

Evaluation of product documentation provided by suppliers of hand held power tools

Prepared by **Health and Safety Laboratory**
for the Health and Safety Executive 2009

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As part of the Noise and Hand-arm Vibration (HAV) Programme supply project, HSE Specialist Inspectors visited manufacturers and suppliers of hand held power tools in the UK to look for evidence of compliance with the Supply of Machinery (Safety) Regulations 1992, as amended. During these inspections, samples of technical, user and supplementary information provided by suppliers were collected. This project aimed to: assess how legible, readable and understandable the user documentation provided by suppliers was; and to identify examples of good practice in the design of written health and safety information for hand held power tools.

A sample of ten user documents provided by manufacturers and suppliers of professional hand held power tools were assessed against research based guidelines for effective written risk communication. This study identified some examples of effective risk communication in the product manuals and leaflets evaluated. However, there were areas where the documentation could be improved concerning legibility, conspicuity, readability, recall and encouraging user compliance.

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

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First published 2009

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EXECUTIVE SUMMARY

Objectives

The objectives of this project were to:

1. Assess how legible, readable and understandable is the user documentation provided by manufacturers and suppliers of hand-held power tools.
2. Provide a summary of findings from the risk communication research for the design of effective written health and safety information.
3. Produce a checklist of criteria against which user documentation can be evaluated and improvements tracked over time.
4. Identify examples of good practice in the design of written health and safety information for hand held power tools.

Method

A sample of ten documents (five power tool instruction manuals and five safety leaflets) provided by manufacturers and suppliers of professional hand held power tools were selected to assess against the research based guidelines for content, conspicuity, readability, legibility and inclusion of factors shown to improve user compliance and change safety behaviour.

Main Findings

The manuals assessed included in their contents the majority of the information required under the Supply of Machinery (Safety) Regulations 1992 as amended. However, when assessed against the recommendations from research into how this information should be presented to be most effective in communicating information to users, there were areas where improvements could be made.

For important information, such as warnings and safety rules, to be effectively communicated to users the information must be easily available to the user, must be presented so that it attracts the attention of the user (conspicuity), must be legible and must be capable of being understood (readability). In addition the information must be conveyed in a way that motivates users to assess and change their behaviour when using the tool and to comply with the safety rules and warnings.

The majority of the documents utilised one or more of the presentation features recommended in the research to increase the conspicuity of warnings and safety rules. In contrast, only three of the ten documents evaluated met the most important factor for legibility which is type size. The text in the majority of the documents was smaller than the recommended size and, therefore, could be considered as difficult to read. In half of the ten documents the assessment of sample text indicated a standard or easy level of difficulty in reading and comprehension which would indicate that the information would be understood by 70% or more of the UK population. Poor and literal translations into English made two of the documents difficult to understand.

Research suggests that including specific and explicit information on hazard consequences and potential severity of illness or injury as a result of misuse of tools may improve compliance with warnings and safety rules. However, the majority of the documents assessed here did not include this type of information within the user manual or in general safety leaflets. Most of the

manuals assessed met the research recommendations concerning the placement of warnings by positioning warning information both before and within the operator instructions.

Recommendation

The recommendation from this report is that manufacturers and suppliers of hand held power tools should design product risk documentation taking into consideration the suggested guidelines for effective communication of risk information.

1 INTRODUCTION

1.1 BACKGROUND

The EU Machinery Directive (Directive 98/37/EC) which is implemented in the UK by the Supply of Machinery (Safety) Regulations 1992 as amended (SM(S)R 1995), requires manufacturers to ensure that machinery placed on the UK market meets essential health and safety requirements to:

- Eliminate or reduce risks as far as possible (inherent safe machinery design and construction)
- Take the necessary protection measures in relation to risks that cannot be eliminated and
- Inform users of the residual risks due to the shortcomings of the protection measures adopted, indicate whether any particular training is required and specify any requirement to use personal protective equipment

As part of the process to inform users of residual risks, the regulations also set out minimum requirements for instructions that must accompany all machinery.

As part of the Noise and Vibration Programme Supply Project, HSE Specialist Inspectors visited manufacturers and suppliers of hand held power tools in the UK to look for evidence of compliance with the SM(S)R. The aim was to assess compliance with regard to the reduction of vibration risks through machine design, declaration of vibration emission, provision of adequate information warning of residual vibration risks and provision of information to facilitate safe use. During these inspection visits to manufacturers and suppliers samples of the technical, user and supplementary information provided by companies to the purchasers and users of the tools were collected in order to evaluate the vibration emission declaration residual vibration risk warning information and safe use information.

The inspection visits carried out by the Specialist Inspectors evaluated the technical information provided with the focus on vibration emission and risks. In addition, this project aimed to look at how this information was presented in terms of usability for the users or purchasers of hand held power tools.

Documentation accompanying a product such as instruction manuals and safety leaflets is a common way of communicating information on product use, hazards, risks and recommended safe working practices. The documentation aims to enable the end users of the products to be well informed on health and safety issues and to adopt the recommended safe working practices (Ferguson et al 2003). Products used in a working environment are often purchased by people other than the end users who may use the product documentation to produce health and safety risk assessments, training materials and safe methods of work which may be communicated to employees using the products by various methods.

The design of this product documentation has been shown to have a significant impact on the effectiveness of communicating the necessary information (Ferguson et al 2003). Research into the effectiveness of design aspects of risk communications suggests that, to be effective, information must be accessible, conspicuous, legible and comprehensible for purchasers and users (Leonard 1999, Ferguson et al 2003). Therefore, in addition to the technical evaluation carried out by the HSE Specialist Inspectors, some non-technical, usability aspects of the documentation provided by suppliers and manufacturers were evaluated against the

recommendations from the risk communication research for conspicuity, readability and legibility.

1.2 AIMS

The aims of this project were to:

1. Assess how legible, readable and understandable is the user documentation provided by manufacturers and suppliers of hand-held power tools.
2. Provide a summary of findings from the risk communication research for the design of effective written health and safety information.
3. Produce a checklist of criteria against which user documentation can be evaluated and improvements tracked over time.
4. Identify examples of good practice in the design of written health and safety information for hand held power tools.

2 DOCUMENTATION GUIDELINES

2.1 PURPOSE OF PRODUCT DOCUMENTATION

Where a product is very familiar to the user, is simple and intuitive to use, and where there are few hazards associated with use and those hazards are well understood by the majority of users/purchasers, then it is probably not necessary for additional information to be communicated to the user/purchaser to ensure that the product is used safely and efficiently. However, products such as hand held power tools are not always familiar to users/purchasers, are complex pieces of machinery that are usually not intuitive to use and their use may pose multiple hazards. For users to operate these types of products without causing ill health or injury to themselves or to others in the vicinity, the effective communication of information on the safe and efficient use of the tool is essential.

How to effectively communicate information to users/purchasers has been the subject of study within the safety and risk fields since the 1980s (Laughery 2006). For information to be effective it must be accessible to the user/purchaser, must attract their attention, and be easy to read and understand for users/purchasers from a wide range of backgrounds (Leonard 1999). In addition, effective communication of information should lead to users adopting behaviour that complies with the safety and correct use rules.

Important information for users/purchasers of these types of power tools includes descriptions on how to assemble, use and maintain the tool in a safe and efficient way. Other important information includes descriptions of the hazards associated with the use of the product, the injuries that could result from these hazards and what actions to take, or to avoid, to reduce the safety risks. This type of cautionary advice informing users/purchasers of danger is referred to as a warning. Warnings have an important part to play in communicating essential safety information to users/purchasers and therefore much research has been carried out to try to establish the factors associated with communicating warnings effectively.

There are many ways to provide users/purchasers with safety information and warnings. Information can be placed on the product itself, or on packaging or labels attached to the product. With hand held power tools, there is likely to be insufficient space available on the tool itself to display the large amount of information that needs to be communicated. Also the original tool packaging is unlikely to be available for the user and it is probably not feasible or safe to attach labels to a hand-held tool. Therefore, it is usual for the product manufacturer or supplier to provide separate written documentation to accompany the machine. This documentation often takes the form of a product manual (instruction or operator manual). Supplementary leaflets on particular aspects of the tool or it's associated hazards (such as hand-arm vibration), technical data sheets and product brochures also provide the opportunity to communicate safety information.

2.2 COMMUNICATION OF INFORMATION TO USERS

Product manuals are commonly supplied by manufacturers to communicate correct use, safety information and warnings to users/purchasers of products such as hand held power tools. It has been suggested that a product manual can enhance the benefits and performance of use of the product, facilitate ease of use and satisfaction with the product, increase safety, and address product liability issues arising from user injury associated with the product (Lust et al 1995). However, unless the user has access to the product information and is motivated to read it, the information will not be communicated. Often, in a work environment, users of the product will

not have access to the product documentation. However, the employers purchasing or hiring the product may use the information in the product documentation as the basis for their own risk information, training material or safe methods of working which can be communicated to the employees who will be using the product.

The use of a product manual to communicate important safety information has disadvantages in that a manual is often considered to be difficult to read and understand, and that the important information is frequently not highlighted in order to capture the readers' attention (Vigilante and Wogalter 1997). Whether a user or purchaser is motivated to read a product manual or not appears to depend on several factors. Studies have identified that people are less likely to read product manuals if they believe they already know how to use the product, if they are short of time or if they are well educated (Wogalter et al 1995; Celuch et al 1992; Lust et al 1992).

Within an industry setting, operators of hand held power tools are likely to be professional users who feel they are familiar with these tools and therefore are not likely to be motivated to read a product manual (assuming they have access to one). However, familiarity with the use of a product does not necessarily mean that the user has full awareness of all the potential hazards associated with use (Vigilante and Wogalter 1997).

Other means of communicating information about the safe and efficient use of a product to users/purchasers suggested in the research includes the use of supplementary instruction leaflets (Conzola and Wogalter 1999), electronically stored information eg. CD-ROM (Wogalter et al 1998), audio-visual information eg. DVD or video tape, verbal messages at the point of sale or hire (Laughery 2006), pre-recorded voice warnings (Conzola and Wogalter 1999), and provision of information via the Internet.

2.3 INFORMATION TO BE INCLUDED IN USER DOCUMENTATION

The content that should be included in information about the safe and efficient use of hand held power tools is prescribed in the Supply of Machinery (Safety) Regulations 1992 as amended (SM(S)R 1995) which is the implementation in the UK of the European Union's Machinery Directive (Directive 98/37/EC). These regulations include essential health and safety requirements for manufacturers of hand held machinery to provide instructions to accompany machinery. The regulations require that, as a minimum, the instructions should include the following information on the power tool:

- Repeat of the information with which the tool is marked eg. Certificate of conformity
- Foreseen use of the tool
- Operator workstation
- Instructions for safe:
 - putting into service
 - use
 - handling (including weight of tool)
 - installation
 - assembly, dismantling
 - adjustment
 - maintenance, servicing and repair
 - training instructions (where applicable)
- essential characteristics of fittings
- ways in which the power-tool should not be used (misuses)

In addition, the target audience for the information may dictate the content. Laughery (2006) points out that prescription drug warning communications to medical professionals may provide more technical information and use more medical language than that used on the pill container label that is presented to the consumer. More technical information may be required for hand held power tools being used in a working environment where the target audience may be the purchasers and/or those responsible for preparing the risk assessment, training and safe method of working.

2.4 INCREASING CONSPICUITY OF INFORMATION

Information is often only sought from product manuals and associated documentation when the user/purchaser has questions about the product (Vigilante et al 1997). It is unlikely that the manual would be read from cover to cover. Instead the user/purchaser will probably scan the information and read the parts that attract his or her attention. Therefore, for important information such as a warning to be effective, a user/purchaser must first notice it. If the user/purchaser notices the important information there is an increased chance of that information being read, understood, remembered and complied with. In order to be noticed studies have shown that information must be as prominent or conspicuous as possible (Wogalter et al 2002). Features that have been reported to make warnings more conspicuous in product documentation include: larger text, high contrast, colour highlights, borders, pictorial symbols/icons and signal words (Young and Wogalter 1990; Wogalter et al 2002). These factors are discussed below. Davies et al (1998) suggest that highlighted safety information may still not be enough to make the information prominent and that the relative size, positioning and the amount of other “clutter” surrounding the warning or other important information on the page may also be important factors in whether information is noticed, read and remembered.

2.4.1 Text

Presenting warnings or other important information in text that is larger and bolder than the surrounding text increases conspicuity (Sanders and McCormick 1993). Young and Wogalter (1990) found that bigger, bolder print in product manuals led to improved recall for warnings. Text should be presented in bullet points rather than in continuous text as it is suggested that this format is more effective as it maintains the readers attention longer and is easier to process (Wogalter et al 2002).

2.4.2 Colour

The use of colour to attract the attention of users/purchasers to important information such as warnings or safety information has been studied. It was found that coloured warning labels were perceived as more noticeable, readable and hazardous (Kline et al 1993) and warnings with thick, colourful borders were found to be more likely to attract attention (Wogalter and Rashid 1998). Red was the colour that people most consistently associated with warnings (Griffith and Leonard 1997). However, the issue of colour blindness should be considered and colour should be used in association with other factors that have been found to increase conspicuity.

2.4.3 Graphics/Symbols

Some studies have reported that one of the factors that increased comprehension and memory of warning information was the use of pictorial icons, as long as the size of the icon was sufficient to be legible and the icon design was capable of conveying the intended meaning to an

acceptable proportion of the general population (Young and Wogalter 1990; Wogalter et al 2002).

Recommended warning graphical representations are given in the relevant International and European standards such as BS EN 61310-1 (1995) Safety of Machinery – Indication, marking and actuation. For example, a triangular shape, black pictogram of an exclamation mark on a yellow background with a black border (see Figure 1) is the standard warning sign for general danger. Graphical symbols may be particularly important for people within the target audience who have low levels of literacy or may not understand the language the warning is written in (Wogalter et al 2002).

Warnings with both text and symbols have been reported to be more noticeable than either text or symbols on their own (Wogalter et al 2002). A combination of pictogram and a text message was found by Davies et al (1998) to be significantly the most noticeable style of warning.

2.4.4 Signal Words

A signal word is a word used at the start of a section of text to indicate that the information following it contains important warning information (see Figure 1). The use of signal words to attract attention and indicate the level of hazard present has been shown to increase the effectiveness of a warning (Wogalter et al 1999a). The most commonly used signal words are DANGER, WARNING and CAUTION (Laughery 2006). Of these DANGER is considered to be more likely to attract attention (Adams et al 1998).

2.5 IMPROVING LEGIBILITY OF INFORMATION

Legibility refers to the ease with which written words can be read. The Royal National Institute for the Blind (RNIB) has produced clear print guidelines (RNIB 2007) which give recommendations on how to design simple, clear, easy to read, printed information. These guidelines recommend that the size of the type used (point or font size) should be between 10-14 point where the height of the printed “x” character is at least 2mm. Type size is considered a fundamental factor for legibility. Young and Wogalter (1990) found that bigger, bolder print in product manuals led to improved memory for warnings. Good contrast between the text and the background is also important and black text on a white background is recommended. Similarly, setting text over images should be avoided as contrast is likely to be reduced. Studies have reported that the typeface used should be simple rather than decorative and that traditional typefaces are likely to be the most legible as they are the ones that people are most accustomed to reading (McLaughlin 1968). The clear print guidelines recommend that continuous blocks of capital letters, underlined text or text in italics should be avoided as these are harder to read (RNIB 2007). The RNIB also recommend using bold or semi-bold weight typefaces to improve legibility.

The clear print guidelines (RNIB 2007) recommend that there is sufficient spacing between lines of text, that columns are clearly separated by an adequate margin or a vertical line, and that text is aligned to the left margin and not justified between the margins as uneven word spacing can make reading more difficult. Leaving a space between paragraphs is recommended as this gives the eyes a break and improves legibility. Having headings and page numbers in the same place, providing a contents list and separating the different sections is also recommended as this makes it easier for the reader to find his/her way around the document (RNIB 2007).

2.6 INCREASING READABILITY OF INFORMATION

For information to be effective in changing safety behaviour of the users, it must be presented in such a way as the target audience can understand the meaning. Readability can be defined as the combination of qualities of printed communication that makes it easy for people to understand the meaning or induces them to continue reading (McLaughlin 1968). Leonard (1999) points out that when developing safe operating procedures for equipment, consideration needs to be given as to how warnings are presented. To be useful a warning must be located where the user/purchaser has access to it, and must be clear and understandable to users/purchasers from a wide range of backgrounds and educational levels. Standard measures of readability include the Flesch Reading Ease (FRE) (Flesch 1948) which calculates the average syllables per word and average sentence length to give a readability score for a text passage. The FRE has become a US government standard test for readability of documents and text with an FRE score within the range of 60-70 is considered to be “Plain English” (Ferguson et al 2003). This FRE score equates to a standard level of reading difficulty that it is suggested should be understood by 70% of the UK population (Payne et al 2000).

The Plain English Campaign (2007) issue guidelines for writing in a style that will be more effective in communicating the message more often, more easily and in a friendly way. The guidelines include keeping sentences short, using active rather than passive verbs, using “you” and “we”, using appropriate words for the reader, avoiding jargon and using bullet points.

2.7 IMPROVING USER COMPLIANCE

2.7.1 Warnings

Warnings are a means of informing users/purchasers of the hazards posed by products and events. With simple, familiar products users/purchasers are likely to be knowledgeable of the possible hazards associated with use of the product and a warning may be included only as a reminder. Where the users/purchasers may not be familiar with the product or where the hazards are multiple and/or complex, warnings need to inform and educate the user/purchaser of the hazards and how to avoid them.

2.7.1.1 Severity, Consequences and Hazard Avoidance

Generally warnings should include information about the hazard, the possible consequences of the hazard, safety instructions on how to avoid the consequences of the hazard, and information about the possible uses and misuses of the product (Leonard and Wogalter 2000). The importance of including instructions on how to avoid consequences was identified by Leonard and Wogalter (2000) who reported that people may be aware of hazards associated with products but that this awareness does not necessarily mean that they understand what they need to do (or not do) to avoid the hazards.

For effective warnings, research suggests that it is important to include information on the potential severity of injuries from use or misuse of the product. This information should help users appreciate the nature and magnitude of potential injuries and from this make their hazard-risk judgement which will affect their motivation to act with caution and comply with safety advice (Wogalter et al 1991; 1993; 1999b). An example of a hazard warning giving severity information would be “.....*can cause intense eye irritation*....”. Other severity descriptors that could be used are: extensive, irreversible, major, mild, minimal, minor, severe, slight or superficial (Wogalter et al 1999b).

2.7.1.2 Signs and Symptoms

Some studies have suggested that giving detailed information on signs and symptoms may help users/purchasers to be able to attribute symptoms experienced to use of the product and take appropriate safety action (Vredenburgh et al 2005). An example of a warning giving this type of information is:

“ If you experience hand rashes, hives, swelling (face and throat), runny nose, watery eyes, difficulty in breathing or a headache while wearing latex gloves, immediately discontinue use, wash skin surface and seek medical advice” (Vredenburgh et al 2005).

2.7.1.3 Explicitness

The descriptions in warning or safety instructions should be specific, explicit and complete but without being lengthy. This enables users/purchasers to better understand the nature of the hazard and potential consequences and use this understanding to make well-informed decisions regarding compliance (Laughery 2006). Explicitness is defined as information that is specific, detailed, clearly stated and leaving little or nothing implied (Laughery 2006). Research suggests that explicit warnings are associated with greater compliance with safety instructions such as the use of personal protective equipment (Dingus et al 1993). For example, “*Severe lung injury can result*” may be more effective than “*You could be injured*” (Wogalter et al 2002) and “*Toxic chemical vapours can result in severe lung damage: always wear type X respirator in area*” may be more effective than “*Hazardous environment, potential health effects, use appropriate precautions*” (Laughery 2006).

Leonard and Wogalter (2000) studied whether people generally interpret vague instructions in the same way and found that people interpreted vague phrases variably. For example, only 84% of respondents considered that “Use in a well ventilated area” meant that the substance should not be used in a small space like a closet (Leonard and Wogalter 2000).

2.7.1.4 Source of Warning

The inclusion in the warning of the source of the warning message has been found to increase the effectiveness of a warning. Wogalter et al (1999a) found that the inclusion of a specific, reputable source for a warning increased the judgement of users that the message was credible and increased the probability of compliant behaviour. Sources that were rated highest for credibility in the Wogalter et al (1999a) study were “*American Medical Association*”, “*US Food and Drug Administration*” and “*Surgeon General’s*”.

2.7.1.5 Injury Statistics

Including injury statistics within warning information has been shown to be a factor in the ability of users to recall safety information (Conzola and Wogalter 1998).

2.7.2 Placement of Information

The first essential step towards achieving user compliance with safety warnings and instructions is for the information to be accessible to the user/purchaser. Warning information has been found to be most effective when presented in close proximity (time and space) to the hazard such as on a product or the packaging (Frantz et al 2000). Where the complexity of the product and the multiple nature of the associated hazards make this impractical, such as with power tools, it is suggested that a brief warning should be placed on the product so that the user is

reminded that there are hazards associated with use but the warning should direct the user to read the operator manual for further information before using the product (Laughery 2006).

2.7.2.1 Warning Placement Within Product Documentation

Product documentation generally contains various types of information on the safe and most effective assembly, operation and maintenance of a product. With complex products such as power tools, where there are likely to be multiple associated hazards, informing users/purchasers of these and how to avoid them is an important part of the development of product documentation. To encourage users/purchasers to notice and read the warning and safety information, research has been carried out into where to place warning and safety information within the product manual and into the order in which warnings should be presented.

Guidelines for warnings design generally suggest that warnings should be placed before the instructions to be most effective as, once the instructions are read, the user/purchaser is likely to stop reading (Wogalter et al 2002). However, the research is equivocal on this point. Some earlier studies have suggested that warnings should be embedded within the instructions to increase attention to, and compliance with, warnings (Frantz 1993).

In a study of the sequencing of multiple safety warnings in product manuals for power tools, the preferred order was to place specific actions to be taken or avoided to prevent serious injury first. Warnings dealing with information appropriate to the later stages of using the product (such as the storage and maintenance) should be placed later in the manual (Vigilante and Wogalter 1997). Prioritising the order in which the warning statements are listed may ensure that the statements that hold the most important safety information for the user/purchaser to be aware of are read, as users/purchasers are more likely to only briefly scan or skip later information.

2.7.3 Supplementary Information

Other effective methods of communicating information to users/purchasers have been suggested in collaboration with product manuals. Showers et al (1992) suggested that the reading of product manuals could be encouraged by audio or video material highlighting product features and safety precautions. Audio-visual materials, such as DVDs, could also be a useful way of informing users/purchasers who have poor literacy levels as it estimated that around 20% of the UK population have low literacy levels. Conzola and Wogalter (1999) found that supplemental print messages combined with a product manual were more effective in achieving compliant behaviour with instructions or warnings than the use of a product manual alone.

2.7.4 Message Framing

Research suggests that the way a risk or safety message is framed can influence safety behaviour. Health and safety information can be framed in a positive or a negative way. Negatively framed messages emphasise the consequences of not adhering to the safety rules while positively framed messages place the emphasis on the benefits of following the suggested safety rules (Ferguson et al 2003). In a study of occupational risk communication leaflets Ferguson et al (2003) found that a message that emphasised the benefits of adopting safe working practices was generally more influential on employee intention to change behaviour than a negative message emphasising the consequences of not adopting safe practices. In addition, it has been suggested that a balance between causes, consequences and solutions within risk communication may influence the adopting of safe working practices (Ferguson et al 2003).

3 METHOD

3.1 SELECTION OF DOCUMENTATION

HSE Specialist Inspectors collected 12 sets of documentation during inspections of powered hand held tool suppliers. These documents were evaluated against guidelines for effective communication of product documentation and safety information based on research findings.

Where available, an instruction manual or operator information booklet for the power tool was selected for evaluation. Where an instruction manual was not available in the manufacturer or supplier documentation provided, or was not available in a downloadable format from the company website, a hand-arm vibration information leaflet or general safety leaflet was selected. If none of these three types of documentation was available, the manufacturer or supplier was not included in the evaluation.

3.2 DOCUMENTATION EVALUATION CRITERIA

The guidelines to evaluate the documentation were compiled from the research literature on effective communication of risk information and from a selection of the content required under the regulations (see Document Guidelines section). The list is not exhaustive but aims to include the major findings from the risk communication research. These evaluation criteria are listed in Table 1.

Each document was assessed as to whether or not the criteria were met. The documentation was considered to have met the criteria if there was at least one example within the documentation. For example, if severity or consequence information was listed for one hazard but not for other hazards listed then the result was taken as a positive compliance. The results were recorded for each set of documentation.

Some of the research recommendations for effective risk communication were omitted from the evaluation criteria because it was not feasible to evaluate these within this study. Recommendations omitted from the evaluation include message framing where it was not possible to carry out a full content analysis on each document to identify the number of positively or negatively framed messages or to categorise the content into cause, consequence and solution. The use of colour as a feature to enhance conspicuity was also not evaluated as some of the product documents supplied were black and white photocopies of the original documentation.

Table 1: Documentation Evaluation Criteria

General	Conspicuity
Contents page/index	Larger text
Headings	High contrast
	Bold text
Contents*	Graphics + text
Declaration of conformity	Borders
Warnings/safety rules included	Signal word
Vibration declaration/value	Illustrations/graphics
Vibration warning	Important information highlighted
Foreseen uses	
Misuses	Readability
Safe use instructions	Flesch Reading Ease
PPE requirements	Flesch-Kincaid Level
Handling instructions	Passive voice
Assembly/dismantling instructions	Length of sentences
Adjustment instructions	Length of paragraphs
Servicing/repair/cleaning instructions	Use of you and we
Training information	
<i>*Selected examples only from content required by regulations</i>	Compliance Factors
Legibility	Warnings before instructions
Bullet points	Maintenance/storage instructions later
Left justification	Warnings included in text
Type size 12-14 point	Warnings listed together
Contrast good	Bullet points
Typeface - simple, clear	Hazard Information
Type style (eg. no blocks of capitals)	Severity/consequences of hazard
Leading (space between lines)	How to avoid consequences
Clear column separation	Symptoms, signs, what to do
Clear section separation	Injury statistics
Space between paragraphs	Explicitness
Type weight (bold or semi-bold)	Source
	Most important/severe hazards listed first

3.3 READABILITY EVALUATION

For the readability evaluation, a sample text of approximately 100 words, starting at the start of a paragraph and finishing at the end of a sentence, was selected for analysis. The text was selected from the safety information section if this type of information was provided. This text was copied into Microsoft Word for Windows 2000 word-processing software and the readability statistics were produced automatically by this computer software for the sample text. Readability statistics produced in this way included average sentences per paragraph, average words per sentence, percentage of passive sentences and Flesch Reading Ease.

4 RESULTS

Out of a sample of 12 sets of documentation provided by manufacturers and suppliers of hand held power tools, 10 companies had provided a document that was suitable to be evaluated in this study. Five documents were power tool instruction manuals, three were hand-arm vibration information leaflets and two were general safety leaflets.

Each document was evaluated against the guidelines listed in Table 1.

4.1 INFORMATION INCLUDED

All of the sample instruction manuals, general and vibration leaflets evaluated included warnings or safety information. Only one of the manuals did not show the declaration of conformity. Two of the five manuals gave vibration emission values and three included one or more warnings that mentioned vibration.

For example:

“Failure to heed this warning can result in bristle breaking and extreme vibration of the wire brush that could result in serious personal injury.”

“ Do not use damaged, out of round or vibrating grinding tools.”

One of the five manuals included neither a vibration value nor a warning.

Four of the five leaflets included vibration warning information. Not surprisingly the vibration specific leaflets were much more explicit in describing the vibration hazard.

For example:

“High vibration risk equipment could cause vibration injury even when used for a short time each day....”

All five of the manuals included information on the foreseen and correct use for the power tool and four of the five also gave misuse information. The instructions for safe use and personal protective equipment requirements (PPE) for the tool were included in all five of the manuals and both of the general safety leaflets. Some warnings concerning PPE were more specific than others. For example:

“Wear protective glasses and hearing protection. Wear additional protection equipment for safety such as protective gloves, sturdy shoes, hard hat and apron.”

in contrast to:

“Use safety equipment as recommended.”

Assembly/disassembly and maintenance instructions were provided in all five of the manuals and adjustment and handling instruction in four of the five. Some form of training requirements were also provided in all five of the manuals. For example:

“Working safely with this machine is possible only when the operating and safety information are read completely and the instructions contained therein are strictly followed. In addition, the general safety notes in the enclosed booklet must be observed. Before using for the first time, ask for a practical demonstration.”

or

“Read all the instructions before using this tool. All operators must be fully trained in its use and aware of these safety rules.”

4.2 CONSPICUITY

Four out of the five manuals used some means of highlighting warning information eg. bold text, larger font, borders, graphics or signal words. Borders were utilised in one manual, signal words in two and graphics in three to highlight the warning. Only one of the vibration/safety leaflets highlighted the warnings and used borders, signal words and high contrast to do this. One other leaflet used graphics alongside the text to identify warnings.

Three of the ten documents used a general hazard pictogram (triangle with exclamation mark) alongside warning text. An example of this from one of the manuals is shown in Figure 1.



Figure 1: Example of a warning from a power tool user manual

4.3 LEGIBILITY

Three out of five instruction manuals displayed information in bullet point format and two left justified the text. Similarly, three out of the five leaflets conformed with the use of bullet points and left justification. A contents page or index for the product document was included in just two of the instruction manuals. Eight of the ten documents utilised headings to separate sections of text.

There was good contrast between the text and the background colour in all but two of the documents. All the manuals used simple typeface and type styles but two of the leaflets used continuous text in upper case or italics. Where it was applicable, the spacing and separation of the text was clear in all but two of the documents.

The main area where the documents evaluated failed to meet the legibility criteria concerned type size. Four of the five manuals and three of the five leaflets were printed in a small font size where the height of the printed character “x” measured less than 2mm. In addition, none of the manuals but three of the leaflets appeared to be printed in bold or semi-bold type weight.

4.4 READABILITY

The Flesch Reading Ease (FRE) score for sample text from two of the manuals was in the 61-70 range which is considered to be of standard difficulty and capable of being understood by 70% of the UK population. The sample text from the other three manuals was evaluated as less easy

to read with scores in the 30-50 range (difficult, understood by 24% of population). In two of the vibration/safety leaflets the sample text also scored 31-50 (difficult), two scored 61-70 (standard, 70% understanding) and one was scored as easy to read with a score of 82.6 (understood by 80% of the population).

Table 2: Flesch Reading Ease (FRE) scores (Payne et al 2000)

FRE Scores	Difficulty	Example texts	IQ required	% of UK pop. understanding
0-30	Very difficult	Scientific journals	126+	4.5
31-50	Difficult	Academic journals	111+	24.0
51-60	Fairly difficult	Quality magazines	104+	40.0
61-70	Standard	Reader's digest	90+	70.0
71-80	Fairly easy	Slick fiction	87+	80.0
81-90	Easy	Pulp fiction	84+	86.0
91-100	Very easy	Comics	81+	90.0

The sample text in four of the manuals used passive sentences. Only one used no passive sentences and two contained higher percentages of passive tense writing (22% and 33%). Two of the vibration/safety leaflets had a high percentage of passive sentences at 25% and 37%.

Sentence length was relatively short in all five samples from instruction manuals, with average sentence lengths between 9.2 and 12.1 words. Paragraphs were similarly short with average number of sentences per paragraph in the sample text ranging between 1.1 and 3. One of the vibration/safety leaflets had long sentences with an average of 26 words per sentence in the sample text. One general leaflet had very short sentences with an average of 6 words and the three remaining leaflets had averages ranging from 12.7 to 17.

4.5 IMPROVING USER COMPLIANCE

All of the vibration/safety information leaflets included warnings within the text but only one of the leaflets listed the warnings together in one section.

Hazard information was provided in four out of the five instruction manuals. In the one exception, safety rules were given without the hazard itself being explicitly mentioned. For example:

“ Remove all articles from the work area, which can be a possible source of danger.”

Hazard information was provided in the three vibration leaflets but not in the two general leaflets.

Some form of severity or consequence of the injury from the hazard was included in two of the manuals and one of the leaflets. For example:

“Prolonged exposure to high intensity noise may cause loss of hearing.”

Of the ten documents evaluated here, only one (one of the vibration leaflets) described the possible signs and symptoms associated with exposure to a hazard. None of the documents gave injury statistics.

In one of the two manuals containing severity or consequence information, the consequence information was less explicit. For example:

“... inattention while operating power tools may result in serious personal injury.”

Three of the manuals and one of the leaflets were reasonably explicit in the descriptions of the hazard, consequence or safety actions. The following example illustrates explicitness regarding the hazard and the safety actions:

“Wear personal protective equipment. Depending on the application use face shield, safety goggles or safety glasses. As appropriate wear dust mask, ear protection, gloves and shop apron capable of protecting you against flying debris from the accessory or work piece.”

This contrasts with the non-specific example of:

“ use safety equipment as recommended.”

Three of the manuals and three of the leaflets gave information on what users should do to avoid or reduce the risk of ill health or injury from hazards. For example:

“Avoid accidental starting. Be sure switch is off before plugging in.”

None of the documents evaluated listed the warnings or safety instructions in order of potential severity of injury. Most grouped the warnings into, for example, work area, personal safety, electrical safety. Similarly, none of them listed the source of any of the warnings (such as “Health and Safety Executive”).

Four out of the five instruction manuals evaluated had warning information placed before instructions for operation of the tool. Three of the five also incorporated warnings in the text as well as listing them together in a “Safety” section. All the instruction manuals had the warnings and safety information grouped together. Four of the five manuals placed maintenance and storage instructions after information on safe operation of the tool.

5 DISCUSSION

5.1 DISCUSSION OF RESULTS

This evaluation of a sample of hand held power tool user documents provides an indication of some areas where information is presented in a format that is in accordance with the recommendations from research findings into effective risk communications. However, there are some aspects of the documentation where manufacturers and suppliers could make improvements in the future to try to communicate information to users more effectively. For the communication of correct use and safety information to be considered effective it must positively influence the behaviour of users so that they act with caution and comply with safety rules during assembly, handling, use, maintenance and storage of tools.

5.1.1 Information Included

The five manuals evaluated were reasonably comprehensive and appeared to cover much of the information required by the regulations. However, it should be noted that the quality and level of detail of the technical information provided, especially concerning the vibration emission, was not assessed as part of this evaluation.

5.1.2 Conspicuity

For warnings or other important information in product documents to be effective in communicating the information to the users, the reader must notice the warning, be able to distinguish it from other text and recognise that it may be important to read. In the majority of the documents evaluated in this study, important information was highlighted by the use of one or more of the design features suggested in research recommendations.

Probably the most prominent warning within the documents evaluated was that reproduced in Figure 1 which is a hazard pictogram alongside a bold, large type signal word, accompanied by warning text, and enclosed within a border. This warning stood out not only because of the use of a symbol and a border, but also because of the size of the warning, its position within the text, the space around the warning and the clear presentation of the entire page.

Colour, especially red, has been shown to be effective in attracting the attention of users to warning information. The use of colour was not evaluated here because some of the documents supplied were not original documents but black and white photocopies.

The majority of the documents evaluated laid out all or part of the information in bullet point format. This is considered as good practice as it has been suggested that bullet point format is more effective in communicating information as it helps to maintain the readers' attention for longer (Wogalter et al 2002).

5.1.3 Legibility

The type size used in a document is considered to be the most important factor in legibility (RNIB 2007; Tinker 1965). Disappointingly only three of the ten documents evaluated were printed in a type size where the height of an "x" character would be larger than the recommended minimum height of 2mm for legibility. These findings are similar to that of Payne et al (2000) who found 47% of patient information leaflets were printed in a type size that was smaller than that recommended. If the user looks at the document and considers it to be difficult to read because of smallness of the type size he/she may be less likely to make the effort to read through the information.

One of the reasons for utilising a small font may be the requirement to produce the same user information in a number of languages. Manufacturers and suppliers usually combine these multiple language versions into one product manual which may be considered to be unmanageably large if a bigger font size is used. Using a larger type size and producing a separate booklet for each language may be a more effective option and Laughery (2006) suggests that further research is needed into how to organise and present multi-language safety information effectively.

Some good practice in achieving legibility was evident as the majority of the documents had good contrast, used simple typefaces and laid out the text clearly.

5.1.4 Readability

Four of the ten documents evaluated using the Flesch Reading Ease (FRE) were of standard reading difficulty and one was easy to read. This suggests that 50% of the documents could have been understood by 70% or more of the population. In contrast, five (50%) of the documents were scored as difficult to read, understood by 24% of the population and had a reading difficulty equivalent to that expected of academic journals. These readability results were better than those found by Payne et al (2000) in a study of patient information leaflets where 64% were scored as very difficult, difficult or fairly difficult to read using the FRE. Similarly Ferguson et al (2003) used the FRE and found the average readability of a selection of HSE leaflets to be “fairly difficult” but with a large variation in readability scores.

It should be noted that the validity and usefulness of FRE has been questioned and one study of patient information leaflets found that a leaflet with a FRE score of 46 (difficult) was rated as easy to understand by 78% of patients (Meade and Smith 1991). One of the limitations with readability assessments such as the FRE is that they do not take into consideration the motivational factors. The reader is more likely to be motivated to carry on reading a document if they feel the text is interesting, contains what he/she needs to know and he/she has the time to read (McLaughlin 1968). However, the motivation to read an instruction manual or safety leaflet, especially if the user considers him or herself to be familiar with the tool, is likely to be low (Celuch et al 1992).

Some concern has been expressed that users or purchasers with higher reading level abilities will dislike or be offended by information that is written for lower reading levels (Ferguson et al 2003). Studies have shown that this is not the case and that people of all reading levels generally prefer written material that is easy to read (Davis et al 1996).

The appropriateness of the language and format of the documents for the target audience was not formally evaluated in this study. However, it was noted that two of the documents used language that was awkward and difficult to understand. This was probably due to a literal translation into English from the language the document was originally written in. The following examples from two of the documents illustrate this:

“Don’t use the machine in explosive rooms!”

“The working area ground has to be anti-skid and enough stable.”

Literal translations into English (or any other language) should be avoided as they are likely to further reduce the probability that users will read and comprehend important safety information.

Readability measures such as FRE provide a relatively quick and easy way to check and compare passages of text. However, as these measures calculate readability scores by counting the number of syllables, words, sentences and paragraphs and applying readability formulae,

other comprehension issues, such as translation errors, may be overlooked. Therefore, when designing product or safety documentation it is advisable to also carry out user evaluation. Ferguson et al (2003) describe a five step procedure to do this.

5.1.5 Improving Compliance

Generally people are inclined to read product manuals when they have questions about the product (Vigilante and Wogalter 1997) so it is important that the manuals provided are easy to read, navigate around and that important warnings and safety information catch the readers' attention.

5.1.5.1 Warning Information

The majority of the product and safety documentation evaluated presented the warning and safety information as safety rules. Safety rules provide information on actions required and actions to be avoided to ensure the safe operation of the tool. For example:

“Wear protective glasses and hearing protection.”

“Never use the machine with a damaged cord.”

These examples of safety rules only imply the nature of the hazard (eg. grinding process, electricity), do not give the consequences of the hazard (eg. eye damage, electrocution) and do not indicate the potential severity of the consequences (eg. severe eye damage, loss of sight, severe burns, death). Including information on the consequences and potential severity of harm from the hazard could make the warning more effective in increasing the motivation of the user to comply (Wogalter et al 1991; 1993; 1999b). An example of a potentially more effective warning from one of the documents is:

“The dust that is produced while working can be detrimental to health, flammable or explosive. Suitable safety measures are required. For example; some dusts are regarded as carcinogenic. Use suitable dust extraction and wear a dust respirator.”

As well as giving more explicit information on the nature of the hazard and the potential consequences, the above warning is also more explicit in what actions the user should take to avoid the consequences. Rather than just giving the instruction to “wear protective equipment” it specifies a type of equipment (“dust respirator”).

However, this warning lacks the brevity and simplicity of the warnings in the first two examples that just give safety rules. A longer, more in depth warning could risk not being effective because it lacks concise impact and in providing more information may make the warning more difficult for some users to comprehend. Therefore, there is a difficult balance to be achieved between giving enough information to motivate users to heed warnings; giving them too much information so they feel they do not have the time or motivation to read it all; and giving information that may be difficult to comprehend. One possible solution may be to mention the hazard briefly within the instruction manual or on the product and refer the user to supplementary information. For example, several manufacturers and suppliers have chosen to provide supplementary leaflets on hand-arm vibration which explain the nature of this hazard, consequences, severity, signs and symptoms, and what actions to take to avoid/reduce potential harm in more depth than the warnings and safety information within the instruction or operation manual for the tool.

The source of the warning and injury statistics were not provided in any of the documentation evaluated. However, one vibration leaflet included the Health and Safety Executive and

Construction Confederation logos on the first page. Including information on the source of the warning (where the source is a respected and reputable authority) could be something manufacturers and suppliers could look at to try to increase the effectiveness of communicating important health and safety information as long as the source is likely to be considered as a trusted and respected source by the target audience.

It should be noted that the warnings quoted here are examples from the manuals evaluated and are used to illustrate a point. They should not necessarily be considered as examples of best practice in designing warnings.

5.1.5.2 Placement of Warnings

All but one of the instruction manuals evaluated placed warnings before the operator instructions as recommended by Wogalter et al (2002). In three of the manuals evaluated, warnings were also embedded within the operator instructions or general text. This belt and braces approach is likely to be the most effective means of communicating important information in light of the equivocal research on the placement of warnings.

One area that does not appear to have been addressed within the instruction manuals evaluated here, is the recommendation that warnings concerning specific actions to be taken/avoided to prevent serious injury should be listed first. This was recommended from the research of Vigilante and Wogalter (1997) into product manuals for power tools. This study found that listing the most important safety information first was preferred by the user and suggests that this would help to ensure that important information stood the best chance of being noticed, understood, remembered and acted on by users. However, this may mean that the user/purchaser is likely to be reminded of the most obvious and well-known hazards whilst possibly remaining unaware of the lesser-known hazards and the actions that should be taken or avoided to prevent injury or ill health. This may be less applicable to purchasers in a working environment who are likely to be motivated to read through all the product documentation in order to prepare risk assessments, training and safe working methods for their employees.

5.1.6 Supplementary Information

Some of the manufacturers and suppliers, whose documentation was evaluated in this study, have already provided additional information leaflets on specific safety topics such as hand-arm vibration. This is good practice as some research suggests that providing supplementary documentation is more effective in achieving user compliance than product manuals alone (Conzola and Wogalter 1999). Employers who have purchased the product may find supplementary leaflets useful to assist them in informing their employees who use the product of health and safety issues.

Laughery (2006) points out that there are many components to warning systems for a product, of which the product manual is just one, and others include printed information on packaging, insert leaflets and verbal messages at the point of purchase (or hire). Manufacturers and suppliers could look at providing supplementary safety information in leaflets, pocket cards, posters, DVDs and downloads from their website.

Research on consumer products indicates that most users make decisions about the safety of products without observing safety messages and that their prior knowledge of the product and its associated hazards may dictate their safety behaviour more than any safety message (Davies et al 1998). Therefore, manufacturers and suppliers may have to undertake some additional educational effort in order to get complex safety information across (Leonard and Wogalter 2000). An example of this may be providing “tool box talks” to customers who may include managers, supervisors and end user employees.

5.1.7 Message Framing

Ferguson et al (2003) found that for occupational risk prevention, a message that emphasised the benefits of adopting safe working practices was generally more influential on the intention of employees to change behaviour than a negative message emphasising the consequences of not adopting safe practices. It has also been suggested that risk information that contains a balance of causes, consequences and solutions may influence the adoption of safe working practices (Ferguson et al 2002). Whilst a full content analysis of each document to identify message framing and balance of content were beyond the scope of this study, these aspects of effective risk communication may need to be considered in the design of documentation or in future evaluations of communication effectiveness.

5.2 EFFECTIVENESS OF DESIGNING WARNINGS TO GUIDELINES

Using the recommendations from risk communication research as guidelines to design warnings is likely to increase the effectiveness of product documentation in informing users/purchasers of hazards associated with the use of a product and increase the probability that they will use the product according to the safe working practices. In a study of healthcare workers and warning information for latex glove use, it was concluded that warning labels designed to meet research recommendations and guidelines (e.g. ANSI) improved the noticeability of warnings, were more effective in alerting people to specific hazards and in behavioural compliance (Vrendenburgh et al 2005).

Ferguson et al (2003) designed risk communication leaflets with simplified word complexity, shorter sentence length and fewer passive sentences to achieve a reading ease of the optimum standard difficulty. The study found that the simplified leaflets were considered by a number of employees to be more usable than the original, more complex leaflets.

5.3 LIMITATIONS

The sample of documentation used was small with only 10 documents evaluated. However, whilst the sample is too small to be representative of the documentation provided by all manufacturers of power tools, it does give an indication of some potential areas that could be improved in the design of product documentation.

The documentation guidelines for effective risk communication suggested here are mainly based on research into consumer products rather than products used in the workplace. Consumer risk communication research findings have been used as the basis of these documentation guidelines as there has been comparatively little research carried out on risk communication issues in workplace contexts (Weyman and Kelly 1999). Whilst it is likely that many of the research findings are applicable to professional users and products in a workplace context, there may be some areas of difference such as the availability of product documentation to the end user, and the potential for training and safety reminders provided through the employer's health and safety function.

6 RECOMMENDATION AND CONCLUSION

Simply being well-informed about a health or safety risk is not in itself sufficient for the user of a product to change their behaviour and adopt safe working practices. However, having that knowledge is the first essential step without which the user is not in a position to even consider whether to adopt safe working practices (Ferguson et al 2003). Communicating this information in a way that is usable and useful for the users or purchasers of products such as hand held power tools is therefore important.

To be usable and useful the research suggests that documentation should be legible, comprehensive, easy to read and understand, and risk information should be noticeable. In addition the documentation should be designed to include factors that have been shown to increase the probability that users will comply with the safe practice guidelines. Some of the recommendations from the research on how to design usable, useful and effective documentation have been compiled here into a set of guidelines (see Table 3 and Appendix 2).

This study identified some good examples of product manuals and leaflets when evaluated against the research recommendations and guidelines for effective risk communication. However, there are areas where the documentation could be improved in the areas of legibility, conspicuity, readability, recall and encouraging user compliance. By taking into consideration these research recommendations and guidelines when designing warning and safety information, the manufacturers and suppliers of hand held power tools may improve the effectiveness of the information in influencing users to act with appropriate caution and comply with the safety rules. It may also assist purchasers in identifying the most important risk information to communicate to the end user employees and facilitate the preparation of risk assessments, in-house training materials and safe working practices. However, it should be noted that taking risk communication guidelines and recommendations into consideration when designing product documentation should be one part of the document design process which should also include user evaluation. As the Plain English Campaign (2007) points out “There is no substitute for testing documentation on real people”.

The recommendation from this report is that manufacturers and suppliers of hand held power tools should design product risk documentation taking into consideration the suggested guidelines for effective communication of risk information.

Table 3: Summary of research based guidelines for producing user documentation

Information included	<ul style="list-style-type: none"> ▪ Include all information required by SM(S)R ▪ Include warnings on vibration ▪ Include training information 	<ul style="list-style-type: none"> ▪ Include noise emissions and vibration levels ▪ Include declaration of conformity within instructions
Conspicuity	<ul style="list-style-type: none"> ▪ Make warnings more noticeable to users 	<ul style="list-style-type: none"> ▪ Use of combination of hazard pictogram, signal word and warning text. ▪ Use of borders around warning ▪ Use of colour ▪ Use of graphics ▪ Use of bullet point format
Legibility	<ul style="list-style-type: none"> ▪ Increase size of text ▪ Make layout clearer ▪ Make finding information easier 	<ul style="list-style-type: none"> ▪ Use larger font (>2mm x-height) ▪ Use bullet points ▪ Include contents page
Readability	<ul style="list-style-type: none"> ▪ Aim for readability score that is of standard difficulty or easy to read ▪ Avoid literal translations 	<ul style="list-style-type: none"> ▪ Avoid jargon or unnecessarily technical terms ▪ Use active voice rather than passive ▪ User evaluation
Compliance	<ul style="list-style-type: none"> ▪ Provide explicit, specific and comprehensive information ▪ Placement of warnings ▪ Message framing 	<ul style="list-style-type: none"> ▪ Include information on consequences, severity and injury statistics ▪ Consider including source of warning ▪ Provide specific information on actions to take and actions to avoid to reduce risk of injury/ill-health from hazard ▪ Place warning information both before and within instructions. ▪ Consider placing the most important safety information first in a list of warnings. ▪ Consider emphasising the positive benefits of compliance with safety behaviour ▪ Balance of information on causes, consequences and solutions
Supplementary information	<ul style="list-style-type: none"> ▪ Provide information in other forms/formats 	<ul style="list-style-type: none"> ▪ Consider providing: safety leaflets, pocket cards, posters, DVDs, website downloads. ▪ Consider providing additional training to suppliers, hire companies, end users

7 APPENDICES

7.1 APPENDIX 1: DOCUMENTATION EVALUATION RESULTS TABLE

Manufacturer/Supplier	A	B	C	D	E	F	G	H	I	J
Type of document evaluated	Inst man	Gen prod	Gen safety	Vib Iflet	Vib Iflet	Vib Iflet				
General										
Contents page/index	N	N	Y	N	Y	Y	n/a	n/a	n/a	n/a
Headings	Y	Y	Y	N	Y	Y	Y	Y	Y	N
Contents										
Declaration of conformity	Y	Y	Y	Y	N	n/a	n/a	n/a	n/a	n/a
Warnings/safety rules incorporated	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Vibration declaration/value	Y	Y	N	N	N	N	N	n/a	Y	n/a
Vibration warning	Y	N	N	Y	Y	Y	N	Y	Y	Y
Foreseen uses	Y	Y	Y	Y	Y	n/a	N	n/a	n/a	n/a
Misuses	Y	Y	Y	Y	N	n/a	N	n/a	n/a	n/a
Safe use instructions	Y	Y	Y	Y	Y	Y	Y	n/a	n/a	n/a
PPE requirements	Y	Y	Y	Y	Y	Y	Y	n/a	n/a	n/a
Handling instructions	N	Y	Y	Y	Y	Y	Y	n/a	n/a	n/a
Assembly/dismantling instructions	Y	Y	Y	Y	Y	n/a	Y	n/a	n/a	n/a
Adjustment instructions	Y	N	Y	Y	Y	n/a	Y	n/a	n/a	n/a
Servicing /repair/ cleaning instructions	Y	Y	Y	Y	Y	Y	Y	n/a	n/a	n/a
Training information	Y	Y	Y	Y	Y	Y	Y	n/a	n/a	n/a
Conspicuity										
Larger text	N	N	N	N	N	N	N	N	N	N
High contrast with surrounding text	Y	N	N	Y	Y	Y	N	N	N	N
Bold text	Y	N	Y	Y	N	N	N	N	N	N
Graphics + text	Y	N	Y	N	Y	N	N	N	Y	N
Borders	N	N	N	N	Y	Y	N	N	N	N
Signal word	N	N	Y	N	Y	Y	N	N	N	N
Illustrations/graphics	Y	N	Y	N	Y	N	N	N	Y	N
Important info highlighted	Y	N	Y	N	Y	Y	Y	N	Y	N

Manufacturer/Supplier	A	B	C	D	E	F	G	H	I	J
Legibility										
Bullet points	Y	N	Y	N	Y	Y	N	Y	Y	N
Left justification	N	N	Y	Y	N	Y	N	Y	Y	N
Type size 12-14 point	N	N	N	N	Y	N	Y	N	N	Y
Contrast good	Y	N	Y	Y	Y	Y	Y	N	Y	Y
Typeface - simple, clear	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Type style (eg. no blocks of capitals)	Y	Y	Y	Y	Y	Y	N	Y	N	Y
Leading (space between lines)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Clear column separation	Y	Y	n/a	Y	Y	Y	n/a	Y	Y	n/a
Clear section separation	Y	Y	Y	N	Y	Y	Y	Y	Y	n/a
Space between paragraphs	Y	N	Y	Y	Y	N	Y	Y	Y	Y
Type weight (bold or semi-bold)	N	N	N	N	N	N	Y	N	Y	Y
Readability										
Flesch reading ease	33.8	64.7	41.1	45.5	69.4	62.9	61.4	82.6	38.9	32.2
Flesch-Kincaid level	11.5	7.1	10.4	9.9	5.8	6.1	8.9	5.2	10.9	12
Passive voice %	22%	11%	0%	33%	8%	11%	37%	0%	14%	25%
Length of sentences	12.1	11.7	11.6	12.1	9.2	6.6	17	14.2	12.7	26.2
Length of paragraphs	2.2	1.5	1.1	2.2	3	1.8	2.6	2.2	1.4	2
Use of you and we	N	N	N	N	N	N	N	Y	N	N
Compliance Factors										
Warnings before instructions	Y	N	Y	Y	Y	n/a	Y	n/a	n/a	n/a
Maintenance/storage instructions later	Y	N	Y	Y	Y	n/a	Y	n/a	n/a	n/a
Warnings included in text	Y	N	Y	N	Y	Y	Y	Y	Y	Y
Warnings listed together	Y	Y	Y	Y	Y	Y	N	N	N	N
Bullet points	Y	Y	Y	Y	Y	Y	N	Y	Y	N
Hazard info	Y	Y	N	Y	Y	N	N	Y	Y	Y
Severity/consequence of Hazard	N	N	N	Y	Y	N	N	Y	N	N
How to avoid consequences	Y	N	N	Y	Y	N	Y	Y	Y	N
Symptoms, signs & what to do	N	N	N	N	N	N	N	Y	N	N
Injury statistics	N	N	N	N	N	N	N	N	N	N
Explicitness	Y	N	N	Y	Y	N	N	Y	N	N
Source	N	N	N	N	N	N	N	N	N	N
Most important/severe hazard first	N	N	N	N	N	N	N	n/a	n/a	n/a

7.2 APPENDIX 2: SUMMARY OF DOCUMENTATION GUIDELINES

Information included	<ul style="list-style-type: none"> ▪ Include all information required by SM(S)R ▪ Include warnings on vibration ▪ Include training information 	<ul style="list-style-type: none"> ▪ Include noise emissions and vibration levels ▪ Include declaration of conformity within instructions
Conspicuity	<ul style="list-style-type: none"> ▪ Make warnings more noticeable to users 	<ul style="list-style-type: none"> ▪ Use of combination of hazard pictogram, signal word and warning text. ▪ Use of borders around warning ▪ Use of colour ▪ Use of graphics ▪ Use of bullet point format
Legibility	<ul style="list-style-type: none"> ▪ Increase size of text ▪ Make layout clearer ▪ Make finding information easier 	<ul style="list-style-type: none"> ▪ Use larger font (>2mm x-height) ▪ Use bullet points ▪ Include contents page
Readability	<ul style="list-style-type: none"> ▪ Aim for readability score that is of standard difficulty or easy to read ▪ Avoid literal translations 	<ul style="list-style-type: none"> ▪ Avoid jargon or unnecessarily technical terms ▪ Use active voice rather than passive ▪ User evaluation
Compliance	<ul style="list-style-type: none"> ▪ Provide explicit, specific and comprehensive information ▪ Placement of warnings ▪ Message framing 	<ul style="list-style-type: none"> ▪ Include information on consequences, severity and injury statistics ▪ Consider including source of warning ▪ Provide specific information on actions to take and actions to avoid to reduce risk of injury/ill-health from hazard ▪ Place warning information both before and within instructions. ▪ Consider placing the most important safety information first in a list of warnings. ▪ Consider emphasising the positive benefits of compliance with safety behaviour ▪ Balance of information on causes, consequences and solutions
Supplementary information	<ul style="list-style-type: none"> ▪ Provide information in other forms/formats 	<ul style="list-style-type: none"> ▪ Consider providing: safety leaflets, pocket cards, posters, DVDs, website downloads. ▪ Consider providing additional training to suppliers, hire companies, end users

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Evaluation of product documentation provided by suppliers of hand held power tools

As part of the Noise and Hand-arm Vibration (HAV) Programme supply project, HSE Specialist Inspectors visited manufacturers and suppliers of hand held power tools in the UK to look for evidence of compliance with the Supply of Machinery (Safety) Regulations 1992, as amended. During these inspections, samples of technical, user and supplementary information provided by suppliers were collected. This project aimed to: assess how legible, readable and understandable the user documentation provided by suppliers was; and to identify examples of good practice in the design of written health and safety information for hand held power tools.

A sample of ten user documents provided by manufacturers and suppliers of professional hand held power tools were assessed against research based guidelines for effective written risk communication. This study identified some examples of effective risk communication in the product manuals and leaflets evaluated. However, there were areas where the documentation could be improved concerning legibility, conspicuity, readability, recall and encouraging user compliance.

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