **Install** a fire extinguisher of dry chemical or foam type adjacent to the designated Paint Weighing Area.

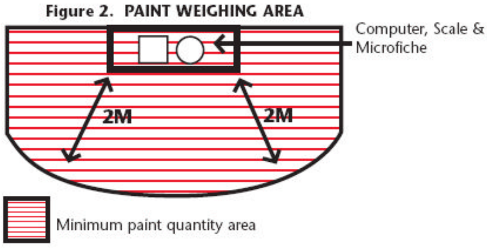
Figures:

Figure 1. PAINT MIX AREA



Designated Paint Mix Area
marked by zig-zagged area
Electrical equipment must not be located in this area because of the presence of paints or thinners.

Figure 2. PAINT WEIGHING AREA



Designated Weighing Area
marked by striped area
Keep paint volume to a minimum because of the electrical equipment located in this area. Do not store paint or thinners in this area.

References:

Australian Standard AS 1940 "The storage and handling of flammable and combustible liquids"
Australia/New Zealand Standard AS/NZS 2430.3.9 "Classification of hazardous areas"
National Standard [NOHSC:1015(2001)] "Storage and Handling of Workplace Dangerous Goods"
Code of Practice for the Storage and Handling of Dangerous Goods (Victoria).

Published by the
Australian Paint Manufacturers' Federation Inc.
Suite 1201, 275 Alfred Street,
North Sydney
Phone: 61 2 9922 3955
Fax: 61 2 9929 9743
Code H11:08:01

Figure 271 Australian Paint Manufacturers' Association Guidance Note: Paint Handling Areas in Panel Shops (Australian Paint Manufacturers' Association, Undated)

Appendix 14: Data used in comparison of NOHSC survey & MVR and fishers survey

The following data were used in the comparison of the findings of the NOHSC-commissioned community survey undertaken in 1998 (National Occupational Health and Safety Commission, 1999) and the findings of the survey of MVR operators and fishers.

Table 257 Perceived Main causes of work-related injuries and illnesses

	Lack of training and education	Worker being careless	Dangerous equipment and procedures	Lack of supervision	Pressure or stress	Dangerous chemicals or substances	Boring or repetitive work	Alcohol or drugs	Unsure
MVR & Fishers	23	43	8	2	6	4	0	2	0
NOHSC	853	377	276	126	452	100	151	100	75

Table 258 Perceived most important ways to prevent work-related injuries and illnesses

	Education & awareness about OHS	Training on safe work procedures	Safe procedures and systems of work	Employee consultation and involvement	Safe equipment	Stronger enforcement of regulations	Regulations clear and easier to understand	Unsure
MVR & Fishers	29	19	16	4	11	3	5	0
NOHSC	653	552	326	276	251	226	176	50