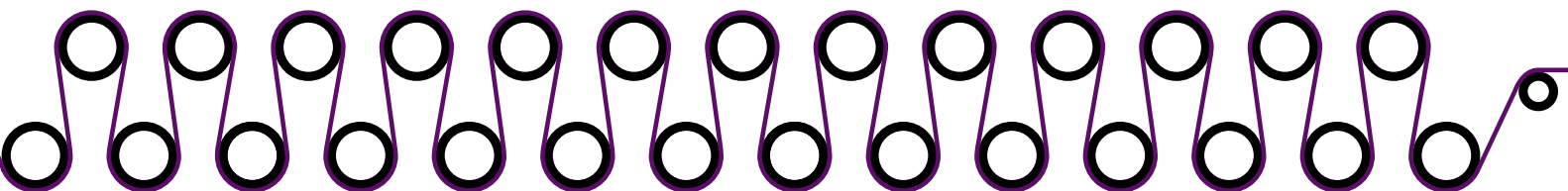
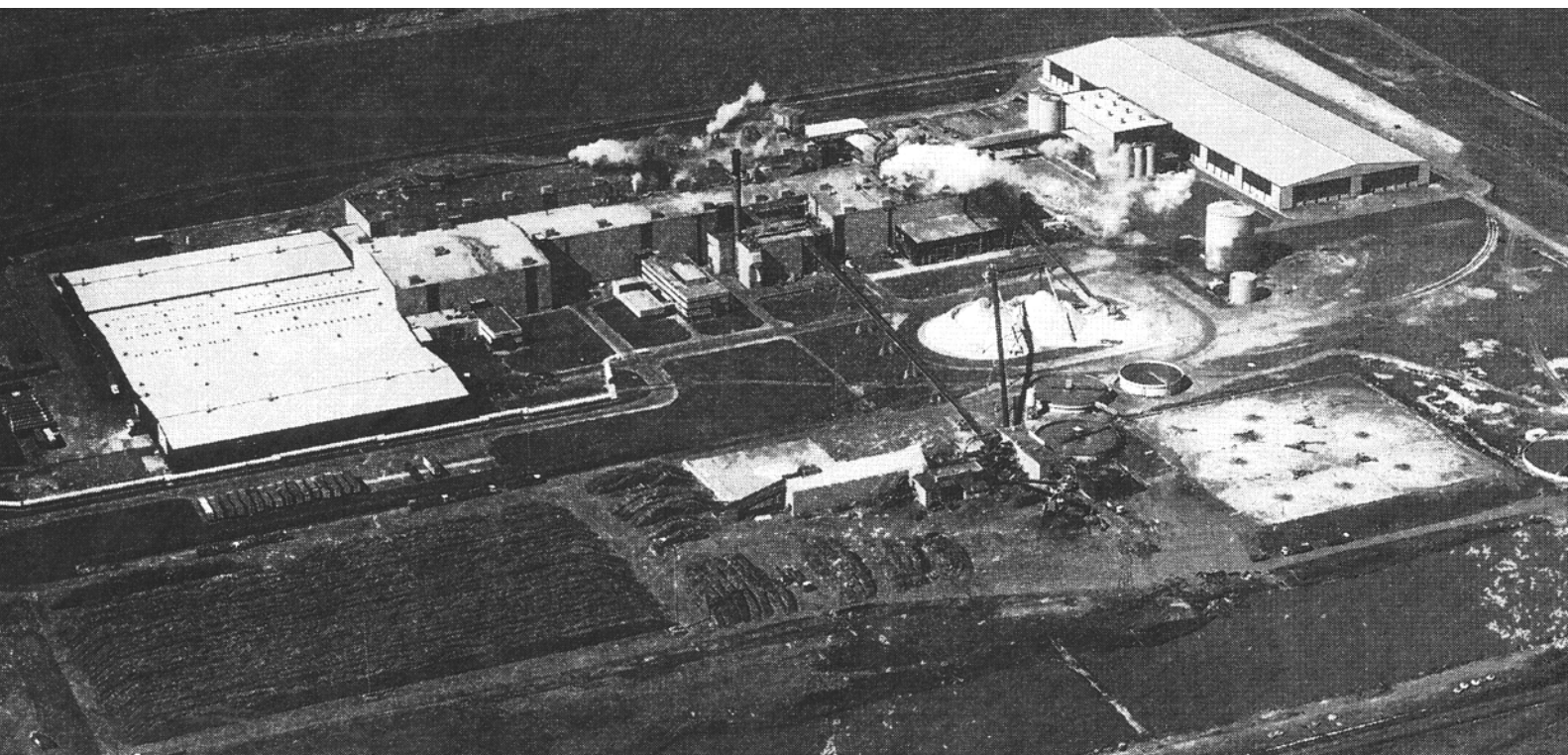




Paper and Board Industry
Advisory Committee

GUIDE TO MANAGING HEALTH AND SAFETY IN PAPER MILLS



.....

Contents

Guide to managing health and safety in paper mills

.....

Part 1: *Application of the Provision and Use of Work Equipment Regulations to the paper and board industry*

Part 2: *Risk assessment in paper mills*

Part 3: *Manual handling in paper mills*

Part 4: *Prevention of heat stress in paper and board mills*

Part 5: *Control of contractors in paper mills*

Part 6: *Making paper safely. Managing safety in the papermaking process*

Paper and Board

Industry

Advisory

Committee

.....

**Part 1: Application of
the Provision and Use
of Work Equipment
Regulations to the
paper and board
industry**

Membership of Working Group

.....

Mr A Barber	The Paper Federation
Mr A Timms	The Paper Federation
Mr S Hawkins	GPMU
Mr D Pimblett	GMBATU
Mr B Sutton	HSE (Chairman)
Miss M Kingman	HSE (Secretary)

Paper and Board

Industry

Advisory

Committee

.....

**Part 1: Application of
the Provision and Use
of Work Equipment
Regulations to the
paper and board
industry**

.....

© Crown copyright 1996

First published 1996

Reprinted 1997, 1998, 2000, 2008

Formerly sold as a single item ISBN 0 7176 1287 2.

Now available only as part of the PABIAC binder

ISBN 978 0 7176 2942 8

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means (electronic, mechanical, photocopying, recording, or otherwise) without the prior written permission of the copyright owner.

Applications for reproduction should be made in writing to:
Information Policy Division, Her Majesty's Stationery Office,
The Office of Public Sector Information, St Clements House,
2-16 Colegate, Norwich NR3 1BQ Fax 01603 723000 or by
e-mail to hmsolicensing@opsi.x.gsi.gov.uk

This guidance is prepared, in consultation with HSE, by the Paper and Board Industry Advisory Committee which was appointed by the Health and Safety Commission as part of its formal structures. The guidance represents what is considered to be good practice by the members of the Committee. It has been agreed by the Commission. Following this guidance is not compulsory and you are free to take other action. But if you do follow this guidance you will normally be doing enough to comply with the law. Health and Safety Inspectors seek to secure compliance with the law and may refer to this guidance as illustrating good practice.

CONTENTS

Foreword	v
General introduction – Regulations 1, 2, 3 and 4	1
Risk assessment: Management Regulations – Regulation 3	2
Suitability of work equipment – Regulation 4	3
Maintenance and inspection – Regulations 5, 6 and 22	4
Information and instructions – Regulation 8	7
Training – Regulation 9	9
Conformity with committee requirements – Regulation 10	11
Dangerous parts of machinery – Regulation 11	13
Controls and control systems – Regulations 14-18	14
Isolation from sources of energy – Regulation 19	21



FOREWORD

In 1993, the Paper and Board Industry Advisory Committee recognised the need for guidance to the industry when the Provision and Use of Work Equipment Regulations 1992 were first introduced. (These Regulations have been replaced by PUWER 98.) It also saw the need to review, in the light of these Regulations, the standards and guidance contained in the Fourth Report of the Joint Standing Committee for Paper Mills *Safety in paper mills* (generally known as the Fourth Report) which was published in 1979.

The following guidance originally fulfilled the Working Group's terms of reference and has been revised to take account of changes introduced by PUWER 98. See Part 6 *Making paper safely* to obtain a comprehensive picture.

In this guidance:

- *must* denotes a legal obligation;
- *do* and *don't*, *should* and *should not* and other recommendations such as *use*, *fit*, and *prevent* represent good practice, which, if adopted, will usually be what is reasonably practicable in the given circumstances although there may be other legally acceptable ways of achieving the same objective.

.....



.....

GENERAL INTRODUCTION – REGULATIONS 1, 2, 3 AND 4

- 1 The purpose of this guidance is to illustrate the impact of the Provision and Use of Work Equipment Regulations 1998 (PUWER 98) on the paper and board industry.
- 2 Virtually all of the requirements in PUWER 98 already existed somewhere in the law or in good practice. The Regulations merely bring together and, in most cases, replace these requirements and clarify the general duties of employers, the self-employed and people in control of premises.
- 3 Employers with well-chosen and well-maintained equipment should need to do little more than before. However, the need for further action should be reviewed against the standards of good practice in this guidance.
- 4 Duties are placed on employers in relation to all *work equipment* provided for *use*, or used.

Definitions

- 5 'Use' means any activity involving work equipment and includes starting, stopping, programming, setting, transporting, repairing, modifying, maintaining, servicing, cleaning and the like.
- 6 'Work equipment' is broadly defined and covers a wide range of equipment, both power and manually operated. For example, it includes single machines such as a broke-cutting guillotine, machines which function together as a whole as in the papermaking process, a forklift truck, a portable drill and a ladder. It does not include structural parts of buildings (walls, stairs, roof etc), substances or private cars.

When did the Regulations take effect?

- 7 The Regulations as a whole came into force on 5 December 1998.
- 8 Existing work equipment which was first provided for use before 5 December 1998 is subject to PUWER 98 regulations 1-24 and 31-39 from 5 December 1998. Regulations 26-30 came into force from 5 December 2002 for existing mobile work equipment in use before 5 December 1998. The remainder of the Regulations applied to all mobile work equipment from 5 December 1998.
- 9 Second-hand equipment bought after 5 December 1998 becomes 'new' equipment and the buyer will need to ensure that it meets all of the Regulations.
- 10 PUWER 98 cannot be considered in isolation. The Management of Health and Safety at Work Regulations 1999 require a risk assessment to be carried out to determine what measures should be taken to comply with relevant legislation. This assessment should help with the selection of suitable work

.....

equipment under PUWER regulation 4 and in the determination of what is 'dangerous' under regulation 11.

RISK ASSESSMENT: MANAGEMENT REGULATIONS - REGULATION 3

11 Risk assessment is the systematic examination of the hazards created by an employer's operations, to decide the likelihood of these causing injury or ill health to people. This assessment takes into account existing control measures and should reach conclusions about their adequacy or otherwise, whether additional measures need to be taken and how they will be maintained effectively.

12 Many of the control measures currently existing in paper mills will have resulted from a more or less formal method of risk assessment. Safe systems of work which operate almost universally in paper mills will have stemmed from an identification of the hazards involved and the precautions needed to be taken to eliminate or reduce the risk. It follows that most mills will already have some competence in risk assessment procedures which could be developed by further training.

13 The assessment procedures require judgements to be made. Make sure you compare your operations against the benchmark standards for the industry, ie those contained in HSE and PABIAC publications, such as *Making paper safely*, Paper Federation guidance (now the Confederation of Paper Industries) and European standards, in particular BS EN 1034 *Safety of machinery. Safety requirements for the design and construction of paper making and finishing machines*. Where you can identify a gap between the standard and where you are, action should be taken to close that gap.

14 The fact that an incident has occurred in an assessed activity does not necessarily mean that the risk assessment was defective. Even if hindsight suggests that the conclusions in an assessment were incorrect it does not necessarily follow that the method by which the conclusion was reached was unsound.

15 The fundamental importance of risk assessment cannot be stressed too highly; the factors which produce accidents are in many cases either readily apparent or should have been found by a systematic examination of the activity. For example, a study of accidents in tissue conversion found that the basic causes were relatively minor deficiencies in guarding but, when coupled with the need for regular operator intervention, gave rise to risks which should have been detected and dealt with. The 'trick' is not to simply accept 'the way we've always done things' as the only safe approach and to challenge and review risk assessments on a regular basis.

.....

Useful reading

5 Steps to risk assessment INDG163(rev2) HSE Books (Single copy free or priced packs of 10 ISBN 978 0 7176 6189 3)

SUITABILITY OF WORK EQUIPMENT – REGULATION 4

16 This regulation is concerned with the selection of work equipment to ensure that it is suitable or adapted to be suitable for its purpose. Regard must be given to the initial integrity of the equipment, for example, is it sufficiently robust for the work it will be called upon to do, and to the working conditions in the place where it will be used.

17 Nearly all of the work equipment used in the papermaking process is purpose designed and manufactured and the question of its suitability should not arise.

18 Risk assessment should consider whether any additional risks will be introduced by the use of the work equipment. For example, will it increase the noise levels, or expose persons to risk during maintenance?

19 Any equipment manufactured ‘in house’, such as specialised items of lifting equipment, must be designed and tested by competent engineers.

20 If work equipment is modified as in the case of a re-build, reassessment must be carried out to ensure that it continues to be suitable for its intended purpose and that none of the changes made will adversely affect the health and safety of those using it. This is particularly important when modifications bring about increases in the running speed of a machine and when retro-fitting items into equipment for which it was not originally designed.

Unsuitable work equipment

- The use of lighting at 110v AC provided from a centre-tapped transformer inside a drying cylinder; in a fault condition there may not be sufficient protection for a person covered in sweat and in intimate contact with a large conducting surface. Extra low voltage, ie 24v or battery operated lighting should be used.
- The use of an overhead crane to lift rotating reels as a means of bringing them to rest; cranes are not designed and are therefore not suitable to lift dynamic loads. The fitting of brakes at the reel-up to bring the rotating reel to rest gets over this problem.
- The use of the forks of a fork-lift truck as a means of access when inspecting stacks of reels or bales. A mobile elevating work platform (MEWP) should be used instead.

- The use of a hand-held circular saw for 'slabbing off' broke. Such equipment is not designed or intended for this purpose. (A portable circular saw may well be suitable when used in a well-designed support frame.)
- The use of fork-lift trucks which are not sufficiently robust for the heavy workload they undertake and which can fail without being overloaded.
- The use of knives made from old doctor blades; knives with retractable (lockable) blades should be used.
- The re-build of a paper-making machine or a reeler-slitter to increase its speed without taking account of the effect of the increase of linear speed on the mechanical integrity; there have been instances of machine parts disintegrating where the speed of rotation has exceeded the critical speed of one or more components.

MAINTENANCE AND INSPECTION – REGULATIONS 5, 6 AND 22

Duty to carry out maintenance

21 Work equipment should be maintained to prevent failures, breakdowns or deterioration in performance to the extent that persons are put at risk.

22 The duties are not simply confined to safety features such as guards and interlocking systems, but extend to such things as bearings and filters which could cause safety problems if not kept in good order.

23 Faults in safety-related systems which do not obviously affect production can be missed unless they are regularly checked.

24 One of the purposes of risk assessment is to identify the criticality of failure; for example, a serious risk could result from an interlock failure on the front face guard of a reeler/slitter or on the gate giving access to a thickness gauge using radioactive sources. The risk assessment should also consider the susceptibility to damage or to excessive wear. This type of approach will assist in deciding the initial maintenance interval and the need for review in the light of experience.

25 A checklist of safety-related maintenance items is recommended. In particular, guard checklists completed at a suitable frequency by machine crew/supervisors are a very effective way to manage the maintenance of safeguards.

26 There is no requirement for equipment to have a maintenance log but if one is kept it must be up to date. This information can be kept manually or on computer.

.....

27 Many mills have found maintenance logs to be a useful aid to risk assessment. A disproportionate amount of maintenance on a machine may be indicative of unsuitability or misuse.

28 Maintenance records are also extremely useful indicators of recurrent health and safety problems and pinpoint those where efforts to eliminate the causes can reduce risk.

29 Condition monitoring using diagnostic equipment can greatly assist with the identification of maintenance needs but it can also bring engineers in close proximity to dangerous machinery. The questions following paragraph 30 must be addressed before this technique can be applied.

Examples of inadequate maintenance leading to risk

- The failure to maintain reel clamps of fork-lift trucks in accordance with the manufacturer's maintenance schedule has resulted in loaded clamps shearing off their fixings.
- The lack of lubrication of bearings has led to fires, disintegration and to reels being ejected from wind-ups.
- Serious burns have resulted from the failure to maintain the rotary carbon joints on the steam fittings to Yankee cylinders.
- Back injuries have been caused by pushing badly maintained trolleys which were provided to reduce manual handling!
- Nip bars on calenders which have been damaged during replacement of calender rolls and not subsequently repaired or adjusted, have exposed dangerous inrunning nips; the use of a simple gauge which ensures that the gap is no more than 8 mm is recommended.
- Sheehan rope systems which are not kept in effective working order cause feeding problems and the temptation to feed by hand.
- A positive, cam-operated interlock switch can fail-to-danger if the cam is not maintained in correct adjustment with the switch. Such failures have occurred where repeated vibration has resulted in the cam becoming loose or where it has been damaged by impact.

Inspection

- The Regulations require inspection of work equipment where there is a risk of major injury resulting from incorrect installation or re-installation, deterioration, major modification/repair, change in use or serious damage which could affect safe operation.
- The purpose is to detect and remedy faults before they result in unacceptable risk, and can range from simple visual inspecting to detailed internal inspection requiring dismantling and/or testing.
- People determining the nature of the inspections and those who carry them out should be competent.
- The frequency of inspection should be based on how quickly the work equipment is likely to deteriorate and give rise to a significant risk. Intervals between inspection should be reviewed in the light of experience.
- Records of the inspection should be kept.

An obvious example of detailed inspections under these Regulations include those required on paper-cutting guillotines. However, mills may wish to take the opportunities offered by 'mini-shuts' to carry out less detailed inspections on safety devices fitted to paper-making machinery in general.

Design for safe maintenance

30 Where maintenance involves any risk to health or safety, work equipment should be constructed or adapted to allow it to be carried out, so far as is reasonably practicable, with the equipment shut down.

There are three questions to be answered when deciding on a strategy for carrying out machinery maintenance safely:

- Is it reasonably practicable for this job to be done with the machine isolated?
- If the machine must be running, can it be maintained without exposing workers to risk. What adaptations need to be made to allow this? For example can adjustment or lubrication points be moved outside of the guarded area?
- If neither of the above is reasonably practicable, what measures are appropriate to protect maintenance workers from risk?

.....

31 Many maintenance jobs in paper mills have to be done with the machinery in motion and so reliance is placed on risk-reduction techniques and other safeguards to protect workers.

32 The use of normal and high-speed video cameras can permit the identification of maintenance problems without exposing persons to risk.

33 When straightening felts, risk reduction is achieved by running the machine at crawl speed (ie, no more than 15 m/min), by training the workers in a safe system of work, and by ensuring the safe system is in fact used.

34 Where maintenance has to be carried out at moving machinery from which the guarding has necessarily been removed, for example, when carrying out dynamic balancing of a flywheel, or where conducting tests using thermographic or stroboscopic devices, appropriate measures must be taken to protect workers from the risk involved. These would include such measures as running at crawl speed under hold-to-run control, temporary guarding, safe systems of work and the provision of training and supervision.

35 The majority of accidents during mill shuts could be prevented by pre-planning. Much thought goes into what has to be done in the time available, but often insufficient thought is given to such matters as safe access and lifting arrangements or how the work of different contractors can impinge on each other's safety. For example, several accidents have occurred where scaffolds erected to give safe access have been partially dismantled by other contractors to allow new plant to be lifted into position, or where no thought has been given to providing safe access in the first place.

36 The increasing use of contractors for both routine and planned maintenance has to be properly managed.

37 It is strongly recommended that contractors be required to be part of the industry safety passport scheme and to provide method statements and risk assessments for the work they are to carry out.

38 It is also considered essential that contractors are given good induction training in the mill's safe working procedures and their activities are subsequently monitored to ensure compliance.

INFORMATION AND INSTRUCTIONS – REGULATION 8

39 The requirements on the provision of information and instructions specifically relate to health and safety rather than to the use of work equipment more generally.

.....

40 Written instructions for managers, supervisors and users of work equipment will be appropriate on the safe use of nearly all main items of machinery used in the paper-making and finishing processes. These must be kept available, preferably on the mill floor to be of any real value. (The instructions could be incorporated into manuals for the achievement of production quality standards, eg ISO 9000 manuals.) They may also be held on computer.

41 The technical content of the information and instructions should be geared to the level of understanding and competence of those concerned.

42 The level of detail in the information and instructions will depend on such factors as the degree of skill required, the complexity of the job or the extent to which the protection of health and safety relies on specific steps being taken.

43 Special arrangements will need to be made for those with language or reading difficulties or for those with disabilities.

44 The requirements for information and instructions can be satisfied in a number of ways; sufficient information may be provided by the manufacturer, or it may be contained in written systems of work or training manuals.

45 Information and instructions should be regularly reviewed and revised, especially when equipment is modified or where the conditions of use of an existing machine may be affected by the adjacent installation of new machinery.

46 The adequacy of the information and written instructions can be decided by applying the following tests.

How to test the adequacy of your information and instructions on the use of work equipment

Do the information and written instructions currently available in any form within the company on the use of work equipment include the following?

- The conditions in which the equipment may be used including how and under what circumstances it may be started and stopped, how it is cleaned and maintained, how it is freed of blockages, how it is set or programmed and the systems of work to be employed.
- The nature and degree of the hazards arising from the work equipment, such as the noise levels, parts which are hot etc.
- A description of the safety measures and how to use them.
- The residual risks and how to protect against them.

- How to recognise dangers and what to do in the event of foreseeable abnormal conditions or malfunctions of the work equipment.
- Any revisions or amendments which experience of using the equipment has shown to be necessary or which have been made necessary by changes or rebuilding of equipment.

TRAINING – REGULATION 9

47 People’s action (or lack of action) often plays a significant part in starting or contributing to the sequence of events which ends in an accident or injury.

48 The training and re-training of all employees, including managers and supervisors will go a long way to reducing accidents by removing some human errors from the chain. The industry has committed itself to training all employees to S/NVQ level 2 in health and safety or its equivalent.

49 The duty to provide adequate training extends to all persons using an employer’s work equipment on their premises, and will, for example, include contractors who use a mill’s lifting equipment.

50 Training in the use of work equipment must include the following:

- methods or systems of work to be employed;
- any risks involved;
- the precautions to be adopted.

How to ensure that the training given is adequate

- Every company should have a training plan to support its health and safety policy.
- To be effective, the plan should include a system for identifying training (and re-training) needs of both individuals and groups of workers. This system should be part of the mill’s risk assessment procedures.
- The persons responsible for giving the training should be competent to do so and should have a complete understanding of the trainee’s job.
- The training should cover all levels from mill senior management to new entrants.

- A list of key 'competences' for each job makes it easier to evaluate an individual's training needs. Job descriptions also help to determine the level of training needed to do it.
- The training programme for each specific job should cover the risks involved, the systems or methods of working to avoid those risks, and the precautions to be taken, such as the wearing, correct use and storage of protective clothing, or special safety equipment.
- Training records help employers to assess the adequacy of an individual's training.
- It should not be assumed that adequate training has been given in an individual's previous employment; it should be assessed.
- Job training for electrical, engineering and maintenance staff working in mills requires special attention because of the varied nature and location of their work and the wide range of hazards which they encounter. A high standard of training is required with particular attention being given to safe working practices in hazardous environments. Training is especially necessary in the erection and use of access equipment.
- The functions and duties of multi-skilled employees should be clearly defined. They should be trained to levels of competence commensurate with these functions and duties and should not be required or allowed to work beyond them.

An engineering skills check-list illustrates a means of quickly checking the training record and competencies of individuals

	Employee 'A'	Employee 'B'	Employee 'C'	Employee 'D'	Employee 'E'	Employee 'F'	Employee 'G'	Employee 'H'	Employee 'I'	Employee 'J'	Employee 'K'
SAFETY											
Manual handling											
COSHH											
Permits to work											
ENGINEERING											
Lifting and slinging											
Fork lift truck											
Vee belt changing											
Taper locks											
Chng mtrs & simple unit sprs											
Identification of treads											
Alignment techniques											
Jacking techniques											
Tightening glands											
Lubrication - knowledge											
Lubrication - know how											
Roll installation											
Drilling a hole											
Use of measuring devices											
Gasket - cutting and fitting											
Simple flange joints											
Simple screwed fittings											
Cleaning filters											
Creation of simple scaffold											
Fault finding - concept											
Use hand tools full range											
Job planning											
Use of inspection sheets											
PM3 slice lip											
PM1 sheehan rope											

Completed training
 Started training

.....

CONFORMITY WITH COMMITTEE REQUIREMENTS – REGULATION 10

51 There is a new duty on employers to check that any work equipment they provide for use complies with any legislation which implements relevant EC Directives in Great Britain.

Machinery Directive

52 The Machinery Directive, which is one of the most important Product Directives, has been implemented by the Supply of Machinery (Safety) Regulations 1992 (SM Regs). These came into full effect on 1 January 1995 and apply to a wide range of machinery ordered and supplied after this date. (The SM Regs were amended in 1994 and some requirements did not come into full effect until 1 January 1997.)

53 The Regulations place duties on the manufacturer and supplier, not on the user.

54 Manufacturers or suppliers have to ensure that the machinery they supply meets with the ‘Essential Health and Safety Requirements’ (EHSRs) of the Machinery Directive. They must either issue the machine with a Declaration of Conformity and affix a ‘CE’ mark or, in the case of machines which are intended to be integrated with other machines and are not capable of working on their own, a Declaration of Incorporation.

55 A ‘CE’ mark and a Declaration of Conformity should not be relied upon as an absolute guarantee of safety. Any obvious deficiencies should be identified by examining the machine and assessing any risks before it is put into use. If a machine fails to meet the EHSRs the employer will be required to bring the work equipment up to the standard of regulations 11-24.

56 As an aid to the employer’s risk assessment, the manufacturer or supplier could be asked to provide any documentation validating conformity with the relevant EHSRs of the Machinery Directive and any European harmonised standards which have been used in the design. This may be particularly important with respect to safety-related control systems using programmable electronic systems, where factors relating to risk are not readily apparent. (While many manufacturers do not object to the release of this type of information from their Technical Files, the user has no legal entitlement to it.)

57 When paper and board making machines are rebuilt, it is strongly recommended that mills seek, where possible, to incorporate the EHSRs; BS EN 1034 will give specific guidance on the standards which meet the EHSRs.

Duties on employers when providing new work equipment

- Specify that the work equipment should comply with current health and safety legislation including legislation implementing any relevant EC Directive.
- Where a stand-alone machine, such as a sheet cutter, is being supplied check that it has a 'CE' mark and has a Declaration of Conformity. This is the manufacturer's affirmation that the machinery complies with all the essential health and safety requirements applying to it.
- If a machine, not capable of functioning independently, such as a size press, is to be assembled with other new or existing machinery, the manufacturer should provide a Declaration of Incorporation. This affirms that it satisfies the relevant essential health and safety requirements of the Machinery Directive but the machine will not be 'CE' marked.
- If it is assembled with other new equipment then the whole assembly will need to be 'CE' marked with all that this entails. The person carrying out the assembly is treated as the manufacturer for the purposes of the SM Regs. Thus where the user puts together new machinery, perhaps from different manufacturers, to form an integral whole, then they take on the responsibilities under the SM Regs.

If machinery is to be incorporated with existing non-'CE' marked machinery, then regulations 11-24 of PUWER 98 apply as appropriate.

- If you import machinery directly from outside the Community then the SM Regs regard you as supplying the machine to yourself and you therefore take on the full supplier's duties in the SM Regs.

Duties on employers when providing second-hand work equipment

- Second-hand machinery imported from **outside** the EC after 1 January 1995 is subject to the SM Regs 1992 and the advice for buying new work equipment should be followed.

If you are the importer of the machine for your own use, the duties in the SM Regs fall on you. In particular, you must ensure that the machine meets the essential health and safety requirements of the Machinery Directive.

- Second-hand machinery which was originally in use **inside** the EC before 31 December 1994 (with the exception of machinery which the manufacturer opted to 'CE' mark) is exempt from the SM Regs.

-
- The user has the responsibility to ensure that it meets regulations 11-24 of PUWER 98 immediately.

Before any work equipment, whether new or second hand, is brought into use, a risk assessment should be carried out.

DANGEROUS PARTS OF MACHINERY* – REGULATION 11

58 There are no additional requirements on the guarding of machinery; industry guarding standards which currently comply with the law will continue to meet these Regulations. These standards are laid out in more detail in *Making paper safely*.

59 The Regulations do, however, specify a hierarchy of safeguarding measures which should be used to prevent danger or injury from contact with dangerous parts of machinery.

60 Safeguarding measures need to be carefully designed and provide the required protection without creating unnecessary difficulties for maintenance and production. See BS EN ISO 14121-1:2007 *Safety of machinery. Risk assessment. Principles* and BS EN 1088:1995 + A1:2007 *Safety of machinery. Interlocking devices associated with guards. Principles for design and selection*.

61 The ease of maintenance should be a major consideration in the selection of safeguarding measures. If a safety measure cannot easily be maintained in correct working order, this can encourage its circumvention or defeat to allow continued use of the machine.

62 The incentive to defeat or bypass a safety measure increases if the measure slows down production, does not allow the operator to use the machine in a customary way, or is difficult to use.

63 The design of the guard or protection device must allow parts to be replaced or maintenance work to be carried out, if possible, without the need for them to be dismantled.

* Regulation 11 only applies to machinery and rotating stock – it does not apply to other work equipment.

-
- 64** The use of programmable electronic systems can sometimes introduce the additional possibility of defeat if access to safety-related software is not properly designed and monitored. For example, the entry of a simple code or the use of an override key can result in all signals from interlocking systems being ignored.
 - 65** While it is recognised that override systems are sometimes necessary for fault-finding and setting purposes, it is usually possible to introduce other safeguards, such as speed limitation and the zoning of guards such that access is only permitted to areas which can be observed from the operating position.
 - 66** Access to any guard override system should be controlled by a written safe system of work and be strictly supervised.

CONTROLS AND CONTROL SYSTEMS – REGULATIONS 14-18

67 Significant new specific duties are placed on employers requiring them to address the safety of controls and control systems. While a number of the practical principles are well understood and applied in paper mills, there are certain aspects of computer and other complex control systems which will require detailed attention by management.

68 The safety-related controls and control systems on paper and board making machines are broadly the controls for the following functions: stop, start, emergency stop, prevention of ‘machine runaway’; prevention of unexpected start up, speed selection (including crawl mode), hold-to-run devices, alarms for the initiation of motion, protective trip devices and interlocking and monitoring systems on guards and on chuck and core holder systems.

Start controls **69** Start controls and controls which change speed, pressure or operating conditions, must be operated by deliberate action. It is important that changes which introduce higher risk cannot be brought about inadvertently, for example by being knocked, or in the case of a foot pedal by being turned over.

70 Where a start signal can be given from a keyboard, the software programme should ask for the start command to be confirmed by a second keyed input and the effect displayed on screen.

Stop controls **71** Stop controls must be readily accessible and should take priority over start and process controls.

72 If, in a stop condition, a risk could result from internally stored energy, such as in hydraulic or pneumatic systems, the stored energy should be effectively isolated or dissipated.

.....

73 In a stop condition, the power to high frequency and infra-red dryers etc should be removed to reduce the risk of fire.

**Emergency stop
controls**

74 Emergency stop actuators should be coloured red, and as far as practicable, on a yellow background.

75 Actuators do not have to be mushroom-type push buttons; they can include wires, ropes, bars and handles.

76 If wires or ropes are used, visibility can be improved by attaching flags. A break in an emergency stop wire or rope should give an emergency stop command automatically. For more information on selecting wires and ropes as emergency stop actuators, see BS EN ISO 13850:2006 *Safety of machinery. Emergency stop. Principles for design*.

77 The emergency stop must take priority over all other functions and operations in all modes.

78 The response of a machine to an emergency stop command should not give rise to additional hazards. It is important, therefore, to choose the optimal deceleration rate.

79 Safety devices and devices with safety-related functions should continue to be effective, for example the shutters over the source in a radioactive thickness gauge.

80 In a process line the emergency stop should not only stop a particular machine or machine section, but also equipment upstream and/or downstream if its continued operation can be dangerous.

81 On a large paper and board making machine, where it is not possible to see the complete machine from the operating position, it is permissible to have two separate emergency stop control systems, one on the wet end and one on the rest of the machine, if it is not possible, for operational reasons, to shut down the whole machine. The actuators should be arranged in pairs and marked with the section to which they apply.

82 Emergency stop devices should be reset manually and individually and should not, when reset, generate a restart command. Also, it should only be possible to reset the emergency stop device intentionally.

83 Emergency stop controls must be located at all areas of work around the paper machinery, especially at points where broke is removed, and on any upper work platforms, basements and at control panels. (As a general guide, there should be an emergency stop control within 15 m of any point on a machine.)

.....

84 Where practicable, the opening of roll nips in an emergency should be delayed until rotation has stopped to avoid the risk of being drawn in.

85 After power has been disconnected by the initiation of an emergency stop (or in the event of a power failure), it should only be possible to restore power to the machine controls by the unlatching of a safety reset circuit using a key-operated switch, preferably sited in the control room.

86 The emergency stop function should ideally function in one of two ways; the type used will depend upon risk assessment.

Emergency stop categories	
Category 0 Immediate removal of power to the machine actuators or mechanical disconnection (declutching) between the hazardous elements and their machine actuator(s) and, if necessary, braking	Uncontrolled stop
Category 1 Power to the machine actuator(s) available to achieve the stop and then removal of power when the stop is achieved. The disconnection of the motors should be by means of electromechanical contactors or circuit breakers	Controlled stop

87 The two categories of emergency stop in the table above represent current thinking on the standards with which emergency stop systems should conform. Whilst the provision of a Category 1 stop for paper and board making machinery may be regarded as best practice, many existing paper-making machines will have an emergency stop system which brings the machine to a controlled stop, but with the power to the machine actuators remaining available.

88 If there is an opportunity to upgrade the emergency stop system on a paper or board making machine, the logic behind the Category 1 stop is that the machine's control systems may have brought about the abnormal condition necessitating an emergency stop and only by removing power can the risk of unexpected start up be eliminated.

89 On machines with a programmable electronic system (PES), the controlled emergency stop may rely on the correct operation of the PES. The emergency stop should, however, operate independently of the PES; if regenerative braking current is not detected within 1 second of the emergency stop being initiated, the drive motor should be disconnected from the regulated supply and either dynamic braking applied by means of a gravity operated contactor or the drive may coast to rest assisted where practicable by mechanical braking.

.....

90 Zero speed detectors or similar protective means should be provided to prevent a drive motoring in reverse following an emergency stop (or at any time during normal operation). Where drives are required to reverse during normal operation the reversal detection system must prevent reversal after an emergency stop from either direction.

Machine runaway protection

91 ‘Machine runaway’ (ie the uncovenanted acceleration from stop, stalled tension or controlled speed) is an inherent danger in electronically controlled closed loop systems resulting from failures within the control system.

92 This can be extremely dangerous if it occurs during an operator intervention; there has been at least one incident of ‘runaway’ while a papermaking machine was in crawl speed mode during the threading of paper.

93 Serious consequences can also arise if the acceleration threatens the mechanical integrity of the machine. This is a particular risk in variable geometry machinery, eg centre-driven rewinders and reel-up and reel-off unwinders, reeler/slitter machines and the rotating knife blocks of sheet cutters.

94 Under ‘runaway’ conditions the normal method of stopping DC motors cannot be relied upon. In addition, electro-mechanical braking used on both DC and AC motors may not be effective in stopping ‘runaway’ machines particularly where high inertia drives, such as for rewinding or unwinding reels, are used.

95 In several cases of machine ‘runaway’ in the past, the normal emergency stop controls proved ineffective. The machines in question were brought to rest by cutting off electrical power at the mains isolators situated some distance away.

96 There are various means of detecting overspeed, the most common being an overspeed switch, but whichever means is used it should be physically independent of the drive control system.

97 The machine runaway protection should, where practicable, be self-monitoring or capable of regular testing (see BS EN 1034).

98 On machines which do not have an automatic Category 1 emergency stop which operates on the detection of the fault conditions above, a manually operated emergency isolator should be provided at the control panel and at other places on the machine from where the control panel cannot be reached quickly. These should be distinct and should be shrouded or sited in a break glass box to prevent inadvertent use.

Faults which can give rise to machine ‘runaway’

- Loss of mechanical transmission to tacho generator or pulse generator.

- Loss of tacho generator signal.
- Reversal of tacho generator signal.
- Loss of motor field excitation.
- A reduction of programmable logic controller or electronic regulator power supplies voltage greater than 20%.
- Electronic component failure leading to uncontrolled acceleration or spontaneous start up or reversal during controlled stalled conditions.
- Loss of current or web tension feed back signal, such that a section of the machine is speeded up to try to restore web tension.
- Overvoltage, eg in particular at reel stands.
- Programming changes which when combined with control faults can cause failures, for example, in the tension control system.

99 All controls should be clearly visible and identifiable and should not be sited where an operator could be exposed to risk.

100 On paper-making and finishing machines operators can be out of sight from control positions and so a warning signal must be issued prior to the start-up of each machine section. This can either be audible and/or visual.

101 The time interval between the warning being given and the machine starting has to be sufficient for people to get clear of the machine or the machine section.

102 As a guide, on paper-making machines the warning signal should last for 5 s and the machine/section should not be capable of starting for a further 15 s. Readiness for start-up should be limited to 30 seconds. On paper-finishing machines, the warning should last for 3 s and start-up blocked for a further 5 s. Readiness for start-up of the machine should be limited to 30 s maximum.

Control systems

103 A control system is not regarded as safe if it does not ensure, so far as is reasonably practicable, that a fault or damage to the system, or the loss of any energy source can result in increased or additional risks.

104 Essentially, the performance of safety-related parts of control systems should be assessed with respect to the occurrence of faults. The greater the risk, the more resistant the control system should be to the effects of failure.

.....

105 Safety-related control systems which rely on the correct operation of a programmable electronic system present particular problems because of their susceptibility to faults. Such faults can be caused, for example, by loss (and subsequent restoration) of voltage supplies, failure of insulation (earth faults), open and short circuit, and the sticking of relays or contactors in either the actuated or deactuated position.

106 Faults in software programmes have also been responsible for a number of 'near miss' incidents where machines have behaved in an unexpected manner. Often, the nature of these faults is that they materialise only when the appropriate conditions in a control/machine environment occur, due for example to electromagnetic disturbance or a drop in voltage, and can be very difficult to locate (see BS EN 60204-1:2006).

107 An uncovenanted movement of a hydraulic ram occurred three times on a PES-controlled machine at roughly yearly intervals. Although radio interference was thought to be the most likely source of the problem this could not be established with any degree of confidence. The only solution was to provide a secondary high integrity hard wired channel for the control system.

108 However, the cause of most incidents involving the aberrant behaviour of a PES-controlled machine is not normally due to some subtle failure mode of the PES. It is more likely to be traced to an inadequate specification for the design of the control and safety system. The example which follows shows the problems which can be created by a system design which did not take account of how it would be operated in practice.

109 Another significant cause of accidents at PES-controlled machinery is the uncontrolled modification of software. A 'machine runaway' occurred some years after a software change which when later coupled with a fault on the tension control system allowed an excessive speed to be set.

110 It is important that the operation of PES-controlled systems is correctly managed. Employers should ensure that programmable systems are only worked on by competent persons who are fully conversant with the system. Changes to application or embedded software, whether carried out in-house or by outside contractors, must be controlled and properly recorded.

111 As a guiding principle, a computerised system should be at least as safe as a comparable conventional one. If two channels of interlocking are required on a conventional machine then there should be two channels of programmable system on the interlocking of a PES-controlled machine, meeting an equivalent level of performance.

112 Where control systems play a part in the safeguarding arrangements on a machine, it is important that their function is identified and assessed to ensure that they are of sufficient reliability for the risk they are intended to

.....

prevent. The 'hardware' of the safety system, such as the interlocking switches, may be of a high standard, but a weakness in the control system could seriously reduce the protection they give.

113 If the risk assessment indicates that the reliability of the control system needs to be increased then modifications should be carried out and the system reassessed.

Example of how inadequate specification and design of control systems can affect the safety of operation

On a type of reel handling/wrapping system, the motive power could not be isolated separately from the control systems. The realignment of photo-electric beams/receivers and other sensors could only be carried out with the control systems live, so the machine could not be effectively isolated. Also, if the machine was isolated mid-cycle, such as when clearing jams, the cycle had to be completed in manual mode to allow automatic mode to be re-set at the beginning of the next cycle. Thus, not only was there a positive disincentive to isolate the machine; the design of the control system prevented routine maintenance from being carried out safely.

As a consequence, there were a number of 'near miss' accidents when operators inadvertently tripped sensors which initiated machine movement.

The system had simply not been designed to take account of the way the machine would be operated and maintained. A systematic approach to the specification would have discovered and remedied the defects.

The solution was to re-design the control system so that it was possible to reset the sensors etc without the possibility of power being put on to the outputs from the PES.

.....

Further information

The performance categories for control systems are given in BS EN 954-1: 1997, BS EN ISO 13849-1: 2006 and BS EN IEC 62061: 2005.

BS EN 1034 sets out the appropriate categories for various safety-related control systems on paper making and finishing machines

ISOLATION FROM SOURCES OF ENERGY – REGULATION 19

114 Work equipment must, where appropriate, be provided with a suitable means of isolating it from all its sources of energy.

115 Cutting off the supply and isolation are not the same. Isolation means both disconnection and securing the break in the energy supply in a way which prevents it being reconnected by mistake or accident.

116 All isolations should be carried out with the knowledge and authority of a responsible person or class of persons who have been given the specific responsibility by management to ensure that the company's rules on isolation are carried out.

117 Isolators should be readily accessible and clearly labelled as to their function.

Electrical isolation

118 Isolating switches should be locked in the OFF position using a lock preferably with a **unique** key.

119 If locking off is not possible then isolation may be achieved by the following methods:

- removing a fuse or link in a non-earthed conductor; the fuse cabinet should be locked, a notice affixed and the fuse or link kept in the charge of the responsible person.
- the removal of the drive belt; the belt should be positively secured to prevent it being replaced on the pulley, for example, by means of a chain and padlock.
- the locking out of a clutch using a multiple-locking system.

.....

The following are **not** acceptable means of effecting isolation:

- the use of individual danger notices, eg 'Do not start' notices;
- the posting of a person to prevent the start up of any part of a machine; or
- reliance on the application of a padlock by someone else;
- reliance on the locking-in of an emergency stop button.

120 Some older machines have non-resetting starter buttons such that when power is reconnected they can start up unexpectedly. It is recommended that these starter buttons be replaced with ones of the resetting type.

121 Mills can decide on their own system for locking off; some mills issue padlocks on an individual basis, each marked with their name or clock number; others have colour coded padlocks for each department.

122 Whichever system is used it should be backed up with proper procedures. There should be a discipline for handover at the end of shifts and rules for removing locks which are inadvertently left in place by people who cannot readily return to site.

123 If a number of persons or trades are working on a piece of equipment, a multiple locking hasp can be used. This should either be attached directly to the isolator or to a box in which the key used to lock off the isolator is locked.

124 The key(s) should be kept in a key safe or in a place to which only the responsible person has access.

125 The 'Lock/tag/try/test' system of isolation is a good discipline which has served mills well for many years.

126 If contractors are involved in the work, make sure that their locking off arrangements are adequate and are compatible with your own. Some mills insist on contractors following the mill's locking off procedures using padlocks and hasps provided. Experience has shown that this system is easier to administer and to monitor.

Work should never proceed without proving that the equipment is dead

127 Where operators are expected to carry out isolations, the means of isolation should be sufficiently close to the machine or plant so that operators

.....

are not discouraged from using it. If operators perceive that the inconvenience of carrying out an isolation is out of proportion to the length of the job they may be tempted to take a risk.

128 Where secondary sources of power or other dangers exist, these must also be isolated. For example, at a pulper, not only should the rotor be isolated but also any pony drive, feed conveyor, the infeed of stock, steam and chemicals.

129 It is not normally acceptable to rely on isolators which only remove power to the control circuits and do not isolate the motive power.

130 Persons have been injured gaining access to PES-controlled machines held on a 'process stop' which interrupts the programme but does not put the machine into a safe state for access. The machine has then restarted due to the inadvertent operation of a sensor or a start signal from another location, or a fault in the control system.

Where in the course of a shut-down it is decided to run part or the whole of a machine, eg for test purposes, the following minimum precautions should be observed:

- All persons in or around the machine should be withdrawn. Only those whom the responsible person considers are safe to continue working can remain. In some circumstances, it may be advisable to post 'sentries' to prevent unauthorised entry.
- All tools and other gear should be withdrawn to a safe place and the responsible person should make sure that the machine is fit to run.
- The motive power should then be made available and an audible warning sounded when the machine is about to be run.
- Before any re-entry to the machine, the responsible person should ensure that effective isolation has again been achieved.

Steam isolation **131** Reliance on a single valve for steam isolation is not considered sufficiently reliable. The best standard to be achieved is isolation by means of two valves with venting in between.

132 If a second valve is not available, then a blanking plate or spade should be inserted at a flanged joint in the pipework.

133 The valves used for isolation should be capable of being locked in the required position.

.....

**Pneumatic and
hydraulic isolation**

134 Pneumatically operated valves should be closed and then the air supply disconnected.

135 Isolation should be manual wherever possible; the use of pneumatics or hydraulics to close valves should be avoided.

136 Valves should be locked in the closed position, for example, by using a chain a padlock on the handwheel.

137 Raised components should be mechanically scotched or blocked.

138 It is recognised that there will be circumstances when the locking off procedure cannot be strictly applied. These circumstances should be identified by management and the extent of the departure clearly detailed. Management should also set out the additional precautions to be observed to safeguard personnel from risk on the reconnection of power.

139 In situations which were unforeseen, the responsible person should also be made aware of the extent of their discretion to depart from the locking-off procedure. The decision to proceed in breach of the lock-off procedure should be justified and recorded.

Permits to work

140 Permits to work are not the same as isolation procedures. They are detailed procedures that supplement isolation procedures and provide written records of what has been done to isolate the equipment and monitor how long it is isolated. Not all isolations will require a permit to work, but those of a complex nature, possibly involving more than one trade, and certainly those likely to last more than one shift, for example, should be covered by permit-to-work procedures.

141 Every item of equipment should have an 'owner' who issues and controls the permit. This person or rank of person should be designated as competent to issue a permit and be familiar with the equipment and its sources of energy or other dangers.

142 The information given in the permit should be precise, detailed and accurate. It should state which equipment has been made safe, the means by which this has been achieved and what work is to be done.

143 No-one should do any work that is not specified in the permit. If a variation is needed then the permit should be cancelled and a new one issued.

144 A permit should list the precautions needed for maintaining safety while work is going on.

145 In most cases a locking-off procedure will be necessary before a permit can be issued.

.....

146 A permit should only be cancelled by the person who issued it or by a person nominated by management to take over the responsibility, eg at the end of a shift or during absence.

147 The suspension of permits is not recommended; if work ceases for any period of time then the permit should be cancelled and a new one issued when work recommences.

148 A system which has been adopted in some mills is to label all equipment with the number of the appropriate permit which needs to be issued to work on it.

149 Other mills have identified the need for a permit to be issued on their computerised maintenance system so that when a job card is issued for a maintenance item it already refers to the safe working procedures to be adopted.

Accidents caused by failure to isolate machinery

- A mill employee was adjusting the abrasive wheel which sharpens the blade on a tissue cutting log saw. The machine had been isolated electrically but not pneumatically. A pneumatic ram operated trapping his hand.
- A maintenance fitter was attempting to clear a blockage in a centrifugal separator/cleaner using a high-pressure water hose. The cleaner had been isolated electrically only. Whilst he was directing the hose into the outlet of the cleaner a timer-controlled pneumatic valve closed. He suffered amputation injuries.
- A maintenance engineer was repairing a clutch on a conveyor with the machine power off. Whilst he was turning the vee belts by hand the conveyor was unexpectedly turned on.
- An operator was rethreading a ragger rope to a hydropulper. Whilst he was securing the rope to the capstan, a timer control switched in and rotated the capstan.
- An operator was fatally injured when the rotor of a waste trim pulper was started up when he was inside.

.....

Paper and Board

Industry

Advisory

Committee

.....

Part 2: Risk assessment in paper mills

Members of the Paper and Board Industry Advisory Committee

.....

Mr C Britchford	Arjo Wiggins Fine Papers Ltd
Mr G Beattie	Graphical Paper & Media Union
Mr A J Cunningham	Amalgamated Engineering and Electrical Union
Mr D Gillett	Paper Federation of Great Britain
Mr B Hudspith	Graphical Paper & Media Union
Mr M Barras	Amalgamated Engineering and Electrical Union
Mr L S Reeves	GMB
Mr P McLaverty	J Bibby Paper Ltd
Mr M Eede	TGWU
Mr N C Henderson	James River Fine Papers Group
Mr C Ward	BPB Paper & Packaging Ltd
Mr A D Porter	HSE
Mrs A J Adams	HSE

Paper and Board

Industry

Advisory

Committee

.....

Risk assessment in paper mills

.....

© Crown copyright 1996

First published 1996

Reprinted 1997, 1998, 2000, 2004

Formerly sold as a single item ISBN 0 7176 1288 0.

Now available only as part of the PABIAC binder

ISBN 0 7176 2942 2

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means (electronic, mechanical, photocopying, recording, or otherwise) without the prior written permission of the copyright owner.

Applications for reproduction should be made in writing to:

Licensing Division, Her Majesty's Stationery Office,

St Clements House, 2-16 Colegate, Norwich NR3 1BQ

or by e-mail to hmsolicensing@cabinet-office.x.gsi.gov.uk

This guidance is prepared, in consultation with HSE, by the Paper and Board Industry Advisory Committee which was appointed by the Health and Safety Commission as part of its formal structures. The guidance represents what is considered to be good practice by the members of the Committee. It has been agreed by the Commission.

Following this guidance is not compulsory and you are free to take other action. But if you do follow this guidance you will normally be doing enough to comply with the law.

Health and Safety Inspectors seek to secure compliance with the law and may refer to this guidance as illustrating good practice.

CONTENTS

Contents

Introduction to risk assessment	1
Why is risk assessment so important?	1
What does the law require?	2
What does risk assessment mean?	5
 Risk assessment and successful health and safety management	 9
Risk assessment as a management tool	9
Setting the policy	10
Organising the staff	11
Planning and setting standards	13
Measuring your performance	14
Audit and review	14
 Risk assessment in practice	 14
Make effective arrangements	15
Decide how to carry out the risk assessment exercise	15
Five steps to risk assessment	16
 Appendix 1 Accidents statistics and causations	 29
 Appendix 2 Examples of risk assessment proformas	 32
 Appendix 3 Examples of safe systems of work	 34
 Appendix 4 Checklist for incident investigation and reports	 42
 Appendix 5 Some important pieces of health and safety legislation	 45
 Appendix 6 Some useful publications	 47

.....



INTRODUCTION TO RISK ASSESSMENT

Why is risk assessment so important?

*"Papermaker suffered lacerations and fractures in hand, burn to arm and bruising to shoulder and ribs when fitting new Sheehan rope to paper machine. The rope caught his finger as it went into the nip. **System of work now being reviewed because it was not necessary to guide the rope like this.**"*

*"Machine operator fell 4 metres from hot air ducting into the basement below a papermaking machine and fractured his skull. He had been clearing away broke after a paper break. **It was usual practice for operators to clear broke in this way.**"*

*"Operator was badly scalded when he was covered by steam from a hose being used to clean down the paper machine. **Protective aprons could have been used but were not.**"*

1 These are examples of accidents which have occurred in paper mills. The cost of human suffering as a result of these injuries is not difficult to imagine and it is a tragic fact that people still die from some of the very serious hazards which exist in paper mills.

2 What may be less obvious is the scale of the financial costs involved. In one of these cases HSE prosecuted the mill. The maximum fine for many offences in a Magistrates' Court is £20 000 and if a case goes to Crown Court the fines which can be imposed are unlimited and individuals can be imprisoned for up to two years.

3 However, these penalties are small compared to costs arising from employer's liability insurance, sick pay, product lost or damaged, business interruption, hiring and training of staff and investigation.

Research has shown that accidents have cost:

- one organisation as much as 37% of its annualised profits
- another the equivalent of 8.5% of tender price
- a third organisation 5% of its running costs

4 Risk assessment is important because it is central to many health and safety issues in paper mills and is an effective way of improving health and safety performance. In addition, many mills are beginning to realise that effective management of health and safety risks is indistinguishable from the sound management practices associated with quality and business excellence. Some mills have found that the introduction of some risk reduction control measures has been cost effective and even beneficial to the business.

.....

Outdated reel wrapping equipment in one mill had dangerous moving parts and the reels of wrapping were heavy and difficult to load. The mill purchased much safer new equipment which did not require any manual handling. The same operator was able to process twice as many reels as previously and these were wrapped to a higher quality standard. The mill estimated that the equipment would pay for itself in a two-year period.

5 Comparing accident statistics between mills shows a wide range of performance. Some mills are successful in maintaining high standards of health and safety and keeping accident rates low. Other mills have demonstrated a consistently poor performance over the years. Why the difference? These are some comments from people who know the industry:

"The Managing Director says the right things but nobody further down takes any notice of him - at the end of the day they know that all senior management is really concerned about is producing paper." - Mill supervisor

"I am worried about what is happening at our mill - operators are taking dangerous shortcuts and nobody seems to care." - comment made by Safety Representative to HSE inspector shortly before a fatal accident at that mill

"Some mills have spent a lot of time producing risk assessments but what they have got is a waste of paper because all they have done is use it as an exercise to justify their own existing (low) standards. They need to return to basic standards when carrying out risk assessment - some of them are not even complying with the Fourth Report." - HSE inspector

"Over recent years the business has become more competitive and we have lost experienced managers who have been replaced with younger managers with lots of technical qualifications. To my knowledge managers have never been given any training in health and safety but the problem now is that the older managers understood the risks but the young ones do not have the experience and do not understand the human element." - Mill Production Manager

"We don't always get things right but when we get things wrong we make sure that we only get it wrong the once. People are our most important asset - safety is always top of the agenda at production meetings." - Chief Executive at a mill which in recent years had been highly successful in reducing accidents

What does the law require?

6 The basis of British health and safety law is the Health and Safety at Work etc Act 1974. The Act sets out the general duties which employers have towards employees and members of the public, and which employees have to themselves and to each other. These duties are qualified in the Act by the

.....

principle of 'so far as is reasonably practicable'. In other words, the degree of risk in a particular job or workplace needs to be balanced against the time, trouble, cost and physical difficulty of taking measures to avoid or reduce the risk. However, in order to successfully argue that it is not reasonably practicable to do more it would need to be shown that there is a gross disproportion between the risk and sacrifice. In other words it would have to be shown that a particular risk is insignificant in relation to the sacrifice needed to reduce it.

7 What the law requires here is what good competent management and common sense would lead employers to do anyway: that is, to look at what the risks are and take sensible measures to tackle them.

8 The Management of Health and Safety at Work Regulations 1999 generally make more explicit what employers are required to do to manage health and safety under the Health and Safety at Work Act. Both the Act and the general duties in the Management Regulations are goal-setting and leave employers freedom to decide how to control risks which they identify.

The Management of Health and Safety at Work Regulations require employers to:

- carry out a risk assessment and record the significant findings (more than 5 people employed)
- make arrangements for implementing the health and safety measures identified as necessary by the risk assessment
- appoint competent people to help them to implement the arrangements
- set up emergency procedures
- provide clear information and training to employees
- work together with other employers sharing the same workplace.

What does competence mean?

It depends on what is required for the situation. It does not necessarily depend on the possession of particular skills or qualifications. For simple situations the following may be enough:

- an understanding of relevant current best practice;
- awareness of the limitations of one's own experience and knowledge; and
- the willingness and ability to supplement existing experience and knowledge.

.....

9 Risk assessment is required under some other regulations in addition to the Management Regulations. The risk assessment provisions in the other regulations are much more specific and generally require particular things for certain groups of people and/or if certain conditions are not met. For example, the requirements for an adequate noise assessment under the Noise at Work Regulations are quite specific.

10 The general requirement for risk assessment under the Management Regulations is very wide ranging and all-embracing. The purpose of the risk assessment is to help the employer to decide what measures need to be taken to comply with the duties under the 'relevant statutory provisions'. This means the general duties in the Health and Safety at Work etc Act 1974 and the more specific duties in the various acts and regulations associated with the Health and Safety at Work etc Act. Appendix 5 of this guidance gives a list of some of the most important statutory duties in paper mills.

Some other Regulations which require risk assessment:

- Control of Substances Hazardous to Health Regulations 2002
- Noise at Work Regulations 1989
- Manual Handling Operations Regulations 1992
- Health and Safety (Display Screen Equipment) Regulations 1992

Risk assessment in paper mills should:

- be suitable and sufficient for identifying the measures needed to comply with requirements and prohibitions imposed under the relevant statutory provisions
- identify any particular groups of persons being especially at risk
- be reviewed if it is suspected that it is no longer valid or there has been a significant change

The significant findings should be recorded.

Inform employees

11 Employers also have a legal duty to provide employees with understandable and relevant information on the risks to their health and safety identified by the assessment and the preventative and protective measures. Safety representatives need to be consulted on these matters.

.....

What does risk assessment mean?

12 Hazard means anything that can cause harm. Paper mills have a wide range of different hazards. Some hazards such as the impeller of pulpers and the substances fed into them can have fatal consequences. Other hazards such as trailing hose pipes and slippery floors may not seem so serious but injuries resulting from such hazards can be very debilitating and also very costly in terms of time lost.

Some common hazards in paper mills:

- moving parts of machinery such as inrunning nips at rolls on the papermaking machine
- falling from heights
- pressure systems
- manual handling eg pushing reels and handling broke
- noise
- vehicles, eg clamp trucks and flat bed lorries
- lifting operations, eg overhead travelling cranes
- high voltage electricity
- slipping and tripping hazards eg wet floors and loose hose pipes
- asbestos
- fire

13 Risk is the chance, great or small, that someone will be harmed by the hazard. The risk arises from the activities carried out where the hazard exists. The extent of the risk takes into account the number of people who may be exposed and the consequences for them.

A clamp truck can cause harm and as such is a hazard. Risk takes into account the number of people exposed and the likely consequences for them. The hazard is great in that accidents involving clamp trucks can lead to fatal consequences. However, if the clamp truck is operating in an area to which access is prohibited to others then the risk is limited to the clamp truck driver him/herself and the possibility of unauthorised people gaining access to the area. There is no risk to the secretary in the office if he/she never has to go into that particular area. But there may be some risk to children from the nearby housing estate if it is easy for them to get onto site. The risk would also be greater if the clamp truck was operating

.....

regularly in an area frequented by many people eg machine operators and there was no separation between vehicle and pedestrian routes.

14 Risk assessment is a careful examination of what, in the work activities, could cause harm to people, so that management can weigh up whether enough precautions have been taken or if more should be done to prevent harm. If the mill has been operating safely in the past then the assessment is not likely to identify a great deal of outstanding action. But even the most health and safety conscious mills have found this a good opportunity to look critically at their risk control systems to try and improve their health and safety performance in a systematic way.

15 When deciding whether to do more, assessors in mills will be faced with a range of possible additional precautions. Which ones should they choose? The principles of risk assessment form a hierarchy of control measures approach. For example, it is better to remove the risk completely than provide the operator with protective clothing. The decision on what needs to be done depends on what is reasonably practicable (see page 3) and sometimes a combination of control measures will be needed.

Principles of controlling risk:

- if possible remove the risk completely eg do not use or stock a dangerous substance
- try a lower risk option eg using carbon fibre reel bars instead of steel
- prevent access to the hazard eg provide secure fencing
- organise work to reduce exposure to the hazard eg put the paper machine control panels inside a sound haven
- control the residual risk by, for example, providing safe systems of work, issuing personal protective equipment and training individuals

Risk assessment of the use of the clamp truck among the machine operators would involve asking some of the following questions:

- *Does the clamp truck have to operate in the same area as people?*
- *If it does can vehicle and pedestrian routes be separated?*
- *Have speed restrictions been implemented?*

- *Is the ground level and in good condition?*
- *Is the clamp truck in good condition and fitted with operational warning lights and alarms?*
- *Is the truck properly maintained?*
- *Is the clamp truck driver trained, experienced and competent?*
- *Is the standard of driving monitored by supervision and management?*
- *Are people having access to the area alert to the operation of the clamp truck?*

16 A suitable and sufficient risk assessment involves identifying the significant risks arising out of work. This means focusing on those risks that are likely to arise because of the work activity. Trivial risks can usually be ignored and so can risks which arise from routine activities associated with life in general (eg tripping over a kerb) so long as the work activity does not make those risks worse.

A suitable and sufficient risk assessment:

- identifies the significant risks arising out of the work
- allows management to identify and prioritise the action which needs to be taken
- is appropriate for the nature of the work and remains valid for a reasonable time

17 For the assessment to be suitable and sufficient it will usually have to take into account not just the *workplace precautions* but also the *risk control support systems*. Workplace precautions provide protection at the point of risk, eg safety hardware such as machine guards and protective goggles as well as working practices involving the way things are done and control documents such as a permit-to-work form. Risk control systems set out the way workplace precautions are implemented and maintained; these may not be documented.

18 A mistake made by some mills has been to consider just the workplace precautions. For example, it is no good just providing warning lights and alarms on a clamp truck operating in a busy area if there is no supporting system of maintaining them, and drivers, supervision and operators do not report defects as they arise. For each workplace precaution there is usually at least one risk

.....

control system to ensure that the workplace precaution remains adequate to control the risk.

Examples of workplace precautions:

- machine guards
- pressure relief valves
- lockable isolators
- 110 volts ac portable tools for use at shuts
- hearing protection
- fire exit signs
- fixed access ways
- working platforms with guard rails

Examples of risk control systems:

- preventative maintenance arrangements
- permit to work system
- procedures for dealing with contractors including induction, supervision, monitoring and review of health and safety performance
- emergency evacuation procedures
- procedures for operator training
- workplace supervision
- project management

19 When workplace precautions are found lacking it is often because of a failure in or a complete lack of a risk control system and it is important that this is identified as part of the risk assessment.

One mill found that a guard was missing from the press rolls on the press section of the machine. The guard which was found nearby was damaged. The risk assessment concluded that the guard should be

.....

repaired and replaced. In the view of the factory inspector this assessment was not 'suitable and sufficient' because it had not taken into account why the guard had not been replaced, responsibilities of supervision and management for making sure guards were kept in place and preventative maintenance arrangements (which, it turned out, were completely lacking for machine guarding).

20 In the best mills, management arrangements, control systems and workplace precautions support each other. Management arrangements are covered in the next section.

21 Some hazards will need more involved assessment than others according to the degree of hazard and the complexity of control measures.

22 For example the risk assessment for activities carried out at a reeler slitter is likely to involve examining all the activities carried out at the machine and the control measures in line with the PABIAC booklet *Reeling and slitting machines in paper and board making industry* (see Appendix 6). It is not likely to be enough just to comment on the physical nature of the guards. If such an analysis for the reeler slitter has not been done then the risk assessment for activities carried out on the machine will be an involved exercise. However this is a good example of a significant hazard which is probably well controlled in most mills because most will already have made sure that they are following the guidance.

23 The assessment also needs to be appropriate to the work and so that it remains valid for a reasonable time. *The acid test of a suitable and sufficient assessment is that it allows management to identify and prioritise the action which needs to be taken.*

RISK ASSESSMENT AND SUCCESSFUL HEALTH AND SAFETY MANAGEMENT

24 Those mills which are the best at controlling their health and safety risks are those which have safety management systems. In order to be effective arrangements for risk assessment need to be integrated into the management system. This section looks at the technique of risk assessment as a management tool and goes on to look at how risk assessment fits into a health and safety management system.

Risk assessment as a management tool

25 The level and type of hazards and risks in paper mills has not changed and mills which have been operating safely in the past will already have the major hazards and risks controlled. However, even when risks are well controlled, systematic risk assessment is an opportunity to critically analyse the adequacy of health and safety standards in a mill. In particular, risk assessment can be

.....

seen as a management tool to:

- identify a hierarchy of hazards/risks to guide the level and frequency of review and monitoring of health and standards in the mill;
- identify the critical control measures and systems and likely consequences of failure of them and make sure that the monitoring arrangements are satisfactory;
- develop risk assessment as an attitude of mind in all staff so that they become aware of hazards and risks.

26 *Managers, supervisors and operators should not see risk assessment and risk management as a separate exercise from their everyday activities but integral to the running of the mill.*

27 Operators need to be aware of the risks in their jobs and the precautions needed to be sure that they can work safely. Similarly, management and supervision need to have a clear understanding of the risks involved in the work under their control so that they can make sure that the right precautions are being taken. They may sometimes need to ask themselves if the precautions are good enough. They also need to be alert to new hazards or risks as they occur so that a 'risk assessment' approach can be used to deal with them.

An operator was injured when he fell 15 feet through the roof of a pulper. The pulper roof was being dismantled to remove the rotor. He had not received any training or done this job before. The job needed doing annually and in order to be done safely had to be done in a certain way but no system of work or safe working instructions were available. This mill had a risk assessment programme which was being undertaken by various teams. When interviewed, the manager who had given the job to the operator had not considered it his duty to consider the risks involved and the safety controls needed - that was the work of the risk assessment team!

Setting the policy

28 The commitment to health and safety standards needs to come from the top of the organisation. Section 2(3) of the Health and Safety at Work etc Act 1974 requires a health and safety policy. Regulation 5 of the Management Regulations explicitly requires employers to have effective arrangements in place to cover health and safety. The arrangements that need to be identified are those for the effective planning, organisation, control, monitoring and review of the preventive and protective measures. This ties in with the general principle of risk assessment which is to identify the preventive and protective measures which need to be taken. These arrangements will need to be recorded and some mills have found it useful to include them in an updated version of the health and safety policy.

Organising the staff

29 The health and safety policy and arrangements referred to above should identify the individuals and especially managers within the mill who have responsibility for risk assessment and make them accountable. Health and safety issues need to be recognised as being a line management duty. Management and staff need to be organised to obtain their commitment.

The commitment of management can be obtained by:

- treating health and safety issues including risk assessment as a line management duty;
- making sure management are given the training and support they need to be able to undertake their health and safety responsibilities competently, eg do they understand the difference between hazard and risk;
- getting all levels of management to agree health and safety objectives;
- establishing management performance standards to judge and assess management performance;
- incorporating health and safety responsibilities into job descriptions;
- holding individuals accountable for performance by appraisals/reviews;
- monitoring the health and safety performance of management.

The commitment of all employees can be obtained by:

- consulting them and their representatives;
- involving them in planning and reviewing performance, writing procedures, carrying out risk assessment and solving problems;
- providing them with the information they need about hazards, risks and preventative measures;
- discussing health and safety issues regularly;
- giving them the training and support they need so that they are competent to do what is required of them;
- encouraging them free of sanctions to report short cuts and to be honest about actual working practice;

- ensuring that management set a good example in their behaviour, eg wearing hearing protection when going into a noise control area.

30 Nearly all mills find that they also need to provide professional health and safety advice via a safety adviser. The role of the safety adviser works best in mills when he/she is seen as a co-ordinating source of expertise and advice. Mills with a poor health and safety culture often see the safety adviser as responsible for health and safety instead of the management. At the same time the safety adviser is given little authority to put things right. For the same reasons safety advisers are best not to be made 'responsible' for risk assessment although they can serve a useful co-ordinating role.

31 One mill which has reorganised to give greater responsibility to production teams has set up a new safety organisation to reflect the new structure. The mill has monthly safety working committee meetings chaired by the department manager. Both trade union and employee representatives sit on the monthly committee meetings. In addition, three times a year the main mill operating council meeting is devoted entirely to safety matters with a longer-term strategic remit and with an overview role of the department safety committees.

32 Many mills set up teams to carry out the initial risk assessment exercise. Using teams can be very helpful in dealing with the large number of assessments which seemed to become necessary with the introduction of the Management Regulations. Teams also have the advantage of combining different skills and experiences. Some points about successful assessment teams are given below:

- Although the make up of mill teams varies, the most successful ones usually have representation from both operators and management.
- The make-up of the team will vary according to the skills required and these will depend on what the team is being asked to assess. Most mills have set up a number of teams to deal with particular discrete areas or topics. For example, one mill has set up department teams to deal with geographic areas, and a central mill team to deal with generic topics such as the use of clamp trucks. Other mills have set up assessment teams to list current departmental tasks and practices and consider the hazards arising from them.
- Members of the team need to understand the nature of the hazards/risks which they are assessing and be able to form competent judgements about risk controls in place or needed. Additional training is likely to be required for assessors to be able to identify hazards and have knowledge about objective standards for health and safety. They also need to understand the meaning of risk, hazard and risk assessment.

- A manager should head the team even if he/she is not personally involved in each assessment because it is essential that management monitor the assessment process.
- One mill found it useful to have trained stand-in team members available so that the exercise was not delayed because of the absence of one person.

33 A team approach does not mean line management no longer have responsibility for health and safety. *The most important factor which makes risk assessment teams effective seems to be that they operate within the framework of a safety management system as described in this section.*

Typical assessment team for a mill department:

- department manager
- department supervisor
- maintenance supervisor
- one or two operatives
- safety representative

*One mill had put a lot of effort into risk assessment but had made little progress mainly because the assessment team was working independently of middle/senior management. No member of the team had the authority to make decisions to implement significant improvements. Also they didn't always have the expertise to deal with some of the risks they found and did not know what standards were required and they had no means of referring the matter to someone who did. The main result of the team's efforts was a mountain of paperwork but little improvement in health and safety standards and no increased understanding of the health and safety risks in the mill. **This mill did not have a safety management system.***

Planning and setting standards

34 Planning for health and safety involves setting objectives, identifying hazards, assessing risks, implementing standards of performance and developing a positive culture. Some mills incorporate health and safety planning into the business plan, others have a separate health and safety plan. Resources need to be allocated. Risk assessment can and should feed into the business planning by identifying the priority and longer term actions needed to meet health and standards. It is only when risks have been analysed and assessed that decisions can be made about control measures.

.....

Measure your performance

35 Measuring performance is about finding out where you are, where you want to be, what the difference is and why. Active monitoring, before things go wrong, involves regular inspection and checking to ensure that your standards are being implemented and management controls are working. Reactive monitoring, after things go wrong, involves learning from your mistakes, whether they result in injuries and illness, property damage or near-misses. Information from active and reactive monitoring should be used to identify situations that create risks that have not been assessed or which have been inadequately assessed.

Audit and review

36 Monitoring provides the information to review activities and decide how to improve performance. Effective monitoring is required under the Management Regulations. Auditing is the structured process of collecting independent information of the efficiency, effectiveness and reliability of the total safety management system and drawing up plans for corrective action. Reviewing is used to describe activities involving judgements about performance, and decisions about improving performance. Reviewing is based on information from measuring and auditing activities. The results from measuring performance can be combined with information from audits to improve the mill's approach to health and safety management.

Risk assessment and successful health and safety management

- set your policy - is there a clear commitment from the top? Does the policy identify who is responsible, and the arrangements for identifying hazards, assessing risks and controlling them?
- organise your staff - are people accountable for health and safety within their control? Do people have enough information about the risks they run and the preventative measures?
- plan and set standards - Do you have a health and safety plan? Have you identified hazards and assessed risks to your own staff and the public, and set standards for premises, plant, substances, procedures, people and products? Have risks been prioritised?
- measure your performance - Are the correct standards being implemented and risks effectively controlled?
- audit and review - Do you learn from your mistakes and identify deterioration in workplace precautions and/or risk control systems?

RISK ASSESSMENT IN PRACTICE

37 With the introduction of the Management Regulations many mill managements saw risk assessment as a complicated exercise because of the

.....

.....

large number and wide range of hazards to be assessed. Because of this some mills were very slow to tackle risk assessment. Other mills who did tackle it found the results disappointing because they ended up with a mountain of paperwork but no conclusions about significant risk. This guidance does not recommend one standard approach to risk assessment because the experience of mills is that there are a number of different methods all of which can be successful.

38 To get started, mills need to make effective arrangements for carrying out risk assessment as part of the mill's management system.

Make effective arrangements

39 Do this by:

- *Identifying* individuals especially *managers* within the organisation who have responsibility for risk assessment, give them the means to do it and make them accountable;

- *Deciding* how the risk assessment is to be carried out, eg:

How are hazards to be identified?

Who is to carry out the exercise?

Is additional *training* needed?

- *Estimating timescales* to carry out the exercise and setting targets;

- Deciding how the *significant findings* are to be *recorded, prioritised, acted upon* and brought to the attention of senior management;

- Making arrangements for *monitoring and review* and *assessing new hazards* as they arise;

- *Consulting* the safety representatives and *involving* the work force to tap their knowledge and experience.

40 Some mills found it useful to start by taking stock of the situation. A great deal of risk assessment activity will have already been carried out without having been called such, eg the development of safe systems of work. The opportunity can be taken to review the adequacy of this work, but if it is decided that it is still valid then it does not need to be repeated. Each mill will have a lot of valuable experience and it makes sense to tap and share experiences between mills.

Decide how to carry out the risk assessment exercise

41 Deciding how the risk assessment is to be carried out is very important. Because the risk arising from a hazard is related to the activities which bring people into contact with the hazard it is important that all the following categories of activity are covered by the assessment:

- routine activities by area and/or generic topic. Clamp trucks is an example of a hazard which can be dealt with either by area or generically or both. For example the maintenance and training and authorisation of truck drivers would be the same procedure for the whole mill but the driving conditions and traffic route layout would be different for each department and that part of the assessment is likely to be different;
- infrequent but repeated tasks eg maintenance work such as pump changes and felt changes
- occasional or one-off tasks such as may occur with new projects;
- new hazards arising from the introduction of new plant and activities which will need to be assessed before start up.

Five steps to risk assessment

42 The process of risk assessment can be broken down into five steps:

- Step one - Identify the hazards
- Step two - Decide who might be harmed and how they might be harmed by identifying the risk activities
- Step three - Taking into account the existing control measures evaluate the risks and decide whether you need to do more
- Step four - Record the findings
- Step five - Review the assessment from time to time and revise it if necessary

Step one - identify the hazards

Look around the workplace

43 This first step is not as easy as it sounds for medium to large sized employers such as paper mills. For small companies with simple processes often all that is needed is to go out on to the shop floor and look for the hazards. Although this also needs to be done in paper mills it will not form the complete picture for hazard identification because not all hazards will be apparent at the time of the inspection. Some hazards can be easily identified by looking around the workplace, others may not be so easily spotted. For example, the poor condition of the paper machine stairway may be obvious as a slipping/tripping hazard but the high voltage electrical supply to the machine house may not be so obvious. Because of this, assessors need to develop a questioning technique about the hazardous activities which are likely to be carried out.

.....

In a waste paper store, examples of some of the more obvious hazards are:

- *the movement of vehicles and pedestrians in the same area*
- *the stacking and destacking of the bales*
- *the cutting of the bale wires*
- *the conveyor belt*
- *slipping and tripping hazards*
- *fire*

Some less obvious hazards may be:

- *the asbestos lagging on the steam pipes running across the roof of the building*
- *procedures for access to the pulper for maintenance*
- *activities of drivers from transport companies when they come into the area*
- *the breaking of the waste paper bales wires because of poor quality wire used in the baling*

44 In the above example it can be seen that some of the less obvious hazards are just as great if not greater than the more obvious ones.

Think about the activities

45 The hazards which may be encountered during machine interventions will need to be carefully considered when undertaking risk assessment. Conventional safeguarding is not provided at many moving parts of the papermaking machine during normal production because the parts are safe by position. However, people may need to gain access to areas where these parts can be reached to thread paper, clear broke, carry out maintenance work and other activities.

46 *Most mills will already have in place safe systems of work to deal with these types of hazards. If these safe systems are adequate then the exercise does not need to be repeated for risk assessment.*

47 Appendix 3 contains examples of safe systems of work found in the paper industry.

.....

Use your experience

48 A further way of approaching hazard identification is to 'brainstorm' the hazards. Some mills started by arranging for assessment teams made up of knowledgeable people including plant operators and safety representatives to meet and discuss the main known hazards in a particular department. This approach has been found particularly useful in identifying some of the most significant hazards and not 'losing the wood for the trees'.

49 Other approaches which have been used involve looking at accident, ill-health and near-miss data and getting together with other mills to discuss common problems.

The mills which have most successfully dealt with risk assessment have used a combination of these.

50 As and when hazards are being identified it is important to ignore the trivial and concentrate on the most significant.

How to identify hazards:

- walk around the workplace and look afresh at what could reasonably be expected to cause harm
- list tasks/activities in a department and identify the hazards
- use knowledgeable people to brainstorm the hazards
- look at accident, ill-health and near-miss data to see where things have been going wrong
- meet with other mills to see what they think their main problems are
- ignore the trivial

What is a trivial hazard and what is significant?

51 This comes down to the level of harm that can be caused. A trivial hazard is one which would lead to very slight injury which people accept as not troubling them. A significant hazard is one which could result in death or serious injury. Between these two extremes there is a great deal of variation in degree of hazard. Because of the large range of hazards in paper mills some mills have used a numbered or ranking system to identify the serious hazards and significant risks and found it useful. The experience is that it is better not to get too complicated and to be aware of the danger of becoming too mechanistic in using the numbers. A simple ranking system which has been found effective

.....

is given in the box above. Using this method risk assessment can concentrate on the high hazard activities first.

Method of ranking hazards:

- 3 - major (eg death or injury or illness causing long term disability)
- 2 - serious (eg injury or illness causing short-term disability)
- 1 - slight (other injury or illness)
- 0 - trivial (very slight injury - can be ignored for this exercise)

52 Before going on to the next step it makes sense to check that several assessment teams are not busy reinventing the wheel in assessment. This is where the safety adviser can often play a useful coordinating role in identifying hazards common across the mill which should be assessed centrally.

Examples of common hazards which might be assessed centrally:

- fire - evacuation procedures
- clamp trucks - training and authorisation of drivers
- lifting operations - inspection, maintenance and thorough examination, training
- asbestos - control and removal
- noise
- work on high voltage electricity

How one mill set about identifying its hazards and assessing risks

Departmental teams were set up in one paper mill to meet for three hours each week to carry out risk assessment. After initial training on risk assessment they started by 'brainstorming' the hazards in their departments. They also used accident and incident data to identify hazards. They then went out into their departments to critically examine the hazards, risks and control measures found. A very simple proforma was used for each hazard and to record the findings. The most serious risks were identified on the forms. Some of these could be dealt with

.....

straight away. Serious risks which had been identified were brought up at the weekly management production meetings as a matter of policy. Actions arising from the assessment exercise were also co-ordinated by the safety manager and are fed into monthly senior management meetings and monitored by means of an action plan which gives target dates for completing actions arising. This mill is well on its way to completing the initial assessment exercise and is now concentrating on dealing with one-off activities such as those carried out at shuts. It is also considering ways of introducing risk assessment into project management.

Step two - decide who might be harmed and how they might be harmed by identifying the risk activities

53 For each significant hazard consider who might be harmed and how they might be harmed. Apart from operators who are in the mill all the time, others who need to be considered include maintenance staff, contractors, cleaners and even parties of visiting school children if this applies. The need is to think not just about what people are meant to do but also what is foreseeable even if that is not authorised.

The driver employed by a road transport company was struck by a fork lift truck as he walked through the lorry loading and parking area of a large mill. The fork lift truck driver was not expecting to find a pedestrian in the area. Access procedures were not clear and high visibility clothing was not issued to visitors to the area.

54 Any groups of workers particularly at risk, eg young or inexperienced workers or those working alone, also need to be given special consideration.

55 A number of the operations carried out at a papermaking machine require high levels of skill and adherence to a safe system of work. The experience of the individuals is applicable here: what may not be a very significant hazard to the experienced papermaker may well be significant to the new machine assistant who has just left school.

An inexperienced machine operator was injured when his hand was taken into the nip at a roll of the papermaking machine. He was trying to remove a piece of debris from the roll. This should not have been done by hand with the machine running but the nip guard had not been replaced following a machine shut.

56 A number of serious accidents in paper mills have occurred because people have taken short-cuts. As far as possible risk assessment should try

.....

and take into account any activities where dangerous short-cuts can be anticipated and take steps to discourage bad practice.

57 The number of people exposed and the frequency with which they are exposed is relevant when considering the size of the hazard. This can be taken into account if using a numerical ranking system to estimate risk.

The asbestos lagging on the steam pipes in the example on page 17 presents a different degree of risk to the different groups of people exposed. The clamp truck driver employed by the mill may be exposed for long periods to low levels of airborne asbestos dust. The driver from the transport company will be exposed to the same levels as the clamp truck driver but for very limited exposure periods. The asbestos will pose a high degree of hazard to maintenance staff or contractors who do work on the pipes if they do not realise that the lagging is asbestos. Properly sealed asbestos which is regularly checked may well be enough to protect the drivers using the area from the risk but additional risk control systems are likely to be needed to protect maintenance staff and contractors.

Step three - Evaluate the risks and decide whether you need to do more

58 This is the main part of risk assessment. For each significant hazard the workplace precautions and risk control systems needs to be considered for each group of people exposed to the hazard to decide whether the risk is adequately controlled. This can be a major task where there are a large number of significant hazards but it needs to be remembered that if the mill has been operating safely in the past then it is likely to be controlling its risks well. The task of evaluating risk can be prioritised by starting with the most significant hazards and dealing with the easiest to evaluate first. Other less significant hazards can also be evaluated straight away if what is required is obvious. Or some mills have started with hazards which they know need to be assessed, eg a newly installed piece of plant. If it becomes obvious that a very detailed assessment is needed or one which requires input from someone with particular expertise then short-term measures might be appropriate to control the risks while longer-term solutions are identified.

59 Evaluating the hazard may not be easy and assessors do not always find it easy to answer these important questions:

- Are the precautions we have provided adequate?
- What are the standards required?

60 Although assessors will have to use their judgement they should try to be as objective as possible in reaching conclusions. Specific legal requirements

.....

and accepted industry standards should be referred to where possible.

61 The risks are adequately controlled if the precautions:

- meet the standards set by a specific legal requirement;
- comply with a recognised industry standard;
- represent good practice;
- reduce risk as far as reasonably practicable.

Some contractors - ABC and Sons - are coming onto site to paint a wall six metres high. The mill has told them to use a mobile scaffold and they have been given a copy of the mill's contractors' rules. Is this enough? (see below)

What else needs to be done?

62 The answer is whatever is needed to comply with the law. The question is easy to answer if there is relevant specific guidance. All that needs to be done is see whether the machine and procedures comply with that guidance. Where it falls short then additional action is likely to be required.

63 If no such industry or legal standard exists then the assessor needs to reach a conclusion about what is 'reasonably practicable'. Are the precautions provided to a standard generally applied in the industry? Can you make the risk smaller by adding to the precautions? Sometimes adding to the precautions need not cost a lot, eg putting some non-slip material on slippery steps.

Standards useful in deciding what needs to be done:

- PABIAC booklets and leaflets
- Publications from HSE Books
- British and European standards
- Guidance and advice produced by the Confederation of Paper Industries
- Guidance and advice produced by various safety and industry organisations

.....

The mill dealing with ABC and Sons decided that telling them to use a mobile scaffold and giving them the mill's contractors' rules was enough. When a factory inspector visited she found that the mobile scaffold was not properly erected (inadequate bracing) because the contractor's men had not been trained to erect the equipment. Also they were working within six metres of an overhead travelling crane. It was the first time that these contractors had been on site and they had not read the contractors' rules. In addition to the precautions taken the mill should also have considered in detail the particular area in which the work was being done and arranged for precautions to be taken regarding the overhead travelling crane. Because of the serious nature of the hazard from the crane the mill should have discussed with the contractors how the work could be done safely. They should have made sure that the contractors understood the rules and that their work would have been closely monitored by mill management particularly because they were new to the site. The mill had not done all that was reasonably practicable to control the risks. The breakdown in workplace precautions witnessed by the inspector was because of an inadequate risk control system, ie issuing the rules and making the mobile scaffold available on their own was not enough.

64 Does the risk have to be controlled by a safe system of work? Usually this is only acceptable if the hazard cannot be removed completely or controlled using adequate physical safeguarding. If the risk has to be controlled by a safe system of work is that safe system of work adequate? The following checklist can be used to help assess a safe system of work.

Checklist for the assessment of a safe system of work

- Is the job covered by the system clearly stated?
- Does the system spell out the hazards that will arise during the work?
- Does it specify how these hazards should be controlled?
- Are the persons who should do the work identified and their individual duties specified?
- Is it clearly stated who should be in charge of the job?
- Is the training that should be given laid down?
- Is it clear whether any protective clothing and personal protective equipment should be worn, or jewellery removed?

- Are the necessary tools and equipment listed?
- Does it further say exactly how, when and where safety procedures (eg fitting temporary guards, issuing permits to work, padlocking isolators should be carried out, and withdrawn?
- Is the slowest practicable speed laid down if the job cannot be done with the machine stopped?
- Are safe working positions specified for all stages of the job?
- Does the system require the exclusion from the area of all people not involved with the job?
- Is good housekeeping while the work proceeds a condition of the system?
- Does it include the removal of components and equipment to a safe place?
- What mention is there of signals and communications between persons engaged in the work?
- Are clear arrangements laid down for informing the responsible people when the job covered by the system is started and completed?
- Are emergency procedures and first aid arrangements clearly identified?
- How is the system checked to see if it is practicable, acceptable to the persons concerned, complies with the mill safety policy and meets all legal requirements?
- How is the system made known to all persons concerned, including management?
- What are the arrangements for monitoring the working of the system in practice and revising it as necessary?

65 In terms of what is 'reasonably practicable' it is worth noting that the costs in remedying failures in risk control systems such as the implementing and monitoring of safe systems of work and monitoring of contractors on site usually involves time, commitment and effort of management and staff rather than capital outlay. Monitoring as part of management arrangements for workplace precautions and risk control systems is now a particular requirement under the Management Regulations.

66 As the assessment exercise progresses mills will find that a number of

.....

risks emerging are of varying significance. Some mills have used a numerical system to rank the risk. However, if such a system is used it is important to avoid being overmechanistic.

Example of numerical risk ranking system:

Hazard:	Likelihood of harm occurring:
trivial - 0	low -1- harm will seldom occur
slight - 1	medium -2- harm will occur frequently
serious - 2	high -3- harm occurring is nearly certain
major - 3	

RISK = HAZARD SEVERITY X LIKELIHOOD OF OCCURRENCE

67 *It is essential that serious risks are brought to the attention of senior management as soon as possible.*

Step four - record your findings

68 Most mills have used risk assessment proformas and examples are given in the appendix. Some mills have found it useful to use a simple proforma to start and to go on to providing more detail as it is required. For example, a solution to a manual handling problem can often be found through a simple risk assessment approach without having to carry out a detailed ergonomic assessment. Other manual handling problems will require a more in-depth approach.

69 Although the Management Regulations do not require that all the risk assessment is recorded, most mills have found it essential to do so. The Management Regulations require a record of the significant findings of the assessment. This is not just a record of assessment leading to findings of significant risk but also conclusions about assessment of significant hazards even if the resulting risk is considered small. Some mills have found difficulty with this because they have generated so much paperwork that they do not know what their significant findings are. It is vital mills develop a system of highlighting significant findings and particularly significant risk.

70 A proforma such as the one on the next page is typical of those in use in mills. In this particular case a high risk has been identified. This is clearly shown on the form and the actions can be transferred onto an action sheet for presentation to management and so employees can be kept informed. Some mills have set up computer databases to input the risk assessment findings. This is a very useful technique when it comes to the next step in risk assessment.

RISK ASSESSMENT PROFORMA

What is the hazard? Reels (2 tonne) being ejected automatically across pedestrian thoroughfare at paper machine de-elevator. How severe is the hazard? High What are the control measures? None Is the risk high, medium or low? High - reels roll silently across and no warning is given. Currently many people have access to area and risk of injury is great.	Who can be harmed? Mill operators, maintenance staff and contractors. What extra control measures are needed? Alternative access available - this route should be blocked off as a general thoroughfare. By whom? Department manager to arrange for temporary barricade and supervision and instruction to prohibit access to route. Permanent blocking off to be arranged. By when? Temporary barricade immediately. Permanent blocking off 3 months time. Further action Need to access area for maintenance reasons etc to be subject to further assessment within next month.
---	---

Signed:

Assessment review date:

Step five - review the assessment from time to time and revise it if necessary

71 If there is a significant change to mill procedures or activities which could lead to new hazards being introduced then these will need to be assessed as they arise. Mills need to organise themselves to deal with this and make sure that their management systems are adequate for the purpose. After the initial exercise, assessment teams are likely to be disbanded and individual managers need to be left in no doubt about their responsibilities concerning risk assessment. For example, risk assessment needs to be integral to project management and managers and supervisors at all levels made aware of their duties to make sure that staff are not knowingly exposed to hazardous activities.

72 Existing assessments will also need to be revised if they are no longer valid. Most mills decide how long an assessment is likely to be valid when it is made and recommend when it should be reviewed. Good assessments also set

.....

action timescales. To be effective, therefore, mills need arrangements to bring these matters forward at the right time. Computer databases can serve a useful purpose when a great deal of information has been collected. The monitoring arrangements for actions arising from risk assessment also need to be recorded.

73 Accident, ill-health and near-miss data, and audits will be useful in identifying hazards which may have been overlooked or risk assessments which have not resulted in adequately controlled risk. A risk assessment approach to accident investigation as explained on the next page will help identify underlying causes, will highlight the necessary precautions and provide senior management with sufficient information on which to base follow-up action. This in turn will help to prevent future injury and loss.

Review the risk assessment when:

- new machines, substances and procedures which could lead to new hazards are introduced
- original risk assessments suggest review might be appropriate
- accident, ill-health or near-miss data show a risk assessment might not be adequate
- audits and workplace inspections reveal hazards/risks which have not been properly assessed or for which control measures have deteriorated eg short cuts taken in a safe system of work.

Example of an accident investigation:

'An employee was struck from behind by a reversing lift truck as he walked through a reel storage area. Several trucks operated in the area taking reels to storage. Stacked reels restricted visibility.'

A brief investigation might conclude simply that either the operator or the injured person should have taken more care. Apart from considering the behaviour of the people involved in such incidents, some of the following aspects may also have to be looked at:

- ***organisational*** - *does the health and safety policy and risk assessment cover lift truck operation and make someone responsible for transport safety? Do managers appreciate the risks and know the precautions?*
- ***competence*** - *do lift truck operators have the right skills and knowledge? Is training provided when needed? What checks are made of the competence of new employees who claim to have had*

.....

training or to be experienced?

- **authorisation** - *are lift truck operators authorised in writing and issued with permits? Is the authorisation limited to certain tasks or trucks? Are keys kept secure when trucks are not in use?*
- **supervision** - *do supervisors have enough knowledge to spot hazardous operations? Do they enforce safe operating procedures?*
- **site layout** - *can trucks and pedestrians be segregated and areas marked? Could a one-way traffic system be introduced? Can reversing be reduced? Is it possible to increase aisle widths? Is the area well lit and are warning signs posted?*
- **vehicle** - *were the brakes, steering, tyres, horn and controls working properly? Is the truck regularly maintained? Could visibility from the truck be improved? Would an audible reversing alarm help?*

74 Appendix 4 contains a suggested checklist for structuring accident investigations.

APPENDIX 1: ACCIDENT STATISTICS AND CAUSATIONS

Table 1: Fatal accident incidence rate (April 1992 to March 1996)

Industry	1992/3	1993/4	1994/5	1995/6
Total manufacturing	1.5(63)	1.6(67)	1.1(48)	Not available
Agriculture	8.2(21)	6.4(16)	5.7(14)	Not available
Construction	8(69)	8.4(73)	6.5(56)	Not available
Papermaking	3.6(1)	3.8(1)	12(3)	8.3(2)

Comparison between papermaking, total manufacturing industries, agriculture and construction according to SIC (Standard Industrial Classification) 80. The incidence rate is calculated as follows:

$$\text{Incidence rate} = \frac{\text{number of injuries}}{\text{numbers employed}} \times 100\,000$$

Numbers in brackets represent the total number of fatal accidents to employees during the period.

Table 2: Major injury incidence rate (April 1992 to March 1996)

Industry	1992/3	1993/4	1994/5	1995/6
Total manufacturing	124(5377)	126(5335)	126(5375)	Not available
Agriculture	165(424)	177(444)	171(420)	Not available
Construction	239(2056)	208(1801)	216(1871)	Not available
Papermaking	325(91)	277(72)	308(77)	325(78)

Comparison between papermaking, total manufacturing industry, agriculture and construction according to SIC 80. Numbers in brackets represent the total number of major injuries occurring to employees during the period. Incidence rates calculated as above.

Major injury is defined in the Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995.

Table 3: Nature of injury
(All reportable in
papermaking) by
percentage

Nature of injury	1992/3	1993/4	1994/5
Fracture	14	13	14
Cuts	6	8	8
Bruises	22	23	22
Burns	4	4	4
Sprains & strains	37	33	32
Others	16	18	20

Others include amputation, loss of sight, dislocation, concussion and internal injuries, poisoning and superficial injuries.

Figure 1: April 1992 -
March 1995 combined

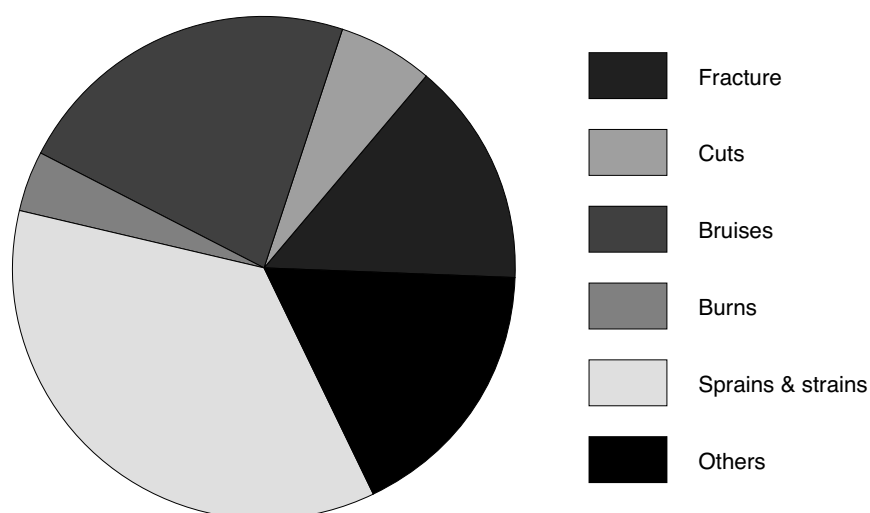
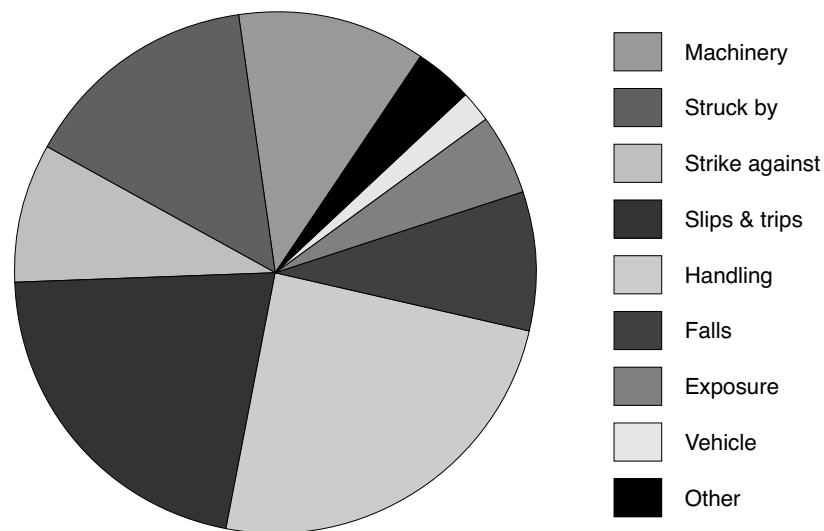


Table 4: Kind of accident
(All reportable in
papermaking) by
percentage

Kind of accident	1992/3	1993/4	1994/5
Contact with moving machinery	12	12	12
Struck by moving (inc falling) object	13	16	16
Strike against something fixed	8	10	8
Slips, trips and falls	22	21	21
Injured whilst handling and lifting	26	23	24
Falls from height	9	9	8
Exposure or contact harmful substance	5	4	4
Struck by moving vehicle	2	2	3
Other	4	5	5

Others include trapped by something collapsing or overturning, drowning or asphyxiation, exposure to fire or explosion, contact with electricity.

Figure 2: April 1992 -
March 1995 combined



.....

APPENDIX 2: EXAMPLES OF RISK ASSESSMENT PROFORMAS

RISK ASSESSMENT PROFORMA	
What is the hazard?	Who can be harmed?
What are the control measures?	What extra control measures are needed?
Is the risk high, medium or low?	What needs to be done?
	By whom?
	By when?

Signed: _____ Assessment review date: _____

RISK ASSESSMENT PERFORMA

Hazard	Who might be harmed?	Is the risk adequately controlled?	What further action is necessary to control the risk?

Assessment undertaken by: _____
Signed: _____
Date: _____

Assessment review date: _____

.....

APPENDIX 3: EXAMPLES OF SAFE SYSTEMS OF WORK

The seven examples of safe systems of work which follow are not mandatory but have been selected to demonstrate the important features of a good system for a typical application.

It is not intended that they should be used by mills in the form in which they are reproduced. They are outlines only and contain very little detail of job procedure. Mills should always draw up and implement their own safe systems of working for particular operations.

Some of the terms used may be peculiar to individual mills and not in general use.

Example 1: Complete shutdown

- 1** This system of work covers safe isolation, locking-off and permission to work during a complete shutdown.
- 2** The operation will be performed by all trained competent personnel under the supervision and control of the machine foreman. Machine trainees may assist only under the strict supervision of their job instructor.
- 3** The main hazard is the starting of the machine while any person is in a position of danger from moving parts during cleaning, repair or adjustment operations.
- 4** Protective clothing will be determined by the task to be performed.
- 5** All special tools and equipment specified by the machine foreman should be collected and checked before commencement of the job.
- 6** The risk can be eliminated by the following safe working procedure:
 - (a) The machine should be isolated at the power supply by the electrician;
 - (b) Before working on any machine or entering any section of a machine all personnel report to the machine foreman;
 - (c) The machine foreman carries out an inspection and ensures that the machine or section is effectively isolated and safe before giving permission to enter or start work;
 - (d) The only acceptable methods of isolating the power supply to a machine or section of a machine are either:
 - (i) the locking in the open position of the isolating switch where the drive is electrical; or
 - (ii) the locking out of a clutch.

.....

The system of isolation used in this mill is a multiple locking system based on the use of callipers and individual padlocks.

- (e) All personnel are issued with their own personal padlock and key which they must carry on their person during their working time in the mill;
- (f) After receiving clearance from the machine foreman each person must then apply their own padlock to isolate that machine or section;
- (g) They must never rely on another person's padlock;
- (h) In every case where a padlock is applied, the person who applied it must retain the key;
- (i) On completion of the work or on leaving the section the person removes his padlock and informs the machine foreman that this has been done.

7 The machine foreman will be responsible for the start-up of the machine. (Start-up procedure is covered by a separate written system of work.) Before instructing the electrician to reconnect the machine power, the foreman will satisfy himself that:

- (a) all persons in or on the machine are withdrawn except those people he considers can safely remain at their place of work;
- (b) all tools and other equipment are removed;
- (c) all guards are replaced;
- (d) all clutches are disengaged and all locks off.

8 Good liaison between all personnel and the machine foreman is essential at all times during a complete shut.

9 Any difficulties should be reported immediately to the machine foreman.

Example 2:
Cleaning pressure
rolls

1 This system of work covers the safe cleaning of pressure rolls.

2 The job will be carried out by competent persons, supervised by a fully trained competent machineman or dryerman under the control of the foreman.

3 The main hazards arising from this job are:

- (a) entanglement in the machine if it should start up;
- (b) damage to eyes, skin and clothing from contact with the highly acidic cleaning agent;

.....

(c) injury to the lungs from breathing the acid fumes;

(d) fire due to ignition of solvents in the cleaning agent.

4 Two operators will be in the machine cleaning the pressure rolls and a third operator will remain outside at all times to monitor the well being of the two men cleaning.

5 Full protective clothing, ie wet suit, rubber gloves and boots, approved respirator and face visor will be worn by the cleaners.

6 Cleaning agent contained in two plastic squeeze bottles, a rubber bucket filled with clean water, scourers, rags and a fresh water hose pipe will be required for this task.

7 The risks can be controlled by:

(a) ensuring that both operators lock off the machine with their personal locks at the appropriate isolator;

(b) creating adequate ventilation by running the hood extractor fans;

(c) ensuring that there is no smoking, exposed flame or sparks and that the roll, cylinder and felt temperatures are less than 52°C;

(d) draping wet felt and plastic sheeting under pressure rolls to prevent damage from spillage;

(e) using plastic bottles which will not discharge contents unless squeezed;

(f) removing all traces of cleaner with scourers and wet rags and avoiding contamination of machine frame;

(g) ensuring that all protective clothing, buckets, bottles, scourers and rags are removed and washed with fresh running water and the area thoroughly checked at the completion of the job;

(h) that both cleaners are fully satisfied that the task is completed before they remove their personal locks and report to the foreman.

8 Supervision of the cleaners' well-being is essential at all times during this process.

9 Any difficulties should be reported to the foreman immediately.

.....

Example 3:
Trimming the wire

- 1 This system of work covers the safe trimming of wire.
- 2 The duty will be performed by competent trained operatives under the control of the foreman or machineman. Machine trainees may only assist under strict supervision.
- 3 The foreman or machineman will trim the wire, while a competent operator will operate the stop-start controls. A trained liaison man will convey instructions between the operator and trimmer, and a fourth man will keep the trim clear of the working area and the moving parts.
- 4 The main hazards of this operation are cuts from the wire and entanglement with moving parts of the machine.
- 5 A knife and a piece of hardboard approximately 0.3 m² will be required.
- 6 These risks will be controlled by ensuring that:
 - (a) the wire is run at the slowest practicable speed;
 - (b) the crew is fully briefed regarding the trimming procedure;
 - (c) only the nominated liaison man gives instructions to the wire operator;
 - (d) the trimmer assumes a safe position on the wire platform, and, using the knife with the hardboard under the wire, cuts the leading edge to enable the strip to be lifted back for tearing;
 - (e) the second man keeps the trim away from the moving parts;
 - (f) when trimming is complete all equipment and waste is removed to a safe place, the area is thoroughly checked and everyone withdrawn before the machine is restarted.
- 7 Good liaison between all concerned is imperative.
- 8 Any difficulties should be reported to the foreman immediately.

Example 4:
Felt straightening

- 1 This safe system of work covers felt straightening when folds or creases which can only be corrected while the machine is running occur in machine felts.
 - 2 The job will be performed by trained members of the machine crew under the control of the foreman, machineman or experienced dryerman. Machine trainees may only assist under strict supervision of a job instructor.
 - 3 There is a risk of injury by being trapped in moving parts of the machine or by being caught in the nip between felt and felt roll or felt and cylinders.
-

-
- 4 Operatives should ensure that their clothing is not loose and flapping and that rings, watches or other items which might become caught in the machine are not worn.
 - 5 Protective gloves should be worn only when the nature of the felt material would otherwise cause injury.
 - 6 Hand tools will only be used at the discretion of and under the control of the machine foreman etc.
 - 7 The hazard should be controlled by ensuring that:
 - (a) the machine speed is reduced to the slowest practicable for the righting operation;
 - (b) felt laps are only straightened out in areas well clear of rolls, nips and obstructions.
 - 8 Good liaison between the crew and the person in control is essential to ensure that no one is at risk or moves to a position of risk during the straightening process, and that everyone withdraws when the job is completed.
 - 9 Any difficulties should be reported to the machine foreman.

**Example 5:
Running on dry felts**

- 1 This system of work covers the safe replacement of dry felts.
- 2 The job should be carried out by machine personnel supervised by the dryerman under the control of the machine foreman.
- 3 All men should be fully trained and competent for the work. Machine trainees may assist only under the strict supervision of their job instructor.
- 4 There is a risk of injury from:
 - (a) intakes between felt and felt rolls, and cylinders and felt;
 - (b) burning on hot cylinder surfaces.
- 5 Men should ensure that their clothing is not loose and flapping and that rings, watches and other items which might become caught in the machine are not worn.
- 6 The specified tools and equipment should be obtained.
- 7 The risk should be controlled by the following procedure:
 - (a) isolating the machine section being worked on during the preparatory work and attaching the new felt;

-
- (b) isolating again when tensioning the new felt;
 - (c) the machine section at each side of the one being worked on should be locked off;
 - (d) isolation should follow normal lock-off procedure with each man putting his lock on the calliper at the appropriate isolator;
 - (e) the running on operation should be done with the machine turning at the slowest practicable speed;
 - (f) all section doctor blades should be down and the steam supply to the section should be shut off;
 - (g) everyone should work from the section gangway where practicable.

8 The old felt should be promptly removed from the section gangway to a safe place.

9 Good liaison between crew and dryerman is essential to ensure that no one is at risk or moves to a position of risk during the process of running on the new felt, and that everyone withdraws when the job is completed.

10 Any difficulties with the system of work should be reported to the machine foreman.

Example 6: Start-up preparation

1 This system of work covers the safe start-up of the machine following a shut.

2 The start up should be carried out by machine personnel supervised by the machineman or dryerman.

3 Everyone should be fully trained. Trainees may assist only under the strict supervision of their job instructor.

4 The main hazard is being trapped by moving parts of the machine.

5 Everyone should ensure that their clothing is not loose and flapping and that rings, watches and other items which might become caught in the machine are not worn.

6 No special tools or equipment are required other than a remote air jet for feeding the tail through the dryers.

7 The hazard will be controlled by ensuring that:

- (a) all machine shut down procedures have been completed and power has been restored;

-
- (b) all sections are ready to start;
 - (c) all non essential personnel and plant are clear of the machine;
 - (d) each section is initially run at slow speed;
 - (e) a warning signal is sounded 10 seconds before the drying cylinders are started up;
 - (f) steam valves and doctor blades are lowered before run speed is reached;
 - (g) the dryerman or his assistant feed up the tail working from a safe position using the air jet provided.
- 8 Close liaison should be maintained between the wet end and dry end men at all times.
- 9 Any difficulties with this system of work should be reported to the machine foreman.

Example 7:
Taking samples

- 1 This system of work covers the safe taking of moisture samples at the presses.
- 2 Taking samples should be done only by the making superintendent or process controller.
- 3 The entire machine crew will be present and fully briefed as to the operation before sampling commences. Laboratory personnel should also be briefed.
- 4 The job has to be done with the machine in production at run speed and there is a risk of injury from moving parts of machinery, including the wet felts and the press rolls.
- 5 The crew should ensure that their clothing is not loose and flapping and that rings, watches and other items which might become caught in the machine are not worn.
- 6 Sampling brushes, maintained in good condition, will be the only hand tools used. Sample tins should be placed where they do not cause obstruction on the machine platforms.
- 7 The hazard should be reduced by taking the following precautions:
- (a) the wet end operator should monitor the well being of the sampler, standing adjacent to the press clutch control console;
 - (b) the sampler should stand in a safe place on the machine platform and

.....

should adopt a balanced stance before lowering the sampling brush at arm's length on to the paper.

8 The completion of sample taking and the withdrawal of the sampler should be promptly reported to the machine foreman.

9 Any difficulties with this system of working should be reported to the superintendent or chief paper maker.

.....

APPENDIX 4: CHECKLIST FOR INCIDENT INVESTIGATION AND REPORTS

The following is an example of a checklist which can be used to structure investigations and written reports. It is intended as a guide and is not comprehensive. Pre-printed report forms can be helpful. Be sure to establish at an early stage whether immediate action is needed. For example, it may be necessary to withdraw a machine or substance from use or stop an activity. The speed of response depends upon assessing relative risks and then deciding on priorities.

1 Obtain basic facts

- names of injured/ill employee(s)/witnesses/people early on the scene
- condition of plant
- substances in use or present
- layout
- place, time, conditions
- injury/ill health/damage/process disruption
- make use of cameras, sketches, measurement to record the undisturbed scene

2 Establish circumstances

- what was being done at the time and what happened?
- immediate causes
- events leading up to the incident
- any evidence linking case of ill health to work
- competence, eg what instructions and training were given before the event and how much experience in the job did the people involved (including managers and supervisors) have?
- what were the established methods of work and procedures?
- behaviour and actions of individuals
- role of supervision and management

-
- has something similar happened before?

3 Identify preventive measures

- assess/reassess the risk
- question the adequacy of existing physical safeguards and work methods and discrepancies with those intended
- reappraise the intended safeguards and work methods - do they satisfy the intentions of the company health and safety policy and do they meet the standards given in Paper and Board Industry Advisory Committee (PABIAC) and other authoritative guidance?

4 Establish whether initial management response was adequate

- prompt and appropriate action such as making safe and dealing with any continuing risks, electrical isolation, suitable fire fighting, effective first-aid response and correct spillage procedures

5 Identify the underlying causes

These might include:

- management or supervision failure
- lack of competence
- inadequate training
- shortcomings in original design
- inadequate performance standards set by firm
- absence of a system for maintenance

6 Determine action needed to prevent a recurrence

In deciding on the right course of action, think whether the outcome could have been more serious, what prevented this from happening and what might be needed to prevent a more serious outcome. Examples of action are:

- improve physical safeguards
- provide and use local exhaust ventilation
- use of mechanical handling aids such as pile turners and mobile lifts

-
- introduce better test and maintenance arrangements
 - improve work methods
 - provide and use personal protective equipment
 - make changes to supervision and training arrangements
 - review similar risks in other departments
 - set up a system to assess the risks from new plant and substances at the planning stage
 - review procedures involving contractors
 - update standards and policies
 - introduce monitoring and audit systems

.....

APPENDIX 5: SOME IMPORTANT PIECES OF HEALTH AND SAFETY LEGISLATION

Besides the Health and Safety at Work Act, the following Regulations are some of the most significant relating to paper mills:

- 1** Management of Health and Safety at Work Regulations 1999 - require employers to carry out risk assessments, make arrangements to implement necessary measures, appoint competent people and arrange for appropriate information and training.
- 2** Workplace (Health, Safety and Welfare) Regulations 1992 - cover a wide range of basic health, safety and welfare issues such as ventilation, heating, lighting, workstations, seating and welfare facilities.
- 3** Health and Safety (Display Screen Equipment) Regulations 1992 - set out requirements for work with Visual Display Units (VDUs).
- 4** Personal Protective Equipment (PPE) Regulations 1992 - require employers to provide appropriate protective clothing and equipment for their employees.
- 5** Provision and Use of Work Equipment Regulations (PUWER) 1998 - require that equipment provided for use at work, including machinery, is safe.
- 6** Manual Handling Operations Regulations 1992 - cover the moving of objects by hand or bodily force.
- 7** Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995 (RIDDOR) - require employers to notify certain occupational injuries, diseases and dangerous events.
- 8** Construction (Design and Management) Regulations 1994 - cover safe systems of work on construction sites and at some of the activities carried out in paper mills.
- 9** Control of Substances Hazardous to Health Regulations 2002 (COSHH) - require employers to assess the risks from hazardous substances and take appropriate precautions.
- 10** Noise at Work Regulations 1989 - require employers to take action to protect employees from hearing damage.
- 12** Electricity at Work Regulations 1989 - require people in control of electrical systems to ensure they are safe to use and maintained in a safe condition.
- 13** Control of Asbestos at Work Regulations 2002 - make requirements concerning work with asbestos.

.....

14 The Supply of Machinery (Safety) Regulations 1992 (as amended) - mills need to be aware that these Regulations place duties on machinery manufacturers and suppliers. Mills may also find themselves with duties under these Regulations if they take over the duty of responsible person as defined by the Regulations.

15 Health and Safety (First Aid) Regulations 1981 - cover requirements for first aid.

.....

APPENDIX 6: SOME USEFUL PUBLICATIONS

Useful generic guidance

Successful health and safety management HSG65 (Second edition) HSE Books 1997 ISBN 0 7176 1276 7

Management of health and safety at work. Management of Health and Safety at Work Regulations 1999. Approved Code of Practice and guidance L21 (Second edition) HSE Books 2000 ISBN 0 7176 2488 9

Managing health and safety: Five steps to success Leaflet INDG275 HSE Books 1998 (single copy free or priced packs of 10 ISBN 0 7176 2170 7)

Five steps to risk assessment Leaflet INDG163(rev1) HSE Books 1998 (single copy free or priced packs of 10 ISBN 0 7176 1565 0)

.....

**MAIL ORDER**

HSE priced and free
publications are
available from:

HSE Books
PO Box 1999
Sudbury
Suffolk CO10 2WA
Tel: 01787 881165
Fax: 01787 313995
Website: www.hsebooks.co.uk

RETAIL

HSE priced publications
are available from booksellers

HEALTH AND SAFETY INFORMATION

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

HSE website: www.hse.gov.uk

Paper and Board

Industry

Advisory

Committee

.....

Part 3:

**Manual handling
in paper mills**

Membership of the Paper and Board Industry Advisory Committee

.....

Mr A D Porter	<i>(Chairman)</i> Health and Safety Executive
Mr C Britchford	Arjo Wiggins Fine Papers Ltd
Mr G Beattie	Graphical, Paper and Media Union
Mr D Collins	Amalgamated Engineering and Electrical Union
Mr A J Cunningham	Amalgamated Engineering and Electrical Union
Mr D J Gillett	Paper Federation of Great Britain
Mr B Hudspith	Graphical, Paper and Media Union
Mr L S Reeves	Portals (Bathford) Ltd
Mr P McLaverty	J Bibby Paper Ltd
Mr C Scott	St Regis Paper Co Ltd
Mr M Eede	Transport and General Workers Union
Mr M Wilcock	<i>(Secretary)</i> Health and Safety Executive

Observer

Mr O Tudor	Trades Union Congress
-------------------	-----------------------

Paper and Board

Industry

Advisory

Committee

.....

Manual handling in paper mills

.....

© Crown copyright 1998

First published 1998

Reprinted 2004

Formerly sold as a single item ISBN 0 7176 0801 8.
Now available only as part of the PABIAC binder
ISBN 0 7176 294 2

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means (electronic, mechanical, photocopying, recording or otherwise) without the prior written permission of the copyright owner.

Applications for reproduction should be made in writing to:
Licensing Division, Her Majesty's Stationery Office,
St Clements House, 2-16 Colegate, Norwich NR3 1BQ
or by e-mail to hmsolicensing@cabinet-office.x.gsi.gov.uk

This is guidance prepared, in consultation with HSE, by the Paper and Board Industry Advisory Committee which was appointed by the Health and Safety Commission as part of its formal advisory structures. The guidance represents what is considered to be good practice by the members of the Committee. It has been agreed by the Commission. Following this guidance is not compulsory and you are free to take other action. But if you do follow this guidance you will normally be doing enough to comply with the law. Health and safety inspectors seek to secure compliance with the law and may refer to this guidance as illustrating good practice.

CONTENTS

Foreword *V*

Introduction *1*

- Why is manual handling an important issue for paper mills? *1*
- What does the law require? *2*
- About this guidance *2*

Simple solutions *3*

- How to identify the problem areas *3*
- Effective assessment teams *3*
- Dealing with common problems using known solutions *4*
- Conclusion *16*

Difficult assessments *16*

- Detailed assessments *17*
- Generic assessments *19*
- Complex activities *22*
- Conclusion *25*

Managing the manual handling risk *26*

- New projects and manual handling *26*
- Training and education in back care *27*
- Conclusion *27*

Useful reading *28*

- Generic manual handling guidance from HSE Books *28*

.....



FOREWORD

WHAT IS PABIAC?

The Paper and Board Industry Advisory Committee (PABIAC) is a Committee appointed by the Health and Safety Commission as part of its formal structures. PABIAC consists of a chairman and up to 12 other members (6 appointed after consultation with the Confederation of British Industry and 6 after consultation with the Trades Union Congress).

WHAT DOES IT DO?

PABIAC was first set up in 1979 and has the job of considering and advising on the protection of people at work from hazards to health and safety arising from their occupation in the paper and board industry and the protection of the public from related hazards.

This means that PABIAC can commission research and produce guidance for the industry. Following PABIAC guidance is not compulsory and people are free to take other action, but if you do follow the guidance, you will normally be doing enough to comply with the law. Health and Safety Inspectors seek to secure compliance with the law and may refer to PABIAC guidance as illustrating good practice.

WHY DOES PABIAC EXIST?

Every year people are killed or seriously injured in the industry. Many others suffer an injury or ill health sufficient to mean they cannot do their normal work. The rate of fatal and major accidents in the paper industry has improved over the past 10 years, but it is still too high. In 1996/97 the rate of fatal and major injuries was two-and-a-half times as much as the manufacturing average.

These deaths, ill health and injury cause pain and suffering; they also cost money. A recent study showed that accidents cost:

- one organisation as much as 37% of its annual profits;
- another the equivalent of 8.5% of tender price; and
- a third organisation 5% of its running costs.

Translate this into money lost in the paper industry and the total losses amount to many millions every year.

.....

SO WHAT IS PABIAC DOING ABOUT THIS PROBLEM?

PABIAC commissioned research to find out why there are so many accidents in the industry. The findings indicate that the main underlying problem is one of safety culture. This means that, for example, the management and workers in the mills do not really believe health and safety is a priority, or they are not aware of the hazards in their place of work.

To help improve health and safety in the industry, PABIAC has agreed an on-going, high-level, accident-reduction initiative with the paper industry. This is designed to make sure everyone working in the industry is made aware of the challenges the industry faces and to get the commitment and leadership needed to deliver improvements in health and safety performance. It will be a long process, but every accident and case of ill health prevented is one less person and family suffering. To help, PABIAC has developed a series of guidance for the paper industry. The guidance is in loose-leaf format with a binder entitled *Guide to managing health and safety in paper mills*. The aim of the series is to help all those involved in the paper industry to identify the main causes of accidents and ill health and to explain how to eliminate the hazards and control the risks. The guidance is simple. It will refer to other relevant documents so that you can build up a clear and comprehensive package.

Each piece of guidance, whether it is priced or free, will have general relevance to everyone involved in the paper making process, including management, individual workers and suppliers. Some documents will be relevant to specific groups, depending on the subject they address. All the guidance is intended to be held in the loose-leaf binder *Guide to managing health and safety in paper mills* and will be punched to fit.

WHAT DOES THE BINDER COVER SO FAR?

Guide to managing health and safety in paper mills

Binder containing six parts ISBN 0 7176 2942 2

Part 1: Application of the Provision and Use of Work Equipment Regulations to the paper and board industry

Part 2: Risk assessment in paper mills

Part 3: Manual handling in paper mills (including Ionising radiations in the paper and board industry)

Part 4: Prevention of heat stress in paper and board mills

Part 5: Control of contractors in paper mills

Part 6: Making paper safely. Managing safety in the papermaking process

.....

Other publications available separately:

Noise assessments in paper mills PBIS1 (free information sheet)

Noise mapping in paper mills PBIS2 (published on the Internet only)

.....

INTRODUCTION

Why is manual handling an important issue for paper mills?

1 People who work in paper mills know that the activities carried out can be hazardous and that the risks need to be well controlled. It is a fact that the number of major injuries occurring in paper manufacturing is comparable with other hazardous industries such as construction and agriculture. Some may wonder why effort should be put into reducing injury from manual handling operations when this type of injury rarely results in a major injury and when it is also true that tragically people still die from some of the very serious hazards which exist in mills.

2 Although it is the case that manual handling operations are very unlikely to result in fatal injuries, the pain, suffering and disablement resulting from this type of injury are often greatly underestimated. Many people suffer very long-term effects from manual handling injuries, some of which result in permanent disability.

Two operators had been unloading a full reel (weighing approximately 2.5 tonnes) from the lowered back stand. One operator subsequently collapsed with back pain. He was off work for 2 months. The injured person had suffered from a back problem for several years.

3 Manual handling accidents account for nearly a quarter of all paper manufacturing accidents reported to HSE. However, in terms of the size of the problem this is likely to be an underestimate. This is because a proportion of sickness absence from work will be attributable to long-term chronic injuries exacerbated by handling activities and including any work-related upper limb disorders (WRULDs) which arise from repetitive operations.

During 1993 and 1994, 1774 accidents in paper mills were reported to HSE. Of these accidents 415 were attributed to handling causes.

4 People suffering from long-term handling injuries report a significant deterioration in the quality of their life. Everyday activities once taken for granted such as gardening, doing the decorating and even lifting up the grandchildren become out of the question for some people.

An operator was carrying reject paper from a guillotine to the conveyor feeding the pulper. This was a regular task carried out over a distance of about 30 metres. The weight of the paper was variable. He sustained a hernia which required surgical treatment. He was susceptible to these and had suffered with this condition on and off for the 25 years he had worked for the mill.

5 The costs to the business are likely to be considerable. In addition to the obvious costs such as civil claims for damages, there are often significant hidden costs arising from production delays, investigation costs, overtime

.....

working, loss of experience, clerical and supervisors' time, hiring and training of replacement staff and even loss of goodwill and of corporate image.

6 *It has been estimated that relatively minor accidents where employees are only off work for a few days cost about £3000, while the average cost of a major accident is about £16 000.*

7 Mills which have invested in tackling their manual handling operations have not only found benefits in improved efficiency by eradicating some of these costs but they have also found that by introducing risk reduction measures they have speeded up jobs, improved quality and released employees to spend more time on other activities.

What does the law require?

8 The Management of Health and Safety at Work Regulations 1999 require employers to assess all the risks to the health and safety of their employees and anyone else who may be affected by the work activity. The employer can then decide what steps need to be taken to reduce the risks. If this general assessment identifies risk from manual handling operations, then the detailed requirements of the Manual Handling Operations Regulations 1992 must be followed.

9 The Manual Handling Operations Regulations 1992 set out a framework for dealing with the risks to the health and safety of employees from manual handling:

Avoid the need for hazardous manual handling, as far as reasonably practicable,

Assess the risk of injury from any hazardous manual handling that cannot be avoided, and

Reduce the risk of injury from hazardous manual handling, as far as reasonably practicable.

Remember manual handling does not just mean lifting by hand. The definition also includes putting down, pushing (as in reel handling), pulling, carrying, or moving by hand or bodily force.

About this guidance

10 During 1993 and 1994, PABIAC ran a campaign on manual handling in paper mills. The campaign included the circulation of manual handling newsletters and the organisation of a series of seminars throughout the country. A great deal of information was collected on problems particular to the paper industry and measures which had successfully been developed by some mills to deal with them.

11 This guidance brings together this material and concentrates on some of the practical issues which emerged during the campaign. Paragraphs 13-45 give examples of:

-
- (a) successful techniques which have been developed to avoid the need for hazardous manual handling altogether; or
 - (b) how the risk of injury from hazardous manual handling has been successfully reduced.

12 Paragraphs 46-72 look at some of the more difficult manual handling issues which mills have had to deal with. Paragraphs 73-83 deal with the management of manual handling risks from a longer-term viewpoint.

SIMPLE SOLUTIONS

How to identify the problem areas

13 Mills set about identifying their manual handling problem areas in a number of ways. Some mills have set up assessment teams to carry out general risk assessment and dealt with manual handling when it emerged as a significant risk as part of the more general assessment exercise. Other mills have dealt with manual handling as a separate issue, eg one mill started by going round the mill and compiling a comprehensive list of all the manual handling activities - the list came to 261 tasks! Accident statistics and ill-health records have also been found to be useful sources of data in identifying where the mill may have a manual handling problem.

14 *It does not matter which method is used, as long as it works for the particular mill.*

One mill decided to prioritise the risk assessment by asking each shift to identify their three most hazardous activities and to assess those first. Once assessment of those three had been completed they went on to the next three, and so on. Some of the most hazardous manual handling operations have been identified as part of this exercise.

Effective assessment teams

15 Many mills have found the use of teams to be an effective approach because the teams are able to combine the range of skills needed to be able to carry out the exercise in a meaningful fashion. To develop good skills in assessment, knowledge and experience of the following is likely to be needed:

- Handling operations
- Human capabilities
- Identifying high risk activities
- Practical risk reduction
- The Regulations.

.....

Possible assessment team:

- Departmental manager
- Departmental supervisor
- Safety representative
- Safety adviser
- Occupational health adviser.

Practical risk reduction involves:

- Considering alternatives
- Acceptability to workforce
- Acceptability to employer
- Ability to consider costs and benefits
- Solutions that work in practice.

16 Additional training is likely to be required.

**Dealing with
common problems
using known
solutions**

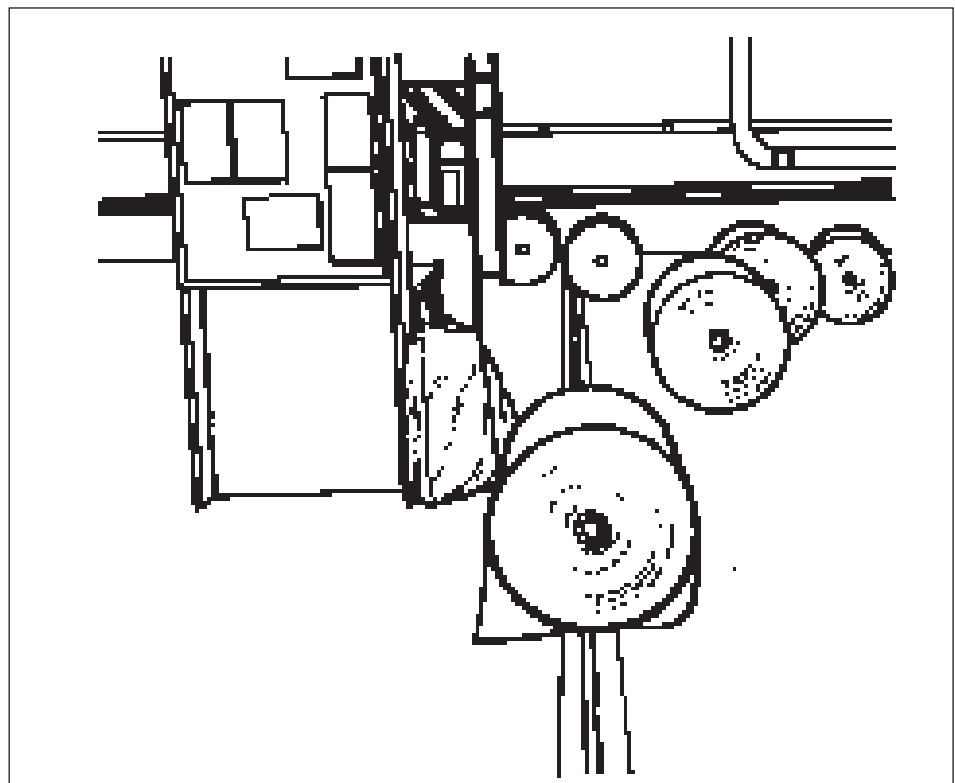
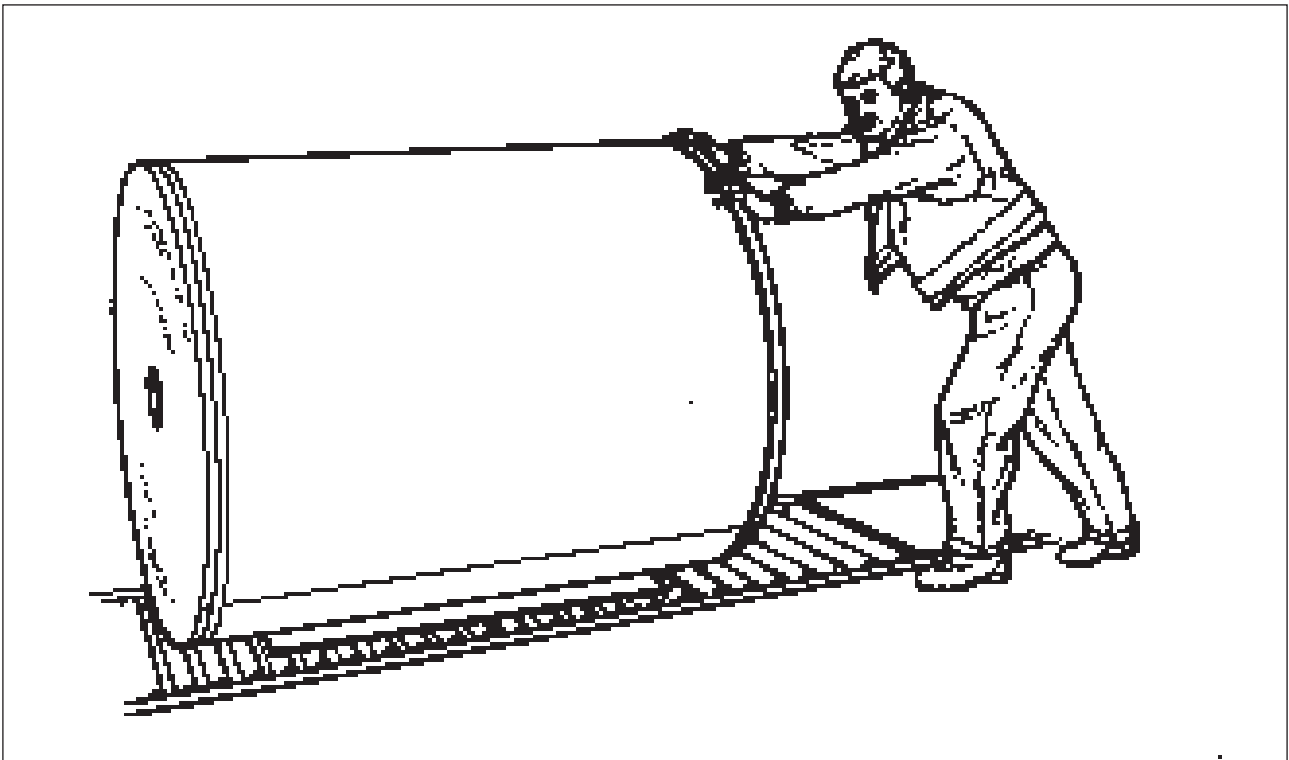
17 Once a hazardous manual handling activity has been identified it is not necessary to carry out a detailed assessment if the activity can be avoided or if a simple solution to the problem can be found. Solutions which avoid manual handling operations should be adopted where possible. However, even if the manual handling operation cannot be avoided entirely, simple solutions can often be found to deal with many problems. The following examples all illustrate straightforward solutions which have been developed to deal with problems common in paper mills.

Reel handling

Problem

18 Pushing and rolling of large reels of paper weighing typically one or two tonnes: this is a widespread problem in mills which has given rise to a large number of back injuries.

An operator sustained a back injury while pushing a finished reel of paper (weight 1.25 tonnes) from a conveyor. The mill is planning to introduce a mechanical handling system.

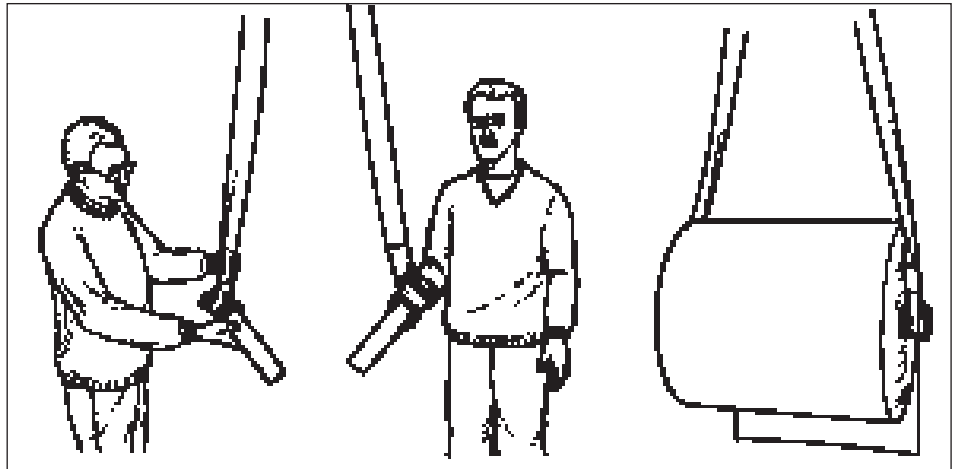


A reel packing worker sustained a back injury while pushing a reel of paper weighing around 11 tonnes. Reels of paper are ejected from a conveyor system to the rewinder for processing. There had been a fault on the rewinder and a backlog of reels had built up in the immediate area. The injured person was moving the reels about trying to make space for the backlog. He felt a pain in his lower back and after continuing to work for a short time was sent home with back pain.

.....

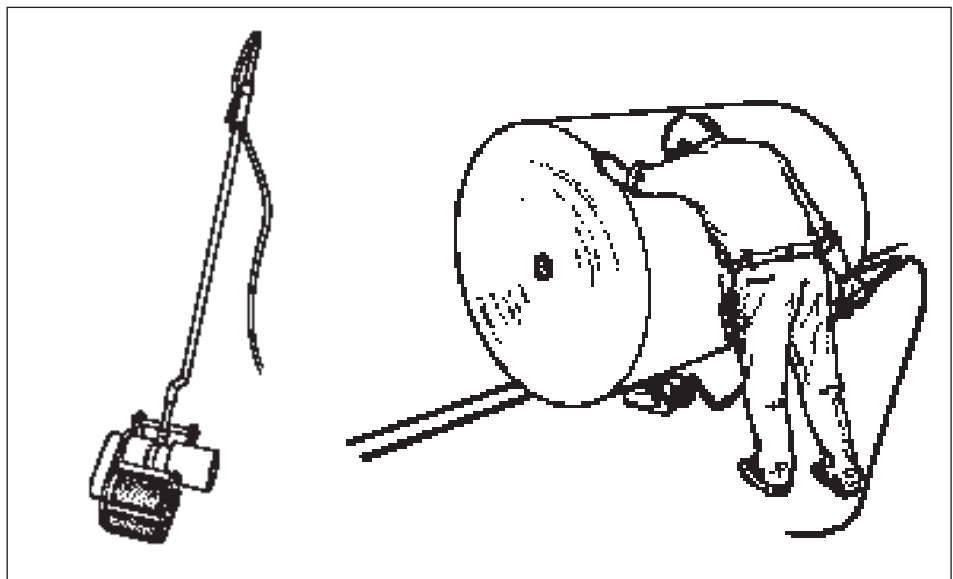
A solution

19 Provide a hoist. In this example metal lugs are slotted into either end of the reel and the reel is then lifted up and transported on the slings.



A solution

20 Use an 'Easimover'. This is a pneumatically powered hand-held device which is placed at the base of the reel and moves the reel along.

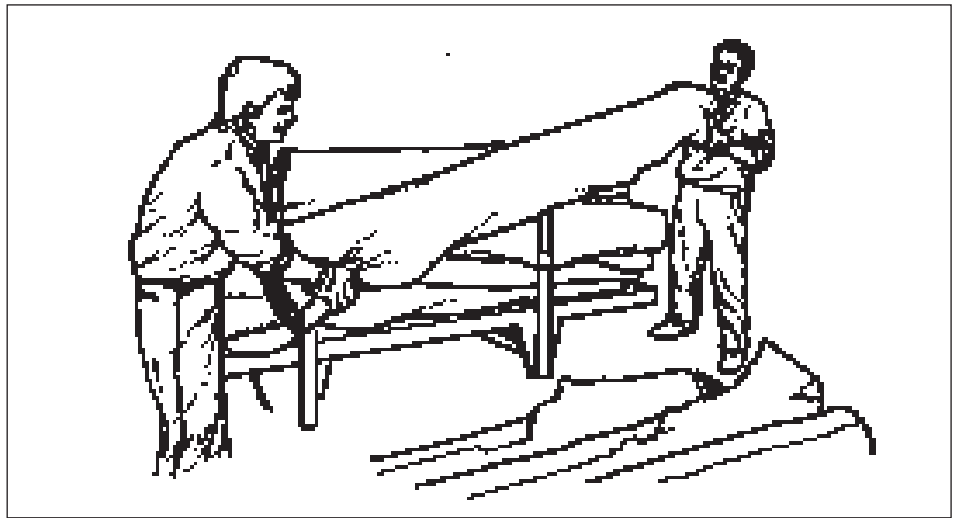


Broke handling

Problem

21 Broke handling is another widespread problem throughout the papermaking process:

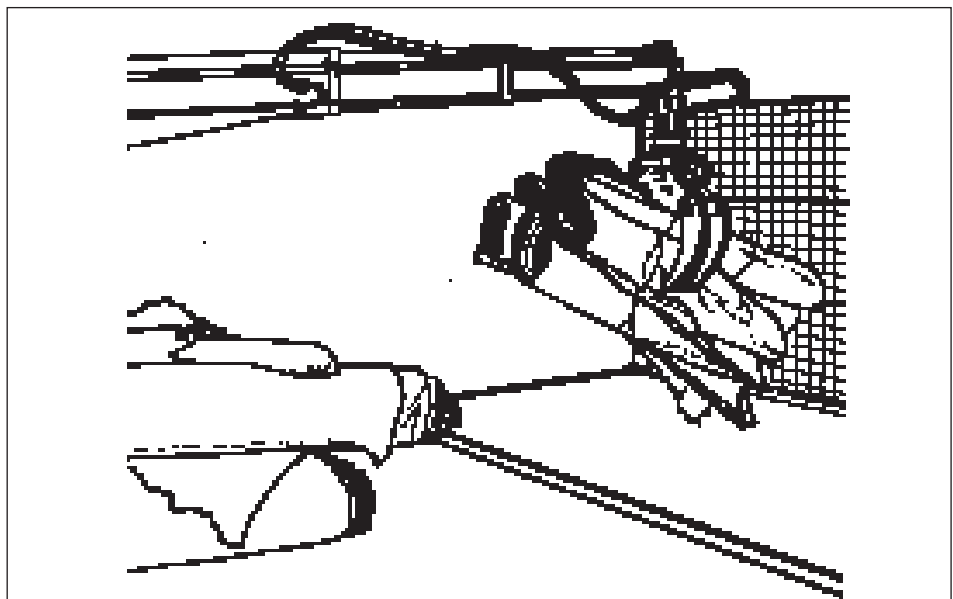
- (a) as loose broke; and
- (b) in the finishing processes as reel broke.



22 In this example two operators can be seen lifting and handling rolls of broke which weigh between 30 and 50 kg each. The job involves removing broke from four paper machines in all, and each machine would produce between 200 and 400 kg of broke per shift. The operation involves lifting broke on to a trolley, taking it on the trolley to the recycling line and lifting it off the trolley on to the conveyor feed to the hydraulic guillotine. Sometimes one operator would have to carry out the job on their own. This was a repetitive operation handling awkward loads. The main problem was the lift off the trolley on to the feed conveyor which involved lifting through a range of heights with a twisting movement to deposit the load in the correct position. All operators complained of severe back pain and this area had the highest incidence of prolonged sick leave relating to back injuries.

A solution

23 The answer to this particular problem was found to be the installation of a hydraulic swivel head grab. This was capable of lifting two to three rolls of broke with the extended arm to allow accurate placement of the load on the feed conveyor. The whole operation can now be carried out by one person.



.....

Other solutions to broke handling problems

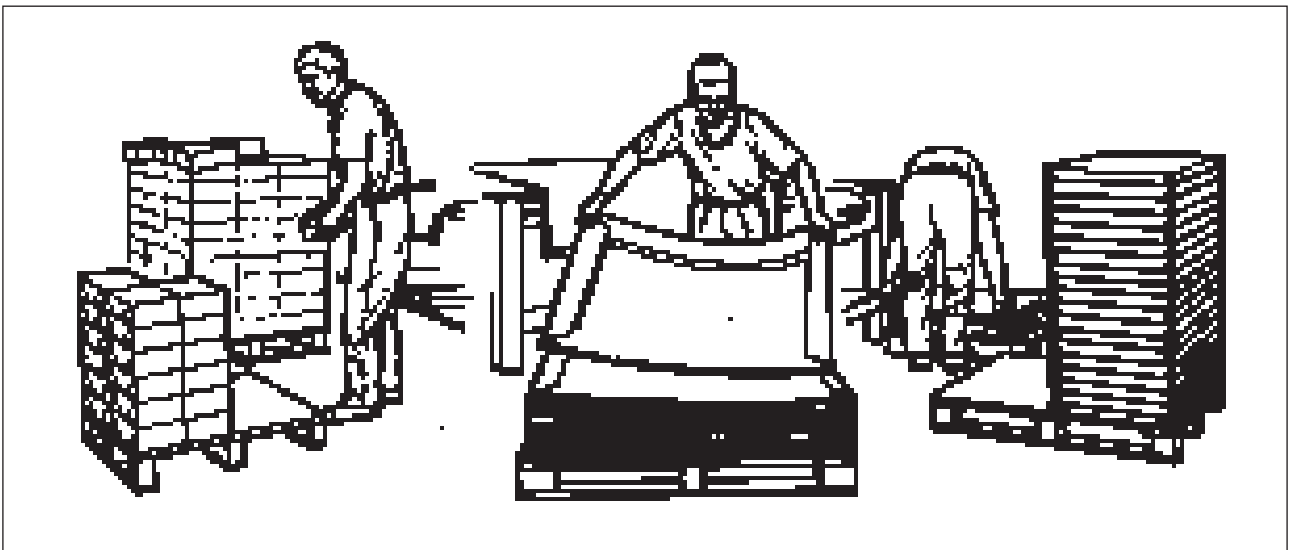
24 Broke handling problems can sometimes be solved by:

- eliminating all broke! (or at least reducing it and securing additional obvious business benefits)
- installing conveyors (under the machine)
- using buggies, clamp trucks, fork-lift trucks
- using reel splitters
- using unwind stands
- eliminating offcuts
- using a deckle machine.

Ream handling

Problem

25 Ream wrapping is now automated in many mills. However, hand wrapping is still sometimes necessary, especially when a range of different products is produced. This is an extremely repetitive task involving weights in the range of 25 kg and paper size up to A3, and involves lifting the product through a range of heights from floor level to waist height usually with a twisting movement (see illustration below).



An HSE inspector questioned operatives working in a ream packing department about their work. Six operatives had been doing the same job for

more than 20 years without apparent problem. However, they all had stories about new recruits who were not able to stay the course, and one female operative revealed that she had been suffering from a hernia for some time.

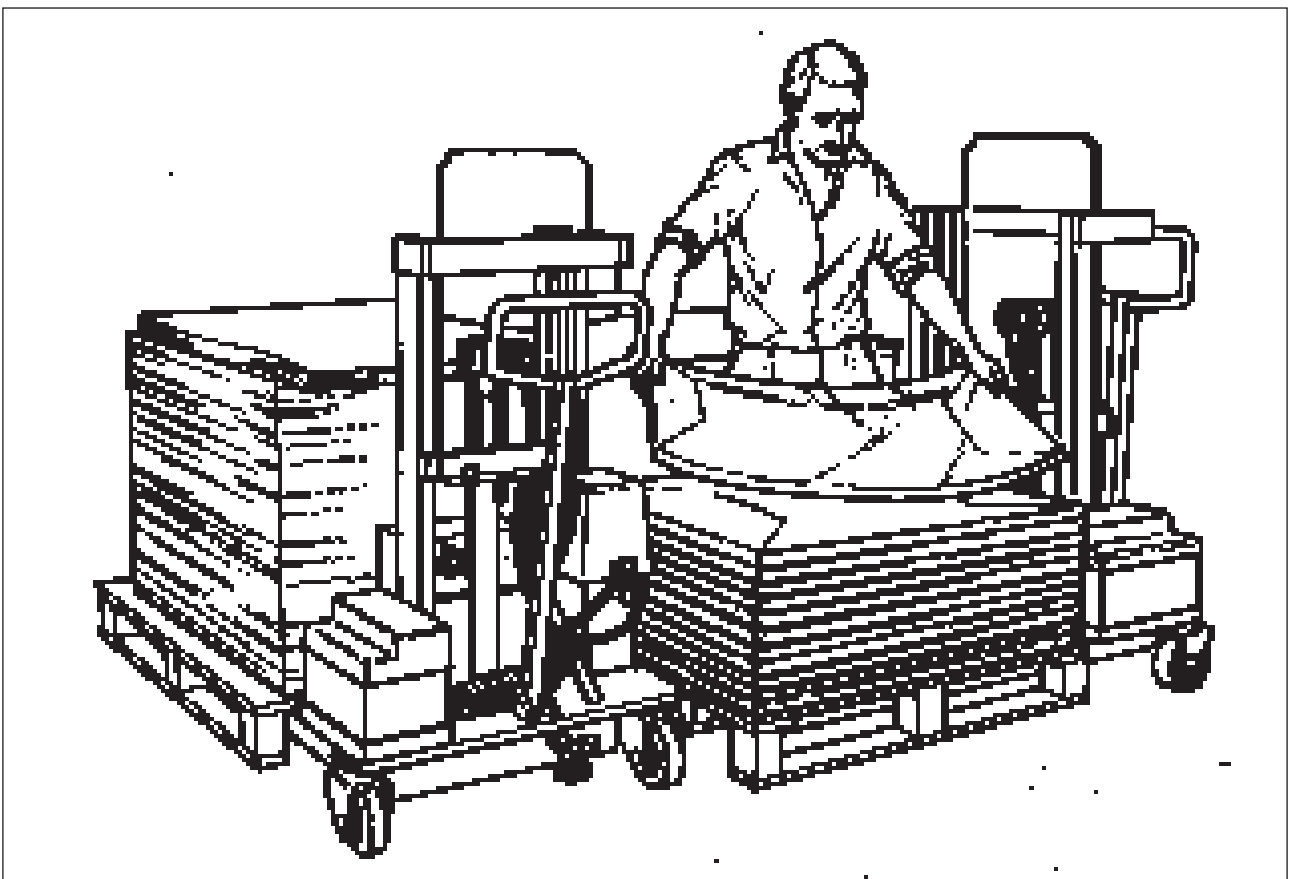
A solution

26 As an immediate measure to reduce the risk of injury the mill purchased an adjustable lift. The introduction of this allowed the operative to work at waist height by removing the need to lift the product from floor level as the stack reduces in height. The mill also proposed carrying out a more detailed assessment to consider the layout of the work in more detail (see illustration below).

Other solutions to ream handling problems

27 Other solutions include:

- hydraulic work tables
- scissor lift tables
- spring-loaded rise and fall tables
- air tables for ease of movement of reams from one workstation to another.



Small reels/biscuits

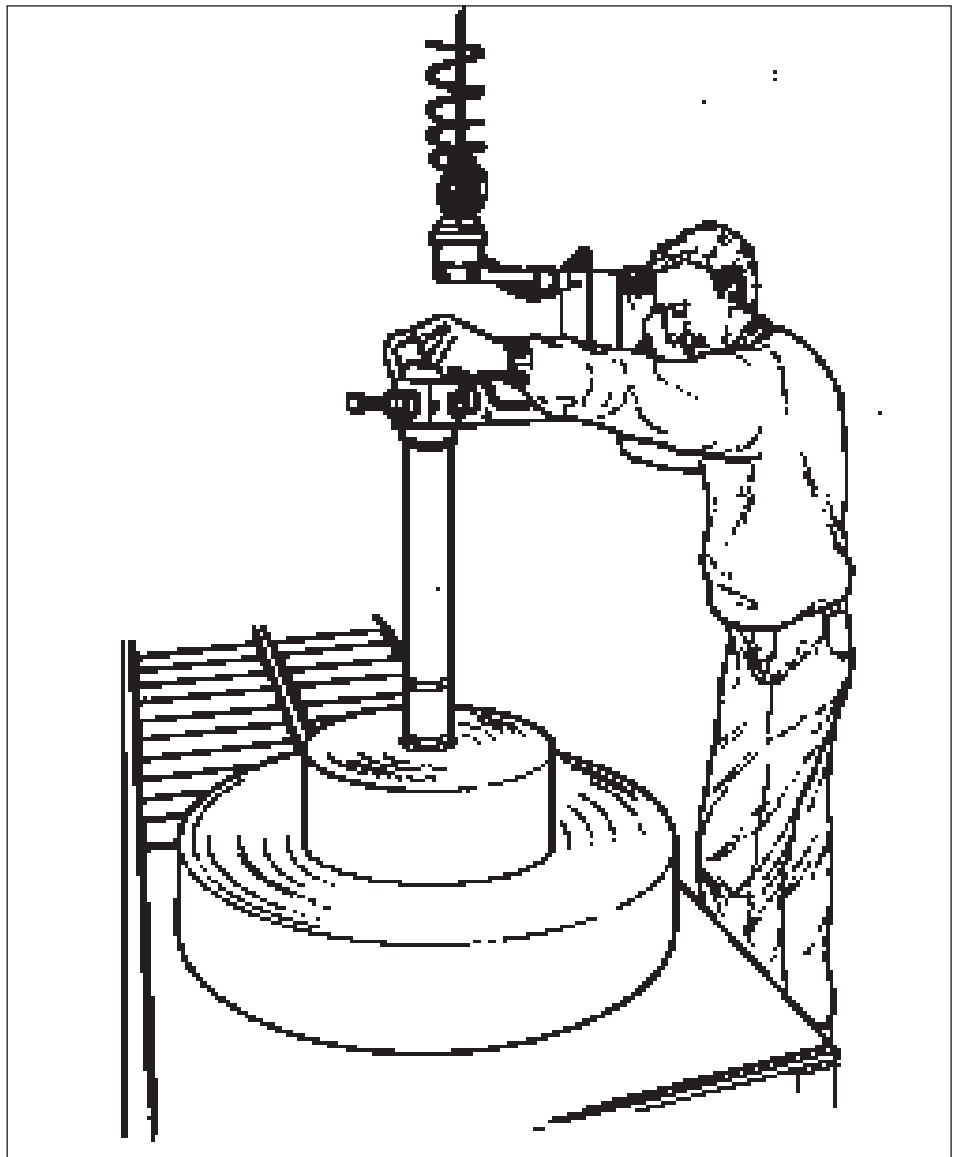
Problem

28 The handling of small reels or teales or biscuits is a particular problem in tissue mills. The work involves the regular lifting, carrying and loading of reels into tissue rewinders/conversion machines.

A new operative on a rewinder machine lifted a biscuit weighing 40 kg on to a machine and pulled a muscle in his right leg. A hoist was provided but accepted practice was only to use it for lifting biscuits on to higher levels of machine.

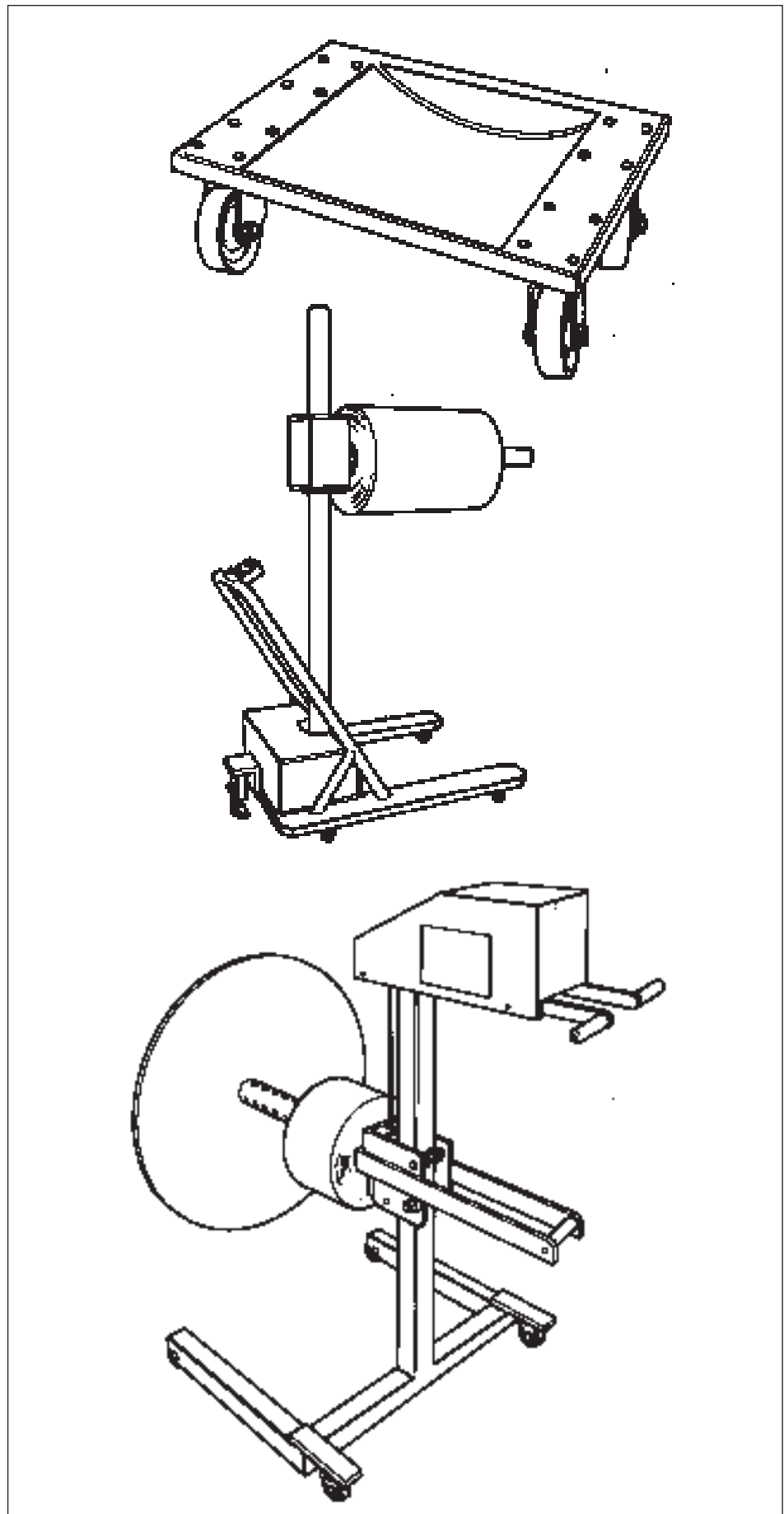
Solutions

29 The following illustration shows a lifting device and a fixed hoist which have been used to overcome these particular manual handling problems.



.....

30 The following illustrations show examples of proprietary mobile equipment which can be used to transport small reels.



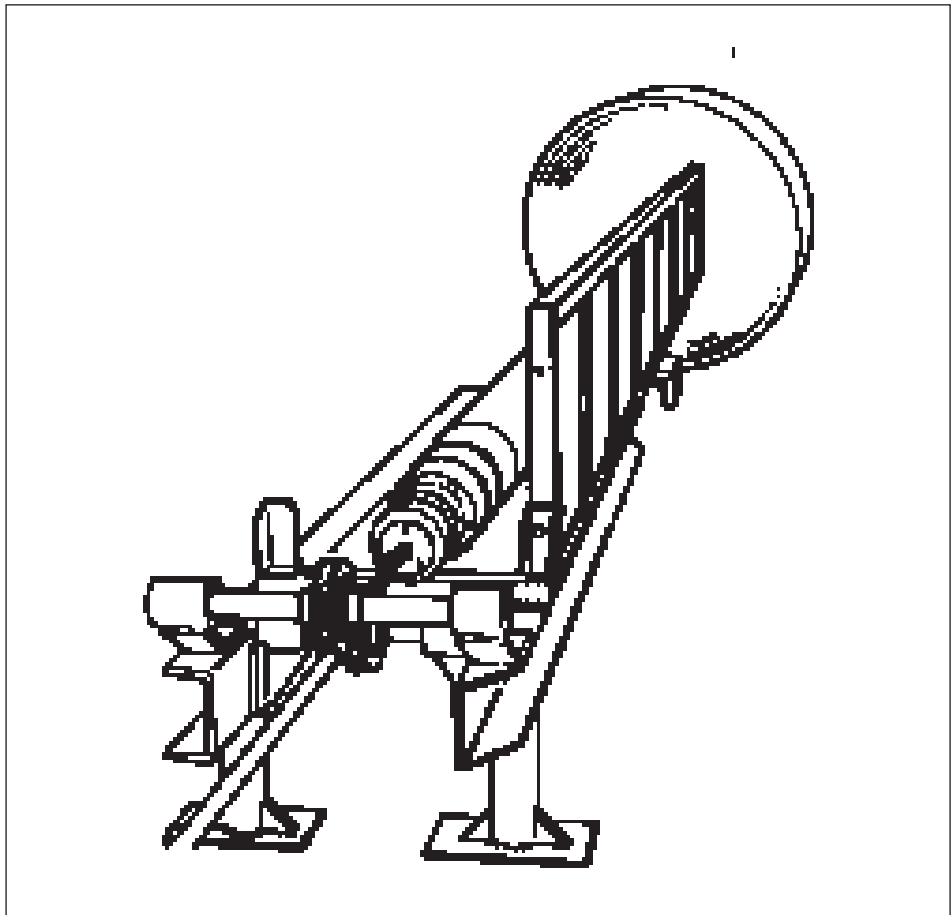
Shell removal

Problem

31 The removal of shells from reels. This is a task which has traditionally been carried out by two operators - one holds the reel while the other pulls on the shell. Many injuries resulted.

A solution

32 The illustration below shows how the problem was solved in one mill. The shells have been modified to include an eye bolt on to which the operator now attaches a wire clip. The shell is then pulled out of the reel under power. This modification had eradicated the manual handling problem and can also be carried out much more quickly.



Fitting cores to shafts

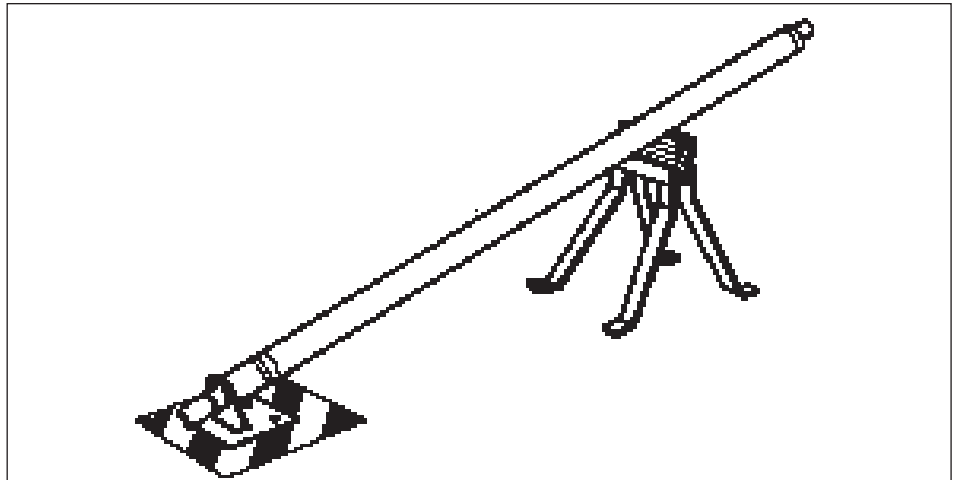
Problem

33 The operator had to fit a core on to the shaft. This was an awkward task because the operator had to hold the shaft with one hand while trying to slide the black cover on to the shaft with the other hand.

.....

A solution

34 A very simple solution to this problem was found by providing two stands to rest the shaft on while sliding the core tube on.



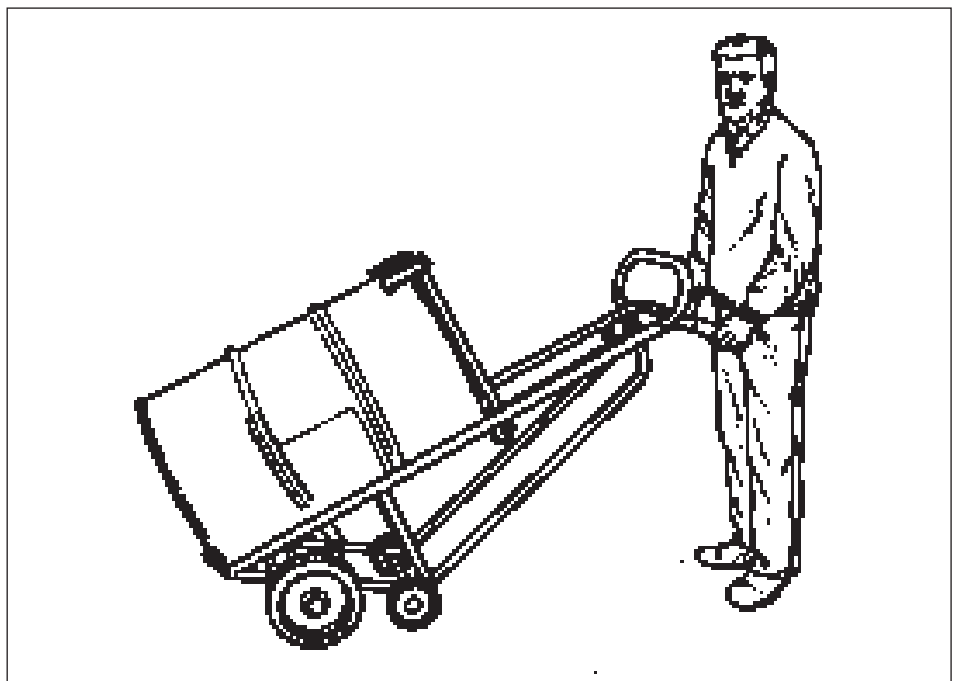
Handling raw materials

Problem

35 Although much of the raw material for the papermaking process is added automatically, sacks and drums still have to be regularly moved in most mills.

A solution

36 The following illustration shows an ergonomically designed trolley being used to transport 45 kg drums of dyes. The addition of the two extra wheels makes the trolley much easier to move.



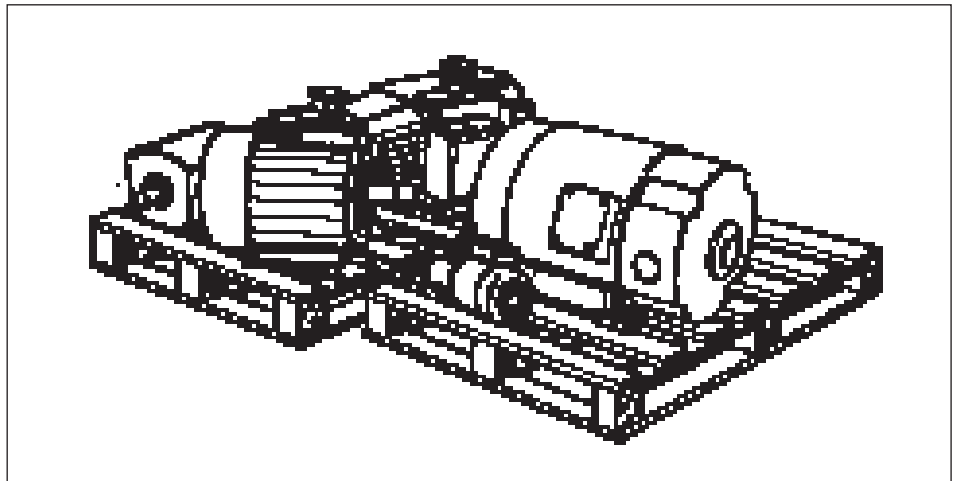
Maintenance activities

Problem

37 A wide range of maintenance activities give rise to a large number of injuries each year in paper mills. Some maintenance activities require detailed assessment and this is dealt with in the next section. Other maintenance problems can, however, be dealt with fairly simply.

A solution

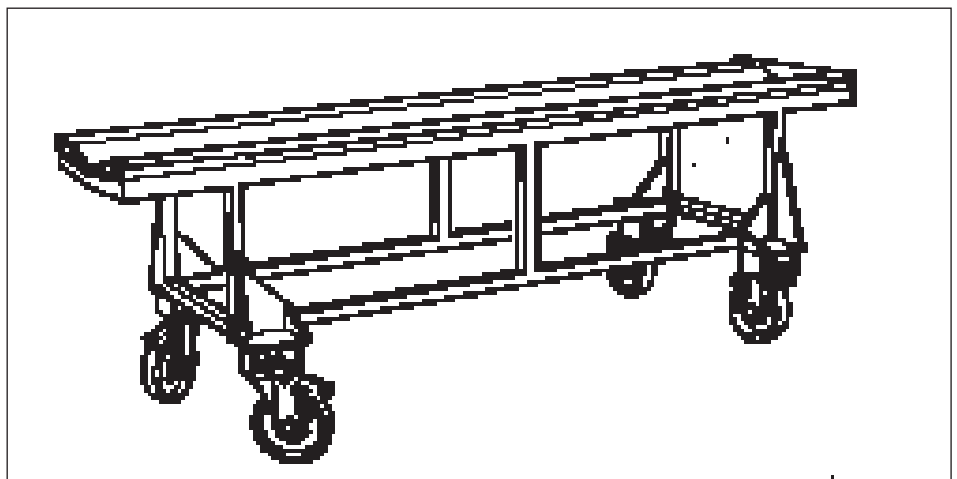
38 Store new machine parts directly on pallets so they can be transported by fork-lift truck.



A fitter lifted a motor/gearbox unit weighing 50 kg on to a work table and suffered internal strain injuries. Such units were normally moved on pallets using a pallet truck but not on this occasion.

A solution

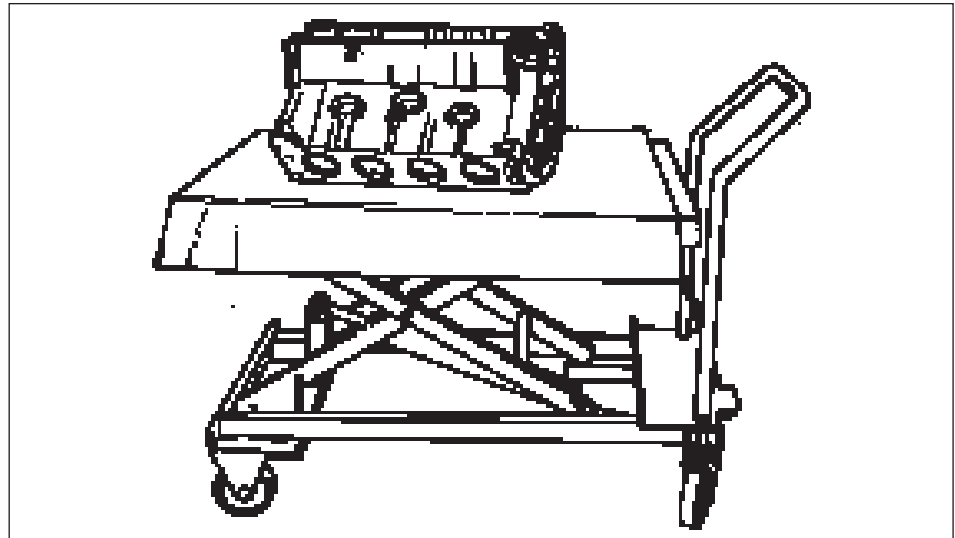
39 Fit wheels to the work table.



.....

A solution

- 40** Use a variable height trolley for versatility.



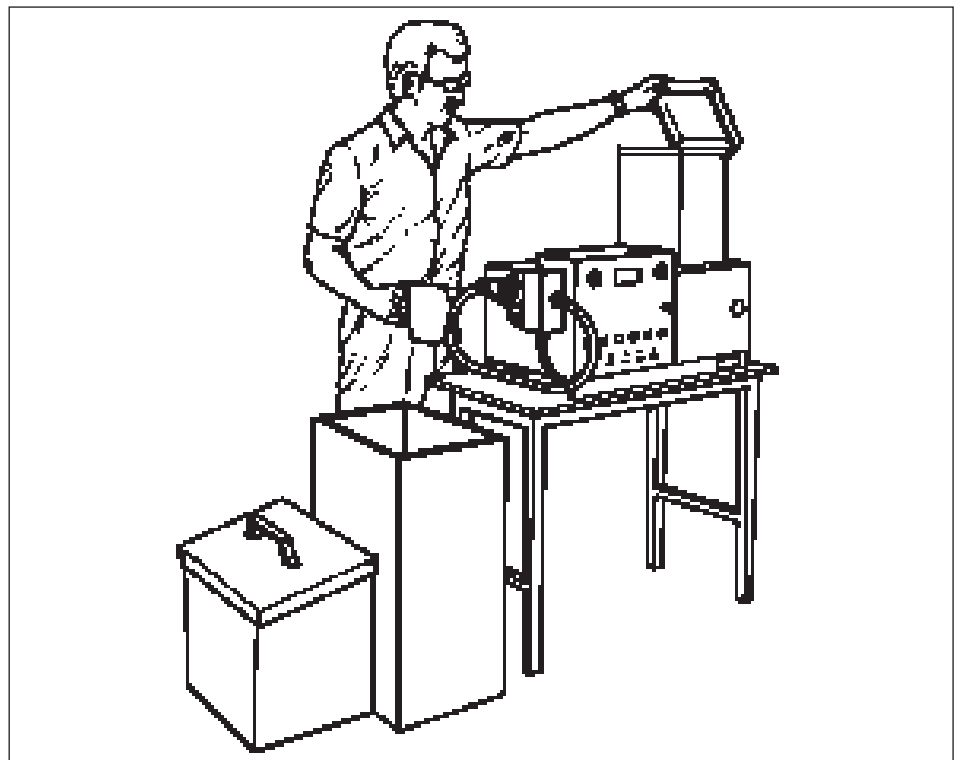
Miscellaneous

Problem

- 41** Loading glue into a gluing machine from 45-gallon drums.

A solution

- 42** The liquid glue was replaced by pellets loaded by means of a small jug, as shown in the illustration below.



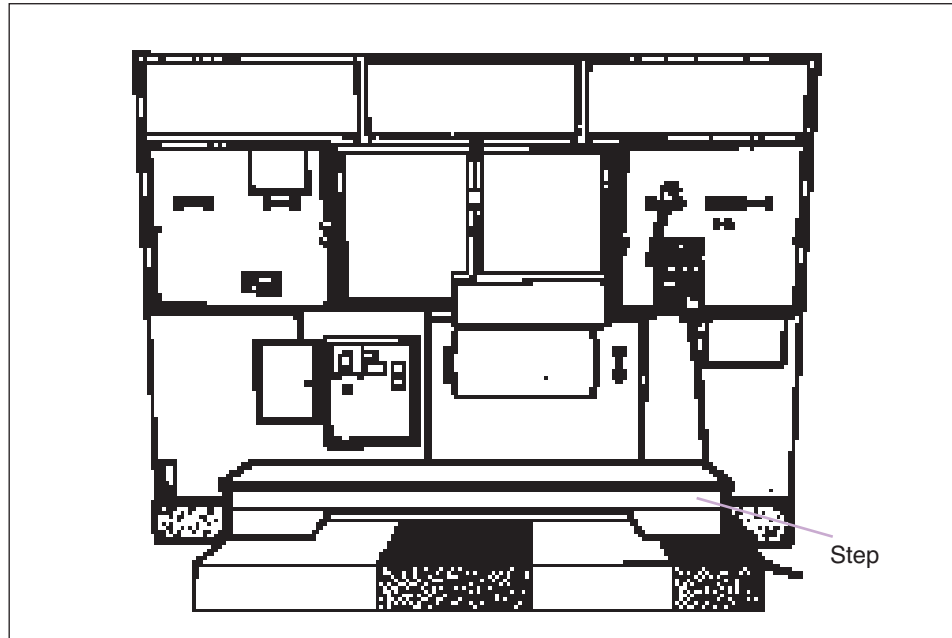
.....

Problem

43 An operator had to stretch to reach into the machine.

A solution

44 A step was provided to raise the height of the operator.



Conclusion **45** This section contained examples of simple solutions which have been found for common manual handling problems in paper mills. Some of the solutions have been devised by the mills themselves and others by companies specialising in developing proprietary equipment to facilitate handling processes. Most of the solutions illustrated were relatively inexpensive to install and have resulted in cost-effective benefits to the mills which have used them.

DIFFICULT ASSESSMENTS

46 Although a number of manual handling problems can be solved quite simply by giving the problem some thought and using common sense, other problems are more difficult to solve. Mills have come across difficulties in three main areas and these will be considered in turn:

- Particular tasks where no single simple solution exists, eg hand packing in a tissue conversion area;
- A wide range of individual tasks where it is not practicable to assess each one separately, eg everyday maintenance tasks;
- Infrequent complex activities which involve a number of different risks, eg planned maintenance shuts.

**Detailed
assessments**

47 Where a significant manual handling problem is evident but no simple solution is apparent, it will probably be necessary to carry out a detailed assessment following ergonomic principles. This is not as complicated as it sounds. Ergonomics is about fitting the task to the person rather than fitting the person to the task, and you do not have to be an ergonomist to apply ergonomic principles. An assessment checklist can lead the assessor into asking the right sort of questions. This is achieved by breaking down the activity into the following aspects:

Task - does it involve:	Example
holding loads away from the trunk?	reel-bar handling
twisting and stooping?	broke handling
reaching upwards?	maintenance activities
strenuous pushing or pulling?	clothing changes
repetitive handling?	ream handling
a work rate imposed by the process?	reel handling
Loads - are they:	Example
heavy, bulky or unwieldy?	reels, biscuits, reel-bars
difficult to grasp?	broke
intrinsically harmful?	doctor blade
Working environment - are there:	Example
constraints on posture?	maintenance activities
poor floors?	pulp and water on machine floor
variations in levels?	machine shuts
hot/humid conditions?	machine shuts
poor lighting conditions?	machine shuts

48 Other factors which also need to be taken into account are:

- individual capability, eg has the person already got a history of back pain? and
- whether movement or posture is hindered by clothing or personal protective equipment.

Example: *Reel-bar handling*

49 Reel-bar handling has long been recognised as a dangerous manual handling activity in paper mills. The activity usually involves metal bars in the

.....

region of two metres in length and weighing up to 100 kg being inserted into the centre of reels. Many injuries have resulted.

50 One mill carried out a detailed assessment of the activity and as a result was able to introduce significant reduction in the risk of injury.

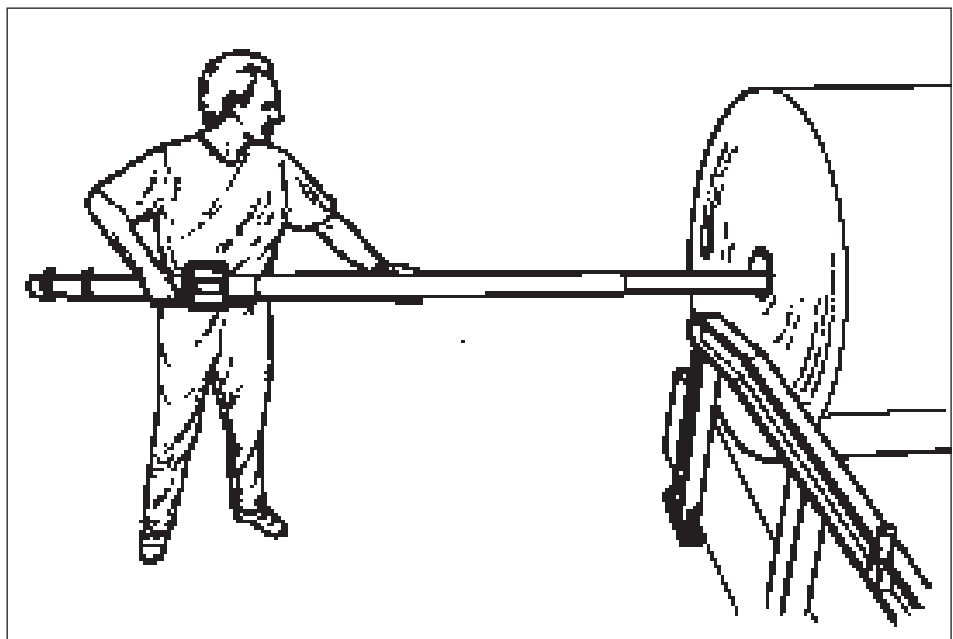
A machine operator injured his back and left arm while attempting to remove a reel-bar from an empty core at a tissue rewinder. The reel-bar weighed approximately 45 kg with an offset centre of gravity and was over two metres in length. His injury resulted in more than four months off work.

51 The main risk factors were found to be:

- the task which involved holding the load away from the trunk, twisting and stooping;
- the load which was heavy, bulky and unwieldy.

52 Once these risk factors had been identified the mill decided to try to do something about the twisting and stooping and the weight of the load. The work area was redesigned to include a feed rail and ramp. This allowed the operators to roll the reel-bar at waist height instead of handling it in a stooping position at knee level. A major innovation was the introduction of lighter reel-bars. The mill first tried using aluminium bars but these were not found to be sufficiently heavy duty. Carbon fibre bars have, however, been found to be successful and the weight of the reel-bar has been reduced by half.

53 In this example the risk of injury has been reduced but not removed entirely. The mill believes that the risk of injury will only be completely removed if the process is substantially altered to eradicate all use of reel-bars.



.....

Example: *Tissue packing lines*

54 Hand packing on tissue lines is less common than it used to be because many of the lines are now automated. However, where it still exists there is usually a significant risk of work-related upper limb disorders (WRULDs). It is not uncommon for operators working on such lines to be reluctant to report any problems because of a fear of losing their job. Good mills realise the importance of encouraging the early reporting of any aches and pains because this can help prevent the development of long-term irreversible effects. A detailed ergonomic assessment will usually be required to reduce the risk of injury in these circumstances.

55 The main risk factors for tissue packing in one mill were found to be:

- the task which involved a high degree of repetitive handling
- a work rate imposed by the process
- frequent twisting and stooping.

56 The assessment was complicated because these risk factors varied for each operating position and each had to be considered separately.

57 As a result of the assessment the following measures were introduced:

- providing adjustable seating
- modifying the height of work surfaces to enable good operator posture
- reducing stretching by reducing width of conveyors
- providing scissor hoist tables to reduce bending and lifting
- arranging for loads to be slid across smooth surfaces rather than having to be transferred by operators lifting them and twisting before putting them down
- making sure that rest intervals were adequate.

58 In cases such as these, mills may find it necessary to bring in outside specialist ergonomic consultants for further advice. Mills may sometimes not realise it is necessary to find an outside consultant until after they have attempted to carry out their own assessment. In this case they will be in a better position to specify the nature of the problem and so have a clearer idea of what they require from the consultant.

**Generic
assessments**

59 Where a wide range of individual tasks are carried out, for example in everyday maintenance tasks, it may not be practicable or worthwhile to assess each one separately. One solution to this problem is to group together common threads from a

.....

range of broadly similar operations and carry out a generic assessment of that group. For example, pump changing activities could be assessed in this way.

60 Everyday maintenance activities can be looked at as a whole and the various types of task, load and working environment listed so that a selection of them can be reviewed. By doing this the range of manual handling risks to which maintenance staff are exposed can be established and most importantly risk reduction measures identified.

Example: Pump/motor/valve removal

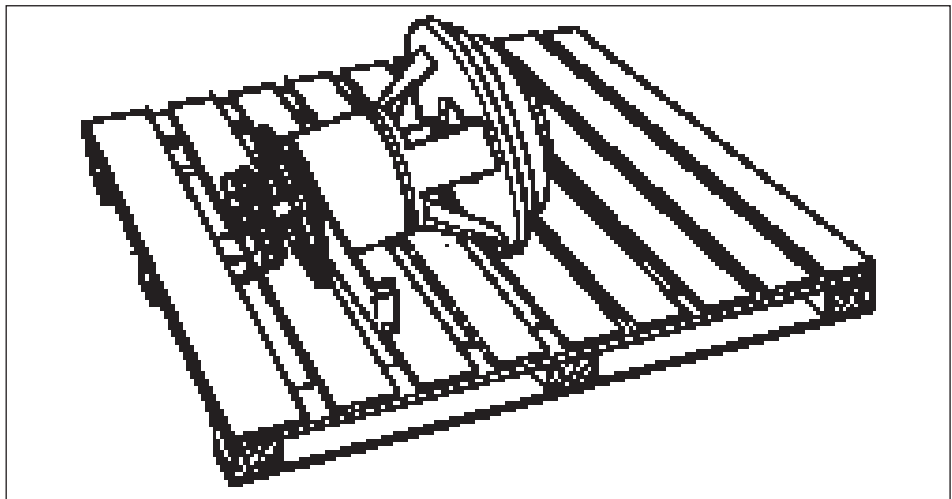
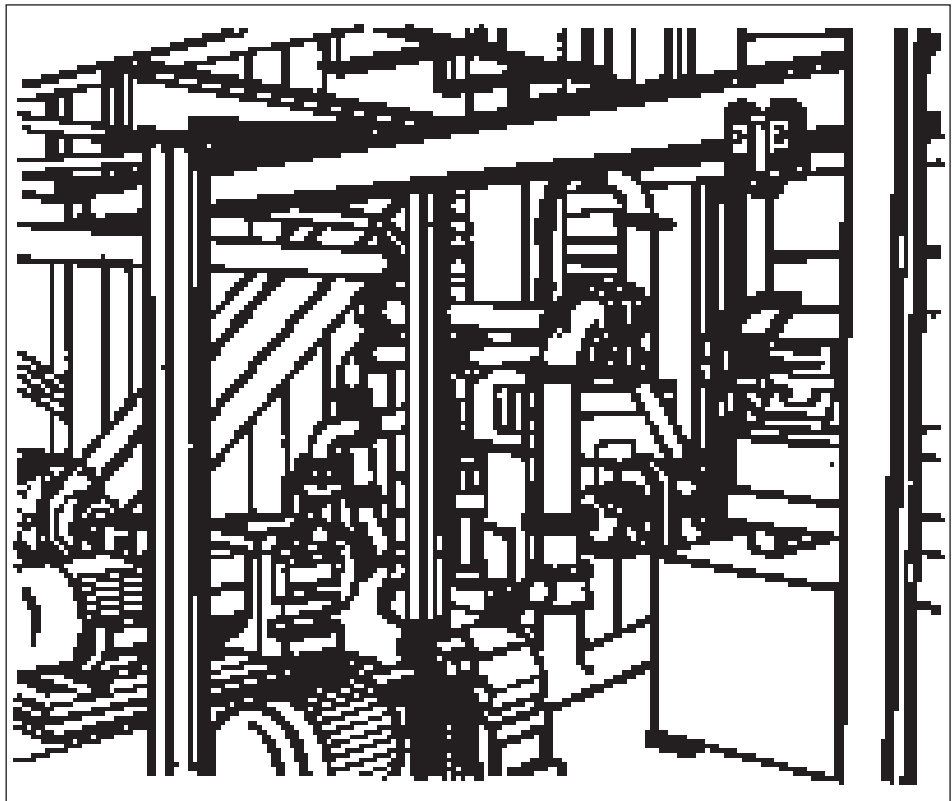
61 The task involves removing pumps and repairing them or replacing them with new ones. The risk factors involved are:

- the load which varies in weight and which may be difficult to grasp. The weight may be unknown
- the task which is perhaps carried out in a confined area and involves twisting, stooping, reaching upwards and strenuous pushing or pulling
- the working environment which possibly imposes constraints on posture, wet and slippery floors, variations in levels, hot/humid conditions and poor lighting conditions.

A fitter was helping a second person to remove a pipeline valve. The fitter held the valve while the other person removed the flange bolts. After releasing it, they both lowered the valve 1.2 metres to the floor. The weight of the valve was unknown but thought to be 'heavy'. The fitter hurt his back and was off work for two weeks.

62 A range of reduction measures (some are mentioned in the previous section) can be introduced to reduce the risk of injury for this type of activity, eg:

- making arrangements for weights to be marked on components. Suppliers/ manufacturers can be required to provide this information and an in-house programme of weighing components can be introduced. Weights of items can be put into computerised maintenance data so that they come out on job sheets
- provision of lifting beams in those areas where regular maintenance access is required (see illustration at top of page 21)
- use of mechanical equipment for transporting components. A range of different equipment will be required dependent on the range of components to be handled
- Palletisation of components in stores so that it is easy to move them by



fork lift truck (see lower illustration above)

- making sure that good standards of housekeeping are maintained in the area where components have to be moved, to ensure firm foothold and minimise the risk of obstructions.

A fitter together with four other people was attempting to push a large electric motor (approximately 1.5 tonnes) on a wheeled bogie. The load was moved a short distance before striking an obstruction and the operation was suspended. Mechanical handling equipment was subsequently used successfully to complete the operation. The fitter was subsequently off work for several weeks with a back injury which was thought to have been aggravated by this activity.

.....

Example: Movement of toolbox

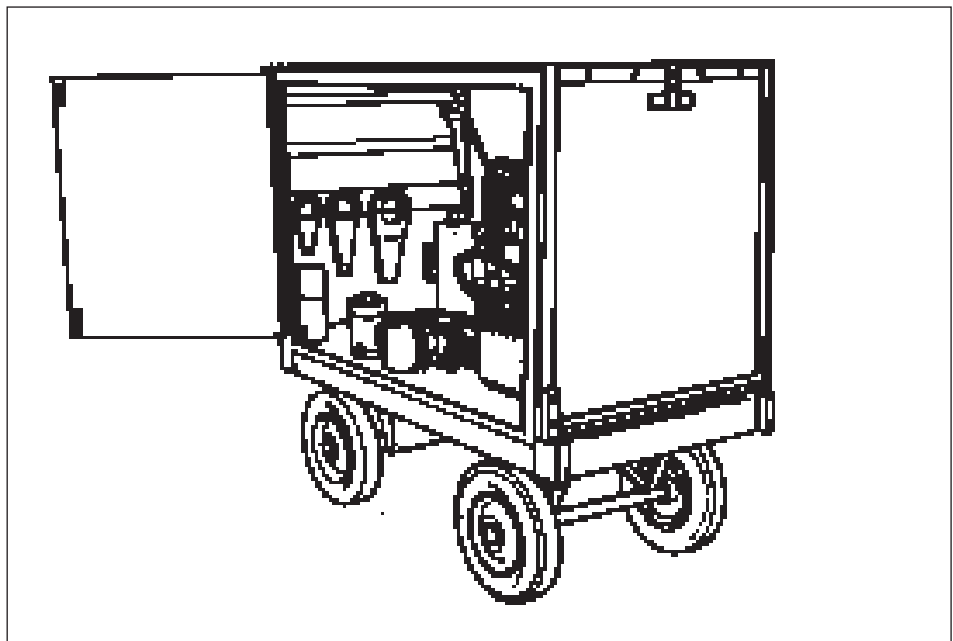
63 Toolboxes can be heavy loads which on their own can give rise to risk of injury. Fitters are renowned for making their own collections of their favourite tools. The risk factors involved are:

- the task which may involve carrying the toolbox long distances
- the load which will vary in weight but may be heavy
- the working environment which may involve variations in levels, ie having to climb ladders with the toolbox.

A maintenance fitter hurt his back lifting a toolbox from his locker. When weighed, it was found that the toolbox weighed 35 kg. The locker was located at floor level. The fitter had suffered for years from a chronic back problem. Since the accident he has been given two toolboxes and a trolley to transport them.

64 Risk reduction measures which can be introduced to reduce the risk of injury from handling of the toolbox include:

- introducing a limit to the permissible weight of individual toolboxes and providing additional ones where necessary
- providing trolleys for the transport of toolboxes around the mill.



Complex activities **65** Infrequent but complex activities such as those that occur at machine shuts can seem very difficult to assess. Typically, paper machines are being shut for shorter periods and during this time a great number of maintenance

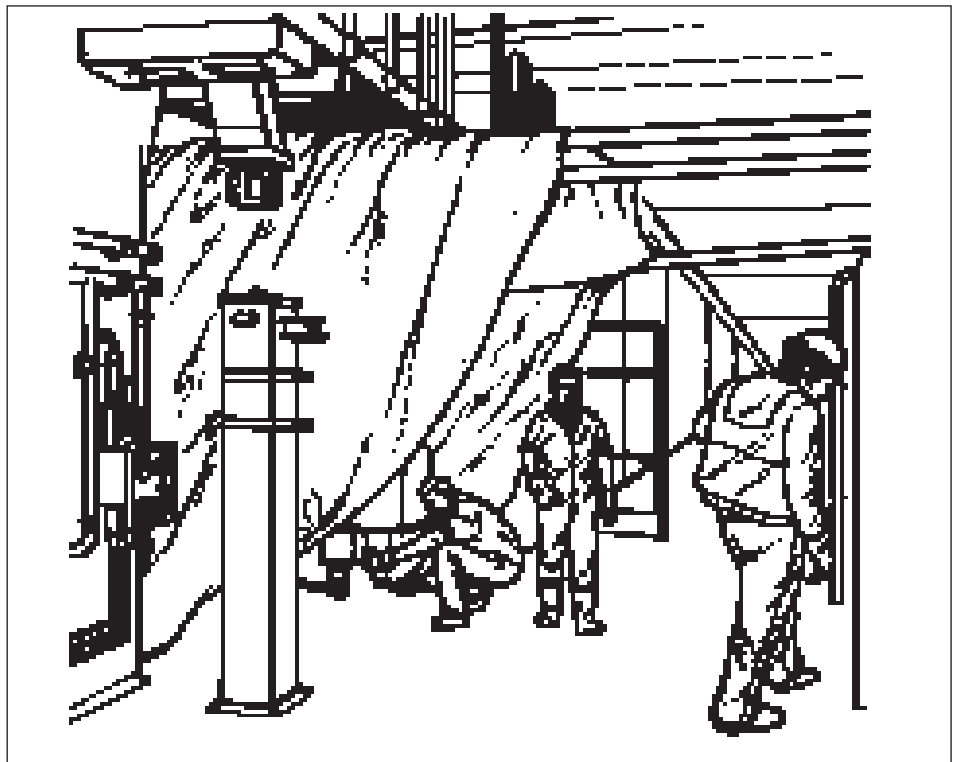
.....

activities take place involving large numbers of contractors in addition to mill employees. Manual handling is just one of the very real risks which are present during machine shuts. Some of the hazards such as working at heights and the hot and humid atmosphere contribute to the manual handling risks. Because of this, some mills have found it easier to consider the whole range of hazards which occur at that time rather than look at manual handling in isolation.

66 *The key to successfully assessing activities at maintenance shuts is to start the assessment in the planning stage.*

67 In order for maintenance shuts to complete the work schedule within the limited time allowed, the jobs to be done need to be very carefully planned. Control of risks needs to be seen as integral to this planning. Many unsafe acts arise from poor planning, leading to the need to improvise which usually entails costly delays in carrying out the activity. Risks including those presented by manual handling need to be considered at this planning stage, eg contractors can be asked to produce method statements incorporating their own risk assessments.

Example: Clothing change



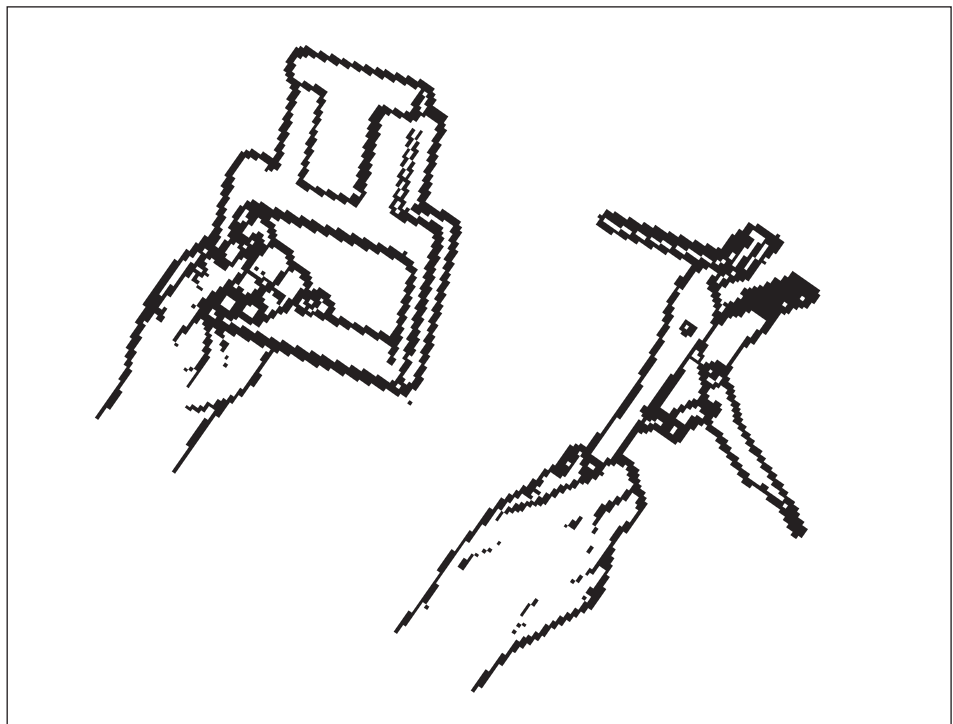
An operator sustained injury to his lower back while lifting a felt-carrying roll with two other men. The weight of the roll was 100 kg and the space was very restricted with less than one metre headroom. One of the men touched the hot drying cylinder and dropped the roll leaving the operator to take the full weight of the load. The mill is now modifying the method of changing felts so that a more accessible roll is fitted last. The provision of mechanical assistance is also being considered.

.....

68 During the planning stage for the next shut, a mill identifies that it needs to carry out a felt change. The mill has been following the same system of work for this activity for many years but decides that it needs to review the system in the light of the need to assess risks.

69 The following measures can be considered:

- Use of mechanical lifting equipment whenever possible for lifting felts inside the machine
- Handling of felts to and from the machine to be mechanical
- Use of mechanical assistance for pulling felts through and across the machine. For example, some mills have built-in hand-operated pulling winches. Some mills use gripper devices for a surer hold on felts when pulling them and these can be used for hand or winch pulling.

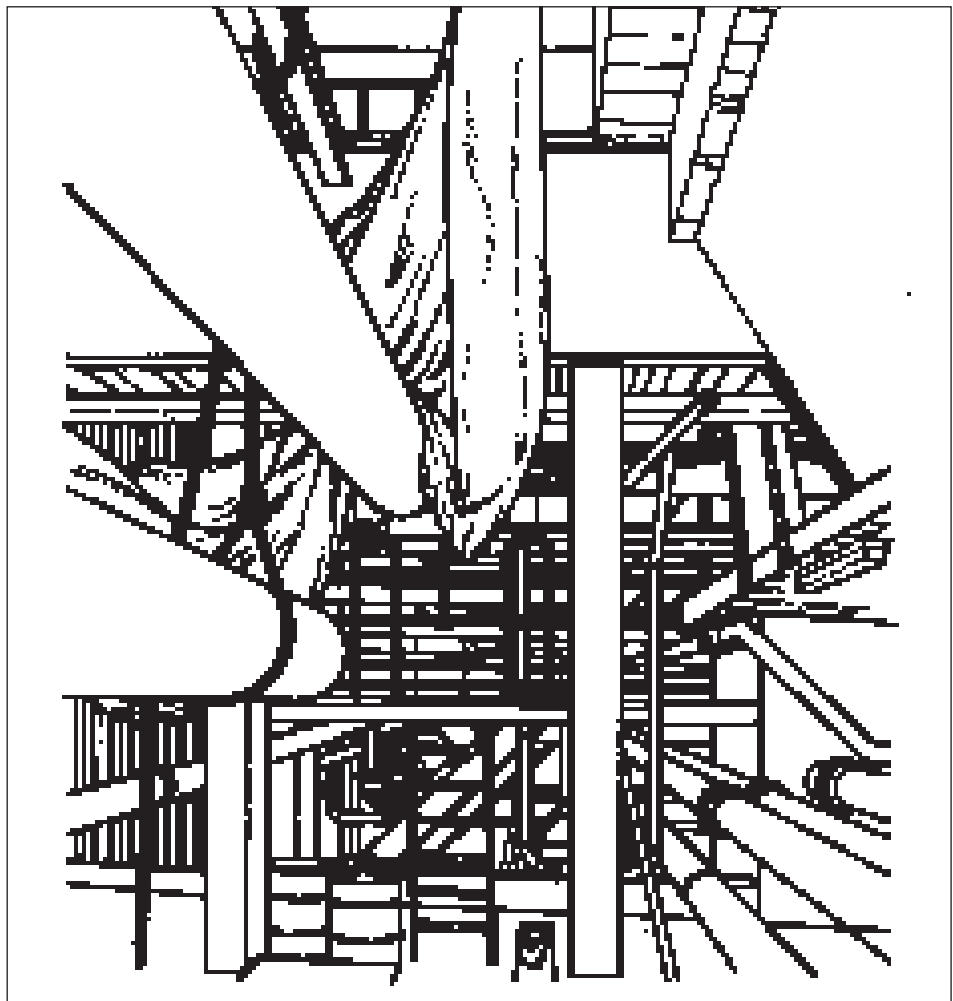


- Access to be made as safe as reasonably practicable using where appropriate:
 - stagings
 - customer-built temporary platforms designed to fit the machine and specific access needs
 - mini cherry pickers
 - providing anchorages and lines to which safety harnesses can be attached.

.....

70 By reviewing procedures and systems before the shut, the mill has the opportunity to introduce new risk reduction measures. The assessment should not be considered to be complete at this stage. The next step is to review the procedure for the felt change when it is happening to see what risks remain, whether anything has been missed and if any further measures can be introduced. Some mills have found it useful to video the activity. Mills which have introduced additional mechanisation into clothing operations have found that not only have they reduced the risk of injury as a result of manual handling but also risk from other hazards such as working at heights with the additional benefit of speeding up the felt change operation.

71 Better access is clearly required in the following illustration.



Conclusion **72** Tasks which present risks of injury but for which there is no simple solution can usually be assessed by analysing them using ergonomic principles. Sometimes ergonomic consultants may have to be brought in. Generic assessments can be used for large numbers of varied tasks that occur in everyday maintenance activities. Complex activities involving a range of hazards, including manual handling hazards, are usually best considered firstly in the planning stage when existing systems of work can be reviewed in the light of developments in risk reduction measures, and secondly when they actually take place to see if practice differs from theory.

.....

MANAGING THE MANUAL HANDLING RISK

73 The assessment of hazardous manual handling operations and the introduction of risk reduction measures need to be integrated into the mill's safety management system.

- Management need to prioritise actions arising from the exercise and incorporate these into an action plan.
- Senior management need to ensure that adequate resources are available to fund the action plan.
- Line management have responsibility to ensure that actions are implemented and assessments reviewed when necessary.
- Supervisors and employees will have responsibilities to ensure that the risk reduction measures which have been provided are used.
- Information gained from audits and accident and ill-health statistics can be used to monitor and review the adequacy of the assessments.

Making improvements:

- Choose the most important things to tackle first.
- Set realistic dates for each of the improvements needed.
- Don't try to do everything at once.
- Remember to agree precautions with the workforce.
- Don't forget that new training and information could be needed.

New projects and manual handling

74 Many of the hazards arising from manual handling operations occur because the individual has to fit into the work environment and not the other way around. The opportunity exists therefore when installing new equipment and work procedures to ensure as far as possible that risks from manual handling activities can be minimised. For example, the felt changes on new papermaking machines are highly mechanised resulting in a faster and safer procedure. It is strongly recommended that these issues are carefully considered before a contract is agreed and appropriate specifications incorporated into the contract.

75 Consideration should also be given to manual handling issues during the management of the project and the installation of new equipment. The application of the Construction (Design and Management) Regulations 1994 (CDM) will also need to be taken into account.

.....

Training and education in back care

76 No mention has been made so far about training for manual handling. This is because this guidance has been mainly concerned with avoiding manual handling and with measures to make the task safe. It is also true that in the past some employers have mistakenly thought that training in manual handling techniques can enable employees to lift greater loads and this has taken the emphasis away from trying to avoid manual handling or trying to make the task safer. To provide training for handling difficult and awkward loads without trying to do something about the task itself is similar to providing personal protective equipment without taking steps to reduce a hazard at source. However, training and particularly education in back care has an important role to play in reducing injury from manual handling. Back injuries account for a large proportion of the accidents which are reported. Training is an important risk reduction measure in activities such as the wide range of maintenance operations which are carried out and for which generic assessments may have been made. Because generic assessments 'generalise' it is important that staff are able to recognise situations which arise outside the application of these assessments. Training and education in back care can help people to recognise those situations which might give rise to injury both inside and outside work.

An accident report received by HSE stated:

'Injured person states that he hurt his back lifting a small piece of paper from the floor.' Investigation by an inspector revealed that the injured person had spent an hour during the previous shift moving 1.5-tonne reels due to a process backlog and that during the 20 years he had worked for the mill he had suffered from a chronic back problem.

77 Some managers have shown cynicism about the origin of some back complaints. This is partly due to ignorance of the nature of progressive and chronic back injuries and also to a lack of commitment to improving the welfare of the workforce. Enlightened mill management realise that it does not matter if an individual's back was made worse by the gardening at the weekend if they are also expected to undertake onerous handling tasks when they are at the mill.

78 The end result is the same - an individual with a chronic back injury will not be able to undertake difficult manual handling operations in the mill or at home!

79 Getting people to take care of their backs is the sign of a concerned employer and makes good business sense.

Conclusion

80 Actions arising from assessments should be prioritised and put into an action plan.

81 Risks associated with manual handling operations should be reviewed as necessary taking into account accident and ill-health statistics.

-
- 82** Effort should be put into trying to ensure that any new equipment and work procedures are designed to minimise any manual handling risks.
- 83** Back care protection programmes can be introduced into mills to protect worker welfare.

USEFUL READING

Generic manual handling guidance from HSE Books

- 1 *Manual handling. Manual Handling Operations Regulations 1992 (as amended). Guidance on Regulations L23* (Third edition) HSE Books 2004
ISBN 0 7176 2823 X
- 2 *Manual handling: Solutions you can handle* HSG115 HSE Books 1994
ISBN 0 7176 0693 7
- 3 *Getting to grips with manual handling: A short guide* Leaflet
INDG143(rev2) HSE Books 2004 (single copy free or priced packs of 15
ISBN 0 7176 2828 0)
- 4 *Manual handling assessment charts* Leaflet INDG383 HSE Books 2003
(single copy free or priced packs of 10 ISBN 0 7176 2741 1)

**MAIL ORDER**

HSE priced and free
publications are
available from:

HSE Books

PO Box 1999

Sudbury

Suffolk CO10 2WA

Tel: 01787 881165

Fax: 01787 313995

Website: www.hsebooks.co.uk

RETAIL

HSE priced publications
are available from booksellers

HEALTH AND SAFETY INFORMATION

HSE Infoline

Tel: 08701 545500

Fax: 02920 859260

e-mail: hseinformationservices@natbrit.com

or write to:

HSE Information Services

Caerphilly Business Park

Caerphilly CF83 3GG

HSE website: www.hse.gov.uk

Paper and Board

Industry

Advisory

Committee

.....

Part 4:

Prevention of heat stress in paper and board mills

Members of PABIAC main committee

.....

Mr A D Porter	HSE (Chair)
Mr G Beattie	GPMU
Mr M Bonnett	AEEU
Mr C Britchford	Arjo Wiggins Fine Papers Ltd
Mr M Eede	TGWU
Mr G Grace	Paper Federation of Great Britain
Mr C Griffiths	St Regis Paper Co Ltd
Mr A Harvey	AEEU
Mr P Hiett	GPMU
Mr R A Hudspith	GPMU
Mr T Mellish	TUC (Observer)
Mr P Planet	Bridgewater Paper Co Ltd
Mr C Surtell	Paper Federation of Great Britain (Observer)
Mr K Vikman	UK Papers (Graphic and Business Papers) Ltd
Mr T Watts	Paper Federation of Great Britain
Mr K Willis	GMB
Mr M Wilcock	HSE (Secretary)

Health subcommittee

.....

Dr A Erlam	HSE (Chair)
Mr G Dews	SCA Hygiene
Mr R A Hudspith	GPMU
Mrs K Parkinson	HSE
Mr A Wooler	UK Paper
Mr S Longbottom	HSE (Secretary)

Paper and Board

Industry

Advisory

Committee

.....

Part 4:

Prevention of heat stress in paper and board mills

.....

© Crown copyright 2000

*Applications for reproduction should be made in writing to:
Copyright Unit, Her Majesty's Stationery Office,
St Clements House, 2-16 Colegate, Norwich NR3 1BQ*

First published 2000

ISBN 0 7176 1768 8

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means (electronic, mechanical, photocopying, recording or otherwise) without the prior written permission of the copyright owner.

This is guidance prepared, in consultation with HSE, by the Paper and Board Industry Advisory Committee (PABIAC), which was appointed by the Health and Safety Commission as part of its formal advisory structures. The guidance represents what is considered to be good practice by members of the Committee. It has been agreed by the Commission. Following this guidance is not compulsory and you are free to take other action. But if you do follow this guidance you will normally be doing enough to comply with the law. Health and safety inspectors seek to secure compliance with the law and may refer to this guidance as illustrating good practice.

CONTENTS

Introduction	1
Relevant legislation	1
Heat stress - the hazard	1
Symptoms of heat stress	1
Risk assessment	2
Assessing heat stress	3
Reducing the risk	6
Safe systems of work	7
Medical assessment, education and training	8
Competence of the supervising medical practitioner	9
Acclimatisation	9
Supervision	10
Personal protective equipment (PPE)	10
Drinking water	11
Appendix 1 Wet bulb globe temperature (WBGT) apparatus	12
References	14
Further reading	14

.....



Introduction

1 Paper and Board Industry Advisory Committee (PABIAC) studies point to the possibility that operators in paper mills can be subjected to such high levels of heat and humidity that they may suffer from heat stress. This guidance has been prepared to help employers understand where this may occur in a mill, to recognise the symptoms and to ensure that any necessary control measures are understood and implemented.

2 The potential for heat stress was identified in a pilot study carried out in four modern mills with large, high-speed machines. It is possible that surveys in other mills may produce similar findings. Employers in mills should use this guidance to assess whether such effects could occur. Companies should also be aware that some personal protective equipment used in industry may not be suitable for work in paper mills. This means that mills may have to review working practices.

3 This guidance is intended to promote discussion between employers in mills, their employees and safety representatives. HSE inspectors will be asking how it has been considered by mills and what measures have been adopted as a result. PABIAC will continue to review this problem and provide further information in the future. The guidance is intended for insertion into the PABIAC binder *Guide to managing health and safety in paper mills*.¹ The guide is designed to build into a comprehensive reference document for the paper and board industry and contains both priced and free publications produced by PABIAC. It is available from HSE Books.

Relevant legislation

- Management of Health and Safety at Work Regulations 1999 (the Management Regulations)
- Workplace (Health, Safety and Welfare) Regulations 1992
- Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995 (RIDDOR)
- Health and Safety (First-Aid) Regulations 1981

Heat stress - the hazard

4 Working in high temperatures and high humidity can not only cause illness and even death, but also loss of concentration leading to lowered productivity and mistakes causing accidents.

Symptoms of heat stress

5 Humans need to maintain their body core temperature within narrow limits. When the body can't eliminate excess heat through increased blood flow and perspiration, body temperature rises from the normal core temperature of 37-38°C and the heart rate increases. The first symptoms may include discomfort, fatigue, dizziness and the inability to concentrate. These symptoms can lead to heat cramps, heat exhaustion and heat stroke. **Heat cramps** are painful muscle spasms in the legs, arms or abdominal area, which can occur

.....

during or after work. Symptoms of **heat exhaustion** include increased pallor and tiredness, dizziness, clammy skin and nausea. Some people may faint. Less common but potentially fatal **heat stroke** occurs when the thermoregulatory system breaks down under heat stress, sweating stops and deep body temperature reaches 41°C, leading to mental confusion and loss of consciousness. Permanent brain damage will result unless the body is cooled as a matter of urgency.

Risk assessment **6** Some work activities will carry an increased risk of heat stress. These will require special consideration and safe systems of work to control the duration and extent of exposure.

Examples of such activities include:

- entry inside drying hoods/shields, or drying cylinders;
- work on coaters and drying cylinders; and
- work above the machines on the cranes or crane track,

although there are many other areas in which people can be exposed. It is important that mills identify all activities in their mill where heat stress is likely.

7 New, or upgraded, machines often operate at higher temperatures and humidities, and existing work practices may have to be modified. Systems of work may need to be reassessed after the installation of new plant or upgrading of old. One of the best ways to control risk is to stop and cool the plant before carrying out the work, or to schedule work in mill shut downs, at a time when plant and equipment will be cooler. However, there are times when there is no alternative to working in hot and humid conditions and in these circumstances a detailed risk assessment should be made and appropriate control measures introduced.

8 Contractors working in the mill may also be at risk from heat stress. Check that they understand the danger, have assessed the risk and identified appropriate precautions. There are some precautions that will be down to you as host employer: check that everyone knows what has to be done and who will do it.

9 Try to implement the hierarchy of control defined in the Management of Health and Safety at Work Regulations:

- Can the task be avoided?
- Does entry into very hot and humid areas have to take place as frequently?
- Can engineering controls be introduced to reduce the severity of exposure?

Assessing heat stress

10 Several factors can influence the heat load on the body. These include air temperature, radiant heat, humidity, air movement, the level of physical work and the amount and type of clothing being worn. Impervious clothing particularly impedes heat loss, and can cause risk during physically demanding tasks at temperatures as low as 21°C, for example during chemical wash up. Using personal protective equipment (PPE) such as respiratory protection may also affect an employee's tolerance to hot environments. It is not possible to estimate the strain placed on the body by looking at any one of these factors in isolation. A number of **heat stress indices** have been developed which aim to integrate these variables to give a single value which represents the amount of physiological strain in a given situation. These include:

- the Wet Bulb Globe Temperature (WBGT);
- effective temperature and corrected effective temperature (ET & CE);
- the Oxford Index (WD);
- ISO 7933;
- the Heat Stress Index (HSI);
- the Predicted Four Hour Sweat Rate (P4SR); and
- the Index of Thermal Stress (ITS).

11 For most applications, ISO 7933 provides a relatively safe baseline as it is the most extensive and detailed method, but it is complex and difficult to use. Advice on assessment and the use of indices is contained in NIOSH guidance and in British Occupational Hygiene Society (BOHS) Technical Guide No 8.^{2,3}

12 An accepted, straightforward and easy-to-use index is the WBGT. This takes account of ambient air temperature, the cooling effect of air movement over the body, relative humidity and radiant heat. It is important to consider all these factors. The relative humidity, for example, will affect the worker's ability

to control body heat by sweating. Surveys of the thermal environment should take account of both diurnal (eg the heating effect of the sun) and seasonal variation. It is also essential that the work rate and degree of physical effort required to do the job are considered. The equipment and the method of measuring WBGT are described in Appendix 1 and in BS EN 27243: 1994.⁴ Direct reading digital apparatus is available which may be hired or purchased and shared between mills. Assessing the potential heat stress is **not** a simple matter of measuring temperature using a dry bulb thermometer as this will only provide data on a single variable affecting the likelihood of heat stress.

13 WBGT temperatures during tasks such as re-feeding after a break and cleaning debris from beneath the felt have been measured at mills producing high and low quality uncoated papers, newsprint and coated paper in the following ranges:

Table 1 WBGT temperatures measured at four mills

Location in mill	Dry bulb (°C)	Relative humidity (%)	WBGT (°C)
Basement main floor areas outside closed shield/hood	27-37	25-52	24-29
Under felt towards wet end	47-51	30-44	38-46
Under felt towards dry end	56-57	51-52	52-53
Rear of machine just outside closed shield/hood	36	30-37	29
Rear of machine by open shield/hood (eg skimming)	51-58	32-62	46-60
Work close to cylinders, shields/hoods raised	34-56	16-34	28-42
Coating mill near mid-panel backing roll, 1st level	40	26	31
Press section	40-43	81-89	39-56
Front of machine within closed shields/hoods (eg cleaning viewing panels)	48	36	42

14 The temperatures shown in Table 1 are **indicative** of the potential exposures that **can** be anticipated in mill environments. Individual mills may have potential for greater or lesser exposures. Mills need to arrange for sampling work to be carried out for both routine and unusual foreseeable tasks that are likely to produce a risk of heat stress in their premises. Sampling can be undertaken by competent consultants or mill staff using the equipment shown in Appendix 1. You can find further information about methods and standards for measuring the thermal environment, effects of heat stress, and protective measures, including reference to a range of ISO standards, in BOHS Technical Guide No 8.³

15 Recognised occupational health standards such as BS EN 27243: 1994⁴ and American Conference of Governmental and Industrial Hygienists (ACGIH) standards⁵ can be used to derive a work/rest regime based on the work rate of the job. These standards cannot, however, be assumed to apply to work carried

.....

out in impervious protective clothing, and may not fully reflect the risk if radiant temperature or air temperature and velocity are high.

16 The ACGIH standard contains Permissible Heat Exposure Threshold Limit Values which describe the degree of work that can be reasonably carried out at temperature ranges between 25°C and 32.2°C WBGT, and the percentage of work time as opposed to rest. These reference levels and those contained within BS EN 27243: 1994 are relevant to a broad spectrum of individuals of varying physical fitness and can be applied to all workers to form the basis of a safe system of work (see Table 2). They assume that the rest period is taken at the same temperature as the work period.

Table 2 Work/rest regimes derived from BS EN 27243: 1994 based on a work rate of 400 watts (demanding physical work)

WBGT range (°C)	Work/rest regime
26-27.5	45 minutes work/15 minutes rest
27.5-29	30 minutes work/30 minutes rest
29-31	15 minutes work/45 minutes rest

17 However, at WBGTs above 32.2°C, frequently encountered in many paper mills, no *standard* work/rest regimes are defined. The simple work/rest regimes shown in Table 2 (which are appropriate to the general population) cannot be applied to work at such elevated WBGT temperatures.

18 In these circumstances, individual mills will need to seek competent medical advice (see paragraphs 27 to 29) to develop their own procedures and systems of work based on the anticipated exposures identified from their sampling work, the work rate for tasks and their frequency, and individual capabilities. To limit exposures within a set machine crew size, job rotation is likely to be necessary and consideration should be given to additional training requirements to allow 'multi-skilling'.

19 The workforce should be selected with particular care by individual medical assessment (see paragraphs 24 to 26) to ensure that they are physically fit. These workers should also be subject to regular medical assessment. A safe system of work which limits exposure time should be agreed with the supervising medical practitioner, adopted, and monitored by a competent supervisor. It should not be necessary for the supervising medical practitioner to attend mills to directly supervise work in hot areas once a system has been agreed; this will be the responsibility of normal mill management. Systems of work should be devised which anticipate all likely tasks giving rise to risk. Such a system will necessarily become increasingly restrictive as the WBGT rises. In these situations the use of body cooling equipment - including

.....

cooled waistcoats and suits to delay the onset of heat stress - may be an option (see paragraphs 33 to 35).

Reducing the risk

20 Consider the following measures, bearing in mind that they may not be practical for every situation. Take care not to introduce additional hazards such as ignition of insulating materials, entanglement from protective clothing or air hoses.

21 Can you reduce the potential for heat stress by:

- identifying areas of high temperature and humidity with clear warning signs?
- placing layers of fire-retardant insulation over the heat source?
- using reflective shields or absorbent shields/hoods (cooled by air or water)?
- having a de-winterisation programme, such as removing roof panels in the summer?
- providing adequate ventilation, for example, introducing cooler air (ie below WBGT of 36°C) by reversing the machine shield/hood fans?
- providing a localised source of cooler air (ie below WBGT of 36°C) in the working area using portable air movers?
- eliminating unnecessary sources of heat, for example by plugging any steam leaks?
- providing plenty of fluid for drinking at convenient locations?

22 Avoid the following tasks where possible:

- entry into the drying shield/hood to clear a wraparound without first raising the shield/hood and allowing excess heat to dissipate;
- multiple entry by an individual into the drying shield/hood area to deal with paper breaks in any one shift **without first** reassessing the duration of earlier exposures and whether a longer rest period is necessary. Guidelines, agreed with the supervising medical practitioner in anticipation of the need for multiple exposures, should be contained within the safe system of work;

- working inside heat shields to clean viewing panels. Design panels to allow cleaning from the outside;
- clearing paper debris or starch powder from within the closed heat shield unless limited to infrequent and brief excursions not exceeding five minutes;
- operating waste conveyors under the felt using controls sited within the shield - move the controls to a position outside the shield.

Safe systems of work

23 Even after application of engineering controls, risk assessments will often highlight the need for carefully defined safe systems of work, especially where sampling has revealed WBGT exposures in excess of 32.2°C. Ask yourself the following questions:

- Have the tasks to which the system of work applies been defined?
- Is there a clear written permit-to-work system for work at WBGT temperatures above 32.2°C?
- Have any necessary procedures for plant isolation been defined?
- Have employees and contractors been subject to medical assessment?
- Do the shift arrangements take account of the need for an acclimatisation period (see paragraph 30)
- Have employees and contractors been properly trained in the system of work?
- Have supervisors and employees been trained to recognise the symptoms of heat stress?
- Have arrangements been made for timing the work period, signalling its end and noting exposure periods within that shift so that repeat exposures can be assessed?
- Have arrangements been made to avoid lone working in situations where workers are likely to be subject to heat stress, for example a 'buddy' system in which individuals are responsible for observing workmates for early signs of heat stress? Most types of lone worker alarm cannot be relied upon in the absence of any other personnel given the effects of heat stress which can include heat cramps, dizziness and fainting, although certain computer-supervised, radio transmission systems with high-frequency calling may be adequate.

- Is any necessary suitable protective clothing available?
- Are drinking fluids and rest facilities available, including access to an air-conditioned refuge not exceeding 20°C?
- Have arrangements been made for rescue and first aid? Rescue and retrieval of an individual who has collapsed needs to be rapid and will rely on suitably trained on-site personnel. First aiders should have been trained to deal with casualties suffering from heat stress and suitable equipment such as rescue harnesses and a stretcher should be available.

Medical assessment, education and training

24 It is essential that a medical assessment programme is put in place to ensure an employee's suitability for high-temperature work. This assessment should take place under the supervision of a competent medical practitioner (see paragraph 27), who in most instances can travel to the mill. The practitioner should be provided with details of the employee's duties, the potential for exposure to high WBGT environments and details of any PPE required. This information should be available from the survey referred to in paragraph 14. Factors to be considered include:

- pre-existing medical conditions, eg diabetes;
- use of prescription or non-prescription drugs which affect thermo-regulation;
- physical fitness;
- obesity (overweight people have an increased risk of suffering heat stress symptoms);
- age (ability to cope with heat stress decreases with age);
- previous heat illness, demonstrating a personal susceptibility;
- chronic skin disorders, which can impair temperature regulation;
- habitual alcohol abuse, with increased risk of dehydration.

25 At the initial medical assessment, workers should be given enough information to recognise their own symptoms. It should be made clear to them that any such symptoms should be immediately reported and that the worker should not resume work until cleared to do so by the supervising practitioner. Such reports should be fed back into the risk assessment and automatically

.....

trigger re-evaluation of the assessment. Remember that heat-induced illness is a defined major injury which should be reported in accordance with the Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995.

26 A programme of regular medical assessments at periodic intervals should be put in place to ensure that workers continue to be fit to undertake this work. The frequency and nature of the assessments should be determined by the supervising practitioner (although medical examination should be carried out at least annually for those employees over 45 years old). This is because initial assessment will indicate any inherent degrees of risk in the employee.

Competence of the supervising medical practitioner

27 As a guide, the practitioner supervising the medical assessments should have the necessary competence to do so. Competence is defined in the Management of Health and Safety at Work Regulations 1999 as having sufficient qualifications, experience or other qualities necessary to carry out this work.

28 The practitioner should normally have received training in occupational medicine. The following qualifications provide evidence of such training:

Diploma in Occupational Medicine (Dip Occ Med)	GP Qualification
Associate of the Faculty of Occupational Medicine (AFOM)	Intermediate qualification
Member of the Faculty of Occupational Medicine (MFOM)	Fully qualified specialist
(Normally at least the Diploma would be required to undertake this supervisory role.)	

29 The practitioner should have had enough experience in evaluation of fitness to work in high temperatures and have had first-hand knowledge and experience of the conditions under which the workers will operate (see paragraph 24). Some practitioners may need to be given the opportunity to familiarise themselves with the tasks performed in the mill environment. It is not necessary for this practitioner to carry out the detailed medical examination (which could be done by another practitioner or a nurse) but it is necessary for him or her to have established the assessment regime and to be responsible for decisions in each case on fitness to work. The Employment Medical Advisory Service (EMAS) may be able to help you find a competent practitioner. You can contact EMAS through all HSE offices.

Acclimatisation

30 Employees frequently exposed to high temperatures throughout the course of the shift need to acclimatise to working in hot and humid conditions, most workers becoming acclimatised over about one week. However, acclimatisation decays quickly, tolerance reducing even over two days and disappearing almost completely after two weeks. This means that someone

.....

cannot be expected to work in a hot environment **for as long** at the beginning of a work period following an absence of a week or more without being at increased risk of suffering heat-induced illness. This should be taken into account when considering shift patterns and staffing. Your medical practitioner should be able to advise. Careful consideration should also be given to the management of contractors in this respect. Acclimatisation is less likely to be a major factor for those who experience occasional, intermittent short-term heat exposure.

Supervision **31** It is important that the necessary systems of work (see paragraphs 6-9) are implemented. Make sure that the work is monitored by a nominated supervisor, such as a machine crew member, who has been trained to appreciate the effects of heat stress and to identify the onset of heat strain. The use of any personal protective equipment needed for the job should also be supervised. The degree of supervision needed will be determined by the risk of heat stress, ie factors such as work rate, task duration and WBGT temperature.

32 No one should work alone in conditions where heat stress could occur. Workers exposed to these conditions should either work in pairs or groups or be under direct supervision.

Personal protective equipment (PPE) **33** Light cotton overalls are the best garments for work in hot environments. Sometimes heat protective garments can be necessary, but note that such clothing can reduce evaporative heat loss. This may dramatically increase body temperature and make jobs more difficult. PPE can only protect against heat for limited periods. Powered visors which project filtered air downwards over the face may provide a cooling effect at lower temperature exposures but caution should be exercised as certain respirators can increase cardio-vascular strain.

34 There are two basic types of body cooling equipment. Passive cooling is provided by ice packet vests which contain numerous pockets for blocks of ice water, dry ice or thermal absorption gels, or wetted over garments designed to give a cooling effect as the water evaporates (ineffective in conditions of high humidity). Active cooling is provided by pumping a cooled fluid around a tight-fitting suit.

35 All body-cooling equipment has its limitations and careful consideration needs to be given to the relative merits before deciding whether to use it. Make sure that you:

- fully evaluate the task before deciding to use cooled suits to avoid instilling a false sense of security;
- obtain manufacturers' advice on performance limitations and safe use;

- train supervisors and operatives so that they understand the limitations and correct use;
- take account of the cumbersome nature of the equipment and how this may affect operatives' ability to complete the required task;
- have arrangements to replenish ice and maintain the equipment.

Drinking water

36 Provide adequate fluids in the work area. In hot temperatures perspiration increases and as much as 1.5 litres of fluid may be lost in an hour. Workers should be encouraged to drink plenty of fluids before they begin working and provision must be made for adequate fluid to be available either during work, or, if this is not practicable, during rest breaks. **Salt should NOT normally be added to water, unless the supervising medical practitioner recommends its use.**

37 After exposure to elevated temperatures, it is important that workers are not suddenly exposed to the shock of cold environments: they should remain on the machine floor or go to a refuge maintained at a warm temperature (approximately 20°C), rather than enter a very cold room or the open air in cold weather.

Appendix 1 Wet bulb globe temperature (WBGT) apparatus

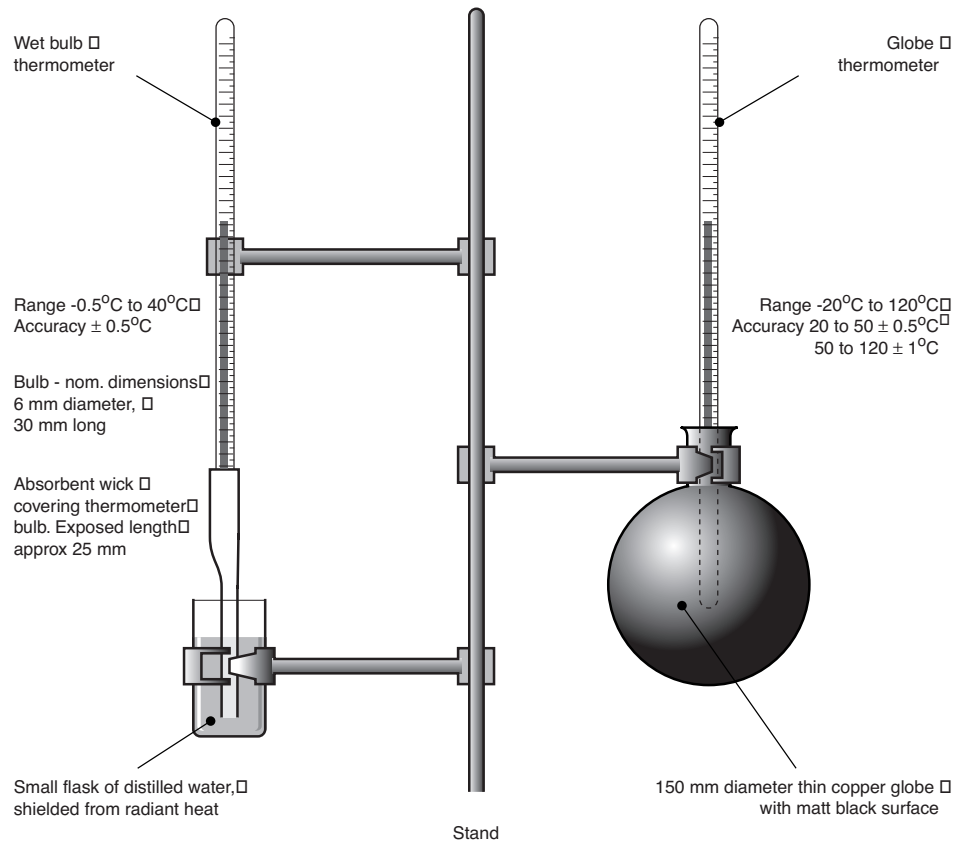


Figure 1 Wet bulb globe temperature (WBGT) apparatus

Basic apparatus

1 The apparatus consists of:

- a thermometer with its bulb covered by a wetted wick. This responds to ambient temperature, relative humidity and rate of air flow; and
- a thermometer with its bulb at the centre of a matt black globe. This responds to ambient temperature and to radiant heat which will increase the temperature within the globe.

Formulae

2 WBGT is calculated using the following formulae:

For indoor applications and for external applications without solar gain:

$$\text{WBGT} = 0.7 \text{ tnw} + 0.3 \text{ tg}$$

For external applications with solar gain:

$$\text{WBGT} = 0.7 \text{ tnw} + 0.2 \text{ tg} + 0.1 \text{ ta}$$

where tnw = natural wet bulb temperature,
 tg = the globe temperature, and
 ta = air temperature (dry bulb)

.....

**More sophisticated
apparatus**

3 More sophisticated direct reading digital instruments are available. These may be used if their readings correspond to WBGT as measured by the basic apparatus and can often be hired. Contact your local HSE office and ask to speak to the Regional Specialist Group (Occupational Hygiene) for details.

.....

References

- 1 *Guide to managing health and safety in paper mills* HSE Books 1997 ISBN 0 7176 1313 5
- 2 Criteria for a recommended standard. *Occupational exposure to hot environments. Revised criteria* 1986 NIOSH Publication No 86-113 Cincinnati
- 3 *Technical Guide No 8 - The thermal environment* (Second Edition 1995/96) British Occupational Hygiene Society (BOHS) ISBN 090 592 7389
- 4 BS EN 27243: 1994 (endorsement of ISO 7243:1989) *Hot environments - estimation of the heat stress on working man based on the WBGT index* British Standards Institution
- 5 The ACGIH TLVs *Threshold limit values for chemical substances and physical agents and biological exposure indices* The American Conference of Governmental and Industrial Hygienists, Cincinnati

While every effort has been made to ensure the accuracy of the references listed in this publication, their future availability cannot be guaranteed.

Further reading

BS EN 12515:1997 (endorsement of ISO 7933: 1989) *Hot environments - analytical determination and interpretation of thermal stress using calculation of required sweat* British Standards Institution

Further information

For details of how to obtain HSE publications, see back cover.

British Standards are available from BSI Customer Services, 389 Chiswick High Road, London W4 4AL Tel: 0208 996 9001 Fax: 0208 996 7001.

.....

.....

Printed and published by the Health and Safety Executive 4/00 C20

.....

**MAIL ORDER**

HSE priced and free
publications are
available from:

HSE Books
PO Box 1999
Sudbury
Suffolk CO10 2WA
Tel: 01787 881165
Fax: 01787 313995
Website: www.hsebooks.co.uk

RETAIL

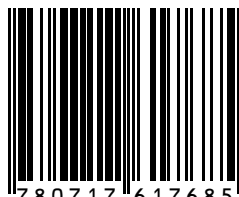
HSE priced publications
are available from
good booksellers

HEALTH AND SAFETY ENQUIRIES

HSE InfoLine
Tel: 08701 545500
or write to:
HSE Information Centre
Broad Lane
Sheffield S3 7HQ
Website: www.hse.gov.uk

£5.00 net

ISBN 0-7176-1768-8



9 780717 617685

Paper and Board

Industry

Advisory

Committee

.....

Part 5: Control of contractors in paper mills

Members of PABIAC main committee

.....

Mr A D Porter	HSE (Chair)
Mr G Beattie	GPMU
Mr M Bonnett	AEEU
Mr C Britchford	Arjo Wiggins Fine Papers Ltd
Mr M Eede	TGWU
Mr G Grace	Paper Federation of Great Britain
Mr C Griffiths	St Regis Paper Co Ltd
Mr A Harvey	AEEU
Mr P Hiett	GPMU
Mr R A Hudspith	GPMU
Mr T Mellish	TUC (Observer)
Mr P Planet	Bridgewater Paper Co Ltd
Mr C Surtell	Paper Federation of Great Britain (Observer)
Mr K Vikman	UK Papers (Graphic and Business Papers) Ltd
Mr T Watts	Paper Federation of Great Britain
Mr K Willis	GMB
Mr M Wilcock	HSE (Secretary)

Members of the Contractors' Working Group

.....

Mr M Wilcock	HSE (Chair)
Mr S Alderman	ICEL
Mr I Magee	Westwell Developments Ltd
Mr M Reed	AEEU
Mr J Tucker	Lakers Process Engineering
Mr C Ward	QPS Consultants Ltd
Mr M West	Arjo Wiggins Carbonless Papers Ltd

PABIAC gratefully acknowledge the help of the various companies and individuals who contributed to the development of this publication.

Paper and Board

Industry

Advisory

Committee

.....

Part 5: Control of contractors in paper mills

.....

© Crown copyright 2000

*Applications for reproduction should be made in writing to:
Copyright Unit, Her Majesty's Stationery Office,
St Clements House, 2-16 Colegate, Norwich NR3 1BQ*

First published 2000

ISBN 0 7176 1764 5

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means (electronic, mechanical, photocopying, recording or otherwise) without the prior written permission of the copyright owner.

This is guidance prepared, in consultation with the Health and Safety Executive (HSE), by the Paper and Board Industry Advisory Committee (PABIAC) which was appointed by the Health and Safety Commission as part of its formal advisory structures. The guidance represents what is considered to be good practice by members of the Committee. It has been agreed by the Commission. Following this guidance is not compulsory and you are free to take other action. But if you do follow this guidance, you will normally be doing enough to comply with the law. Health and safety inspectors seek to secure compliance with the law and may refer to this guidance as illustrating good practice.

CONTENTS

Preface v

Introduction 1

Section 1 Why manage contractors? 4

Section 2 Your action plan 10

Section 3 Five practical stages for managing contractors 14

Stage 1 Planning 15

Stage 2 Choosing a contractor 29

Stage 3 Contractors working on site 35

Stage 4 Keeping a check 38

Stage 5 Reviewing the work 41

Section 4 From the contractors' perspective 44

Appendix 1 The law 48

Appendix 2 Chart showing requirements of the Construction (Design and Management) (CDM) Regulations at the main stages of a construction project 63

References 68

Further reading 70

Further information 71

PREFACE

WHO SHOULD READ THIS BOOK?

It is aimed at:

- managers, supervisors and safety advisers in paper and board mills;
- the managers, site supervisors and safety advisers of contractors working in the industry;
- safety representatives working in mills or for contractors; and
- employees of contractors or mills.

It has been produced by the Paper and Board Industry Advisory Committee in consultation with paper mills, contractors and trade unions.

It aims to help you to:

- assess your current practice;
- understand and comply with the law;
- apply good practice.

It does not claim to be comprehensive, but offers guidance and practical ways of managing jobs involving contractors (whether it is one individual or several contractors), building health and safety into every stage. It supplements and complements the training given to contracting staff under the Contractor Safety Passport Scheme supported by the paper industry, and may be used by mills as part of their contractor assessment system.

WHAT IS IN THE BOOK?

Sections 1 and 2 offer guidance on:

- understanding some of the problems; and
- assessing current arrangements and drawing up an action plan.

There are four key exercises to carry out. They are designed to help you assess your company's position in terms of managing contractors. They lead to an action plan for making improvements.

.....

Section 3 offers practical guidance on safe working. You may find the information in this section particularly helpful if you:

- plan jobs involving contractors;
- want guidelines for tendering and selecting contractors;
- arrange agreements with them on behalf of the company;
- work with them at any stage when they are on site;
- want help with monitoring or reviewing contractors' jobs;
- manage a company working as a contractor in paper and board mills.

Section 4 looks at the position from the contractors' perspective.

Appendix 1 gives an overview of some of the relevant law.

There are quotes from managers in the industry and examples of real situations given throughout the book which reinforce the guidance given.

At the end of the book there is a list of references and further reading and some details about the Contractor Safety Passport Scheme supported by the Paper Federation of Great Britain.

TERMS USED IN THIS BOOK

In this publication:

- the word 'must' indicates a definite legal requirement;
- 'do's and don'ts' and 'should and should not's' and other recommendations represent best and good practice, which, if adopted, will lead to compliance with what is reasonably practicable although there may be other legally acceptable ways of achieving the same objective;
- 'think about', 'consider' and similar phrases contain a tip or hint which may not amount to a precise legal requirement but indicate an approach to a health and safety problem which should be considered;
- a 'safeguard' is a means of reducing risk to health and/or safety.

HOW TO USE THIS BOOK

This publication may be used to help you identify what more you need to do to control contractors, and as:

- an aid for planning;
- learning material for self-study;
- a reference to dip into;
- a staff training aid about managing contractors.

Within each section there is a summary of the key points.

INTRODUCTION

1 The use of contractors in the paper and board industry can range from a single individual carrying out specialist emergency repair work to major one-off capital projects involving large numbers of contractors and subcontractors over many weeks. They may be used for overhauling machinery in a production environment, on a day-work basis as extra hands to supplement a mill's own team, or they may be specialist companies such as felt and chemical suppliers.

2 Using contractors may be routine in your company, for example mills often use contractors to supplement their own engineering staff for planned work during mill-shuts, which can be of variable duration, from a couple of hours to several days. At times, the number of contractors' staff may significantly exceed that of the mill's own workforce involved in the work. Contractors of different trades are likely to be working close to each other carrying out different activities, each with different kinds of risks. Meanwhile, production may be continuing near by on an adjacent machine.

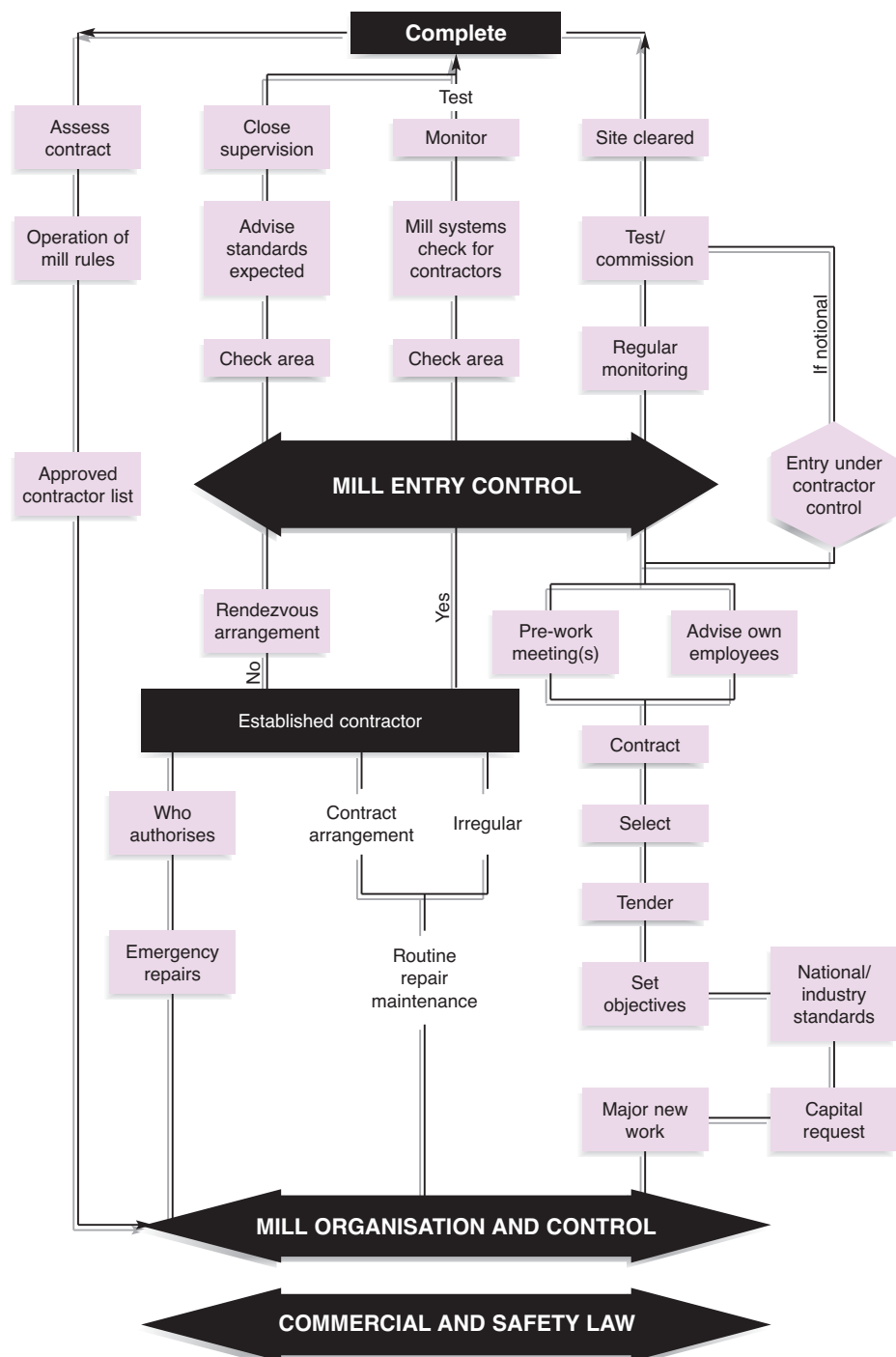
3 Figure 1 is a flow chart illustrating the variety of contractual relationships that may exist between a mill and its contractors. However, in all relationships with contractors there are common key steps. This guidance provides help and advice on:

- identifying and planning the tasks to be carried out;
- identifying the respective roles and responsibilities of mill and contractor management teams;
- establishing mill mechanisms for managing contractors on site;
- establishing effective guidelines for tendering and selecting contractors;
- agreeing safe working practices as a condition of contract, particularly the safety implications for both the mill and contractor employees when working together in areas where production will continue;
- communication with employees likely to be involved/affected;
- liaison with the contractors while they are on site; and
- monitoring procedures (including review and reselection procedures).

4 For each type of contract, mills will need to consider the level of management necessary for safety. This guidance helps to identify the respective duties of both mill and contractor. These measures are based on the principles of CDM and other relevant legislation. In practice, an effective procedure for the management of contractors will be a proven business benefit and help mills comply with their legal duties.

5 If you have people working under your control and direction who are self-employed for tax and/or National Insurance purposes, they are likely to be treated as your employees for health and safety purposes. You may therefore need to take appropriate action to protect them. If you are in any doubt about who is responsible for the health and safety of a person working for you, this could be clarified and included in the terms of the contract. However, remember, you cannot pass on a legal duty that falls to you under the Health and Safety at Work etc Act 1974 (HSW Act)¹ by means of a contract and you will still retain duties towards others by virtue of section 3 of the HSW Act. If you intend to employ such workers on the basis that you are not responsible for their health and safety, you should seek legal advice before doing so.

Figure 1 Contractor control framework



.....

'... the core workforce has got smaller ... it is more cost effective and flexible to use contract labour as and when needed as opposed to employing a high fixed-cost element of 'own staff'. This ... is exaggerated at a major plant rebuild when ever greater numbers of contract labour are required - technical specialists, general engineering and construction being the categories most commonly employed.

'It is now expected that these major plant rebuilds are carried out more efficiently in shorter time frames (every shut day is lost production and revenue potential), at lower costs than ever before in order to obtain maximum returns from the investments.

'This process puts greater pressure on those charged with implementing the major plant rebuild - there are fewer managers and supervisors to plan, manage, execute and control the often complex interactions that a major plant rebuild can bring.

'In management of safety terms ... the cumulative effect of all these factors is a greater potential for risk.'

Contractors were working on the 1st press of a paper machine. The rolls had been removed and the pins were being inspected. The showers were started for no apparent reason - the production staff wanted 'to see if they were OK'.

6 Accidents are always costly and the situations described above have the potential for significant losses, and serious or fatal injuries, if things go wrong. Near-misses and accidents during work involving contractors will only be avoided if positive steps are taken to manage the work properly. This publication explains the responsibilities for health and safety of both mill management and contractors, and describes good practice, including the benefits of contractor safety passport schemes.

SECTION 1: WHY MANAGE CONTRACTORS?

7 Accidents and ill health resulting from inadequately managed work activities can be costly in both human and financial terms. This section covers the broad categories of contractors likely to be used in paper and board mills, and summarises the implications of failing to manage contractors. It ends with an exercise that will help you examine your own procedures for managing contractors and see if there is room for improvement.

WHO COUNTS AS A CONTRACTOR?

8 A contractor is anyone you get in to work for you who is not your employee. They may be self-employed or come from another company. They include engineering contractors, chemical supplier's representatives, specialists such as felt/wire representatives, and employment agencies. Some may be subcontracted to a main contractor who is managing a larger job. If subcontractors are used, channels of communication and control can get confused. Some mills make it a policy not to allow subcontractors - you should decide your policy at the outset. Most of this guidance applies equally to subcontractors.

9 Contractors in mills generally fit into one of three broad categories:

- contractors attending site on a regular basis (including mill shuts);
- those carrying out small, one-off or infrequent tasks such as emergency or specialist repairs or small project work; and
- those carrying out large, infrequent or one-off jobs such as large capital projects.

10 Don't forget contractors visiting low-hazard parts of the mill such as offices, for example to service equipment like photocopiers.

11 Mills may find it helpful to consider each of these broad categories and check that they have made adequate arrangements for them to work safely. At least some of the needs of each category are likely to be different.

12 In addition, some contractors may work in the mill on a day-work basis, and may even be on site all the time. Check and agree who is responsible for their safety. Don't rely on assumptions about either the contractor's responsibility for safety, or their level of knowledge and understanding of the risks. Although a contractor may have a safety passport it is unwise to make assumptions about health and safety arrangements. The greater the specialist expertise the contractor needs to use for their work, the more responsibility they

.....

may have for safety, particularly if there is no expertise within the mill. An example might be contractors servicing specialist instrumentation.

13 At times such as mill-shuts there may be large numbers of contractors on site, often working in proximity and to a tight deadline. You need to think about how the work of one contractor may affect that of another and how they interact with your own maintenance or production activities. The more activities that are going on, the greater the chance there is of something being overlooked.

'It is quite common during a major rebuild for work to be taking place at the same point in the machine house building, but at different levels. For example, sole plate removal and machine installation on machine floor level, repairs to hydropulper at basement level, and removal of old and installation of new steam systems in between, on scaffolding.'

14 In this example, hard hats may not give enough protection against hazards from above. What other precautions can you think of?

THE COSTS OF GETTING IT WRONG

15 The most significant costs of accidents and ill health are perhaps the hardest to measure. They are the human costs to the injured or sick, their families and society in general. An aim of all safety management systems, including management of contractors, is to reduce the risk of injury and ill health.

16 Managers in industry also know that accidents and ill health cost money. Whether people are injured, plant and machinery damaged, or product wasted, organisations lose money. Large-scale losses such as those arising from major fires or explosions, or involving loss of life, are very visible and may run into many millions of pounds. Costs from less serious accidents, which injure but do not kill people, should not be underestimated. Among the possible losses - sometimes uninsured - are:

- production time;
- key workers;
- product;
- equipment.

17 There may also be compensation to pay and other legal costs and penalties.

18 A recent HSE survey found that employers who put real effort into making health and safety practices work effectively reported many benefits from doing so. For example, they save money from tighter control over using and storing materials, and can avoid the need for re-work because the process helps to

.....

focus on the detail of a project resulting in a more complete understanding.

'The key to a safe, within cost and to time project is effective planning'.

Contractors had to stop work when new work, of which they had not been informed, began on a previously vacant structure above them. The delay caused more than doubled the length of the short contract.

19 Better understanding of health and safety may also lead to improved staff morale and better industrial relations.

COMMUNICATE WITH CONTRACTORS

'Safety is important even at the enquiry stage. Clients should specify and contractors should ask about the standards to be applied so that costs can be built in to the tender.'

20 Many accidents involving contractors occur because normal principles for safe working are not applied to the work carried out by the contractor in the mill. As a consequence, avoiding accidents, and their costs, is merely a matter of chance - and this is not a reliable way to run a business. All work, whether it involves contractors or not, needs to be:

- assessed, to identify the hazards and the steps needed to minimise risks; and
- supervised or monitored as necessary to make sure that agreed health and safety procedures are followed.

21 When work involves contractors it is important that there is two-way communication on these matters, and that both sides are satisfied with the arrangements to be made and understand their respective responsibilities.

22 Accidents may also result from poor communication between the mill and the contractors. Mill production staff may not know when contractors are working nearby, or contractors may not know of the dangers on site. It is dangerous to assume that contractors will know about the hazards associated with the process or site. Although you will be very familiar with them others may not be.

A contractor was intercepted just as he was about to walk across the crust on a pulper. Just think of the consequences!

.....

'There is no point in carrying out risk and COSHH assessments if their conclusions are not communicated between the mill and contractors, and supported by necessary training and instruction for those carrying out the work.'

Contractors were found using drums of flammable chemicals as work benches for hot work, introducing a risk of explosion.

23 Problems sometimes arise because assumptions are made and not checked out. For example, if a job, such as hot work, involves a risk of fire, you may recognise the need for fire extinguishers or water hoses, but do you know if the contractors are trained in simple fire-fighting methods? They may be relying on the availability of your fire-fighting team to deal with any fire. Confusion on this point could allow a small fire to get out of control.

24 A management approach that builds in planning, communication and monitoring will help to prevent accidents resulting from poor communication. These issues are covered in Section 3 of this guidance, which relates to 'Planning', 'Choosing a contractor' and 'Contractors working on site'.

INCLUDE CONTRACTORS

25 Make arrangements to ensure that contractors are covered by your health and safety procedures. They may be strangers to your site and won't know:

- about the hazards on your site (don't forget risks to their health as well as safety);
- your approach to safety including your site rules and safety procedures;
- what to wear;
- about special equipment they need to use;
- what to do in a fire or emergency, or if an accident occurs;
- the sound of the alarm, and how and when to raise it;
- the first-aid, welfare and smoking facilities they can use.

26 You may take good practice for granted in-house, but don't assume the same applies to contractors. Even regular contractors may need reminding and a contractor passport does not cover the special arrangements on your site.

27 It can be helpful to involve contractors' managers and supervisors in your own health and safety management meetings, workplace tours and inspections and investigations. Involve the contractors' safety representatives, too, as well as your own. This helps communication, and makes the contractors aware of your approach to safety. Similarly, you can involve the contractors' workforce in your site health and safety meetings and health and safety campaigns.

.....

28 Do you need to improve your procedures for work with contractors? Are you sure they cover all contractors, every time? Maybe you've never had an accident involving a contractor - yet!

DELEGATION

29 If you delegate the task of managing contractors, decide who will take responsibility for the details. Use Section 3 of this guide to help make contractor arrangements a practical reality for you.

BASIC COMMUNICATIONS

30 Many contractors in the paper industry, particularly those involved in machine re-builds and new machine installations, will not have English as a first language, so special arrangements may be necessary to help improve communication. Don't make assumptions about the level of understanding - check!

31 The noise from production machinery can make it difficult to hold conversations, and people may be tempted to remove their hearing protection to improve their ability to hear. This exposes them to risk of damage to their hearing, and seldom improves communication. Discuss important matters away from the noisy areas to avoid confusion.

KEY POINTS

- Accidents are expensive! You can lose: staff, productive days, product, equipment and money.
- Contractors are subject to even greater hazards and risks than your own staff because they are new to your business. Don't leave them out of your in-house health and safety procedures.

'In our group of companies, contractors are twice as likely to have accidents as our own employees. That tells us that we have got to work on our relationship with them.'

QUESTIONS: MANAGING CONTRACTORS IN YOUR ORGANISATION

Think about your current practice when working with contractors. Choose the response that most closely matches what you do now. Put down what actually happens, not what you think should happen.

1 We always know who's on site (be honest!)

- (a) Yes ☐
- (b) Most of the time ☐
- (c) Occasionally ☐

2 There has never been a major incident or accident involving contractors on site

- (a) True ☐
- (b) Don't know ☐
- (c) False ☐

3 We assess contractors' competence in health and safety and check for evidence before they get the job

- (a) Always ☐
- (b) Usually ☐
- (c) Sort of ☐

4 We check all our contractors have up to date safety passports

- (a) Always ☐
- (b) Sometimes ☐
- (c) Never ☐

5 We look into contractors' procedures for health and safety to make sure they can fit in with ours

- (a) Always ☐
- (b) Sometimes ☐
- (c) Never ☐

6 We plan for the contractor's job and assess the hazards at each stage

- (a) Always ☐
- (b) Some of the time ☐
- (c) It's been known to happen ☐

7 We inform them of the hazards on site and of our emergency procedures before they start

- (a) Without fail ☐
- (b) Usually ☐
- (c) Rarely ☐

8 We keep track of their progress until the job finishes

- (a) Always ☐
- (b) Sometimes ☐
- (c) Rarely ☐

9 After the job we talk to the contractor about the work, including health and safety. If necessary, we keep records

- (a) Always ☐
- (b) When possible ☐
- (c) No, hardly ever ☐

Scoring - Add your scores. (a) = 8, (b) = 5, (c) = 1

If you scored between:

64-72 - VERY EFFECTIVE

You are doing well. Identify what you might improve and do it!

43-63 - NEED TO IMPROVE

In theory, you are halfway there. You still need to develop procedures in some areas. Make sure your procedures are followed by all employees. List the urgent and important matters to work on. Use the action plan on page 13.

9-43 - NEED TO START

Top marks for honesty! Perhaps the questions have helped you to identify some shortcomings. If there are urgent developments needed, plan them using the action plan on page 13.

Your goal is to be able to answer (a) every time. No one says it is easy. But your goal is good practice. And you will find much of it is plain common sense.

SECTION 2: YOUR ACTION PLAN

32 This section is written to help you assess your existing procedures and practice, including the way your workers are involved. After reading it you should be able to summarise your company's current strengths and weaknesses and draw up an action programme based on an analysis of your own arrangements.

HEALTH AND SAFETY MANAGEMENT

33 The checklist will help you gain an overview of health and safety and managing contractors. It covers five aspects of health and safety management:

- 1 Policies** - your health and safety policy, including arrangements for contractors.
- 2 Organising** - involving those working in the organisation, in-house staff and contractors; lines of communication and authority.
- 3 Planning and doing** - practical arrangements and methods of working used; contractor management, deciding what needs to be improved and how to go about it.
- 4 Monitoring** - keeping track of what actually happens.
- 5 Reviewing and learning** - checking how the company is getting on with contractor management, deciding what needs to be improved and how to go about it.

34 These aspects are based on HSE's leaflet INDG275 *Managing health and safety - Five steps to success: Special help for directors and managers*.²

YOUR CHECKLIST

35 Use the checklist to help you assess your current position. Think about your company's current approach and tick the column that applies.

36 The columns are:

Need to start - means you don't yet have in place the good practice described. Or if you do, it is not used.

Need to improve - means you don't think current approaches are effective enough. There is room for improvement.

.....

Very effective - means you are happy with the way things are because they are effective. The business has high quality standards for safe work with contractors and the approaches are proving successful.

37 The checklist is general but you could customise it by adding good practice at the left-hand side or supplying more detail in the existing descriptions.

38 You may also want to do more than simply tick the box. Note down any thoughts that come up, especially those that help you to assess your current approach.

39 Before using the checklist and action plan shown in this section, it could be helpful to copy them so they can be used again. Or you may want to adapt them, changing the headings and columns to suit your own way of planning.

CHECKLIST: SUCCESSFUL HEALTH AND SAFETY MANAGEMENT

	Need to start	Need to improve	Very effective
Health and safety policy			
1 We have one! - a clear statement of management's commitment to health and safety			
2 It says who is responsible for health and safety			
3 It states or refers to our arrangements for managing contractors			
4 It is regularly reviewed, based on its effectiveness in preventing injuries and reducing losses, and is updated if needed			
5 Staff know their responsibilities for managing contractors on site			
Organising			
6 Staff responsible have enough knowledge about the risks and preventative measures for all jobs involving contractors			
7 Staff have an adequate understanding of health and safety law			
8 Staff responsible know what to look for when checking that contractors are working safely and know what action to take if they find problems			
9 Health and safety is a key issue in the selection of contractors			
10 We take steps to ensure our contractors are competent in health and safety			

	Need to start	Need to improve	Very effective
11 Staff are involved in discussing contractor arrangements for management and supervision			
Planning and doing the job			
12 We recognise the different needs of the different categories of contractors and make appropriate arrangements when planning the work and supervising the contractors			
13 We discuss and agree the job with contractors. Our requirements and the contractors' responsibilities for health and safety are in writing			
14 We have safe working procedures and site rules. Contractors are made aware of them in advance			
15 Staff responsible plan the contractor's job with them. We ask for a safety method statement			
16 Contractors sign in and out - we always know where they are			
17 Contractors are given site information before starting the job			
18 We go through the job before allowing work to start			
Monitoring			
19 Staff responsible check on progress with the job and that contractors are working safely			
20 Staff responsible take corrective action if contractors aren't working safely			
21 We check on contractors' arrangements for supervision			
22 We tell contractors to report all incidents/accidents (even minor ones)			
23 If the contractor sends different staff we will know			
24 When a job is finished, staff responsible review how it went, including the health and safety performance of the contractor			
25 The review is recorded for future use			
26 The company is good at learning from mistakes and improving contractor arrangements			

.....

40 Use your responses to identify the actions needed to improve your management of contractors.

41 Prioritise the urgent and important actions and plan your contractor safety improvement programme. At the end of this section you can use this information to develop an action plan.

MAKING IT HAPPEN: AN ACTION PLAN

42 As a reminder of the strengths and weaknesses in your current practices, look back over your:

- responses to the checklist;
- scoring in the questions on your organisation.

43 Use your strengths and weaknesses to:

- list what you need to start or improve;
- mark the urgent actions on your list;
- note the important ones; and
- prioritise actions that are both urgent and important.

ACTION PLAN: MANAGING CONTRACTORS

What needs to be done	By whom	When	Resources	Progress

SECTION 3: FIVE PRACTICAL STAGES FOR MANAGING CONTRACTORS

KEY POINTS

Stage 1: Planning

- Ensure that you have a good planning framework to pull together all the separate elements of the plan. Write plans down and meet and consult with all parties involved.
- Define the job.
- Identify hazards: Consider the individual elements and the effect of each on the whole project.
- Assess risks.
- Eliminate and reduce the risks.
- Specify health and safety conditions.
- Discuss with contractor (if selected).

Stage 2: Choosing a contractor

- What are the criteria for selecting contractors and placing them on an Approved List?
- What safety and technical competence is needed? Has the contractor got it?
- Ask questions.
- Get evidence: safety passport schemes are a good way of demonstrating the training of individual workers.
- Make contractors aware of your company safety culture.
- Go through information about:
 - the job;
 - the site, including site rules.
- Agree respective responsibilities for risk assessments and precautions.
- Ask for a safety method statement.
- Decide whether subcontracting is acceptable. If so, how will health and safety be ensured?

Stage 3: Contractors working on site

- All contractors show their passports, sign in and out.
- Name a site contact.
- Reinforce health and safety information and site rules.
- Check the job and allow work to begin.
- Facilities for contractors, washroom, toilets, canteen etc.

Stage 4: Keeping a check

- Assess the degree of contact needed.
- How is the job going:
 - as planned?
 - is the contractor working safely and as agreed?
 - any incidents?
 - any changes in personnel?
- Are any special arrangements required?

Stage 5: Reviewing the work

- Review the job and contractor's performance with all those involved, including the contractor:
 - how effective was your planning?
 - how did the contractor perform?
 - how did the job go?
- Record the lessons, review and link to re-selection procedures.

MANAGING CONTRACTORS - CHECKPOINT

44 The stages are linked. During Stage 3 'Contractors working on site', different needs could emerge and the job may change. If so, you need to return to Stage 1 'Planning'.

45 At Stage 5 'Reviewing the work', evaluate all the previous stages:

- your plan;
- your contractor;
- the job;
- how you kept a check.

46 Try not to see each stage in isolation.

STAGE 1: PLANNING

- Ensure that you have a good planning framework to pull together all the separate elements of the plan. Write plans down, and meet and consult with all the parties involved.
- Define the job.
- Identify hazards: consider the individual elements and the effect of each on the whole of the project.
- Assess risks.
- Eliminate and reduce the risks.
- Specify health and safety conditions.
- Discuss with contractor (if selected).

.....

'It's important not to jump straight in and get work done without planning the job properly. If there are contractors on site already it can be tempting to ask them to do additional work at the same time, and this can lead to problems.'

47 This stage is about how to plan the contractor's job. After working through it you will be able to understand more about the practicalities of risk assessment and planning to reduce risks.

48 Some work will involve the Construction (Design and Management) Regulations 1994 (CDM) (your designer should bring this to your attention). At this stage, you will need to define the roles and responsibilities of all parties involved, and the relationships between them. See Appendix 1 for further information on CDM.

49 All work involving contractors needs to be planned, but the practical detail of the plan will reflect the nature of the job, the risks involved, the category of contractor involved in the work (paragraph 9 of this guidance describes possible categories of contractor), and the expertise of the contractor. The first stage of the process is to:

- define the job to be undertaken by the contractor, or each of them if several will be at work on the same project; and
- agree how it can be done safely.

50 Some work, such as a mill-shut or major plant rebuild may have been scheduled and planned months or weeks in advance. Some work may need to be done at short notice because it results from an emergency or breakdown. Whatever the type of work, health and safety needs to be built in by the process of risk assessment:

- identifying hazards - anything that can cause harm, for example, hot working conditions and confined spaces;
- evaluating risks - the chance of harm actually being done, for example, of workers developing heat stress.

51 Identifying hazards, assessing the risks and planning how to eliminate or control them is a straightforward process. Much of it is common sense, but some tasks may present more of a challenge, perhaps because of their complexity.

'It is common for contractors to need access to elevated positions that are not normally work areas. Scaffolding needs planning. During a major rebuild several contractors may need scaffolding in adjacent areas. We find that chaos can result if each has responsibility for providing their own

.....

scaffolding: each may use a different scaffolding contractor, or may choose to try to erect their own tower scaffolds, which may not be suitable. We take responsibility for provision of access and working scaffolding during major rebuilds: we appoint a single authorised scaffolding company and liaise with the contractors, at an early stage, about their access needs.'

52 Contractors have responsibilities for preparing a risk assessment under the Management of Health and Safety at Work Regulations (MHSWR) 1999.³ Their risk assessment should fit in with your own and provide you with information. Contractors will also need information from you about the job, the state of the plant etc when preparing their assessment.

53 There is a need for communication and close co-operation between you and the contractor so that all risks associated with the job are covered.

54 Contractors may prepare a detailed safety method statement on how they intend to carry out the job so that risks are controlled and managed. This should be based on an assessment of risks to the health and safety of employees and others who could be affected by the work. Don't just file these: make arrangements for a competent person to assess them against statutory requirements, HSE published guidance and industry standards. Consider also how the methods described will impact on other activities on your site, including the work of other contractors.

Emergencies and breakdowns

55 Work resulting from emergencies or breakdowns is not exempt from the requirement for a risk assessment - inadequately planned action following a breakdown may result in an accident and make a bad situation worse.

56 Sometimes there is no quick way to deal with an emergency or breakdown situation; planning and execution of the work will be time consuming and this cannot be avoided. However, it may be possible to carry out some breakdown work quickly, such as specialist repairs to instrumentation, to minimise lost production. This can be done, provided all reasonably practicable steps are taken to ensure safety, through proper planning.

57 Specialist contractors, who may not be familiar with the mill, may need to be brought in at short notice, perhaps during the night shift. Although they (and their employer) may not have experience of the mill in question, they should be familiar with the type of work they are expecting to do and the conditions they will foreseeably encounter. This will enable them to produce generic risk assessments, and their staff should be trained so that they can identify any departures from the risk assessment or unusual problems presented by the job in hand. These can then be discussed and arrangements made to deal with them on site. The work should not progress unless adequate arrangements have been made for safety.

.....

58 You will also need to carry out an assessment of the local working conditions and arrangements before the contractor arrives on site: access and working platforms may be needed, or a clean-up may be in order to provide a clean and safe work area. Once the contractor arrives there may not be the opportunity (for example, it may be the middle of the night) to brief them fully about the hazards in the areas they may need to work in or pass through. Appropriate supervision by a responsible mill representative will protect the contractor from harm by ensuring that they move about the site and leave it safely. The degree of supervision appropriate in the circumstances will depend on the category of contractor, or the experience the contractor has of your mill and procedures and the nature of the work (see paragraph 9 for details of categories of contractors).

59 Although breakdowns requiring a quick response may occur without warning, some planning can be carried out in advance. For example, you can produce generic risk assessments for the most common, high-risk jobs, such as working at height, in hot environments or confined spaces. You should identify any particular circumstances which might alter the conclusions of a generic risk assessment, such as the introduction of new equipment or processes. You can also identify a list of approved contractors who can be brought in, so that shift managers are not faced with making choices without sufficient knowledge of the contractors or their expertise and reputation for competence in safety matters.

60 Whether work is planned well in advance or results from a breakdown, the mill site will have health and safety rules that will need to be observed. These will be general, for example:

- signing contractors on to site;
- responsibilities of management for supervision of the work;
- use of personal protective equipment (PPE), for example hearing protection in noisy areas, safety footwear etc; and
- prohibitions on smoking.

61 There will also be work-specific rules, for example:

- use of permits-to-work; and
- procedures for electrical and other power or energy isolation.

62 Mill staff who are likely to be involved in the supervision of contractors on site need to be trained in these rules and their application. Mill management should monitor to ensure they are observed.

63 Not all plans are carried out without difficulties; contingency plans can help to prevent problems from escalating.

.....

64 Some work in mills will attract CDM. This will include building and demolition work and also work such as major plant rebuilds (see Appendix 1). Mills may deal with capital projects such as building a new combined heat and power plant, by appointing an independent principal contractor, and having no responsibility for the day-to-day work until the plant is handed over.

65 Major plant rebuilds, however, may involve machinery adjacent to equipment remaining in production. Segregation of the work areas may be difficult. Mills may choose to adopt the role of Principal Contractor (see page 59), if they consider this to be necessary for the co-ordination of contractors and the control of the hazards in the rebuild activity in the production environment. CDM will help mills by applying specific principles to the planning and Rebuild processes. For further information see Appendix 1 and the 'References' section.

A mechanical engineering firm requested scaffolding to be supplied on the back side of a paper machine. The request was not met, so a board which had been left from a previous job was used. The board snapped and two employees fell approximately 5 m and the bearing housing they were changing fell with them. Both employees were fortunate to escape only with minor injuries.

'Labour-only' contractors were exposed to asbestos fibres during the demolition of welfare facilities. Although there was a site Asbestos Register and an asbestos policy, entries in the register were misleading and failed to alert the mill supervisor to the presence of asbestos. The asbestos was not labelled in situ. Once the structure was partially demolished, asbestos was noticed among the debris and the work was stopped. A licensed asbestos contractor was brought in to clean-up and finish the job. The paper mill was prosecuted by HSE.

66 The following exercises will help you identify hazards, evaluate risks and decide what precautions may be required. It is a good idea for individuals to do these exercises on their own, and then discuss them in a group. Remember, these are just exercises: in reality it is important to get out of the office and look at the area in which the work will be done, and to speak with people who will be involved, to be sure that nothing is overlooked.

67 See also the PABIAC guidance *Risk assessment in paper mills*⁴ 1996 ISBN 0 7176 1288 0, part of the PABIAC *Guide to managing health and safety in paper mills*⁵ 1996 ISBN 0 7176 1313 5.

68 If you have a job where the CDM Regulations apply, there are particular things you will need to do. Look at Appendix 1 for an introduction to CDM and also see the 'References' and 'Further information' sections.

.....

EXERCISE 1: IDENTIFY THE HAZARDS

Identify the hazards arising during a planned shut of a paper machine, at which contractors will change rolls, while felt roll guides are being overhauled. Production is continuing on an adjacent paper machine. Write down every hazard you can think of under the two headings.

A: The work the contractors have to do, and their working environment:

B: The interaction between contractors, and between contractors and production activities:

You may have identified these hazards:

- difficult access;
- working at heights;
- production machinery remaining in operation;
- hot and humid conditions;
- crane movement;
- slippery or uneven floors or other working surfaces;
- poor visibility and communication;
- various energy sources and moving parts of machinery;
- manual handling;
- collapse of temporary lifting equipment;
- hot work;

.....

Some of the risks you may have included are the chance or likelihood of:

- falling from a height;
 - crushing or other injuries in moving machinery;
 - hearing loss;
 - heat stress;
 - electric shock or burns;
 - fire;
 - manual handling injuries (eg back strain);
- ... and there may be others.

Production staff must ensure that they wash down properly after a chemical wash. When doctors or felt rolls have to be removed by contractors after a chemical wash, residue in the felts and vapours in the atmosphere can be very strong if there is not adequate ventilation. An appropriate assessment needs to be carried out at the planning stage. Consideration should be given to the effectiveness of washing-down, any ventilation required and the PPE needed by the contractor.

EXERCISE 3: ELIMINATE AND REDUCE THE RISKS

Ask yourself if it is possible to eliminate any of the risks. It may not be possible in this example but in other circumstances you may be able to work out different ways of doing things. Think ahead about the future maintenance requirements for new plant, and make provision for things like access and use of lifting machinery during dismantling.

Finally, using the same jobs again, list ways to reduce the risks. Work out the precautions that will be needed.

Tick the column to identify which precautions are:

- 1** up to you;
- 2** up to the contractor;
- 3** a joint responsibility.

You may need to agree who will be responsible for what, depending on the circumstances. Suggested precautions include the following:

Precautions to reduce the risk	1	2	3
- Before the job starts, inform the contractors of the results of the overall risk assessments, control measures and emergency procedures. - Clean and isolate machinery and plant. - Provide temporary access facilities. - Make arrangements for the safe use of temporary lifting equipment. - Institute permits for work at high level. - Provide protective equipment. - Cordon off work area, display warning notices. - Inform the contractor of dangers in the work area, precautions and emergency procedures before the job starts. - Use of safe systems of work, for example for isolations during roll change. - Make arrangements for safe working in the hot environment. - Train to use equipment safely, including personal protective equipment (PPE). - Communication, throughout the work, with the people involved.			

Ask yourself whether the precautions:

- meet the standards set by a legal requirement;
- comply with recognised industry standards;
- represent good industry practice;
- reduce risk, so far as is reasonably practicable.

The free HSE leaflet *5 steps to risk assessment*⁶ contains useful information on assessment of simple tasks, including a way of recording significant findings. See the 'References' section for other material.

.....

PERMIT-TO-WORK SYSTEMS

69 Permits-to-work (PTWs) are an essential part of safe systems of work for many activities involving contractors in paper mills. PTWs are tools by which potentially dangerous situations can be made safe, and kept under control until all work is completed and people and plant are no longer at risk. Situations where permits are appropriate include those where the work involves:

- a significant risk of death or serious injury to those carrying it out, or to others;
- unusual risks outside the normal expertise of those carrying out the job, such as work in the vicinity of radioactive sources (eg in thickness gauges);
- the need to isolate a number of separate power sources or supplies to process plant; or
- precautions to prevent a serious fire or explosion during hot work (eg to prevent ignition of dust in tissue mills, or spilt oil).

Operations Director: 'In my view, PTWs must be supported by up-to-date records of valves, isolators, starters, pipes etc that need to be locked-off. Some mills, like ours, are now using information technology to maintain an up-to-date schedule of multiple lock-off points. This makes for easy updating, and simplifies record keeping.'

Nine lock-offs had been used to facilitate safe working in a couch pit on an agitator. Unknown to most personnel present at the time, there was a transfer system on a common line between three tanks. As a result, water poured into the couch pit and the two people working inside had to evacuate the area immediately. This could have resulted in injury in the pit where electrical hand tools were in use.

A contractor was hosing down in a pulper when water hit a 'magic eye' and started the agitator: poor communication had meant that a permit-to-work had not been used. Although the contracting firm had done this work many times before, the individual employee had not, and did not know the precautions needed.

70 There may be other situations in which a PTW is needed to ensure safety and these will be identified by risk assessment. Clear and specific site rules can then be made, identifying the activities for which PTWs are required. When individual jobs are being planned it will then be obvious if PTWs are needed, and this can be communicated to the contractor. However, it may not be possible to identify in advance all activities likely to need a PTW: mill managements need to understand the principles behind PTWs to help them recognise other situations in which they will be needed. The decision to use a PTW depends on the hazards involved in the work, but you also need to take account of good industry practice.

.....

71 Examples of activities for which PTWs will be appropriate include:

- most kinds of electrical work;
- entry into confined spaces, for example, drying cylinders and enclosed chests;
- work on or near overhead travelling cranes and their tracks;
- work on steam pipes or pipes carrying process chemicals;
- hot work, ie burning or flame cutting, for example at the backside of dryers where the environment may be oily and dirty;
- work on plant with multiple serious hazards, for example pulpers where there will be risks from machinery, ingress of water and general confined space hazards;
- work on interlocked or programmable logic controller (plc) systems, or systems with sequenced starting;
- asbestos removal.

72 PTWs specify the work to be done and precautions to be taken and provide a clear record that all foreseeable hazards have been considered. It is important that great care is taken when identifying foreseeable hazards: injuries have resulted when lines supplying steam, water and other liquid feeds, or electronic controls on pneumatic or hydraulic systems, have been overlooked.

73 Separate permit forms may be necessary for different tasks such as:

- entry into confined spaces;
- hot work;
- work on electrical systems;

even if these are being carried out on the same piece of plant.

74 This allows proper emphasis to be given to the particular hazards present in the work and the precautions that need to be taken.

75 Many accidents occur each year because PTW systems are not used, or because a PTW has not been used properly. PTW systems have certain key elements and failure to apply any one can have serious consequences. They should not be applied automatically to all work requiring isolation - this can lead to the proliferation of paperwork and collapse of the system.

Essential elements of a permit-to-work

76 The sequence in which the following steps are carried out is important and should be followed.

- **Permit title and type** (for example, hot work, electrical, mechanical etc).
- **Permit number** - reference to other relevant permits or isolation certificates.

- **Job location.**
- **Plant identification.**
- **Description of work to be done and its limitations.**
- **Hazard identification** - including residual hazards and hazards introduced by the work.
- **Precautions necessary** - these should be specified (perhaps using a checklist on the form), and the person(s) who carries out the precautions, eg isolations, should sign that precautions have been taken.
- **Protective equipment.**
- **Authorisation** - signature confirming that isolations have been made and precautions taken, except where these can only be taken during the work.
- **Date and time duration of the permit.**
- **Acceptance** - signature confirming understanding of the work to be done, the hazards involved and the precautions required. Also confirming the permit information has been explained to all workers involved.
- **Extension/shift hand-over procedures** - signatures confirming checks have been made and that the plant remains safe to be worked upon, and new acceptor/workers have been made fully aware of the hazards /precautions. New expiry time given.
- **Hand back** - signed by the acceptor certifying that the work is completed and the site has been cleared of any equipment or materials that may create a risk to mill staff. Signed by the issuer certifying work is completed and plant is ready for testing and recommissioning.
- **Cancellation** - certifying work tested and plant satisfactorily re-commissioned.

77 Do people understand how to use the PTW system? Training (for mill staff and contractors) is essential for the proper use of PTWs. Remember that your PTW system is probably different to the last mill where your contractor worked. Monitoring and supervision are also crucial - genuine mistakes can happen and these need to be picked up. Short-cuts may be taken, such as failing to check that precautions have been taken or failing to cancel formally all copies of a

.....

PTW before isolations and other precautions are removed and, unless discovered, these bad practices can prove fatal.

In addition to its normal supervision of the use of PTWs, one mill has a small team comprising the Safety Officer, Works Engineer and the Mill Manager, who periodically have a brief meeting to examine copies of all PTWs issued. The team try to think of any improvements that could be made, to avoid the need for the work or to make it easier or safer to accomplish. This approach has enabled them to make a number of improvements on site.

'Contractors also need to exercise judgement when working under a mill's PTW. Systems will vary and contractors should not assume that each system is the same. My firm recently worked in a mill where there was a single master key lock-off system. We didn't know who had the key, and he didn't know where work was going on. It was not a good system.'

Contractors were working on a chest when there was an explosion, lifting the lid into orbit. As welding gear was in use it was decided that there had been a gas leak from the equipment. Hoses and valves were replaced. Work resumed and there were three further explosions before it was realised that flammable gas was being generated by rotting pulp. There was a serious risk to health as well as that of explosions: a proper risk assessment followed by gas monitoring of the environment, as part of a PTW, would have detected the problem.

Four men were in a tank installing a baffle when water poured in and began to fill the vessel rapidly. Although the water supply was supposedly locked-off, auto-valves had been overlooked. The men had to swim in the tank until they could escape through openings such as the top manhole.

A PTW was cleared after work had been done on an overhead travelling crane. A short time later a hammer fell from the crane landing on the floor between two mill staff. Although the PTW had been cleared, the acceptor had not checked the area before signing off the permit.

EXERCISE 4: PLANNING FOR SAFETY

This exercise helps you to practise planning for safety. Identify a real job which needs to be done. Identify all the tasks that will be going on in the area at the same time. Consider the individual jobs and their interaction. Draw up a plan noting the following:

- hazards - anything that can cause harm;
- risks and how they will be eliminated or reduced;
- health and safety communication needed with contractors;
- people who need to be involved for health and safety;
- working methods and procedures for health and safety.

If you are stuck for ideas, these may help you:

- changing refiner plates;
- repairs inside a drying cylinder;
- changing a valve;
- inspecting an item of plant;
- plant maintenance;
- cleaning a tank.

Identify the job

- Has this job or one similar to it been done before?
- Is there a record of how it was done and the hazards involved?
- What are the hazards?
- What are the risks?

Plan how it will be done safely

- How can the risks be eliminated or reduced?
- How do the risks affect how the job should be done?
- What precautions are needed?
- Who needs to be involved?
- What procedures and working methods should be used?
- What standards do you intend to set for hardware, people and systems to achieve? For example, do you require 110 V electric tools as standard on site?
- What do the people involved need to be told before the job begins?

KEY POINTS

You need to follow these three key points for health and safety:

- Plan all jobs involving contractors.
- Carry out a risk assessment during the planning stage and use it to decide what precautions are needed.
- Exchange information.

MANAGING CONTRACTORS - CHECKPOINT

- ☐ Do you ask contractors to provide risk assessments or safety method statements? Keep a check of those who don't or are unwilling. Make sure you agree exactly how to do the work.

STAGE 2: CHOOSING A CONTRACTOR

- What are the criteria for selecting contractors and placing them on an approved list?
- What safety and technical competence is needed? Has the contractor got it?
- Ask questions.
- Get evidence - safety passport schemes are a good way of demonstrating the training of individual workers.
- Make contractors aware of your company safety culture.
- Go through information about:
 - the job
 - the site, including site rules.
- Agree respective responsibilities for risk assessments and precautions.
- Ask for a safety method statement.
- Decide whether subcontracting is acceptable. If so, how will health and safety be ensured?

'Everyone working on your premises should know the health and safety standards they have to achieve.' HSE.

78 Since the use of contractors is increasing in the paper and board industry, your choice of contractor can have a big impact on health and safety in your company.

79 Has health and safety been included in the criteria for choosing the tender? Has the buyer/contract manager been trained? Does the tender board have the right competencies? Forgetting health and safety standards at the tender stage can be expensive in the long run!

80 This stage looks at how to assess the contractor's competence before you make your choice. After working through it, you should be able to describe what is involved, identify some health and safety questions to ask contractors and explain the benefits of using preferred contractors.

Successful selection of contractors

81 Approach contractor selection with care. It is not something to do casually. It could be said that selecting contractors needs even greater attention than selecting new employees! For a start, your senior managers and staff responsible for selecting and controlling contractors need to know what standards and criteria to apply.

.....

'It's not uncommon for a less experienced production supervisor - or even senior management - to go for the DIY approach, especially if the job is small or sudden. To save money or time they'll try to sort it out themselves or call in someone they know, not always the most competent person, to get the job done fast or cheaper.' Works Manager.

82 Set out the skills, knowledge and experience your employees will need if they are involved in selection, control, monitoring and review of contractors and subcontractors. The knowledge and experience needed may differ between projects - a team of people may possess the expertise between them. Make arrangements to identify any training needed - and to provide it. Think about how you can be sure that your staff actually have the necessary skills, knowledge and experience.

'I've got their health and safety policy - now what?'

83 Companies often ask for contractors' health and safety policies but rarely do anything with them. They are important and should tell you a lot about the contractor. A good policy should include or refer to the arrangements the contractor has made for putting the policy into practice. It will be supported by sensible procedures and working practices.

MANAGING CONTRACTORS - CHECKPOINT

- ☐ Look out for the quick fix!
- ☐ Take care when you need someone in a hurry - don't miss out safety. Spell out the conditions.
- ☐ Don't assume that because a contractor is on your approved list and his staff have safety passports these questions are unnecessary, or that the contractor is competent to do every type of work.
- ☐ Identify the category of contractor coming on site. Make sure that the arrangements you make for management of contractors reflect the contractors' understanding of the hazards on site.

84 Before the work starts, spell out the conditions your contractor has to meet and select the one best equipped to meet them. Health and safety is one of your conditions. Identify health and safety procedures associated with the job and include them in the contractor's specification. When bids are received, check them against the specification to make sure that proper provision has been made for controlling risks.

85 The deciding factors about the contractor you choose may include:

- **Availability** - contractor W is available . . . but do they know about the hazards of working in a paper mill?
- **Technical competence** - contractor Y seems technically competent . . . but last time they were on site there was an accident!

- **Reliability** - contractor Z did the job last time . . . but they always sent different people each day.
- **Health and safety** - check their policy, performance and procedures.
- **Cost** - contractor X is the cheapest . . . but are they the safest? To avoid cost issues clouding the picture, it might be best to select a range of competent contractors before inviting them to tender.

Subcontractors 86 Problems can arise when there is further subcontracting unless there are good arrangements between all parties. You may wish to set down rules about subcontracting.

A works supervisor explains:

'Contractors may have a safety method statement and a health and safety policy. But sometimes their subcontractors are just a couple of men and the contractor leaves the subbie to get on with it. Now we give contractors our site rules and go through it with them. They have to abide by them if they want our work. We are very strict about the use of subcontractors and make sure the main contractors know their responsibilities. It has helped the situation with subcontractors.'

MANAGING CONTRACTORS - CHECKPOINT

- ☐ Subcontractors are at arm's length. Make the point to your main contractor that they must:
 - ☐ manage their subcontractors;
 - ☐ make sure the subcontractor complies with site rules, working methods and procedures.

Look around for contractors 87 Suppose your company needs someone to clean out pitch dispersal equipment. Six companies have been identified. How do you find someone competent, with the right approach to health and safety and with experience in the paper and board industry? It's not just a matter of cleaning. It's how to do it safely, given the particular hazards present.

- **Build relationships to set up a list of preferred contractors** - this happens over time and has definite advantages. Many mills find it best to have an approved contractor list - it helps them maintain control on a large site. You can check their safety record from time to time and keep them in touch with your rules and standards. You'll have a list of contractors in place with considered and reliable arrangements for safe working. You do not need to carry out a

complete selection process every time. The approved list can also be a way of controlling contractors: firms removed from the list because of poor safety performance will lose out.

- **Use your contacts in the business** - are there networks you can use? Others in your kind of work will be using the same sort of contractors. Find out who they think has a professional approach. Ask your contacts what they know about the contractor's health and safety competence.
- **Use informal networks** - listen to others in your company. People on site may have heard of experiences with particular contractors or have seen a contractor at work in a different context.
- **Interview different contractors** - ask them for information. Get them to say how they work, what they know about health and safety and how they implement their own health and safety policy. Use the checklist 'Questions for contractors'.

Ask questions and get evidence

88 You are unlikely to need to ask all the questions in the checklist. The depth of questioning needs to be tailored to the risks of the job. Pick out which are the most important, given your knowledge of the job and the skills the contractor needs. You may also need to include questions about key people who would be put on the job. Ask who will be supervising and managing the work. What are their experience and knowledge of the particular health and safety issues and their level of awareness and training? Decide how much evidence is necessary to support what they say. For example a good way for contractors to demonstrate their commitment to knowledge of health and safety would be to show that their staff have attended the safety passport training scheme operated for the paper industry by SCATS (Safety Contractor Accredited Training Scheme) established by the Engineering Construction Industry Training Board (ECITB) (see 'Further information').

89 PABIAC fully support this approach since it will help to drive up standards across the industry if mills progressively make training on this type of scheme a mandatory requirement for the employees of contractors who come on site. But don't assume a passport is a guarantee of compliance in all areas. It only shows a basic level of training and it cannot train contractors in the special conditions found or systems used in your mill.

90 The CDM Regulations say that you must select competent contractors. Competence is not just a matter of technical qualifications or training achievements, although these may be important. You need to assess the wide range of abilities needed for the work.

.....

CHECKLIST: QUESTIONS FOR CONTRACTORS

This is not a complete checklist - can you think of anything else which needs to be added?

Experience

- What experience do you have of the paper and board industry?
- How familiar are you with the hazards in this type of mill?
- Have you done this sort of job before?
- What are the main problems?
- Can you provide existing risk assessments or safety method statements, eg for a similar job?
- Can you supply references?

Health and safety policy and practice

- Do you have a health and safety policy?
- Has HSE taken action against your activities in the last five years?
- What are your health and safety procedures?
- Do you plan to use any subcontractors?
- Will you provide a safety method statement for this job?
- What safety checks do you make on equipment and materials?
- How do you protect people exposed to hazardous substances?
- Do you provide all necessary safety equipment and PPE?
- Do you keep accident statistics?
- What is your history over the last five years?
- Does your Employers' Liability Compulsory Insurance cover the work to be done?

Training and competence

- Are you a member of a trade/professional body?
- How do you ensure your subcontractors are competent?
- How do you prepare them for working safely while on site?
- What health and safety training do you provide?
- Can you show us your training programme and records?
- How is health and safety information passed on to staff and contractors?
- Have they got current certificates of competence and participation in health and safety training, for example the safety passport scheme?

Supervision

- How do you plan to supervise this job?
- Who will be responsible for supervision on site?
- How are changes which arise during a job dealt with?
- How will you liaise with us?
- If you identify a problem, what action do you take concerning your staff or subcontractors?
- Will you report incidents/accidents to us?
- Are you prepared to abide by our rules?

Add your own questions that may arise over time and from experience.

.....

91 You are trying to gauge how seriously they take the subject. How do they react if you ask to see evidence of safe working procedures or training records? Beware of companies who say they'll provide them, then don't. How willing is the contractor to learn about, and comply with, your standards? What about any regular contractors? If you don't know much about their health and safety procedures and technical competence, find out.

Selecting a contractor to replace a fibreglass tank lining

'We needed a specialist contractor to reline a tank. We don't really have this expertise in house. We knew that entry into the tank would need a permit-to-work, to make sure the tank was isolated from all its supplies, like water and chemicals, and that measures were in place for the work itself to be done safely.

We knew of some companies doing this work in mills. We got in touch, and made enquiries about their experience. We asked for and followed up trade references, and then asked some companies to quote for the job. Their tenders set out how they would do the work, and we made an assessment of the methods they described. We also asked questions about their arrangements for health and safety - their Safety Policy and Control of Substances Hazardous to Health (COSHH)⁷ assessments for example, and about the training of their workers. We used this information to make our choice. Although this was a one-off job, the work was well done and we were pleased with the firm's whole performance: we would use them again.'

Agreeing the job

92 An agreement doesn't need to be written for it to be legally binding. At its most basic, the company agrees to pay the contractor when the contractor does a job. However, writing your agreement can help to make each party's responsibilities clearer. You can specify everyone's responsibilities for health and safety.

93 Prepare information in advance about your company's rules and procedures to give to contractors. Complying with these can be part of the agreement between you.

KEY POINTS

This step is about establishing the contractor's competence. You need to:

- select contractors with health and safety as one of your key conditions;
- specify your requirements for health and safety;
- ask questions and get evidence. Find out their:
 - experience;

- health and safety policy and practice;
- training and competence;
- supervision arrangements.
- develop preferred contractors - those you can rely on, with established arrangements for health and safety.

STAGE 3: CONTRACTORS WORKING ON SITE

- All contractors show their passports and sign in and out.
- Name a site contact.
- Reinforce health and safety information and site rules.
- Check the job and allow work to begin.
- Facilities for contractors, washroom, toilets, canteen etc.

94 This stage covers the job itself - signing in and knowing who is on site, establishing a named contact and briefing contractors before the job starts. It explains ways to sign in, gives examples of prepared materials to use, what to check, and information to provide about the job before it starts.

Arrival on site

95 All businesses need to control the coming and going of people in and out of their premises. Maybe you already have a reception area or security lodge with a book for visitors to sign, and issue passes to those entering the site. Some mills go further and also have 'contractor boards' in their departments - they chalk up the names of the contractors at work and their mill contacts. It is worth looking at your arrangements to see if there is room for improvement. Think for example about the arrangements for contractors who may be called in at night to deal with an emergency repair. Do you always know who is with you - and where they are? How do you deal with contractors who do not have passports? What additional information and training will they need?

'We had an unplanned site evacuation recently during a mill-shut. With some contractors we had 100% compliance: we knew everyone who was on site and where they were. Others, we hadn't got a clue - they had just come in by the back door. We need to check that our team knows that this is important and that they must pull contractors up for it.'

Safety rules

96 Contractors need to be told about your site health and safety rules - such as the use of eye protection or other protective equipment; whether or not smoking is permitted; what to do in the event of fire or other emergency etc. You may have sent the contractor a copy of your site rules in advance. It is a good time to recap on these when contractors arrive on site - some sites give contractors a plastic card with basic site rules on them - see paragraphs 98 and 99, 'Ready references'. Don't forget to cover *your* PTW system. Everyone uses a different system and yours may not be the same as the last mill the contractor worked in!

Site hazards 97 Contractors need to be told about the hazards they face when they come on site. Often an induction talk is the best way of passing this information on. It is worthwhile checking that they have understood any essential points. It is helpful to keep records of who attended the talk, the date and topics covered. This can help to avoid having contractors attend talks unnecessarily, or new personnel being allowed to work on site before they have been briefed, and can help to show when refresher briefing is due for those contractors who visit the site regularly. You will need to do more for those contractors who do not have safety passports.

Ready references 98 Standard information can be made up in advance, eg printed cards, notices, booklets covering details of site rules, key telephone numbers, a site map with escape routes and emergency assembly points, first-aid facilities, fire procedures etc. Some companies use an induction video about the company and the site. It shows the key health and safety messages before any work starts. Some sites integrate this system to their site security.

99 Ready references are also helpful for contractors and the mill managers with responsibility for day-to-day oversight of the contractor's work: a checklist helps to ensure that important areas are not forgotten.

Site contact 100 Contractors need a site contact - someone to get in touch with on a routine basis or if the job changes and there is uncertainty about what to do. The site contact should be somebody nominated who is in a managerial position with sufficient authority and competence to make any necessary decisions.

101 The site contact will go over the job with the contractors:

- checking what precautions are necessary for any risks involved and whether a PTW is needed;
- ensuring everything necessary has been done;
- confirming further contact, supervision arrangements and the time limit agreed for the job, if appropriate.

102 Assess your approach to signing in and contacts. Tick the column that applies. If you have ideas which are not in the left hand column, add them.

Signing in and contact on site	No need to improve	Need to improve	Need to start
We have a reception area/ security lodge			
Contractors sign in daily			
Contractors always use site passes			
We give written site rules to contractors			

Signing in and contact on site	No need to improve	Need to improve	Need to start
New contractors are taken through our site rules, including PTW			
All contractors have a contact person while on site			
We insist they make daily contact with the site contact			
People leaving the site MUST sign out			
ALL contractors are covered (including subcontractors)			

Note: The signing in procedure links to the next stage in the process of managing contractors.

Contractors and mill plant and equipment

103 To carry out some tasks (for example carrying out roll changes), contractors may need the use of your own plant and equipment (for example overhead travelling cranes and fork-lift trucks). It is for you to see that your equipment is not operated by untrained and inexperienced people. You may wish to arrange for your own trained staff to operate such equipment, working with the contractors, or you may decide to check that the contractors' staff have the required training and competence. Some mills arrange for contractors' staff to be 'tested' by their in-house trainers, before they are authorised as users.

MANAGING CONTRACTORS - CHECKPOINT

- ☐ Don't let contractors or their subcontractors turn up and just get on with the job, even if they were there the day before. Things may have changed.

KEY POINTS

- Signing in and out is important for all contractors, whenever they come and go.
- All contractors need a site contact.
- Pass on information about the site - the hazards and risks, site rules, emergency procedures, the alarm, the first-aid facilities etc.
- Exchange information with them about the job and go through any safe working methods before work begins.

STAGE 4: KEEPING A CHECK

- Assess the degree of contact needed.
- How is the job going:
 - as planned?
 - is the contractor working safely and as agreed?
 - any incidents?
 - any changes in personnel?
- Are any special arrangements required?

104 This stage is critical in controlling jobs with contractors. It's about monitoring, checking on what is being done and how, and whether the job is going as planned. Changes can be sorted out and agreed if there are problems. Where you have more than one going on at the same time, prioritise jobs according to risk, to focus your efforts sensibly.

105 After working through this stage you should be able to assess the degree of contact needed and identify what to check up on.

'If a company has made the effort to define and communicate its safety standards to contractors, it may then be a hugely wasted effort unless it sets out to check whether or not the standards are being followed and adhered to.'

Working to plan

106 You need to have a plan against which you can check (see Stage 1). Do not just have a quick look and say something vague like: 'How are things going? . . . OK . . . fine. Carry on . . .', but check to see that the contractors are doing the job in the way you agreed. Check also to see that your own staff have done what has been agreed.

How much checking is needed and how often?

107 Contractors are responsible for supervising their own work and for ensuring that they work safely. However, you can't just leave them from the start to get on with the job and pay them when they have finished. Too much could go wrong in between.

108 You usually do not need to watch them all the time. You have to weigh up what is reasonable. The amount of contact with the contractor must be related to the hazards and risks associated with:

- the job;
- other jobs which may be going on in the same area at the same time;
- the site;
- the understanding the contractor has of the hazards other than those in their own work; and
- how familiar you are with the contractor.

.....

109 The amount of checking or monitoring needs to be decided and agreed at the beginning of the job. For high-risk jobs, for example where a PTW is used, more contact will be needed than for jobs which you consider low risk. Similarly, contractors visiting the site at short notice and out-of-hours may need closer supervision than regular visitors, because of their unfamiliarity with the site. Risks may increase at certain stages or milestones in a project - for example at the point when recommissioning of plant or machinery begins, and contractors have to recognise that the plant that they have been used to working on 'dead' is liable to be in an operating condition so that PTWs may become necessary.

110 Think about the main areas of foreseeable risk. What could change and how quickly? Think about the work of each contractor if there is more than one, how they can endanger other contractors, or the safety of your employees and vice versa.

111 The start and finish of the day, or shift changeovers, are important times for going through the job and reviewing progress, and considering what has changed in terms of the original plan. Make sure that changes are notified to every contractor and member of the mill staff who need to know. Changes to one part of a plan can affect others - often significantly.

112 Although consultation between the contractor and their site contact at set times is important, the contractor should also expect to see their site contact at other unspecified times, when they will be looking out for safe working practices.

113 You selected the contractor who met your conditions, and specified the terms in your agreement. As the work proceeds, make sure your terms and conditions are being met. You may need to check more often at the beginning of the job until you are satisfied of their standards. There are other important reasons besides safety for doing this. Look for competence - in safe working as well as technical ability.

Accidents **114** Encourage all contractors to report incidents, near misses and injuries - even minor ones - to you. This will help you to:

- report injuries to self-employed contractors (see Appendix 1 for information on your duties under the Reporting of Injuries, Diseases and Dangerous Occurrences Regulation 1995 (RIDDOR)⁸);
- measure the performance of individual firms;
- identify trends and incidence rates;
- learn from past experience; and
- look at underlying causes and put matters right before someone is hurt.

115 Keeping contractors informed of your assessment of their performance, based on this data, can help them to improve.

.....

.....

116 You can either actively investigate contractor incidents yourself, or get the contractor to do so with your involvement. It is important that you get the results of their investigation, and that they are credible. Check that the reporting and investigation process concentrates on establishing root causes, and the identification of any improvements needed.

117 Records also help to ensure that your 'corporate memory' is preserved, even if individual managers and other staff leave the company. This approach takes time and requires a degree of mutual trust, but it pays off in safe working.

118 Think about:

- checking against milestones for the project;
- how you assess the contractor's health and safety plan, the quality and quantity of their risk assessments, their method statements, and working practices (and how these are implemented in practice);
- what action you will take if the contractor's performance falls below a set minimum standard: this needs to be established in advance as a clearly defined procedure;
- what standards you will use to confirm that work has been carried out satisfactorily. These may need to be specific to the type of work in question: for example, by obtaining clearance certificates following asbestos stripping.

MANAGING CONTRACTORS - CHECKPOINT

- ☐ Is the work is being done as agreed, for example using the necessary PPE according to the conditions of the PTW?
- ☐ Is the contractor going beyond the scope of the job intended? Have any problems arisen which mean you need to rethink the job?
- ☐ Are any special arrangements needed due to changes of timing, out of hours or weekend work?
- ☐ Are there any changes in workers - new people who haven't been on site before and who need information?

KEY POINTS

It is important that you keep a check on how the work is going against:

- the plan;
- your agreement, including the job specification;
- agreed working methods, including any PTW or safety method statement.

Try to be active, not reactive. Don't just leave contractors to get on with the job.

.....

STAGE 5: REVIEWING THE WORK

- Review the job and the contractor's performance, with all those involved, including the contractor:
 - how effective was your planning?
 - how did the contractor perform?
 - how did the job go?
- Record the lessons, review and link to reselection procedures.

119 Finally, the job is over - or is it? This stage is about learning from the job and about the contractor when the job is completed. It explains the need for reviewing, identifies what to review and describes how reviews can be used.

Why does the job need reviewing?

120 The contractor's job is complete when the work has been done according to plan and the agreement you made. Reviewing is about evaluating the quality of the work against the plan and to learn what will be done differently next time to improve your procedures.

121 Review involves evaluating the health and safety of all other stages:

- your planning;
- choice of contractor;
- the work; and
- the effectiveness of the contact and supervision.

122 Any surprises and lessons learned should be recorded and used for the next time. The record can be used when revising your list of preferred contractors.

CHECKLIST: FOR REVIEW

The checklist shows some review questions. Others may come to mind as well. This list is not complete.

The contractor

- Were there any health and safety problems?
- Would you accept them back on site again?
- Did you need to take action?
- Did you have to pull them up on anything?
- How good were they at housekeeping?
- Would you give them a reference?
- Do you know enough about them to include them on a preferred list?

The job

- How was your planning - was the hazard identification and risk assessment adequate?
- Has the work been done as agreed, for example, as in the contract or in accordance with the safety method statement?
- Has any necessary testing been done, checked and recorded (for example, after asbestos stripping, or work on pressure systems)?
- Were all the permits signed off?
- Have any remaining actions been agreed and taken into account?
- Is there a record of achievements and shortfalls?
- Do plant records, including any drawings, need modification?
- If the job is likely to be done again in future, is it recorded to assist planning next time?

Who is involved in reviewing?

123 If you are responsible for managing the job, you carry out the review as part of the process.

124 It is essential to get the contractor to participate, and good practice to involve others, for example safety representatives and production staff. Contractors need to know if they have to improve, and they will add useful information from their own point of view.

125 Make sure that feedback about contractors' performance, and any interventions, reaches those responsible for choosing contractors. It is important for information to be passed between departments, and between individual mills. Senior managers also need to be kept informed of important developments.

126 Put the specific recommendations of the review in writing for future reference. They need only be brief. Why not copy it to the contractor? If there were problems, they **need to improve**.

MANAGING CONTRACTORS - CHECKPOINT

- ☐ What happens now when your contractor is finished? Do you just get the bill? Make sure you don't miss the review step.

KEY POINTS

After the job is finished, review it to:

- evaluate quality;
- learn what went well and what didn't so the lessons may be applied next time.

.....

Remember to provide positive feedback where it is due - everyone likes a pat on the back!

Review the:

- contractor; and
- the work.

Keep a record!

SECTION 4: FROM THE CONTRACTORS' PERSPECTIVE

WHAT LEGAL RESPONSIBILITIES DO YOU HAVE AS CONTRACTORS?

127 As a contractor you have your own legal responsibilities under the Health and Safety at Work etc Act 1974 (HSW Act), the Management of Health and Safety at Work Regulations 1999 (MHSWR), the Control of Substances Hazardous to Health Regulations 1999 (COSHH), the Construction (Design and Management) Regulations (CDM) 1994 and other regulations. You must:

- protect your own employees and the employees of the mill and other contractors from the hazards of your own activities and the plant and substances you bring on site;
- protect members of the public who may be affected by your activities (an example would be where work takes place on or near a site boundary);
- provide information to the mill management about the way you will be carrying out your work and the hazards you introduce so that the mill can organise safety and health measures for everyone exposed to risk, for example about chemicals, noisy equipment or construction plant you may be bringing on site;
- co-operate with mill managements in implementing effective control measures.

128 More details on MHSWR and CDM can be found in Appendix 1 of this guidance. For information on other legislation, see the 'References' section.

HOW CAN CONTRACTORS MANAGE HEALTH AND SAFETY IN THEIR PROJECTS?

General management systems

129 Effective management systems will help to ensure that your work in paper and board mills is planned, organised and carried out safely and without risks to health. Key elements in a general system for management of health and safety include:

- a commitment to health and safety by the directors or owners;
- an effective health and safety policy, including arrangements for managing health and safety;
- competence - knowledge of, and training about, hazards and controls. The appointment of competent advisers;
- an adequate understanding of how to carry out a risk assessment;
- arrangements for monitoring of performance by senior management;
- established standards for plant and substances, control measures, systems and procedures, and employees, for example relating to:
 - provision of safe plant and its maintenance;

- COSHH;
- safe systems of work;
- training, instruction and information for employees;
- supervision;
- proof of competence and skills, including the safety passport scheme.

Management of specific projects

130 After setting up general management systems it is important that steps are taken at the earliest possible stage to control individual projects. The detailed arrangements made for specific projects or jobs will reflect the hazards, risks and duration of the work you are to do, dangers created by work being done by others at the same time and the category of contractor to which you belong. Always agree these things with the mill - don't assume they share your view.

Before tendering

131 Find out the mill's approach to safety and ensure your arrangements for health and safety are appropriate for the work being tendered. Trained and competent staff need to prepare outline method statements or plans and carry out risk assessments to make sure the hazards and risks, plus cost effective control measures, are identified. Mill managements can provide important information to help this process, including information about hazards on site, and any special control measures expected, such as permits-to-work.

Tendering

132 Include in the tender realistic costings for control measures, including health, safety and welfare. Assume the client will expect this and use it as a measure of your competence. You may need to base your tender on published standards and refer to specific health and safety guidance where appropriate, for example, GS28/3 *Safe erection of structures Part 3: working places and access*.⁹

Once the contract has been won (if you are not on the mill's approved contractors list some of these might need to be sorted out before tendering).

133 Organise arrangements for communications:

- Who is the mill contact?
- Who is your responsible representative for health and safety on site?
- How will problems with the mill and other contractors be resolved?

.....

134 Make detailed plans for health and safety:

- Decide how the mill's own health and safety arrangements including rules and procedures apply to your operations, and make arrangements to observe them; if you are on the mill's approved contractors list you may have seen these before, but don't assume they haven't changed.
- Plan and arrange for the control measures identified by your risk assessments. Drawing up a method statement, reflecting your risk assessments, will help you here, and will demonstrate to the mill how you intend to apply health and safety principles in practice.
- Find out what specific responsibilities the mill will have while the work is carried out. Don't assume - check!
- Check that the arrangements for dealing with fire, accidents and emergencies are adequate for the circumstances, and that your employees know what to do in such situations.
- Check that your supervisors know and understand the mill's rules, and your own. Give them copies of written instructions for reference.
- Liaise with mill management about any problems you may have in implementing the control measures or site rules.
- Contact the mill safety manager as good practice and talk to the mill safety representatives.

ONCE WORK BEGINS

135 Maintain good communications with the mill management and staff representatives - they will need to know how your work is progressing and will let you know how their own work or that of other contractors might affect you.

136 Make sure that your site management has sufficient knowledge and expertise to implement and supervise the work according to your plan for health and safety. Make sure that they know the extent of their authority, and when to refer matters above them. It is becoming more common now to monitor managers according to their health and safety performance - this has to be handled carefully, to avoid cover-ups.

137 Monitor your team to check that the rules and procedures that have been agreed for the job are being observed. This can be done by carrying out unannounced site visits/spot checks, focusing on key topics such as:

- safety in work at heights;
- electrical safety;
- implementation of PTWs;
- COSHH and safe use of chemical substances;
- manual and mechanical lifting and handling;
- the way your work affects others;
- availability of on-site documentation; and,
- the adequacy etc of first-aid and welfare facilities.

.....

138 Using a checklist can help to ensure that important things are not forgotten, and, if well designed, can form useful records. You may find helpful the checklist contained in HSE's Construction Summary Sheet No 17 *Construction health and safety checklist*.¹⁰

139 If problems arise, and changes have to be made in the way the work is carried out, inform your mill contact, and your competent health and safety adviser. Make sure the risk assessment for the work is reviewed, to identify any additional measures needed to ensure safety.

140 Make arrangements for dealing with injuries, incidents and near-misses, involving your own staff, or others affected by your work activity. Procedures should take account of the need for:

- contacting the emergency services and obtaining other specialist help;
- making the work area safe, or taking precautions, before carrying out an urgent rescue;
- first aid or other emergency action, such as fire-fighting, to prevent an escalation of the situation;
- notifying the appropriate mill contact and, if necessary, HSE;
- ensuring that other contractors not under your control are warned of, and protected from, any residual risks;
- carrying out an investigation to establish root causes and identify any improvements needed;
- keeping appropriate records; and
- using any lessons learned to change the way you do things in future.

WHEN THE WORK IS COMPLETED

141 Participate in and, if necessary, initiate a review of your work. Review will help you to identify lessons to be learned and sharpen your performance in a competitive world. Look at the review questions on page 41, and answer those questions that are relevant. You may be able to think of others.

DAY WORK

142 Contractors' staff are often taken by mills on a day-work (labour only) basis, and their employer may believe that the client mill has assumed responsibility for the health and safety of these workers. Workers may spend months or years on site on this basis. Equally, where contractors carry out specialised or skilled work, the client may be expecting the contractor to take responsibility for their own safety. It is important that respective responsibilities for health and safety are explicit and understood by all.

APPENDIX 1: THE LAW

BACKGROUND

1 All work activities are covered by health and safety law. Not all of it will apply to everything you do, but you need to know the main points. Knowing the key Acts and Regulations and how they apply to your work activities is your responsibility. If you need help:

- get hold of any relevant Health and Safety Commission (HSC) Approved Codes of Practice, IAC publications (like this one) or HSE guidance books;
- get advice from a competent source such as a Trade Association; or
- look at the Acts and Regulations themselves.

2 You can also speak to someone at the HSE InfoLine on 08701 545500, or at your local HSE office.

3 Health and safety legislation likely to apply to the work of contractors is listed below. Contractors, and those who manage their work on the mill site, need to be familiar with the key requirements of:

- Health and Safety at Work etc Act (**HSW Act**) 1974;
- Control of Asbestos at Work Regulations (**CAWR**) 1987;¹¹
- Electricity at Work Regulations (**EAWR**) 1989;¹²
- Noise at Work Regulations (**NAWR**) 1989;¹³
- Management of Health and Safety at Work Regulations (**MHSWR**) 1999;
- Manual Handling Operations Regulations 1992;¹⁴
- Personal Protective Equipment at Work (**PPE**) Regulations 1992;¹⁵
- Construction (Design and Management) (**CDM**) Regulations 1994;
- Control of Substances Hazardous to Health Regulations (**COSHH**) 1999;
- Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (**RIDDOR**) 1995;
- Construction (Health, Safety and Welfare) Regulations (**CHSW**) 1996;
- Confined Spaces Regulations (**CSR**) 1997;¹⁶
- Lifting Operations and Lifting Equipment Regulations (**LOLER**) 1998;¹⁸
- Provision and Use of Work Equipment Regulations (**PUWER**) 1998.¹⁹

4 Depending on the circumstances, the requirements of the Supply of Machinery (Safety) Regulations (**SMR**) 1992²⁰ may also be relevant.

.....

5 The basics of the Management of Health and Safety at Work Regulations (**MHSWR**) 1999, the Construction (Design and Management) (**CDM**) Regulations 1994 and the Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (**RIDDOR**) 1995, which are the regulations most relevant to working with contractors, are set out in the following pages.

6 Further publications are listed in the 'References' and 'Further reading' sections. Refer to the relevant publications if you want help in understanding the law.

7 Although only the Courts can give an authoritative interpretation of the law, you should, where appropriate, consider everyone working on your site, even if they are self-employed for tax purposes, when carrying out your risk assessments or developing safe systems of work. You never know when your work can overlap with someone else - sometimes with disastrous consequences! Develop communication on site and encourage the exchange of information right from the start of the contract.

Health and safety inspectors

8 Health and safety inspectors can visit workplaces to carry out inspections, and may visit without appointment. They may want to check that arrangements for managing contractors at work on site are adequate. Inspectors can:

- give advice;
- require improvements to be made (including serving Improvement Notices);
- stop work from starting or continuing (by serving Prohibition Notices);
- prosecute.

9 Inspectors have a wide range of powers to help them do their job, and may take photographs, samples and statements.

10 Ultimately the courts can impose sanctions for breaches of health and safety law. Usually this involves levying fines, but can include imprisonment for serious offences.

MANAGEMENT OF HEALTH AND SAFETY AT WORK REGULATIONS 1999 (MHSWR)

11 These Regulations apply to everyone at work and encourage employers to take a systematic approach to dealing with health and safety by:

- assessing the risks which affect employees and anyone who might be affected by your work, including contractors. Businesses employing five or more people must record the significant findings of the assessment. **A risk assessment is nothing more than a careful examination of how people could be harmed by your work - it enables you to decide whether you have already taken enough precautions or should do more to prevent the risks;**

- appointing a competent person or persons to assist in applying the provisions of health and safety law, and in devising and applying protective measures. Competent person(s) don't have to be consultants, or have particular formal qualifications, but they must be competent. This means they must have sufficient training and experience or knowledge to understand the risks and be familiar with current good health and safety practices in paper mills, and also possess other qualities as necessary to do their job.

It makes sense for both mills and contractors to directly involve their appointed competent persons in projects from an early stage. This is especially important where high-risk work, or major building, construction or demolition work is taking place;

- setting up emergency procedures;
- providing training;
- co-operating with others on health and safety matters, eg contractors who share your site;
- providing temporary workers, such as contractors, with health and safety information. Some of these may already be covered in your safety policy.

12 MHSWR also specifically states that where two or more employers share a workplace - whether on a temporary or a permanent basis - each employer shall:

- co-operate with other employers;
- take reasonable steps to co-ordinate between other employers to comply with legal requirements;
- take reasonable steps to inform other employers where there are risks to health and safety.

13 The same principles of co-operation, co-ordination and communication between organisations underpin the CDM Regulations, explained next.

14 For more information on MHSWR, read the Approved Code of Practice.³

CONSTRUCTION (DESIGN AND MANAGEMENT) REGULATIONS (CDM) 1994

15 Paper and board mills often engage contractors to build, repair, maintain, convert or extend premises, and demolish buildings and install, commission, decommission and dismantle large items of fixed plant.

16 The CDM Regulations 1994 apply to most construction-related work of this nature. They outline key principles in designing and managing the work which contractors carry out.

.....

17 The construction industry has traditionally had high rates of serious accidents and a poor health record. Many construction accidents happen because:

- the project or job is poorly managed;
- clients don't take safety into account when setting budgets and timetables for projects;
- designers have not adequately considered the health and safety aspects during the design and planning process;
- contractors are not informed of particular hazards associated with the circumstances in which seemingly routine work will be done; or
- the contractors are not competent to deal with the complexity of the work.

18 Some of the activities carried out by contractors in paper mills will be general construction tasks, for example roof repairs. Others will involve specialist contractors, for example when new process machinery is installed. Whether the work involves general construction contractors or specialists, CDM can help to prevent costly accidents.

What is CDM about?

19 CDM requires that health and safety is taken into account and managed through all stages of a construction project, from design and planning to on-site work and subsequent repair. Essentially, CDM is about designing out hazards where possible and planning jobs so that the remaining hazards can be managed and controlled during the construction phase, and subsequently during demolition. See paragraphs 35 to 40 of this appendix for advice about CDM health and safety plans.

Who is CDM for?

20 CDM affects everyone in the building and construction phases including demolition, extension and maintenance of structures. The Regulations describe different roles and responsibilities. See paragraphs 43 to 59 for details.

When does CDM apply?

21 CDM applies to construction work, including:

- most common building, civil engineering and engineering construction work, including maintenance of buildings;
- all design work carried out for construction purposes;
- all demolition and dismantling work;
- work on electrical, mechanical and similar services.

22 The Regulations apply to any construction project which is:

- notifiable; or
- involves more than four people in construction work at any time; or
- involves demolition or dismantling.

.....

23 A notifiable project is one where the construction phase will last for more than 30 days or will involve more than 500 person days of construction work. Notification must be sent to HSE. The planning supervisor is responsible for ensuring the necessary notifications are sent.

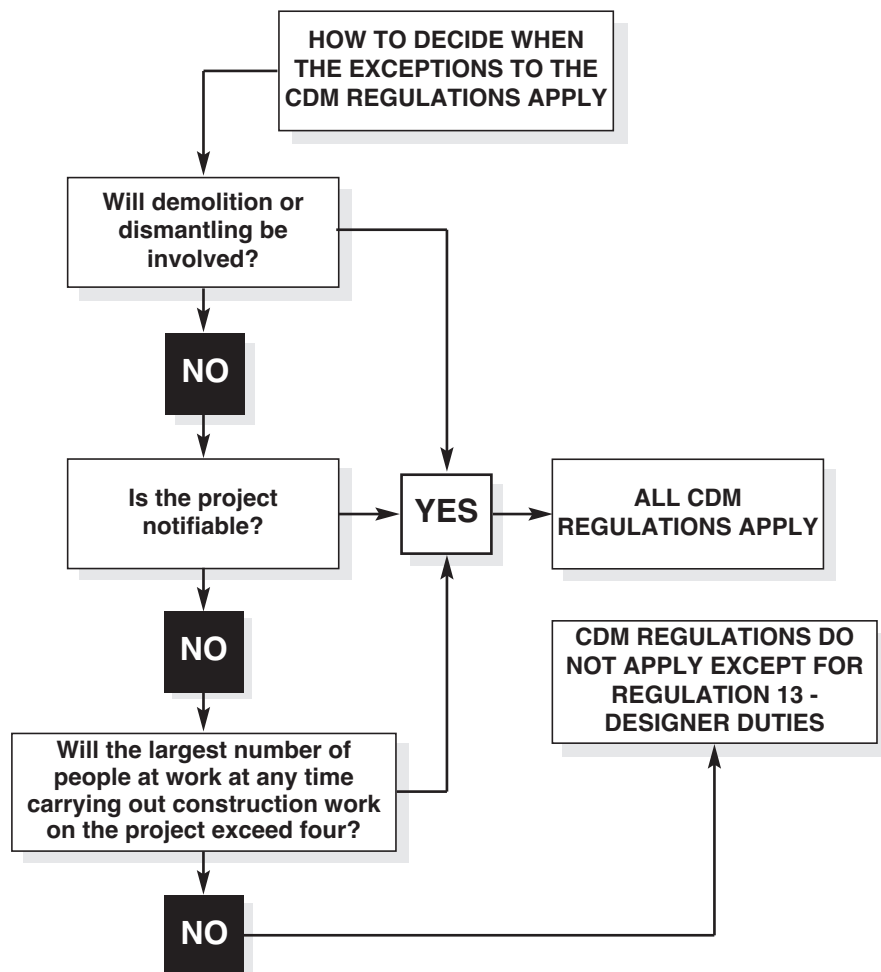
24 This means that (for example):

- work to repair a roof which takes two men ten days, will not attract CDM;
- works to build a toilet block which takes eight men 20 days will attract CDM;
- works to extend a building which take three men 40 days will attract CDM (and be notifiable);
- demolition of a shed which takes three men 20 days will attract CDM.

25 It is the responsibility of the designer for any project to ensure that the client for the work is aware of the duties of clients under CDM before starting work.

26 More details on the notification and the application of CDM are given in pages 20 and 98 to 105 of *Health and safety in construction*.²¹

Figure 2 When do exceptions to the CDM Regulations apply?



When is work on fixed plant subject to CDM?

27 The installation, commissioning, decommissioning and dismantling of fixed plant is subject to CDM if people are at risk of falling more than 2 m. The maintenance of fixed plant is not covered by CDM. Some maintenance will involve the partial dismantling of plant, for example the removal of rolls. Such partial dismantling will not be subject to CDM. CDM will apply to total dismantling, for example at the end of a machine's working life in a mill, or before its relocation elsewhere.

28 Fixed plant is frequently connected to mechanical, electrical and similar services. Some fixed plant can be supported by a separate structure. Work on these associated services and structures will be construction work subject to CDM. However, HSE inspectors will not seek to extend the application of CDM to the *maintenance* of associated fixed plant even when this is done at the same time as work on the associated services or structures. However, other health and safety law such as the Health and Safety at Work etc. Act 1974 and Provision and Use of Work Equipment Regulations 1998 *will* apply to the maintenance of fixed plant.

29 If you are in any doubt contact your local HSE office for advice.

Role of the client and principal contractor in the paper and board mill environment

30 CDM places duties on designers, clients (the person or organisation for whom a project is carried out), planning supervisors and principal contractors. See Appendix 2 which contains a chart setting out the respective responsibilities of each throughout all stages of a project.

31 The client must appoint a planning supervisor and principal contractor for each project. The Regulations allow the client to appoint themselves to either or both of these roles, provided that:

- they are competent to carry out the duties and functions given to planning supervisors and principal contractors under the Regulations; and
- they either carry out or manage construction work as part of their undertaking, or arrange for any person at work under their control (including an employee) to carry out or manage construction work.

32 These provisions allow clients with suitable competence and relevant experience to fulfil, for example, the role of principal contractor if they consider this to be necessary for the effective control of the work on site. The experience and competence can be shared by a number of people in a team.

33 If the mill takes on the role of principal contractor and/or planning supervisor, it must discharge all the duties of the principal contractor contained in CDM regulations 16, 17 and 18, and, as planning supervisor, develop a CDM health and safety plan in accordance with regulation 15. A copy of this plan should be provided to any contractor that will be working on site.

When does CDM end?

34 A project includes all the construction work required to achieve the end result desired by the client. In general, clients want a fully operational building, a fully functioning plant or a refurbished or repaired building etc. The project encompasses all the design, planning and construction work involved. In practical terms, CDM ends when the building, plant or machine is handed over to the mill management.

What is the CDM health and safety plan?

35 The health and safety plan develops with the project and has at least two clear phases (the first is associated with design and planning of the project before tendering or contractor selection, the second is associated with the construction phase). The planning supervisor is responsible for seeing that the pre-tender plan is started and available. The purpose of the plan is to ensure information relevant to health and safety is passed on to those who need it. The pre-tender stage health and safety plan may include:

- a general description of the work and details of project timescales;
- details of health and safety risks as far as they are known, including information provided by designers about particular project risks they were unable to eliminate and assumptions in broad terms they have made about precautions which will be taken;
- information required by possible principal contractors to allow them to identify the health and safety competencies and resources they will need for the project;
- information on which to base a construction phase health and safety plan.

36 The pre-tender stage health and safety plan needs to be available to possible principal contractors at the start of selection or tendering procedures. It informs them of the health, safety and welfare matters they need to take into account when planning for site work. Often the necessary information will already be contained within existing documents (for example, preliminary documents and design drawings). In these cases the plan can simply be an index to where the necessary information within the other documents can be found. Where this is not the case, a separate plan containing the additional material will be required.

37 The plan only needs to contain information which is specific to the project and is necessary to assist the development of safe systems of work. It does not need to repeat information which a competent contractor would already know. Including unnecessary or irrelevant material can make essential information more difficult to identify and reduce the effectiveness of the plan as a way of passing on information.

38 For the construction phase, the principal contractor develops the health and safety plan so that it addresses issues which are relevant to health, safety and welfare matters key to the project. Issues which need to be considered for inclusion in the plan include:

- how health and safety will be managed during the construction phase, including details of how information and instructions will be passed to contractors and how their activities will be co-ordinated;
- contractors' risks assessments and health and safety method statements for high-risk activities;
- enough information about welfare arrangements to allow contractors on the project to understand how they can comply with welfare requirements;
- common arrangements (for example on welfare, site hoardings and emergency procedures);
- how contractors, material suppliers and plant and equipment supplied for common use will be selected;
- how the views of workers and their representatives on health and safety issues associated with the project will be co-ordinated;
- information on necessary levels of health and safety training for those working on the project and arrangements for project-specific awareness training and refresher training such as toolbox talks;
- arrangements for monitoring compliance with health and safety law;
- site health and safety rules and relevant health and safety standards where appropriate, particularly where standards above the minimum statutory requirement are requested by the client;
- procedures for delivering information for the health and safety file.

39 The extent to which particular items need to be addressed within the plan will depend on the degree of risk associated with the project and how much coverage has been given to issues in other documents (for example contract preliminaries and contractor health and safety policies). Where issues are covered in the principal contractor's health and safety policy, a simple reference to the safety policy arrangements may be sufficient. Where risks are low and easily managed, the level of documentation required will be low. Where risks are greater or more difficult to manage a more extensive plan will be needed as a tool for effective management of the risks.

40 The plan should be developed as far as possible before construction work starts, and then reviewed as necessary to account for changing project circumstances. On many larger projects design may not be complete. In these cases the construction phase plan will need to address:

- the general management arrangements (for example who will be responsible for management, how many supervisors will be needed at different stages, how information will be passed to contractors, how method statements will be agreed etc);
- welfare arrangements and how they will be provided and maintained;
- procedures for site security;

- details of work early in the project for which information is available, explaining how it will be managed and controlled; and
- how new design information will be handled and incorporated into the plan.

What is the health and safety file?

41 This is a record of information for the client or end user. The planning supervisor ensures that it is produced at the end of the project and is then passed to the client. It gives details of health and safety risks that will have to be managed during maintenance, repair, renovation or demolition. Contractors should pass information on these matters which becomes available during the construction phase to the planning supervisor for inclusion within the file. The client should make the file available to those who will work on any future design, construction, maintenance or demolition of the structure. Much of the information gathered in the file will come from existing sources of information and, in the case of large items of new or refurbished machinery, may already exist in the technical file produced by the manufacturer in compliance with SMR.

42 Details of how information for the file should be presented is best agreed with the client at an early stage. This will ensure that the information for the file can be gathered in a consistent manner and the file assembled and presented to the client in a way which will make it easy for the client to use. For example, some businesses prefer the file to be a separate document. Others prefer the necessary information to be incorporated within O and M manuals. In these circumstances the file will simply highlight where the necessary health and safety information can be found within the manual. Files may also be electronically produced and stored; a paper copy is not required by law.

What do the CDM Regulations require?

The client

43 Clients should:

- appoint a planning supervisor and principal contractor for each project;
- take reasonable steps to satisfy themselves that the planning supervisor, principal contractor, project designers and any contractors they appoint directly, are competent and adequately resourced to deal with health and safety problems associated with the project;
- pass on relevant information reasonably available to them about health and safety matters which relate to the project to those who are undertaking the planning. If there is a health and safety file already available, relevant sections of this should be provided;
- ensure, so far as is reasonably practicable, that construction work does not start unless a suitable health and safety plan has been prepared.

.....

44 Clients may appoint agents to act on their behalf, but before doing so they should make reasonable enquiries to satisfy themselves that the agent is competent to fulfil the client's duties.

The designer

45 The term 'designer' includes everyone preparing drawings and specifications for the project. Designers include architects, structural engineers, surveyors, and may include the mills themselves, and machinery manufacturers in the case of large papermaking plant. Before preparing any design, the designer should ensure that the client has been made aware of their own duties under the CDM Regulations.

46 Designers should ensure that when they design for construction work they consider foreseeable health and safety risks during construction and eventual maintenance and cleaning of the structure in the balance with other design considerations, such as aesthetics and cost. They should apply the hierarchy of risk control. This means designers need to identify the hazards inherent in carrying out the construction work and where possible alter the design to avoid them. If the hazards cannot be removed by design changes, the designer should minimise the risks and provide information about the risks that remain.

47 The design should describe any matters which require particular attention by a contractor. Enough information should be provided to alert contractors and others to matters which they could not reasonably be expected to know about.

48 The designer should also consider in the same way how buildings can be maintained and repaired safely once built. Although CDM does not apply to the maintenance of fixed plant, other legislation may have the effect of requiring similar consideration in respect of fixed plant. Designers should do this when they develop almost any design, including design work for projects where the appointment of a planning supervisor or principal contractor is not required by the CDM Regulations.

49 Although CDM requires designers to consider the health and safety of those carrying out the construction and cleaning of the structure, there are other important health and safety issues that need to be addressed at the design stage. Here are some examples of what designers can do to improve health and safety across a broad spectrum of issues:

- designing plant (including machinery), foundations and mill structures using best practices for the reduction of noise emission IN THE WORKPLACE (designers already look to control environmental noise emissions - this needs to be extended, for the future protection of workers in the mill);
- designing for non-fragile roofing materials instead of fragile ones (falls through fragile materials are a major cause of fatal and serious injuries);

- designing safe access to roofs;
- designing in fixings and runway beams to enable lifting equipment to be used when plant has to be dismantled for maintenance etc;
- designing safe access to be used when plant or its emissions have to be monitored;
- designing in bund walls around storage tanks to contain spillage;
- designing buildings with non-slip floors where water and similar contamination is foreseeable;
- designing easy access for window cleaners;
- avoiding the need for chasing for cable runs (a job which inevitably exposes workers to high dust and noise levels) by embedding conduit within the wall finish;
- when designing foundations in contaminated land, specifying a driven pile foundation (which does not bring contaminated material to the surface) instead of bored piles;
- avoiding concrete blocks weighing more than 20 kg (these are difficult to lift and are likely to lead to long-term back injury to block-layers). See Construction Information Sheet CIS37 *Handling heavy building blocks*.²²

50 Designers should co-operate with the planning supervisor and other designers on health and safety matters and supply relevant information. Where CDM applies, information can be passed via the planning supervisor; where CDM does not apply, it should be supplied as part of the design information provided to the contractors. The information should include:

- the principles of the design relevant to the health and safety of those working on the project (for example, erection sequences which must be followed to ensure stability);
- descriptions of special requirements for safe working (for example, temporary propping of unstable structures);
- any special assumptions the designer has made about working practices (for example, the site will have been levelled before structural erection begins to allow the safe use of mobile elevating work platforms (cherry pickers) for access for erectors).

51 Detailed advice for designers can be found in *Designing for health and safety in construction*,²³ *Information on site safety for designers of smaller building projects*²⁴ and *Managing construction for health and safety*.²⁵

The planning supervisor

52 The planning supervisor is appointed by the client. The role of planning supervisor may be taken on by a company or an individual. The function can be discharged within the client's organisation, or within the design or construction team. Alternatively it can be done by some other independent person, partnership or organisation. The role is to:

- co-ordinate health and safety during the design and planning phase of the project;
- ensure that the pre-tender stage health and safety plan for the project is produced in time for it to be provided to bidding contractors as part of the selection process;
- give advice about health and safety competence and resources needed for the project;
- ensure that written notice of the project is given to HSE;
- collect information for inclusion in the health and safety file which they ensure is prepared, before passing it to the client on completion of the contract.

53 CDM does not require planning supervisors to visit the site or to assess the performance of the principal contractor once construction work has begun.

The principal contractor

54 The principal contractor is appointed by the client to plan, manage and control health and safety during the construction phase of the project.

55 Site work should not start until the principal contractor has developed a construction phase health and safety plan based upon information provided in the pre-tender health and safety plan. The plan may need to be modified and amended during the construction phase to take account of changing conditions on site as work progresses or the design changes.

56 When planning the job, the principal contractor will need to identify the hazards and assess the risks of the job. To do this properly, information, including method statements and risk assessments, may be needed from other contractors who will be working at the site.

57 When risks arise because of potential interactions between contractors (for example, site transport matters) or a number of contractors are exposed to a common risk (for example, from the site electrical distribution system), the principal contractor should take a positive role in ensuring the general principles of risk prevention and control are applied.

58 The principal contractor's health and safety plan should take account of both general and specific hazards and risk control measures and reflect general principles of risk assessment.

Contractors

59 These are the firm's or self-employed people working at the site. They should help the principal contractor to achieve safe and healthy site conditions. They should co-operate with other contractors working on the site and provide health and safety information (including risk assessments) to the principal contractor.

.....

Further information

60 For those who manage or work on sites where CDM applies, or those who take on the role of planning supervisor, further information is provided in *Managing construction for health and safety* and *A guide to managing health and safety in construction*.²⁶ They explain what to do to comply with the details of the Regulations.

61 For those contractors who work on larger sites where CDM applies, asking about the project health and safety plan before starting work will be valuable. Employees need to be told what it says that affects them. Proposed working methods should fit in with the plan and with site rules. If they do not, tell the principal contractor.

62 If any of the work requires design input, even for temporary works, the Regulations will apply to the design aspect even if the Regulations do not require the appointment of a planning supervisor or a principal contractor. See *Designing for health and safety in construction* for more information.

Health and safety competence

63 Everyone letting or subletting contracts will normally take steps to satisfy themselves that the people who will do the work are competent and resourced. CDM requires that anyone letting or subletting contracts should satisfy themselves that those who are to do the work:

- are competent in relevant health and safety issues; and
- intend to allocate adequate resources, including time, equipment and properly trained workers to do the job safely and without risks to health.

64 Decide in advance what competencies will be needed to do the work safely and without risk to health and how these can be demonstrated. Ask appropriate questions, and ask to see relevant documentation.

65 The pre-tender stage health and safety plan should act as a guide to the significant health and safety issues associated with the project.

66 When tendering for work, being able to answer questions on these subjects will help designers and contractors to demonstrate competence and their suitability for the job.

REPORTING OF INJURIES, DISEASES AND DANGEROUS OCCURRENCES REGULATIONS 1995 (RIDDOR 95)

67 These Regulations require the reporting of work-related accidents, diseases and dangerous occurrences. They apply to all work activities but not to all incidents. They place duties on employers, the self-employed and those in control of work premises.

68 Reports are made to the enforcing authority for the premises at which the accident or incident occurred. For paper and board mills this will be the local office of the Health and Safety Executive.

.....

.....

69 Reports need to be sent about:

- deaths or major injuries (these are defined in the Regulations);
- over-three-day injuries (see paragraph 72);
- certain work-related diseases; and,
- certain near-misses, known as dangerous occurrences.

70 Employers are responsible for reporting accidents involving their own employees or any self-employed person working on their premises. This will include, for example, injuries to self-employed subcontractors, and effective arrangements should be made to ensure all such injuries are reported to the mill management. Employers must also report any injury to a member of the public if they are killed or taken to hospital as a result of an accident in connection with work.

71 If employees working for a contractor are injured on the mill site, it will be the responsibility of their employer to report the injury. However, it will help the mill management to monitor the work of the contractor and decide on the adequacy of the work arrangements made if the contractor also reports accidents and incidents to the mill. The Regulations also require records to be kept.

Over-three-day injuries

72 Reporting over-three-day injuries sometimes causes confusion. The following guidance deals with the most common misunderstandings.

- If a person is injured at work and is disabled from doing their normal job for more than three days, the injury is reportable, even if the person attends work and carries out other 'light' duties until they have recovered from their injury.
- If a person is injured at the end of a shift cycle and will not normally return to work for more than three days, their absence from work for rest or recreation is irrelevant. The injury is reportable if they would be unable to carry out their normal duties for more than three days if they had been at work.

73 Remember: failure to report a reportable injury is an offence. If in doubt, ask for advice.

OTHER LEGISLATION

74 Employers should be aware that other legislation, not enforced under the HSW Act, may also be relevant to the relationship between occupiers and third parties entering their premises. An example is the Occupiers' Liability Act.

KEY POINTS

- You need to understand the law.
- You have a legal responsibility towards your contractor. They have to work safely and owe a responsibility to you.
- Communication and co-operation are needed on both sides - something that requires active management.

APPENDIX 2

Chart showing requirements of the Construction (Design and Management) (CDM) Regulations at the main stages of a construction project (*see page 64*).

CONCEPT AND FEASIBILITY	DESIGN AND PLANNING	TENDER/SELECTION STAGE	CONSTRUCTION PHASE	COMMISSIONING AND HANDOVER
Appoint planning supervisor (regulation 6(1)(a)) Planning supervisor to be competent and have made adequate provision for health and safety (regulations 8(1) and 9(1)) Provide planning supervisor with relevant information (regulation 11) Ensure that when arranging for any designer(s) to prepare a design, they are competent and have made adequate provision for health and safety (regulations 8(2) and 9(2))	Appoint principal contractor (regulation 6(1)(b)) Principal contractor to be competent and have made adequate provision for health and safety (regulations 8(3) and 9(3)) Comply with health and safety legislation where client's work activities overlap with the construction work (HSW Act, MHSW Regs, etc).	Ensure that when arranging for any contractor(s) to carry out or manage construction work, they are competent and have made adequate provision for health and safety (regulations 8(3) and 9(3)) Take such steps as is reasonable for the client to take to keep health and safety file available for inspection (regulation 12(1))		
Ensure notification is submitted to HSE (regulations 7(1) and 7(3)) If required, be in a position to give adequate advice to client on competence and provision for health and safety by designers (regulation 14(c)(i)) Ensure, so far as reasonably practicable, designers comply with duties (regulation 14(a)) Take such steps as is reasonable for the planning supervisor to take to ensure co-operation between designers (regulation 14(b))		Ensure further notification details which were not known at the time of appointment are sent to HSE (regulation 7(4))	Ensure so far as is reasonably practicable, that the principal contractor's health and safety plan is suitable (regulation 10)	
CLIENT		PLANNING SUPERVISOR		

CONCEPT AND FEASIBILITY	DESIGN AND PLANNING	TENDER/SELECTION STAGE	CONSTRUCTION PHASE	COMMISSIONING AND HANDOVER
PLANNING SUPERVISOR		If required, be in a position to give adequate advice to client on competence and provision for health and safety by contractors (regulation 14(c)(ii))		
		If required, be in a position to give adequate advice to contractors on competence and provision for health and safety by designers (regulation 14(c)(i))		
	Ensure pre-tender stage health and safety plan is prepared (regulation 15(1) - (3))	If required give adequate advice to client on the suitability of the health and safety plan prepared by principal contractor (regulation 14(c)(ii))		
	Ensure health and safety file is prepared (regulation 14(d))		Deliver health and safety file to client (regulation 14(f))	
DESIGNERS	Where appropriate, take reasonable steps to inform the client of their duties under the CDM Regulations (regulation 13(1))			
	Give adequate regard to the hierarchy of risk control when carrying out design work (regulation 13(2)(a))			
	Ensure design includes adequate information about health and safety (regulation 13(2)(b))			
	Co-operate with the planning supervisor and other designers (regulation 13(2)(c))			
	Ensure that when arranging for any designer(s) to prepare a design they are competent and have made adequate provision for health and safety (regulations 8(2) and 9(2))			
		Ensure that when arranging for any contractor(s) to carry out or manage construction work, they are competent and have made adequate provision for health and safety (regulations 8(3) and 9(3))		

PRINCIPAL CONTRACTOR					CONCEPT AND FEASIBILITY	DESIGN AND PLANNING	TENDER/SELECTION STAGE	CONSTRUCTION PHASE	COMMISSIONING AND HANDOVER
								Ensure health and safety plan is prepared for construction work and is kept up to date (regulation 15(4))	
								Take reasonable steps to ensure co-operation between contractors (regulation 16(1)(a))	
								Ensure compliance with rules if these are made, take reasonable steps that only authorised people are allowed onto site and display notification form (regulation 16(1)(b) - (d))	
								Provide planning supervisor with information relevant to the health and safety file (regulation 16(1)(e))	
								May give directions to contractors (regulation 16(2)(a))	
								May make rules in the health and safety plan. If they are made, they should be in writing. (regulations 16(2)(b) and (3))	
								So far as is reasonably practicable, ensure information is provided to contractors (regulation 17(1))	
								So far as is reasonably practicable, ensure contractors provide training and information to employees (regulation 17(2))	
								Ensure discussions with and advice from people at work and that there are arrangements for the co-ordination of views from people on site (regulation 18)	

CONCEPT AND FEASIBILITY	DESIGN AND PLANNING	TENDER/SELECTION STAGE	CONSTRUCTION PHASE	COMMISSIONING AND HANDOVER
PRINCIPAL CONTRACTOR			Ensure that when arranging for any designer(s) to prepare a design they are competent and have made adequate provision for health and safety (regulations 8(2) and 9(2))	
			Ensure that when arranging for any contractor(s) to carry out or manage construction work they are competent and have made adequate provision for health and safety (regulations 8(3) and 9(3))	
CONTRACTORS			Co-operate with principal contractor (regulation 19(1))	
			Pass to principal contractor information which will affect health and safety, is relevant to the health and safety file or is relevant to RIDDOR (regulations 19(b), (e) and (f))	
			Comply with directions of principal contractor and rules in health and safety plan (regulations 19(c) and (d))	
			Provide information and training to employees (HSW Act, MHSW Regulations, etc)	
			Ensure that when arranging for any designer(s) to prepare a design they are competent and have made adequate provision for health and safety (regulations 8(2) and 9(2))	
			Ensure that when arranging for any contractors to carry out or manage construction work they are competent and have made adequate provision for health and safety (regulations 8(3) and 9(3))	

REFERENCES

- 1 *A guide to the Health and Safety at Work etc Act 1974* L1 HSE Books 1992 ISBN 0 7176 0441 1
- 2 *Managing health and safety - Five steps to success: Special help for directors and managers* INDG275 HSE Books 1998
- 3 *Management of health and safety at work. Management of Health and Safety at Work Regulations 1999. Approved Code of Practice and Guidance* L21 HSE Books 2000 ISBN 0 7176 2488 9
- 4 *Risk assessment in paper mills* HSE Books 1996 ISBN 0 7176 1288 0
- 5 *Guide to managing health and safety in paper mills* HSE Books 1996 ISBN 0 7176 1313 5
- 6 *5 steps to risk assessment* INDG163 HSE Books 1998
- 7 *General COSHH ACOP and Carcinogens ACOP and Biological agents ACOP. Control of Substances Hazardous to Health Regulations 1999. Approved Codes of Practice* L5 HSE Books 1999 ISBN 0 7176 1670 3
- 8 *A guide to the Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995* L73 HSE Books 1999 ISBN 0 7176 2431 5
- 9 *Safe erection of structures* GS28 Part 3 HSE Books 1986 ISBN 0 11 883530 0
- 10 *Construction health and safety checklist* CIS17 HSE Books 1996
- 11 *The control of asbestos at work. Control of Asbestos at Work Regulations 1987. Approved Code of Practice* L27 HSE Books 1999 ISBN 0 7176 1673 8
- 12 *Memorandum of guidance on the Electricity at Work Regulations 1989. Guidance on Regulations* HSR25 HSE Books 1989 ISBN 0 7176 1602 9
- 13 *Guidance on the Noise at Work Regulations 1989* L108 HSE Books 1998 ISBN 0 7176 1511 1
- 14 *Manual handling. Manual Handling Operations Regulations 1992. Guidance on Regulations* L23 HSE Books 1998 ISBN 0 7176 2415 3
- 15 *Personal protective equipment at work. Personal Protective Equipment at Work Regulations 1992. Guidance on Regulations* L25 HSE Books 1992 ISBN 0 7176 0415 2

-
- 16 *Safe work in confined spaces. Confined Spaces Regulations 1997. Approved Code of Practice, Regulations and Guidance* L101 HSE Books 1997 ISBN 0 7176 1405 0
- 17 *Construction (Health, Safety and Welfare) Regulations 1996* SI 1996/1592 The Stationery Office 1996
- 18 *Safe use of lifting equipment. Lifting Operations and Lifting Equipment Regulations 1998. Approved Code of Practice and Guidance* L113 HSE Books 1998 ISBN 0 7176 1628 2
- 19 *Safe use of work equipment. Provision and Use of Work Equipment Regulations 1998. Approved Code of Practice and Guidance* L22 HSE Books 1998 ISBN 0 7176 1626 6
- 20 *Supply of Machinery (Safety) Regulations 1992* SI 1992/3073 The Stationery Office 1992
- 21 *Health and safety in construction* HSG150 HSE Books 1996 ISBN 0 7176 1143 4
- 22 *Handling heavy building blocks* CIS37 HSE Books 1993
- 23 *Designing for health and safety in construction* HSE Books 1995 ISBN 0 7176 0807 7
- 24 *Information on site safety for designers of smaller building projects* CRR72 HSE Books 1995 ISBN 0 7176 0777 1
- 25 *Managing construction for health and safety. Construction (Design and Management) Regulations 1994. Approved Code of Practice* L54 HSE Books 1995 ISBN 0 7176 0792 5
- 26 *A guide to managing health and safety in construction* HSE Books 1995 ISBN 0 7176 0755 0

FURTHER READING

Buying new machinery INDG271 HSE Books 1998

CDM Regulations - work sector guidance for designers Construction Industry Research and Information Association (CIRIA) Report 166 ISBN 0 86017464 6

Guidance on permit-to-work systems in the petroleum industry HSE Books 1997 ISBN 0 7176 1281 3

Guidance on systems of work during maintenance in paper and board mills IACL58 HSE Books 1992

Having construction work done? Duties of clients under the Construction (Design and Management) Regulations 1994 MISC193 HSE Books 1999

Managing risk - Adding value. How big firms manage contractual relations to reduce risk. A study HSE Books 1998 ISBN 0 7176 1536 7

Supplying new machinery INDG270 HSE Books 1998

Working together: Guidance on health and safety for contractors and suppliers INDG268 HSE Books 1998

Also see the HSE Construction Information Sheets (CIS) series, available from HSE Books.

While every effort has been made to ensure the accuracy of the references listed in this publication, their future availability cannot be guaranteed.

See back cover for details of where to obtain HSE publications.

The Stationery Office (formerly HMSO) publications are available from The Publications Centre, PO Box 276, London SW8 5DT. Tel: 0870 600 5522 Fax: 0870 600 5533. They are also available from bookshops.

FURTHER INFORMATION

The Contractor Safety Passport Scheme

The SCATS (Safety Contractor Accredited Training Scheme) was established by the Engineering Construction Industry Training Board (ECITB). The Scheme is approved by the Client/Contractor Safety Group and delivered through ECITB Approved Training Providers. There are about 60 of these providers covering England, Scotland and Wales.

Details of providers are available from the Paper Federation of Great Britain:
Tel: 01793 889605, Fax: 01793 886363 or e-mail e-t@paper.org.uk.

The contractor carries the cost and the passport is held by the individual, not the company. Passport holders are entered on the ECITB database. The life of the passport is three years. Initial training is two days for operators and three days for supervisors. A written examination is taken at the end of the course. A one-day refresher is required after three years to maintain the passport.

Obviously, passport holders will still need to undergo safety induction training specific to each mill focusing on special conditions and the risk assessments/safe systems of work for each area of work.

.....

.....

.....

**MAIL ORDER**

HSE priced and free
publications are
available from: ☐

HSE Books
PO Box 1999
Sudbury
Suffolk CO10 2WA ☐
Tel: 01787 881165
Fax: 01787 313995
Website: www.hsebooks.co.uk

RETAIL

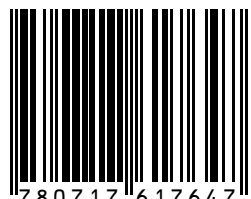
HSE priced publications
are available from
good booksellers

HEALTH AND SAFETY ENQUIRIES

HSE InfoLine ☐
Tel: 08701 545500
or write to:
HSE Information Centre
Broad Lane
Sheffield S3 7HQ
Website: www.hse.gov.uk

£ 8.00 net

ISBN 0-7176-1764-5



9 780717 617647

Paper and Board

Industry

Advisory

Committee

.....

Part 6: Making paper safely

Managing safety in the papermaking process

Members of the Paper and Board Industry Advisory Committee

.....

Mr A D Porter	HSE (Chair)
Mr G Beattie	GPMU
Mr M Bonnett	AEEU
Mr C Britchford	Arjo Wiggins Fine Papers Ltd
Mr M Eede	TGWU
Mr C Griffiths	St Regis Paper Co Ltd
Mr A Harvey	AEEU
Mr P Hiett	GPMU
Mr R A Hudspith	GPMU
Mr T Mellish	TUC (Observer)
Mr P Planet	Bridgewater Paper Co Ltd
Mr T Watts	Paper Federation of Great Britain
Mr K Willis	GMB
Mr M Wilcock	HSE (Secretary)

Members of the PABIAC Working Group

.....

Mr Mike Wilcock	HSE (Chair)
Mr Alan Barber	Fort James UK Ltd
Mr George Dews	SCA Hygiene Products UK Ltd
Mr David Gillett	Paper Federation of Great Britain
Mr R Gipp	Sittingbourne Paper Company
Mr P Hiett	J R Crompton Ltd
Mr G McSkimming	Inveresk plc
Mr Denis Pimblett	GMBATU
Mr Tony Stratton	Kappa SSK Ltd
Mr Alan Timms	James Cropper plc
Mr P Walmsley	Shotton Paper Company plc
Ms Maureen Kingman	HSE (Secretary)

PABIAC would like to thank the various organisations and individuals who contributed to the development of this publication and provided photographs.

Extracts from British Standards are reproduced with permission of BSI under licence number 2000SK/0497. Complete standards can be obtained by post from BSI Customer Services, 389 Chiswick High Road, London W4 4AL. Tel: 020 8996 9001.

Paper and Board

Industry

Advisory

Committee

.....

Part 6: Making paper safely

Managing safety in the papermaking process

.....

© Crown copyright 2001

First published 2001

Reprinted 2005

Formerly sold as a single item ISBN 0 7176 1907 9.

Now available only as part of the PABIAC binder

ISBN 0 7176 2942 2

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means (electronic, mechanical, photocopying, recording or otherwise) without the prior written permission of the copyright owner.

Applications for reproduction should be made in writing to:
Licensing Division, Her Majesty's Stationery Office,
St Clements House, 2-16 Colegate, Norwich NR3 1BQ
or by e-mail to hmsolicensing@cabinet-office.x.gsi.gov.uk

This is guidance prepared, in consultation with the Health and Safety Executive (HSE), by the Paper and Board Industry Advisory Committee (PABIAC) which was appointed by the Health and Safety Commission as part of its formal advisory structures. The guidance represents what is considered to be good practice by members of the Committee. It has been agreed by the Commission. Following this guidance is not compulsory and you are free to take other action. But if you do follow this guidance, you will normally be doing enough to comply with the law. Health and safety inspectors seek to secure compliance with the law and may refer to this guidance as illustrating good practice.

CONTENTS

Preface v

Introduction 1

Section 1: General guidance 4

Principles of machinery guarding 4

Safety-related control systems 10

Safe systems of work 14

Removing broke 16

Fabric changing 18

Web feeding systems 20

Safe access to plant 22

Safe work in confined spaces 27

Housekeeping 30

Section 2: Stock preparation 33

Manual de-wiring 33

Wire balers 35

Conveyors feeding pulpers 36

Pulpers 40

Ragger ropes 43

Section 3: Papermaking machine - wet end 45

Head box 45

The wire 47

Transfer to press section 52

Section 4: Papermaking machine - press and dryer sections 53

Press section 53

Dryer section 56

Sizing and coating units 60

Calenders and supercalenders 62

Yankee cylinders 65

Section 5: Reel-ups 68

Appendix 1: Updated information on design and implementation of safety-related electrical control systems 73

References 85

Further reading 88

Further information 89

.....



PREFACE

WHO IS THIS GUIDANCE FOR?

If you use papermaking machinery, this guidance will help you carry out a risk assessment, compare what you have now with the control measures recommended, and decide what more you need to do. It will also be useful when carrying out workplace inspections.

WHY IS THIS GUIDANCE NEEDED?

It replaces the long-standing *Safety in paper mills*, more commonly known as the 'Fourth Report'. The law, technology and safeguarding philosophy have moved on since the report was first published in 1979 and PABIAC considered the information available on this subject needed updating.

Also, the paper industry has a poor accident performance record which partly stems from a lack of knowledge about standards of safeguarding. This guidance is intended to fill that knowledge gap.

HOW TO USE THIS GUIDANCE

This guidance gives practical advice to users of papermaking machines on how to comply with the law. The 'General guidance' section covers broad topics which apply to all papermaking processes. It includes a part on 'Principles of machinery guarding' which sets out the general requirements on guarding. In the following sections, which deal with hazards on the papermaking machine, appropriate levels of safeguarding are selected from these general requirements. You can also refer to 'Principles of machinery guarding' to help you decide on guarding standards for machines not specifically covered by this guidance.

The 'General guidance' section also covers safe systems of work, together with other general systems-related issues such as safe access and work in confined spaces. These are NOT repeated in detail in the rest of this publication to save space, but reference is made throughout to these general sections to ensure mills remember that achieving a satisfactory standard of risk control is usually a matter of both technological control AND safe systems of work.

WHAT IS NOT COVERED BY THIS GUIDANCE?

It does not include information on ionising radiations, control of fire risks (except in relation to housekeeping), or hazardous substances.¹

.....

STATUS OF THIS GUIDANCE FOR THE SELF-EMPLOYED

Although only the Courts can give an authoritative interpretation of the law, in considering the application of this guidance to persons working under your direction, you should consider the following:

If you have people working under your control and direction who are self-employed for tax and/or NI purposes, they are nevertheless treated as your employees for health and safety purposes. You may therefore need to take appropriate action to protect them. If you are in any doubt about who is responsible for the health and safety of a person working for you this could be clarified and included in the terms of the contract. However, remember, you cannot pass on a legal duty that falls to you under the Health and Safety at Work etc Act 1974 (HSW Act) by means of a contract and you will still retain duties towards others by virtue of section 3 of the HSW Act. If you intend to employ such workers on the basis that you are not responsible for their health and safety, you should seek legal advice before doing so.

MEANING OF TERMS USED IN THIS GUIDANCE

Where you see the word '**must**' in this guidance it means a legal obligation, ie you are breaking the law if you do not comply. Terms such as '**should**' and '**need to consider**' do not indicate a legal obligation, but do indicate good practice. There may be other legally acceptable ways of achieving the same objective. Others terms such as '**you may**', '**you are recommended to**' give general pointers on the way an objective may be met.

When you see the term 'mills' in the context of what is required, for example 'mills have duties to', 'mills should work towards' etc, it refers to employers and other duty holders (including employees) in mills.

INTRODUCTION

WHAT DOES THIS GUIDANCE INCLUDE?

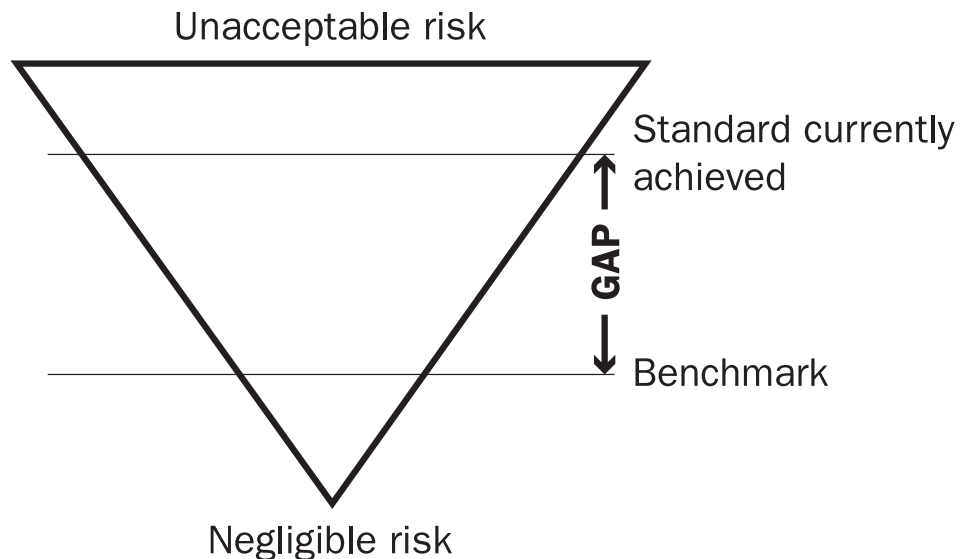
- 1 This guidance includes advice on hazards arising from the papermaking process, not only on guarding but also on matters such as housekeeping, safe access and systems of work.
- 2 The advice on guarding of machinery applies to existing machinery which is not 'CE' marked. New machines² are covered by the Machinery Directive, and a European Standard on papermaking machines BS EN 1034-1: 2000³ will help manufacturers comply with the Directive. (BS EN 1034-3 *Winders and slitters, plying machines* is also available⁴).
- 3 In preparing this guidance PABIAC has tried to follow the European Standard to avoid different levels of protection applying to machines of different ages - in particular certain dimensions have been altered from the original Fourth Report to reflect current standards and practice. However, where well-established UK levels of protection are significantly higher than in the European Standard, we have tried to maintain these. This approach may need to be reviewed in the future.
- 4 In law, mills have duties to ensure the health and safety of their employees and others under the Health and Safety at Work etc Act 1974 (HSW Act sections 2 and 3). They also have certain duties under the Provision and Use of Work Equipment Regulations 1998 (PUWER 98).⁵ However, where the Supply of Machinery (Safety) Regulations 1992 applied to the equipment at the time of supply, the manufacturer or supplier has the primary duty to ensure the machinery is safe and complies with the Essential Health and Safety Requirements (EHSRs). Relevant standards (eg BS EN 1034) will be helpful.

RISK ASSESSMENT

5 This guidance is not intended to be a substitute for your own risk assessment.^{6,7} You will still have to ensure that the levels of safeguarding recommended here deal adequately with the risks arising from your papermaking processes. However, it does provide a benchmark that PABIAC believes all mills **can** achieve and that all mills should work towards achieving by a phased programme of work. To do this mills need to know:

- where they are now;
- where they should be; and
- what is the difference and why.

Figure 1 The 'Risk gap' triangle



6 Mills should close the gap between where they are and where they should be by using the technical standards in this publication and BS EN 1034. They will also need to introduce safe systems of work and operating procedures to effectively control risks. Where mills feel unable to achieve the standards in this document they will have to satisfy themselves using their own risk assessments that they are achieving an equivalent or better standard. Mills should also be aware that the photographs used in this publication are illustrative only, and that, where necessary, they may have to adapt the guarding shown to their own circumstances. The Confederation of Paper Industries has more details of the safeguarding systems shown and others that are currently being developed (see 'Further information' for address and telephone number).

.....

WARNING!

Remember - proper control of risks should involve technical controls AND safe systems of work. These can only be delivered by a company with the right safety culture that really believes health and safety matters. Refer to the machinery-specific sections for guidance on particular safeguarding issues and the general sections for more on safe systems of work.

While PABIAC has tried to include as much as possible in this guidance, it does not cover every hazard and risk on your machine or in your mill. It does not take into account detailed design differences between machines, processes or differences in working methods. Mills should therefore be conscious of different or additional hazards and risks around their factory and take appropriate action to identify and control them.

Also, PABIAC has suggested separation distances throughout this guidance based on normal practice and processes - where necessary taking into account the use of rubberised or coated rolls. There may be circumstances where, for process reasons, mills have used additional clothing on rolls, ie that converts a normally smooth roll into a 'tacky' roll. In these circumstances PABIAC would advise caution with the separation distances in this publication and urge mills to ensure that the guards provided prevent access to these rolls or any in-running nip created at all times they are in motion.

SECTION 1: GENERAL GUIDANCE

PRINCIPLES OF MACHINERY GUARDING

7 Authoritative guidance on principles of safeguarding dangerous parts of machinery is set out in various European Standards which have been adopted as British Standards and supersede former British Standards which dealt with the same subjects. The levels of safeguarding recommended in this guidance take their lead from the European Standards but PABIAC recognises that these standards may not always be practicable on existing papermaking machinery.

Hierarchy of safeguarding measures

8 Safeguarding measures fall into a hierarchy of four levels:

- fixed (enclosing) guards;
- other guards or protection devices, eg interlocking guards, nip guards;
- protection devices, eg trip nip bars which do not prevent access but stop the movement of the dangerous part before injury occurs and preferably before contact is made, use of crawl speed and hold-to-run control devices; and
- provision of information, instruction, training and supervision.

9 Your risk assessment is the starting point for choosing safeguarding measures. Consider each level in turn, making use of the measures as far as practicable. You may need to combine measures from more than one level to reduce the risk. However your preference should always be to adopt the highest level of safeguarding possible.

Fixed (enclosing) guards

10 A guard is 'fixed' if it needs a tool to remove it.

11 Lift-off guards, which have been used on older papermaking machines, are generally of poor design and encourage misuse. **PABIAC now considers that lift-off guards do not provide a suitable standard of protection and if you have these guards you should plan to replace them.**

12 Fixed guards which guard the dangerous parts but which are designed to allow limited access, eg for clearing broke, cleaning etc, are more effective in preventing danger. These guards can have openings in them, eg for feeding the paper, as long as the size of the opening and its distance from the dangerous part complies with the safe reach distances in BS EN 294: 1992⁸

.....

(see 'Distance guards'). If a fixed guard has to be removed more than once a week, for example for maintenance, it is often better to replace it with an interlocked guard (see 'Interlocking guards').

Distance guards

13 The height of the guard, its distance from the danger point (eg an in-running nip), and how far it has to extend to stop someone reaching around it to the danger point, can be worked out from tables in BS EN 294: 1992. If it is not practicable to achieve these reach distances, there is a duty to provide alternative safeguarding (from the safeguarding hierarchy) which achieves an equivalent level of safety.

14 Distance guards should generally be at least 1.4 m high to reduce the likelihood of someone climbing over them. A gap of up to 200 mm can be left underneath the guard to allow for cleaning.

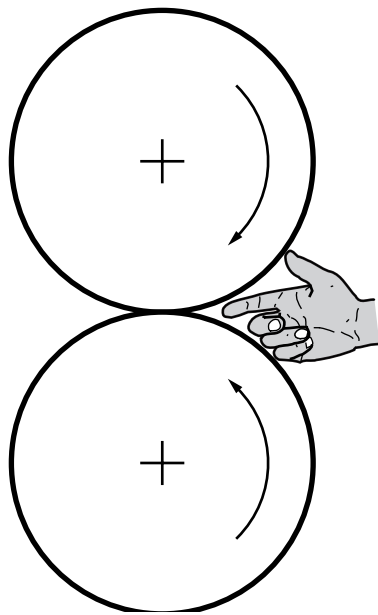
Guarding for transmission machinery

15 Eliminate entanglement hazards on machine drives by enclosing the dangerous parts with fixed guarding. Rotating shafts present a particular risk of entanglement - particularly if they are slotted or have projections, eg bolts or screws for counting devices. Enclosing guards or loose sleeves can be provided which effectively eliminate the risk. If there are projections, then enclosing guards should be provided.

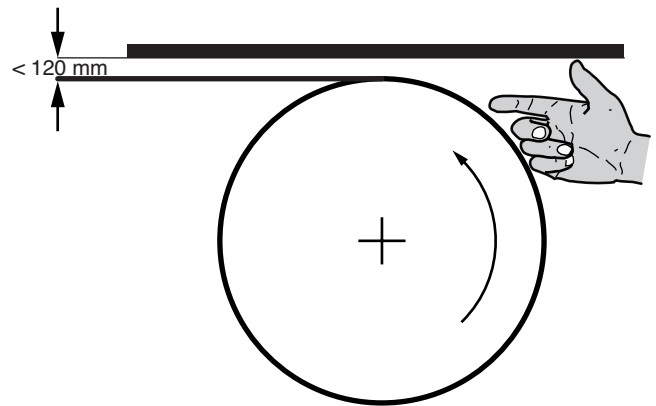
16 It is not acceptable to rely solely on lockable gates at either end of the drive side to guard the transmission machinery of a papermaking machine; experience has found that this type of guarding is impracticable because of the frequent need for access, particularly by maintenance personnel, while the machine is running. If access to moving machinery is required, enclosed guarding for the dangerous parts of each drive should be provided.

Guarding for in-running nips

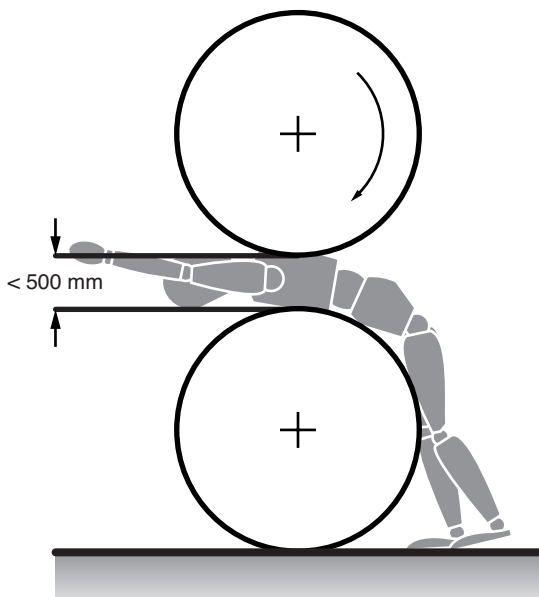
17 In-running nips are the main hazard on a papermaking machine. They arise between rolls rotating in different directions, between rolls and fixed parts, between Sheahan ropes and pulleys and between felts/wires and rolls. There is also a drawing-in hazard between rolls and heavy grades of paper and board where the material is unlikely to tear. This can be designed out by having a large enough gap between the rotating and fixed parts. See Figure 2 for examples of in-running nips.



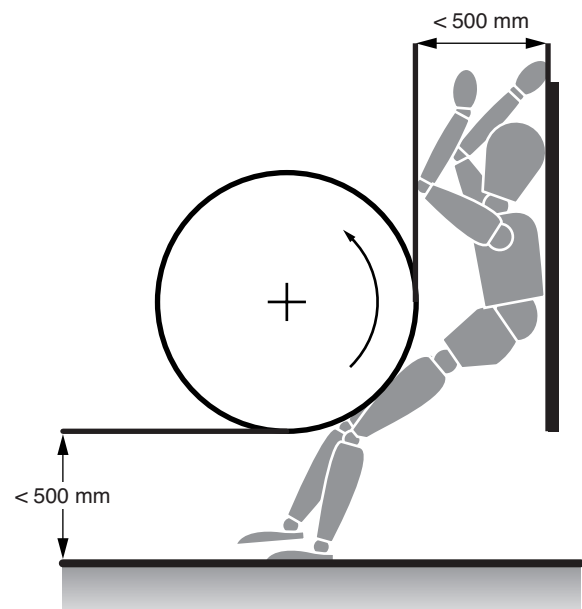
Two counter-rotating rolls



Roll and fixed part



Body reaching between two rolls



Body between roll with felt at right angles and a fixed part

Figure 2 Examples of in-running nips

18 Where an in-running nip between two rolls (such as a drying cylinder and a felt roll), or between a roll and a fixed part, can be reached by an outstretched arm, guarding is unnecessary if the gap at the nip point is at least 120 mm.

However, if the whole body can get close to the in-running nip the gap needs to be at least 500 mm (see Figure 2). Your risk assessment should take into account that certain machinery is designed to open so-called 'protected nips' for operational reasons, creating a different risk and creating an 'unprotected' situation. Where nips cannot be safeguarded in this way, the next best option is to fit a guard directly on the nip.

.....

19 Nips which are only accessible from the sides of the machine can have fixed guards. The guard should extend far enough to prevent someone reaching round it to the nip. BS EN 294: 1992 calls for a reach distance of 850 mm (but see 'Distance guards').

20 Nips which can be reached from passageways, decking, catwalks or gangways through the machine must be guarded across their whole width. Examples of nip bars are shown in Figure 3, but alternatives, such as interlocked gates or fixed guarding, may be equally effective (see 'Distance guards' and 'Interlocked guards'). Round section nip bars are not suitable because they create new in-running nips.

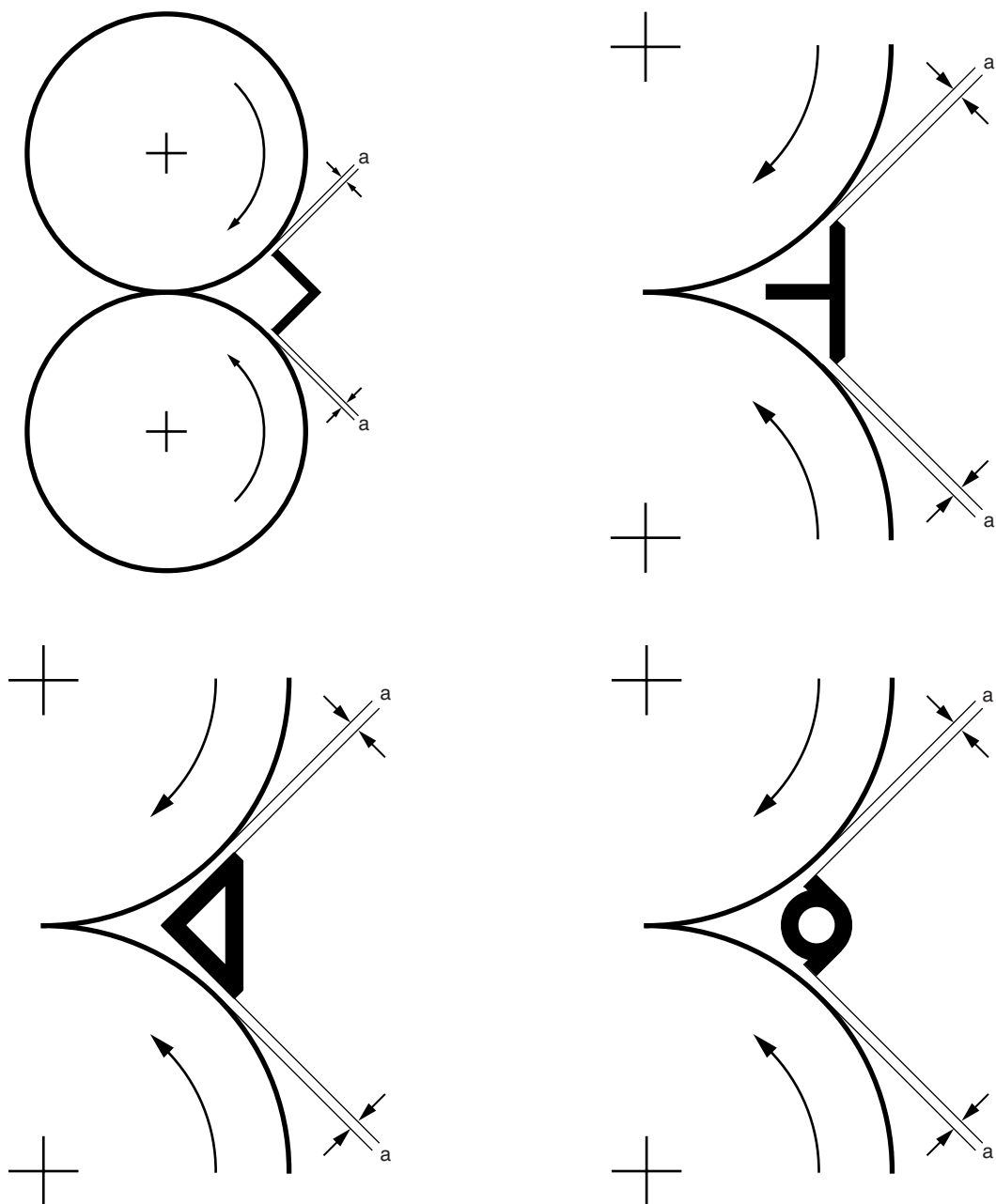


Figure 3 Examples of nip guards
($a \leq 8 \text{ mm}$)

.....

21 The gap between the nip guard and the rotating machine part should be as small as practicable, at no point be more than 8 mm and allow for deflection under operating conditions.

22 It is not acceptable to leave an accessible nip without appropriate safeguarding. Mills should pay particular attention to providing safeguards for nips in areas away from 'normal' working areas where access is required only infrequently and provide either local safeguards at these nips or prevent access to the areas concerned using fixed or interlocked fencing.

Interlocking guards

23 An interlocking guard has a device - usually a switch - which prevents the hazardous machine parts covered by the guard being started up until the guard is closed. Opening the guard will also stop the machine movement.

24 The higher the risk of injury, the more dependable the interlocking system has to be. Two basic designs of interlocking system are normally used on papermaking machinery:

- a system with a single actuator (switch) on the guard and a single control channel; and
- a system with two independent actuators (switches) on the guard with separate control channels to each so that if one fails, the other will continue to work.

25 The second type is used in higher-risk situations. A trapped key exchange system is also suitable for higher-risk applications. (For very high-risk situations, dual-control channels with cross-monitoring are required for the interlocking system; this is a requirement, for example, on the front face guard of a large reeler slitter.)

26 Interlocking with guard locking is required if, on opening the guard, the dangerous parts take some time to run down. Guard locking ensures that the guard cannot be opened until motion has ceased. As a rough guide, guard locking is necessary if the time taken for the dangerous parts to come to rest is more than 10 seconds.

Crawl speed

27 This is the slowest speed at which the machine can run, and should be no more than 15 m/min. (NB on reeler-slitters the maximum crawl speed should be 10 m/min.)

28 There are some jobs, such as inspection, setting up, removing broke and felt straightening, which cannot always be done with the machine stopped. Operating the machine at crawl speed is only regarded as a risk-reduction

.....

measure as long as it is combined with a safe system of work, instruction and training to reduce the risks to which the workers are exposed.

Hold-to-run control

29 This is an actuator which has to be held depressed to allow the machine to run at no more than crawl speed; if the actuator is released, motion ceases. Running machine sections under hold-to-run control is recommended for removing broke, but must be provided if the machine can be run in reverse. The operator should be able to see the danger points from the position of the hold-to-run control actuator.

Routine maintenance, inspection and testing

30 Various types of safeguarding may be found in paper mills and it is essential that these are maintained in working order and checked to ensure they are still in place and functioning properly. In addition, the Provision and Use of Work Equipment Regulations 1998 (PUWER 98) require any checks carried out in-house to be recorded. Further guidance on PUWER can be found in Part 1 of the PABIAC loose-leaf *Guide to managing health and safety in paper mills*.⁹

SAFETY-RELATED CONTROL SYSTEMS

IMPORTANT NOTE

The information in the following paragraphs 31-47 is superseded and updated by Appendix 1: Updated information on design and implementation of safety-related electrical control systems.

The new Appendix provides a technical framework that can be used by mill engineers for the design and implementation of safety-related electrical control systems that are used to carry out safety functions at papermaking machines. This is drawn from published standards and other sources that take a systematic approach towards the specification, design, installation and operation of safety-related electrical control systems so as to achieve safety performance requirements derived from a risk assessment.

What is a control system?

31 A **control system** responds to input signals from the machine, or from the operator, and generates output signals which make the machine operate in a desired manner. So if, for example, an operator presses a start button, the control system may respond by closing a contactor and energising a motor.

32 A part of a control system is said to be 'safety-related' if it has a role in the safeguarding of the machine, operators and others. So if, for example, an operator opens an interlocked gate, the control system responds by bringing the machine to a stop or by preventing it from being started while the gate is open.

33 The more critical the role played by the safety-related part of the control system, the more resistant to faults it must be. BS EN 954: 1997¹⁰ classifies systems according to their ability to resist the occurrence of faults and whether they will continue to perform their safety function after a fault has occurred. Fault resistance may be achieved by the reliability of the parts and the way the parts are combined in the design of the control system.

Categories of control systems

34 There are five main categories of performance of control systems in accordance with BS EN 954-1 which are broadly:

Category	Basic requirements
B	Use of good engineering principles
1	Use of well-tried components and principles
2	Incorporates a safety function check at machine start-up and may also be checked periodically
3	A single fault will not cause the safety function to fail
4	Two or more faults will not cause the safety function to fail

.....

How to apply BS EN 954-1

35 The categories should only be used as 'benchmarks' of performance. It is important to bear in mind that safety-related parts of control systems may not neatly fit into a single category, particularly if they use different energy sources - a control system can incorporate electric, electronic, programmable electronic, pneumatic or hydraulic devices.

36 The categories should **not** be regarded as hierarchical with regard to safety. For example, a single mechanical link will meet the requirements of Category 1 but not the criteria for Categories 3 and 4, but its level of safety performance may be considered at least as reliable or even more reliable than technologies that meet Categories 2, 3 and 4. Therefore, the selection of categories is a matter of judgement which should be part of a risk assessment.

Steps in a risk assessment process for selecting a category for a control system

37 The following list aims to help you carry out a risk assessment on existing machinery to determine the level of performance you need from safety-related control systems.

- Assess the risks on the machine, taking into account the hazards which occur in normal operation (eg cleaning, clearing broke, webbing up etc) and in foreseeable abnormal conditions (eg persistent misfeeds, machine break-down).
- Select appropriate risk-reduction measures, eg fixed guards, nip bars, interlocked guards, trip devices, photoelectric devices, crawl speed, emergency stops.
- Determine which of the measures for risk reduction will be achieved by a safety-related control system.
- What contribution do the safety-related parts of the control system make as part of the safety function in achieving the necessary level of risk reduction? What would be the consequences of failure?
- How often will demand be placed on the machine's safety functions? For example, the control system for an electro-sensitive safety system on a guillotine is called into use every time the operator puts a hand through the light curtain and so needs to give a higher level of safety performance than a gate interlock system which is only used occasionally and where the result of failure may not be serious.
- Select a category to assess the safety-related parts of the control system against, taking account of the factors above on how to apply BS EN 954-1.

.....

Selecting a category for safety-related parts of a control system at a refurbished machine

38 If the work is being done by in-house personnel, follow the steps in a risk assessment process as set out above.

39 There are also a number of questions which the designer needs to address.

- What is the rationale for the design, ie what levels of risk are assumed, and what are the design objectives?
- What assumptions have been made about the way the machine will be used, cleaned, set up etc?
- How and why does the system meet the design objectives?

Guidance on performance categories of safety-related parts of control systems used on papermaking machines

40 The following paragraphs deal with examples of control systems which implement safety functions and will comprise safety-related parts: emergency stop, pre-start warning device, overspeed control and protection, interlocking and guard-locking systems, control system to infrared dryers, temperature and pressure control systems and prevention of unexpected start-up. They describe the minimum requirements for the safety function in terms of system behaviour and the principles by which an acceptable level of safety performance can be achieved.

Emergency stop

41 The emergency stop function should be designed in accordance with BS EN 60204-1: 1998 *Safety of machinery. Electrical equipment of machines Part 1: General requirements* and BS EN 418: 1992 *Safety of machinery. Emergency stop equipment, functional aspects. Principles for design*. See Appendix 1 for more information.

42 Those parts of the pneumatic and hydraulic system used in the emergency stop function may be allocated as Category 1.

43 An emergency stop circuit can remain inactive for long periods of time and it is important that, when required, it functions effectively to avert danger. The best advice is to design the system with simplicity and reliability in mind rather than with redundancy and monitoring.

Pneumatic and hydraulic systems

44 The safety-related parts of the control systems for pneumatic and hydraulic systems may be to Category 1. This would apply, for example, to the control systems for raising and lowering suspension type dryers.

Speed control system

45 The risks that occur in the event of overspeed at a machine arising from control system failure are significant. See Appendix 1 for updated information.

.....

.....

Pre-start warning device

46 Failure of a pre-start warning device could result in the machine being started before the waiting time has elapsed (ie people would not have enough time to leave a hazardous area on hearing the alarm) or the machine could be started up without a warning being sounded.

47 The timing functions should be monitored during the start-up sequence when the machine is energised to ensure that failures which give rise to danger are detected and the starting sequence is disabled. See Appendix 1 for updated information.

.....

SAFE SYSTEMS OF WORK

48 Safe systems of work are formal procedures or methods of working. They are needed when guarding of dangerous parts cannot eliminate all of the hazards and some element of risk remains. **Safe systems of work should not be used as a substitute for guarding.** (See also Parts 1 and 2 of the loose-leaf PABIAAC Guide.^{7, 9)}

49 Before a safe system of work can be drawn up, you have to examine the task to identify all of the hazards. You need to take account of:

- *What* is used, eg the plant and substances, what mechanical things can go wrong, what the consequences of failure might be, toxic hazards, electrical hazards, design limits.
- *Who* does what, eg delegation, whether contractors might be involved,¹³ training, foreseeable human errors, short cuts, need for co-operation and co-ordination of others, ability to cope in an emergency.
- *Where* the task is carried out, eg in a confined space,^{14, 15} at height, in hot and humid conditions,¹⁶ in close proximity to people doing other work, such as contractors.
- *How* the task is done, eg whether under pressure of time, whether regular or infrequent, the consequences of failing to follow the procedures.

50 It is important that the people who will be doing the work and those who supervise the work, are involved in drawing up systems of work; they have practical knowledge of unusual risks and help to avoid systems of work which are based on false assumptions about the job.

51 Systems of work commonly fail for one or more of the following reasons:

- the system is irrelevant or impractical - it was drawn up as a paperwork exercise, without consultation, by someone who will not be involved in managing or using the system;
- failure of communication - the system is introduced without people being trained in it or having it explained to them;
- failure of supervision - those in charge are not familiar with the system or they do not enforce it;
- following the system takes too long - if the time and effort involved is out of proportion to the time the job would take, people working under pressure are strongly tempted to take the easier and quicker option of a short cut.

.....

52 You need to monitor a system of work to make sure that employees (particularly new ones) and contractors are familiar with it, that they still find the system workable, that it is actually being followed, and that nothing has changed which would require it to be amended. It is recommended that systems of work are specifically covered by site inspections or management audits.

REMOVING BROKE

53 Removing broke accounts for a significant number of accidents every year. (Broke includes 'wads', also known as 'plug-ups', and 'wraparounds'.) Operators get injured, for example, when broke hooks they are holding get taken into in-running nips, they are hit by a falling 'slab' of broke while trying to direct it from the reel into the under-machine pulper, or they try to reach into a nip to remove broke or pulp.

Hazards

- Trapping or entanglement in moving machinery.
- Musculoskeletal injuries due to pulling heavy loads of broke from the machine.
- Being struck by tools used to remove broke while a machine is moving.
- Ignition from static electricity discharges.

Action

54 The safety of those involved in broke removal relies on training and strictly following safe systems of work. The following are some of the issues which you need to consider in deciding whether your systems of work are adequate.

- Unless the machine is designed to permit broke to be removed safely while it is running or automatic systems have been fitted, you should only remove broke from the machine when it is stopped.
- In principle all rolls on a machine should be capable of being stopped and this should be the aim if any close access is required.
- When the machine is stopped, you can use suitable tools such as a broke hook, air knife, or similar to reach into the machine from the side to completely avoid the need for entry.
- If you have to enter a machine section, isolate and lock-off that section and the sections either side of it. (See section on isolation in *The application of the Provision and Use of Work Equipment Regulations to the paper and board industry*⁹ in the loose-leaf PABIAC Guide for guidance on disconnection of control systems for short-term interventions.)
- Only if the machine cannot be stopped and/or automatic cleaning equipment cannot be fitted should cleaning take place on moving rolls. If a roll or cylinder has to be rotated to remove broke this should either be with the machine running at crawl speed (ie no more than 15 m/min) or preferably under hold-to-run control. The hold-to-run control should be sited in a place where the operator can see the danger zone. Movement should stop as soon as the control is released. At all other times access should be prevented by local fixed or interlocked guarding.

-
- In all cases where access is proposed to moving machinery, a thorough and effective risk assessment should have been carried out and the outcome recorded. All **additional** measures that are required to further reduce the risks, such as those arising from manual handling, static or tools being dropped, should be identified, set out in operating instructions and implemented.
 - If the machine section can be reversed, this should only be possible under hold-to-run control.
 - Do not unwind broke paper from a reel which is suspended from a crane. Cranes are not designed to withstand dynamic loads.
 - Removing broke from under low felts/fabrics in basements or at high level can be extremely hazardous due to the design of the machine. Mills should be aware of the need to provide safe means of access and carry out effective risk assessments taking into account the confined nature of some working areas. In no circumstances is it acceptable for operators to crawl into confined parts of machinery unless the machine is stationary, has been properly isolated and an effective safe system of work is in place, that includes consideration of the precautions needed for entry into confined spaces where necessary (see 'Safe work in confined spaces' in this section for more information).

FABRIC CHANGING

Hazards

- Entanglement in moving machinery.
- Entanglement in the fabric or other material being removed or fitted.
- Falling from a height.
- Being struck by tools or materials falling from above.
- Musculoskeletal injury due to handling large, awkward or heavy materials or equipment.
- Hot and humid conditions.
- Failure of lifting equipment used.
- Cuts from sharp tools used to seam or trim fabrics.
- Failure of communications between team members.
- Slippery or wet conditions.

Action

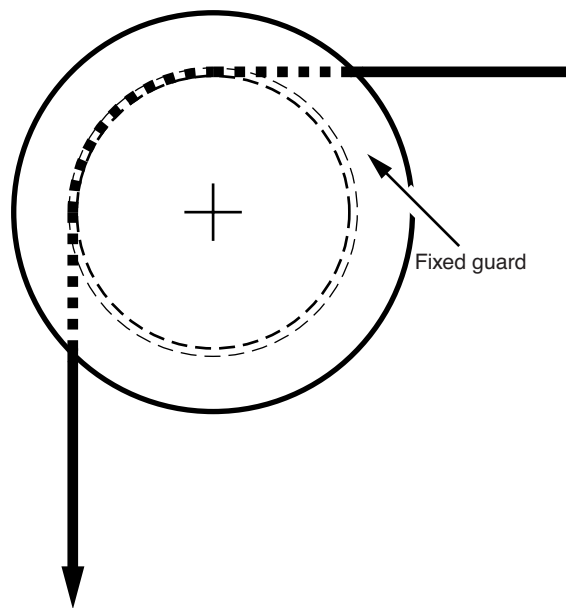
- Fabric changing should be carried out under the control of an experienced, competent person. A thorough risk assessment should be carried out and a written safe system of work developed as a result. The system of work should consider all aspects of the work including how to deal with stress and exhaustion and shift changeovers - particularly the problems associated with communication.
- Fabric changing should only take place on a stationary, isolated machine. However, if absolutely necessary for the fabric changing process, the machine should only be allowed to move under strictly controlled conditions that should be defined within the system of work, and even then under slow crawl or, preferably, hold-to-run control.
- Whenever a machine is moving, all operators involved must be in line of sight of the person operating the controls or an effective system of signals should be used to maintain communications.
- All lifting equipment should be maintained and examined in accordance with the Lifting Operations and Lifting Equipment Regulations 1998.¹⁷ If jacks or winches are used it is preferable that these are purpose-built or designed into the machine and are fit for the purpose intended. If rolls need to be suspended for any length of time then additional supports in the form of stands or blocks should be inserted.

-
- Suitable means of support should be provided for felts and wires as they are unrolled ready to be put into place.
 - Appropriate precautions should be taken to prevent cylinders rotating freely while being worked on.
 - Safe means of access should be provided to every place operators are required to work - where necessary, temporary access platforms should be built. Only if absolutely necessary should work be carried out from ladders and then additional fall arrestor devices ('safety or full-body harnesses' with a maximum fall of 2 m and shock absorbing devices) should be used. If fall arrestor devices are used, mills should ensure that they cannot snag on parts of the machine frame or other equipment.
 - Only those sections of walkways and handrails necessary to allow access for the fabric replacement shall be removed. Where openings have to be left unattended then appropriate temporary barriers and signs should be erected. All handrails and walkways should be replaced after work is completed and before normal operations recommence. Walkways and floors should also be checked for tools, materials or spillages.
 - Where manual handling is unavoidable,¹⁸ those involved should be properly trained to lift safely. See guidance on manual handling in the loose leaf PABIAC guide.¹⁹ See also the section on housekeeping in this booklet and the PABIAC publication on heat stress.¹⁶

55 For information about rope changing see 'Dryer section'.

WEB FEEDING SYSTEMS

Figure 4 Inadequately guarded Sheahan rope pulleys have been responsible for many accidents



Hazards

- In-running nips between ropes and pulleys of Sheahan rope system.
- Hand-feeding into machine roll nips.
- Hand-feeding into reel-ups.
- Pressure to take short cuts.
- Fire from friction on broke build-up around nip bars.

Action 56 The following web-feeding methods are listed in order of preference, with the safest first:

- Automatic web feeding systems which remove the need for any manual intervention, eg air chutes to Sheahan rope systems, tail conveyors, turn-up devices etc. Automatic feeding is now common and should be the goal for the whole industry.
- Sheahan rope systems with manual tail feeding.
- Manual feeding into Sheahan rope nips should be at the slowest practicable machine speed. Identify the places on the Sheahan rope system, eg at the beginning of a dryer section, where manual tail feeding is permitted. (Accidents tend to happen when misfeeds keep happening and operators, usually through frustration, try to re-feed the tail from the break-point.) Where access for feeding the tail is not essential, guard the intake between the rope and pulley - for example see Figure 4.

- Manual feeding using tail carrying devices or air knives to keep hands away from in-running nips. This should only be done by fully trained, experienced operators at the slowest practicable machine speed. The aim should be to eliminate hand feeding throughout the industry.
- Hand feeding - but not directly into roll-nips or where access to roll-nips is possible. Hand feeding into machine roll-nips is dangerous and should be eliminated. Where hand feeding is unavoidable, this should only be done by fully trained, experienced operators at the slowest practicable machine speed.

Stress caused by web feeding

- 57** Webbing up a machine can be one of the most stressful jobs in a mill. Operators feel under perceived pressure to 'get the machine away' which increases as misfeeds continue. Accidents at this time are probably more likely than at any other. Also, if it has taken a long time to get the sheet through the machine, there is pressure not to stop it for short-term interventions, such as removing broke. Operators can take chances rather than risk having to go through the feeding process again.
- 58** If the culture of the mill is perceived to be 'production first' then it will be demonstrated in the practices used (or condoned) during webbing-up and in the risks taken to avoid stopping a machine. Set out your policy in this area. Make it clear in both words and actions.
- 59** Some mills have recognised the pressures from persistent misfeeding and have empowered supervisors to give the crew a break. In other mills, relief operators from other machines are brought in to take over.

'Operators confronted by abnormal situations will be guided not just by instructions but by what they understand are the real risks and by the attitudes of supervisors or managers. In this, nothing is so pervasive or damaging, particularly if a complex or unusual situation arises, as a culture in which a 'macho' attitude to safety has been implicitly encouraged or if departures from safe practice are winked at. Most people wish to 'get on with it'. Few wish to appear timid or to refer to possibilities of danger that are not clear or visible. If these natural attitudes are not to dominate at critical times, positive steps to encourage the attitude of 'stop and think' and the asking of 'what if . . . ?' questions must be an inherent part of training objectives and of what management say and do.'

SAFE ACCESS TO PLANT

60 Safe access should be provided to all places where people are expected to work. This guidance follows BS EN 1034: Part 1 and sets out recommended requirements but, where necessary or practicable, mills may need to go further to provide safe access. In particular, mills should examine where access is required on a regular basis and consider the means of access in conjunction with the job(s) operators are expected to undertake.

Hazards

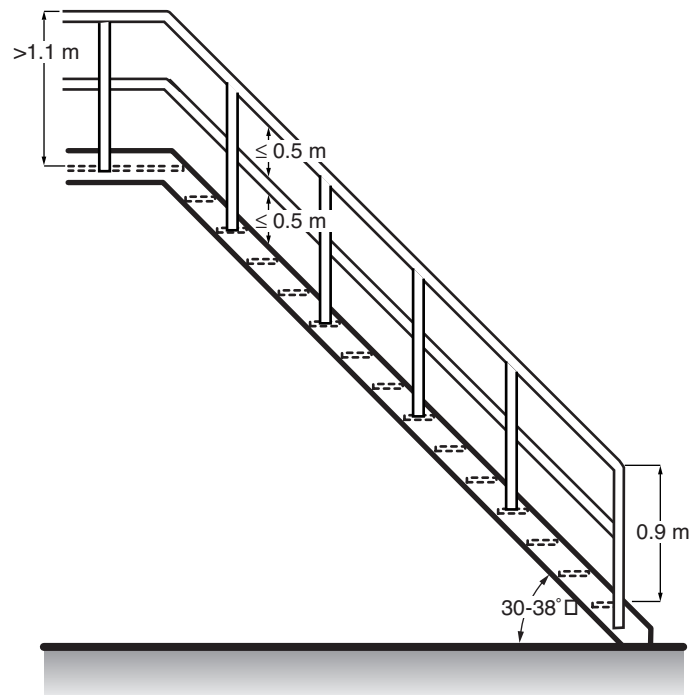
- Slips, trips and falls.
- Complete absence of proper walkways to places where people are expected to work.
- Excessive physical effort needed, eg to climb a series of ladders.
- Falling materials or objects.
- Hazards generated by the machine, such as entanglement on adjacent machinery, hot surfaces and a hot, humid environment.

Action

Selection of means of access in order of preference:

- Access directly from floor level is preferred whenever possible. It is especially important that frequently operated controls can be reached from ground level.
- If this is not possible or practicable, a stairway as illustrated in Figure 5 may be used. A stairway should be regarded as the norm for reaching elevated plant.
- If a stairway is not possible, a stepladder as illustrated in Figure 6 or, as a lesser alternative, a ladder as illustrated in Figure 7 may be considered. The selection should be made on the basis of risk assessment, which will include an assessment of ergonomics. One or more of the following conditions will need to be satisfied to justify the use of a stepladder or ladder in preference to a stairway:
 - short vertical distance;
 - the means of access will be used infrequently;
 - the user will not be carrying large tools or equipment when using the means of access;
 - only one user at a time is likely to use the means of access;
 - the structure of the machine does not make stairs possible.

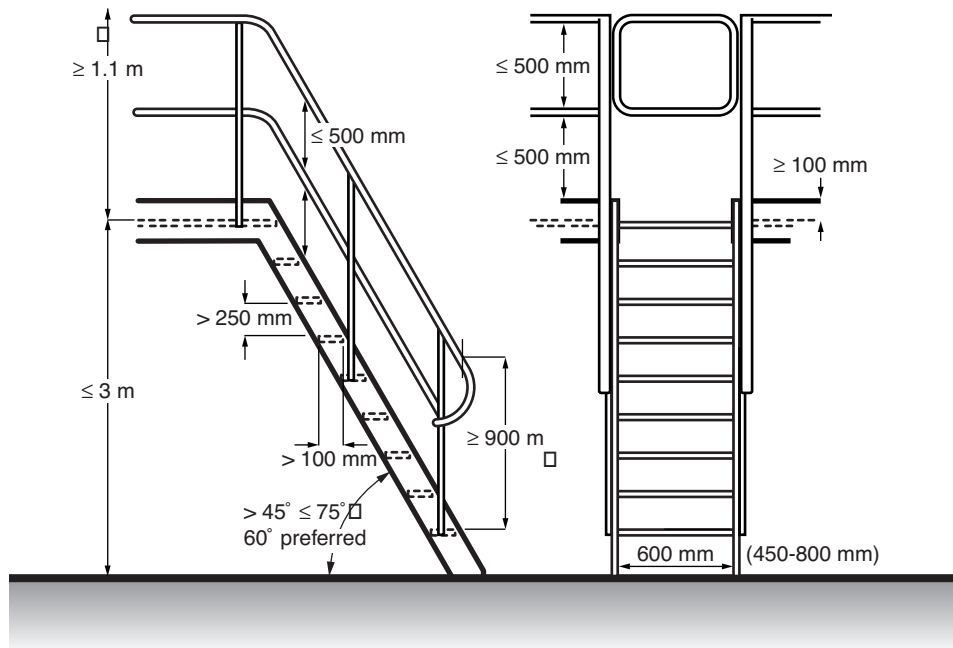
Figure 5 The main recommended requirements for a stairway access



Stairways

- In addition to the requirements in Figure 5, the climbing height of individual flights should not exceed 3 m without a landing. An exception is permitted in the case of a single flight only, which may have a climbing height of not more than 4 m.
- Where the height of possible fall is more than 500 mm, the stairway should have a handrail and intermediate rail.
- If a headroom of 2.3 m cannot be achieved along the whole length of the stairway, fit padding to the protruding objects and provide warning signs - remember to provide guarding to prevent entanglement if necessary.
- The width of the stairway should be increased to 1 m if several people will usually cross on the stairs.
- Stairways and handrails are not designed as lifting equipment! Do not allow them to be used for slinging or as anchor points for lifting equipment.
- Where stairways give access to a working area and operators are liable to fall down the stairs, then mills have found, through experience, that a spring-loaded barrier that drops into place at the top of the stairs can be very effective to prevent falls.

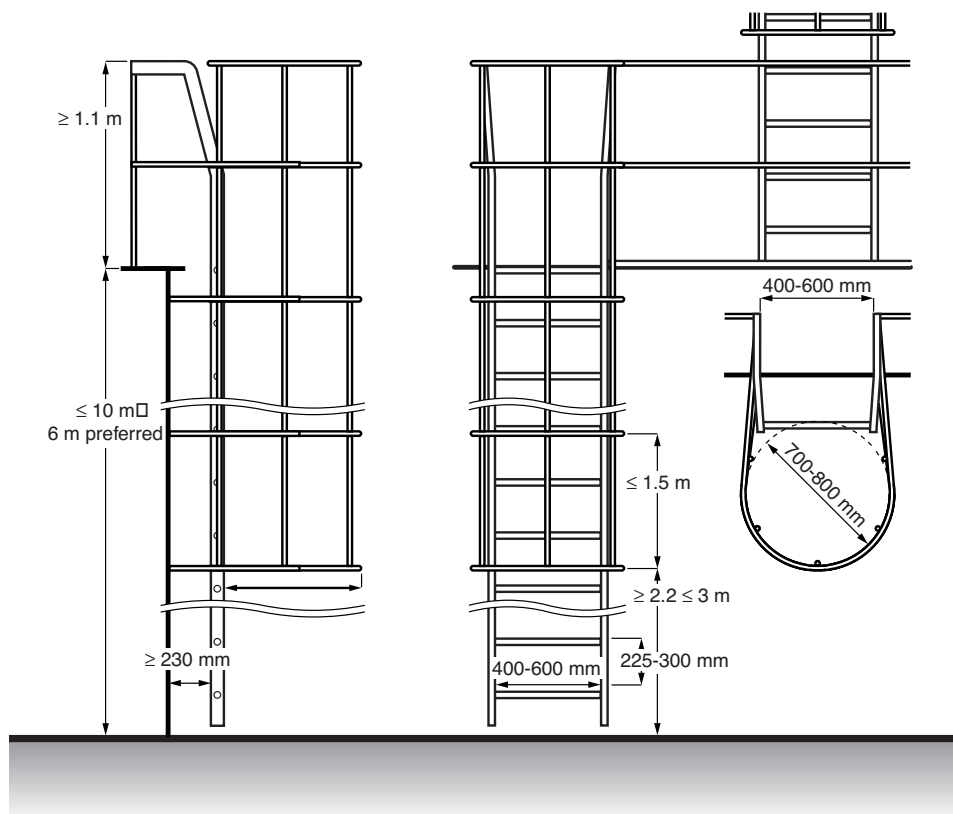
Figure 6 The main recommended requirements for stepladder access



Stepladders

- In addition to the requirements in Figure 6 where the height of possible fall is more than 500 mm, handrails and intermediate rails shall be provided on both sides. On the same flight, the riser height should be constant. If unavoidable, the riser height of the first step may be reduced by up to 15%.

Figure 7 The main recommended requirements for ladder access



.....

Ladders

- In addition to the requirements in Figure 7, the spacing between the floor level and the first rung shall be the same as the spacing between the rungs.
- The top rung should be at the same level as the walking level in the arrival area. If the gap between the walking level and the ladder is more than 200 mm, the floor should be extended to reduce it. There should be a minimum of 230 mm behind each rung to allow room for the foot and provide a firm foothold.
- A safety cage (hoops) or other type of anti-fall device should be provided where the height of the ladder is more than 3 m. At the arrival area, the safety cage should extend up to the height of the guard-rail on the platform served by the ladder (ie 1.1 m above the platform level).
- The length of intermediate platforms between two flights of the ladder should be at least 700 mm.
- The opening at the arrival area should be provided with an inward-opening, self-closing gate. The gate should have a handrail at 1.1 m and intermediate rail.

Work platforms and walkways

- The headroom over platforms and walkways should be 2.1 m.
- As a guide, platforms and walkways should be at least 600 mm wide and preferably 800 mm wide. However, the width and clear length should be determined by such factors as the need for unrestricted work-movements when using tools, the number of operators likely to be on the walkway or platform at the same time, the frequency and duration of the tasks undertaken, people passing each other etc.
- Where you could fall 500 mm from a platform or walkway, provide handrails at a minimum height of 1.1 m above the platform with an intermediate rail and toe board. The maximum gap between the handrail and intermediate rail, and between the intermediate rail and toe board, should be 500 mm.
- Do not allow handrails or intermediate rails to be used as a means of access to a higher level.
- Securely fasten open-grid flooring to the framework.
- If a section of flooring in a working platform or walkway has to be removed, for example, when changing a felt, erect temporary protection around the opening and put up a warning notice. Make sure that there is a system of work for replacing the flooring when the job is completed and that the person(s) responsible knows that it is their job to do it.

-
- If temporary access platforms are required, ie for non-routine maintenance work, then a competent access contractor should be used to provide scaffolding or supply a mobile elevating work platform ('Cherry Picker').

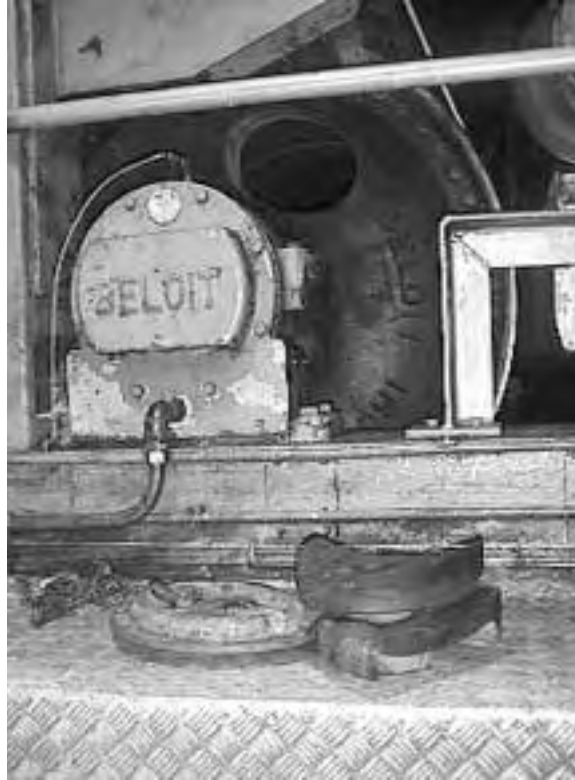
**Hot surfaces and
humidity**

61 Further guidance on working in a hot environment can be found in the PABIAC guidance *Prevention of heat stress in paper and board mills*.

SAFE WORK IN CONFINED SPACES

Figure 8 Drying cylinder with access hatch open.

The legal definition of 'confined spaces' includes places where hot conditions may lead to a dangerous increase in body temperature.



Hazards

- Lack of oxygen (eg arising from rust forming in tanks when unused for a time).
- Entry of poisonous gas, fume or vapour from connecting pipes.
- Water, stock or other liquid suddenly filling the vessel.
- Hot and humid conditions leading to a dangerous increase in body temperature and heat stress.
- Fume and gas from welding carried out inside the confined space.
- Vapours/gases/fumes, eg from coating or cleaning process.
- Access and egress from restricted openings - particularly in an emergency.
- Mechanical hazards from plant unexpectedly starting up.

Action

- Identify the plant in your mill which falls within the definition in the Confined Spaces Regulations 1997.¹⁴ This will include, not only plant with limited openings, such as drying cylinders, head boxes and closed-top pulpers, but also open-topped vessels where, for example, there is a risk of drowning from the failure to isolate the infeed of liquid.

-
- Decide which tasks can only be done by someone going in to the confined space. (Remember that the Regulations prohibit entry to a confined space if it is reasonably practicable for the work to be done by other means. For example, could remote-controlled cameras be used for inspection?)
 - Identify and assess all the risks, as well as the specific risks which bring the confined space within the Regulations - these may be mechanical, electrical and other risks, such as falls from height. Do not forget to identify situations that could involve a risk of heat stress - further specific information and guidance on this problem can be found in the PABIAC guidance *Prevention of heat stress in paper and board mills*.
 - Use a safe system of work for entry to confined spaces and support this with a permit-to-work to ensure that safeguards to deal with the risks are in place before the work can start.
 - Emergency arrangements for getting someone out of the confined space must be in place before work begins. Rescuers will need to be trained in procedures and the use of rescue equipment. They will also need to take part in regular emergency exercises to test the arrangements.

Consider the following points when drawing up a permit-to-work system/safe system of work for entry into confined spaces:

(See also the section on 'Safe systems of work' in 'General guidance'.)

- Appoint a competent person to take control and be in charge. Set out their responsibilities so that they know exactly what they have to do. State the precautions that have to be taken before the work starts, and how often and at what stages they have to carry out checks. Decide the level of supervision required.
- Not just anyone can go into a confined space - you have to consider their age, size, fitness and general medical condition. You should train them and provide an annual medical examination.
- Establish what isolations are needed before entry. Remember that all sources of energy - not just electrical sources - and infeed of liquids etc need to be isolated.
- Where people entering the confined space may be exposed to heat stress, the system of work should also set out the length of time a person may remain inside and the frequency of rest periods. This will depend on the amount of physical effort involved in the work.
- In the case of entry to drying cylinders, establish the means for securing the cylinders to prevent them turning under their own inertia with someone inside.

-
- Decide the procedure for testing the air.
 - Consider whether any risks will arise from the work being done, eg fumes from welding.
 - Decide whether ventilation should be improved, eg by opening other access doors or providing mechanical ventilation.
 - Electrical lighting and tools inside metal tanks and cylinders need to be extra-low voltage (typically 25 V). Consider the use of air tools instead.
 - Decide how communications will be maintained between people inside the confined space and those outside, especially in an emergency.
 - Remember that you will need to ensure that contractors follow your safe systems of work!

HOUSEKEEPING

Figure 9 What your mill should look like



Remember that slips, trips and falls account for a third of all accidents in paper mills and represent a huge personal and financial cost.

Hazards Slips, trips and falls due to:

- Inadequate cleaning.
- Hose reels/trailing cables.
- Poorly maintained floors and stairways.
- Wet floors - particularly in combination with paper dust and chemicals.
- Spillage of chemicals, eg oil, starch, retention agents.
- Fire from the accumulation of dust and debris, especially tissue dust.

Action **Housekeeping policy^{20, 21}**

Remember that cleaning operations can expose operators to other risks, for example those associated with safe access and moving machinery - refer to the relevant sections of this guidance for additional advice. Cleaning on a machine should be carried out with the machine stationary and isolated unless access to dangerous parts is prevented.

- Draw up a housekeeping policy. Good housekeeping depends on clear standards and a commitment to maintain those standards at all levels, from boardroom to shop floor. The policy should set out the standards you want to achieve on housekeeping and how you intend to achieve them. Most importantly, it should allocate resources. The policy should also state who is responsible for managing housekeeping, for day-to-day housekeeping activities, for inspection and maintenance of floors, for actioning reports of defects etc.
- The housekeeping policy should not conflict with the environmental policy, eg on clearing oil spillages.
- Make sure that contractors follow your policy or get them to take their own rubbish away!

Cleaning

- You have to have a regular regime to keep on top of cleaning. The frequency of cleaning will depend on the product being made and the amount of dust produced. It is also helpful to prioritise areas and activities which you know from previous accidents or from risk assessment will need to be cleaned more often. These will include machine hoods, ductwork, ledges on buildings etc.
- Clarify responsibilities to ensure that cleaning regimes are maintained. For example make individuals or teams responsible for checking that designated areas are clean before shift changeovers.
- Vacuum cleaning is the best method for cleaning dust, especially tissue dust - air lines just disperse the dust. Air lines may be used after vacuum cleaning to remove coagulated deposits. Fit proprietary trigger-controlled blow guns with safety nozzles to air lines - these reduce the risk of eye injury from particles blown into the atmosphere and the dangers from close skin contact - however mills should remember to consider the provision of eye protection against any dust that may be blown into the air.
- Site air and water hoses close to where they need to be used to avoid long lengths of pipe.
- Keep hoses coiled or off the floor when not in use - preferably fit automatic retraction systems.
- Overalls and clothes should not be cleaned with an air line. Serious injuries, sometimes fatal, have been caused when an airline has been pointed towards the anus, even at some distance. More commonly, eye injuries result from dust and debris on the clothes being blown at high velocity.²²

-
- Give careful consideration to safe access requirements, particularly building ledges and suspended services at high level. A mobile elevating working platform is often the most practical solution.

Those mills which have made a commitment to the reduction of slips, trips and falls have seen the benefits of their efforts in fewer accidents and reduced costs. Managers achieved results by showing commitment in their actions - by making sure that employees and supervisors understood the importance they attached to the prevention of slips and trips and by not condoning bad housekeeping.

Supervisors, in particular, were recognised as having a key role. It is they who have to juggle the day-to-day demands on their staff, and standards tend to suffer without a clear steer on where housekeeping falls in the list of priorities. Supervisors were 'empowered' to use their resources on housekeeping and agreed with management on what they could realistically deliver.

Crucially, managers showed that they were prepared to take prompt action on hazard reports from employees and this, in turn, encouraged better reporting.

Maintenance and cleaning of floors

- Check floors for loose finishes, holes and cracks etc, and deal with defects promptly. Provide adequate drainage to prevent standing water and growth of slime.
- Mark out through-routes which take people away from slippery areas.
- Warn of changes in floor-level, particularly at the beginning of a ramp, eg by painting a hatched area on the floor, and make sure the area is clearly lit.²³
- The cleaning regime has to be right for the floor surface - incorrect cleaning techniques can reduce the slip-resistance of the floor.
- Cleaning methods will also differ according to what has been spilled - make sure operatives are properly trained in the right method. For example, cleaning a spillage of starch with water will make the slipping hazard worse - spillages of starch should be contained and cleaned up by dry sweeping. Oil collecting in basements can be vacuumed out before using absorbent material.
- If in doubt, consult a reputable flooring or cleaning product manufacturer for the cleaning method most suitable for the floor and type of contamination expected.

SECTION 2: STOCK PREPARATION

MANUAL DE-WIRING

Figure 10 Pneumatic cutters are easier to use than manual cutters



Hazards

- Wire whipping when cut and causing severe injuries to face, hands and arms.
- Musculoskeletal injuries from repetitive movements during cutting or twisting to remove wire.
- Cuts, puncture wounds from discarded baling wire.
- Tripping on loose wire.
- Vehicle movements in bale delivery area.
- Bales falling.

Action

- Provide full-face visors, preferably with chin guards to prevent wire whipping underneath, and gauntlets (or gloves with additional forearm protection) for cutting wires around bales of waste or pulp.²⁴ Gloves are not adequate by themselves.
- Train operators in the correct sequence for cutting wires to reduce the risk of wire whip.

-
- If possible, mark out a danger zone in which wire cutting can be confined. Keep untrained, unprotected people away from the danger zone.
 - If the wires are removed put them in a bin or wire baler. Make sure that the ends of the wire do not stick out.
 - Pulling wires from under a bale is a manual handling hazard. Where possible, provide devices which lift the bale clear of the conveyor, to remove the risk of back injury. Alternatively, some mills have fitted cleats on the side of the conveyor to wrap the wire around - as the bale proceeds up the conveyor, the wire is pulled clear.
 - Precautions should be taken to reduce the risk of injury due to vehicle movements^{25, 26} in the bale delivery area and from people being injured by falling bales. These depend on the geography of the mill and the type of bale handled, but will include, for example:
 - segregation of vehicles and pedestrians;
 - the provision of high-visibility clothing;
 - clearly marked pedestrian walkways;
 - training for all drivers that includes regular refresher training;
 - crash protection bars for both machinery and people;
 - good lighting; and
 - the prohibition of all unauthorised personnel in the area.

WIRE BALERS

Hazards

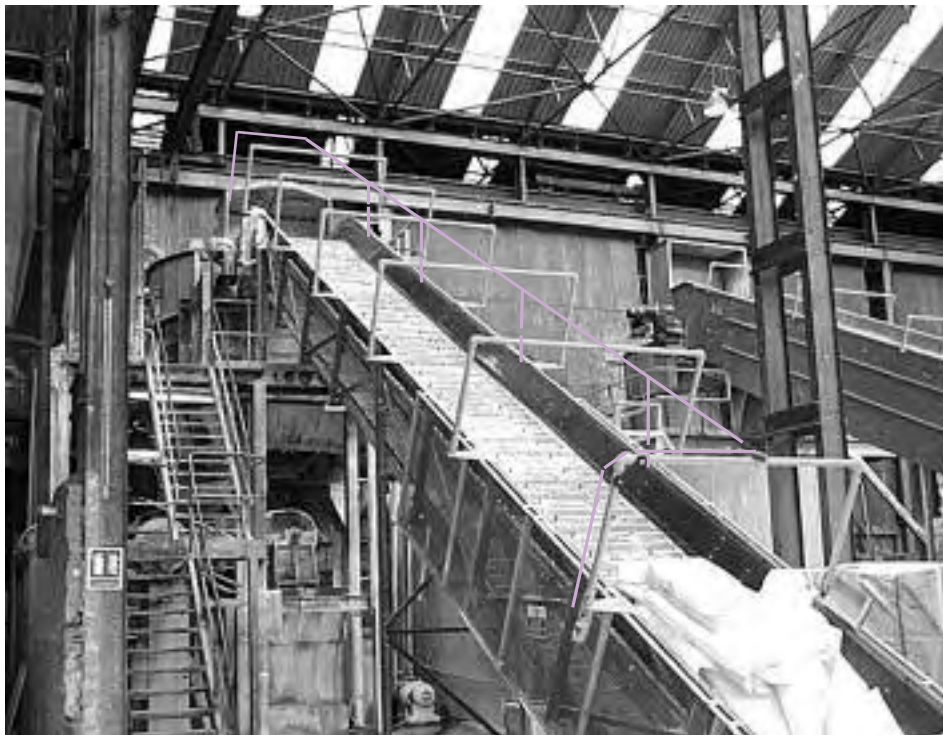
- In-running nips on wire drawing rollers.
- Shearing hazards from wire cutting tool.
- Puncture wounds and cuts from stray wires.
- Coil ejection under pressure and subsequent entanglement.
- Manual handling of coils.

Action

- Suitable and effective training should be provided for all operators of wire baling machines. Operators should be provided with and wear suitable protective equipment, including full-face visor with chin guards and strong gauntlets that extend to cover the wrists.
- The feed point should be safeguarded to prevent access to the drawing rollers, and access to all other dangerous parts should be prevented by means of fixed or interlocked panels.
- The machine should be stopped and isolated when access is required for maintenance or cleaning.
- If regular access is required for operational or cleaning purposes then the relevant sections should be interlocked. Where the wire is baled under pressure then no access should be possible until pressure at the ram/plate has been released.
- The door for coil removal should have a two-stage release mechanism so that if excess pressure has been produced in the coil, the door is not forced open, with the potential to hit the operator.
- Mechanical aids to move the completed coil from the machine to the disposal point should be considered.

CONVEYORS FEEDING PULPERS

Figure 11 It is important to fit the right sort of emergency stops to a conveyor in the right place



Hazards

- People going onto the conveyor.
- Falling onto the conveyor or getting clothing or footwear snagged, for example on baling wire or between slats of the conveyor, and being carried into danger.
- Conveyor starting up while someone is on the belt, for example when clearing blockages or retrieving contraries.
- Bales falling from, or back down, an elevated conveyor.
- Falling off the conveyor or into the pulper when clearing blockages, or carrying out maintenance, eg on 'magic eyes' at the top of the conveyor.
- Damaged or missing slats.

Action **Access onto conveyors**

- The starting point for thinking about conveyor safety is how to keep people off them. If anyone is having to go onto the conveyors frequently or routinely, then you need to find out why and tackle the causes. For example, if blockages keep happening, then maybe you need to change the way the conveyor is fed - some redesign of the conveyor might be the answer - or simply to give the operators better training. If the reason is to remove contraries, then you should provide arrangements for pre-sorting.

- **Going onto a moving conveyor should not be permitted in any circumstances.**
- Clearing of blockages at the top of the conveyor should be done from a working platform (with fixed access) - not from the conveyor itself.
- If you cannot avoid going onto a conveyor then the conveyor itself, any associated feed conveyor and any pulper being fed, must be isolated, **regardless of the length of the job.**
- **Never** rely on the locking-in of an emergency stop button to prevent the conveyor being started up when going onto it. Use a full-body harness fixed to a suitable, tested, anchorage point above the working position. Make sure that the lanyard is as short as possible and in all cases sufficient to prevent the wearer reaching the surface of the pulp should they fall into the pulper! The lanyard should not exceed 2 m and include a shock absorbing device. All fall arrestor equipment should be regularly checked for damage. A simple safety belt is not considered suitable.
- Consider an additional drop-down guard or door for the entrance to the pulper which can be bolted in place for the period of the work to prevent someone on the conveyor falling into the pulper. (A harness is still required to protect people from falling off or through the conveyor.)
- Some conveyors can be reversed to help clear blockages. You should only be able to start the reverse motion under hold-to-run control and the control should be in a place where the operator can see the whole of the conveyor. Make sure that any in-running nips created between the belt and rolls when the conveyor is reversed are guarded.

Emergency stops on conveyors feeding pulpers

- The purpose of the emergency stopping system is to stop the conveyor in the event of danger. It is not intended as a means of preventing unexpected start-up while someone is on the conveyor.
- The system used must be easy to operate by a person who, for example, has fallen over on the conveyor or is trapped, or by someone seeing someone else in danger on the conveyor.
- You need to test the emergency stop devices regularly. You should be aware that self-monitoring emergency stop relays will not check, for example, that the actuators work. Physical checks and regular testing are still needed to make sure that emergency stop devices are not, for example, clogged up with paper dust.
- The control system for the emergency stop system on conveyors feeding pulpers should meet the performance levels of Category 3 of BS EN 954-1: 1997. (See 'Safety-related control systems' in 'General guidance' section.)

-
- **Note:** Personnel detection systems which, for example, rely on a signal receiver over the conveyor and transmitters which are worn on a belt, are only acceptable as additional safeguards; they should not be used as alternatives to emergency stop devices.
 - There should be at least one emergency stop button close to the feed point of the conveyor.
 - On the conveyor itself, any of the following emergency stop systems may be used. They are listed in order of preference:
 - A trip wire fitted along the top edge of one, but preferably both, of the conveyor side panels.
 - A single trip wire hung centrally up the length of the conveyor with pull cords suspended from the trip wire to make it easy to operate (see Figure 11).
 - Trip wires arranged like 'goal posts' over the conveyor. The first goal post should be at the start of the inclined section. The maximum recommended distance between sets of 'goal posts' is 3 m. They will also need to have suspended pull cords to make them easy to operate.

Whichever of the above systems is used, the trip wire should either have a switch at both ends or have a single switch at one end and tension spring anchors at the other so that the emergency stop system will work if the wire is pulled from any direction and from any position along it. The system should also stop the machine if the wire breaks.

- Push buttons along the top edge of one of the conveyor side panels, but preferably both. The recommended interval between push buttons is 3 m or less.

Additional requirements for horizontal conveyors feeding pulpers

- The main risk with horizontal conveyors is from people falling on them. If horizontal conveyors feeding pulpers are less than 1.1 m high, they should be provided with fencing at least 1.1 m high along the sides. Provide fencing of the type which does not allow people to climb on it, eg shear sided, vertical slats etc.
- There is also a risk of people falling into the pulper, for example, while clearing blockages or carrying out maintenance, close to the entry point to the pulper. Provide fixed tunnel guarding at the entry point, extending at least 1 m along the sides of the conveyor. Where a 'goal post type' emergency stopping system is used, or emergency stop buttons are provided along the sides of the horizontal conveyor, the fixed tunnel guarding should extend from the last goal post or emergency stop button to the entry point of the pulper.

.....

Falling bales

- The sides of the conveyor should be high enough to prevent bales falling off. If necessary, you can fit a horizontal bar across the conveyor at its lower end to knock over bales standing on end.
- Keep the carrier bars (flights) on your conveyors maintained in good order.

Safe systems of work

- In addition to safe systems of work for normal operating procedures at the conveyor, safe systems will also be needed to cover isolation procedures, clearing blockages and maintenance of the conveyor.

A typical conveyor accident

An operator broke his forearm when he fell from an elevated conveyor, attempting to clear a blockage caused by wet bales.

Frequently, the conclusion of an accident investigation is to make sure that operators wear a harness in future. The investigation fails, however, to look for the underlying causes of the problem. A thorough investigation would look for answers to the following types of questions:

- *What did the risk assessment have to say about this?*
- *Why were the bales wet? Do wet bales cause regular blockages?*
- *What can be done about it?*
- *Have the operators who load the conveyor been trained to avoid blockages?*
- *Is the design of the conveyor suitable for the material used?*
- *If blockages are inevitable, what other ways could they be cleared besides the operator having to go on to the conveyor? For example, could they be cleared from a walkway on the side of the elevated conveyor?*
- *Were the procedures for clearing blockages adequate?*
- *Do people have to go onto the conveyor for other reasons?*
- *What about the arrangements for supervision - were responsibilities clearly set out and understood? Did the supervisor have enough time to do the job properly?*
- *Why wasn't a harness being used? Was it readily available? Was it working properly? How difficult was it to use? What training had been provided? Where was the anchor point?*

If you don't try to uncover the real reasons for the accident, it may happen again.

PULPERS

Figure 12 Pulper with fixed grille on hatch to prevent people falling through



Figure 13 The fencing around open-topped pulpers should be designed so that people cannot climb onto it



Hazards

- Drowning in a loaded pulper - if you fall in, your chances of getting out alive are negligible, even with the rotor stationary.
- Drowning in a pulper if water is turned on while working inside.
- Contact with rotors/impellers.
- Burns from hot stock splashing from openings.

- Contact with chemicals while manually dosing the pulper - remember reactions in the pulper can give off toxic gas.
- In-running nip between ragger rope and capstan.
- Entanglement in motor drive.
- Contact with guillotine for ragger rope.
- Struck by material falling from the feed conveyor.
- Falls from height while entering or working in pulper.
- Toxic fume or oxygen deficiency while working inside.
- Lifting of replacement parts.

Action *Preventing falls into pulper*

- The feed opening must be at least **1.1 m** above floor level. Keep the floor area around the feed opening clear of raw material to maintain the effective height of the guarding.
- Where pulpers are fed by a horizontal conveyor, fit a tunnel guard which extends at least 1 m from the opening. (For further requirements see 'Conveyors feeding pulpers'.)
- Under no circumstances should you use boxes or steps to reduce the level of protection below 1.1 m.
- The fencing around open-topped pulpers should be designed to prevent people climbing on it, for example, it could be sheer sided or have vertical bars, so as not to give a foothold. If you currently have guard rails and toe boards around your pulper you are strongly recommended to replace these with the type of guarding described.
- Inspection hatches or other openings in the pulper which are large enough for a person to fall or be drawn through, should have fixed grilles.

Access to pulpers

- All pulpers, including open-topped ones, are confined spaces as defined in the Confined Spaces Regulations 1997 and all entry should be in strict conformity with these Regulations. (See 'Safe work in confined spaces' in 'General guidance'.)
- No one should be allowed to go into a pulper unless ALL sources of energy (not just electrical power), the conveyor feeding it, the infeed of

.....

water and other raw materials, have been ISOLATED, purged where necessary and a permit-to-work has been issued.

- Extra-low voltage lighting should be used inside the pulper (typically 25 V).
- You need to provide a safe means of access for people working inside the pulper. Do not leave the arrangements to the people doing the job. For example, you need to consider how ladders are to be secured when working on the rotor. If the job is likely to take some time, a proper working platform will be needed. Scaffolding will almost certainly be needed for working on the pulper sides or pipework.
- Fix a notice to the pulper warning that people are working inside.

Lifting aids

- Provide a mechanical means for lifting above the pulper. However, you should remember that it will be in a corrosive atmosphere and take this into account when making arrangements for inspection, examination and testing.

RAGGER ROPES

Figure 14 An unguarded ragger rope capstan and guillotine



Figure 15 Ensure the guard is interlocked with both the movement of the capstan and the pneumatic system for operating the guillotine



Hazards

- Nip between the rope and capstan.
- Contact with the guillotine.

Action

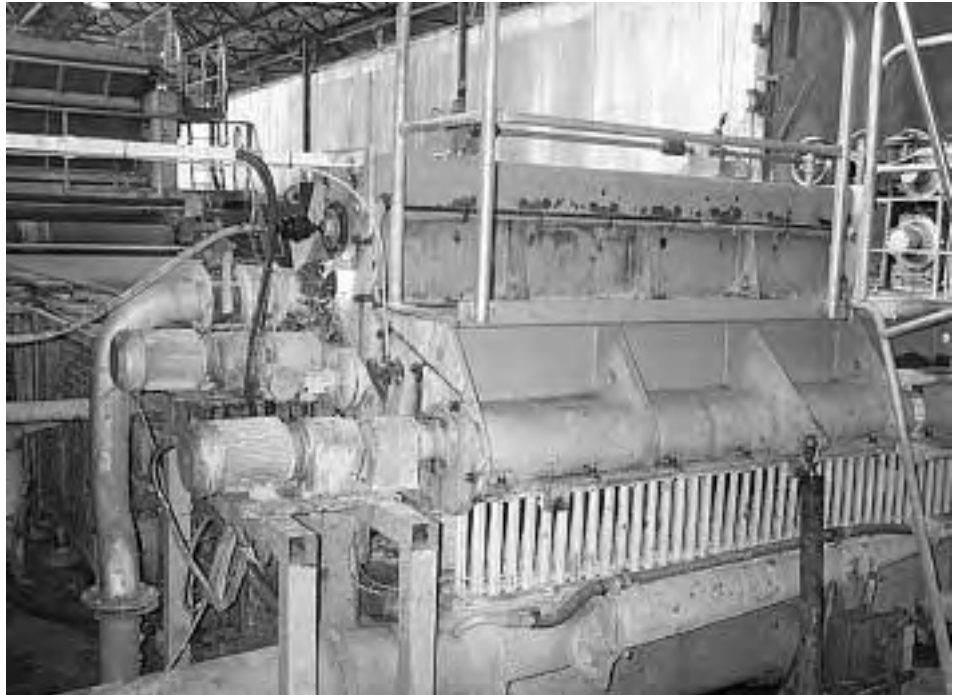
- You must guard the intake between the ragger rope and capstan and access to the guillotine. A fence-type guard with interlocked access gate is suitable. An override facility may be provided to allow the capstan only to operate under hold-to-run control at crawl speed (**no more than 5 m/min**) to allow for feeding new ropes.

-
- The safety-related control system for the interlock on the gate should be to Category 3 of BS EN 954 - see 'Safety-related control systems' in 'General guidance'.
 - The capstan and guillotine must be isolated when changing blades. Accidents have occurred during maintenance because the electrical system has been isolated but not the pneumatic supply to the guillotine blade which normally operates on a timer. Make sure your isolation procedure is written down, clearly detailed and operators are trained to use it.

SECTION 3: PAPERMAKING MACHINE - WET END

HEAD BOX

Figure 15 Head box showing guarding for evener roll drives



Hazards

- Entry into confined space - being overcome by toxic chemicals during cleaning of the box.
- Entanglement on drive shafts.
- Falling into open breast box - danger of coming into contact with agitators, or baffle rolls inside the box.
- Being struck by unsecured head box lid.
- Falling from top of head box, particularly where access required to adjust 'the slice'.
- Inadvertent start-up during entry into the box for maintenance or cleaning.
- Adjacent slippery floor surfaces.

.....

Action Confined spaces

- Head boxes are confined spaces as defined in the Confined Spaces Regulations 1997 and all entry should be in strict conformity with these Regulations. (See 'Safe work in confined spaces' in 'General guidance' and 'Access to pulpers'.)

Guarding

- Exposed drive shafts, agitators, baffle rolls etc should be enclosed by guards. A slot may be provided in the guard to allow tool access for adjustments. The slot should not be big enough to allow a hand or loose sleeve to reach the rotating parts.

Safe access

- Access is needed for cleaning and adjustment. Provide platforms and walkways which meet the requirements in 'Safe access to plant' in the 'General guidance' section.
- Provide a means to secure the head box lid when open to make sure it is not dislodged.

Cleaning

- The area around the head box should be a priority area for cleaning - see 'Prevention of slips, trips and falls' in the 'General guidance' section.

Clothing

- Provide operators with appropriate, close-fitting workwear to further reduce the risk of entanglement.

Systems of work

- Apply a permit-to-work system to ensure isolation of all power (electrical, hydraulic and/or pneumatic) and isolation and blanking of all stock valves before entry for maintenance or cleaning. Train all relevant personnel, including contractors, in the permit-to-work system and isolation procedures.

THE WIRE

Figure 17 Provide a guard to prevent access to the underside of the wire and the couch pit if there is a risk of drowning or contact with agitators

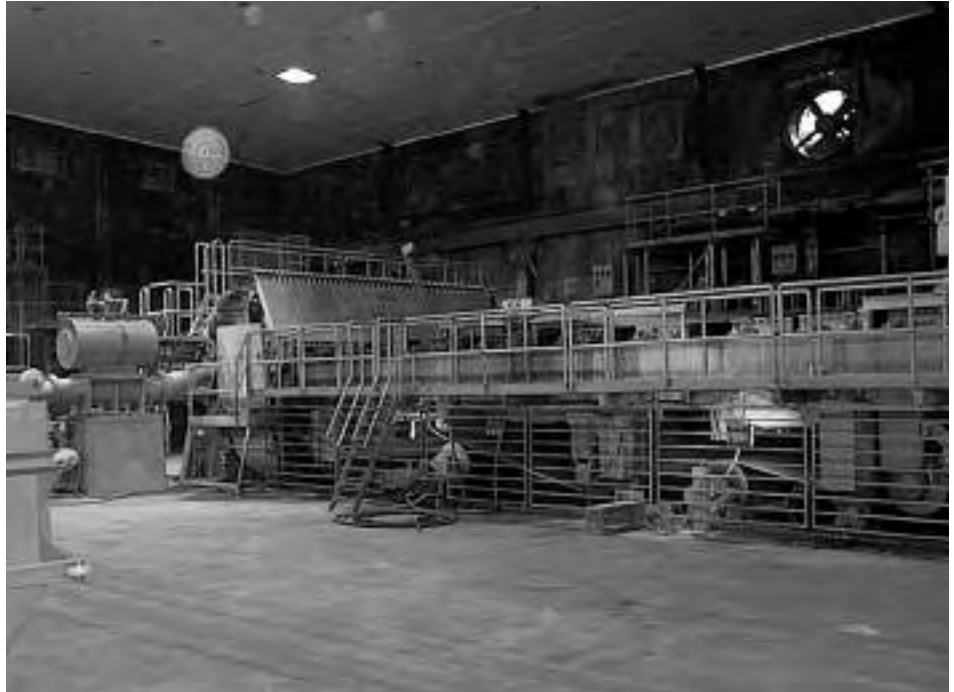


Figure 18 Any guarding should conform to BS EN 294: 1992



Hazards

- Noise from couch roll.
- Manual handling and falling during wire changing.
- In-running nips between wire and rolls.
- Entanglement with drive and couplings to the shake mechanism and the wire drive rolls.
- In-running nip between dandy roll and the wire.
- In-running nip with other wires.
- High-pressure showers for cleaning wires.
- Cutting hazard from edge of wire.
- Falling from platform and cross-machine walkways.
- Falling into the underwire pit and either drowning or coming into contact with paddle or auger.
- Chemical cleaning with the machine running.

Action **Noise reduction**

- Significant noise reductions of around 3 dB have been achieved by altering the pattern of the holes in the couch roll and regular maintenance of the seals.^{27, 28} (See also PABIAC Noise Information sheets.^{29, 30})
- Keep the vacuum system properly maintained to control noise emission.

Changing a wire

- A written safe system of work, which addresses the manual handling issues, is needed for changing a wire - see 'Fabric changing' section for further advice.
- Provide a safe means of access and working platforms (preferably permanent) for changing wires.
- Radio communication between the people involved in wire changing has been found to make the job easier and safer.
- Make sure that personnel have been trained in safe slinging.

Guarding

Figure 19 An example of a specialised dandy application illustrating the principles of safeguarding

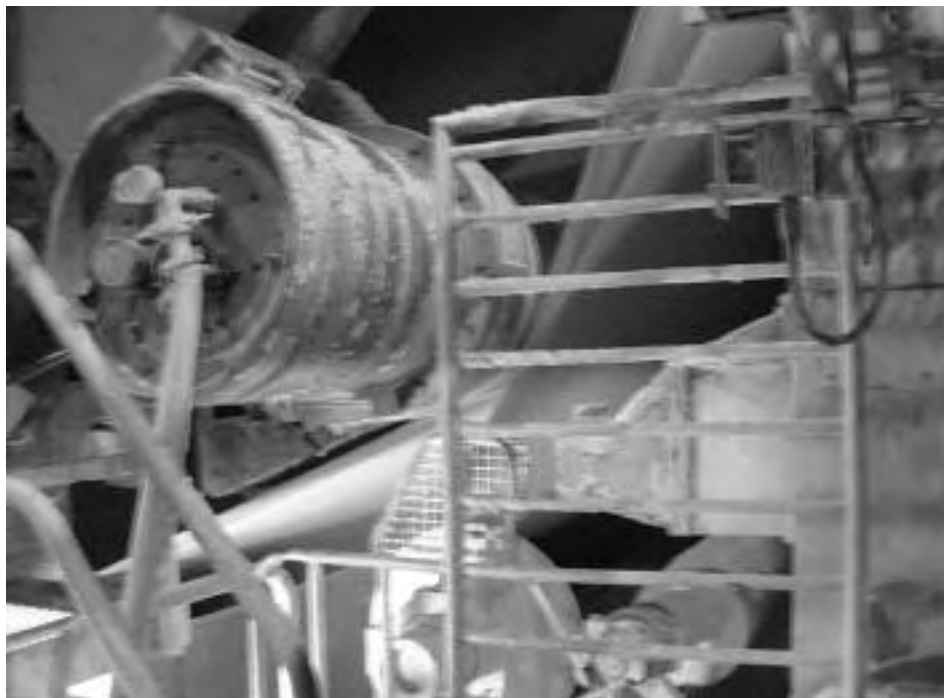


- Guard in-running nips between the wire and wire rolls and between wire and couch. Fixed side-guards, which you cannot reach around, fitted close to the nip are most effective.
- On multi-wire machines, provide guarding extending 850 mm from each side of the nip at each accessible station where two wires meet. The design of the guard should take into account the need for removal for wire changing and should not impede visibility.

There is a risk of drowning from slipping and falling into the under-wire pit, particularly if the pit is deep or has an auger. Provide a barrier around the wire (front and back side) to prevent someone falling into the pit. The design of barrier should permit cleaning with hoses but not allow people to reach dangerous parts.

- Drives to the wire shake, couch or other rolls must be completely enclosed with fixed guarding.
- Provide guarding at the front and back sides to prevent access to the in-running nip between driven dandy rolls and the wire (see Figure 19). Guarding is not necessary on undriven dandy rolls mounted in loose bearings which would lift if someone became drawn in.
- Provide guarding to prevent people coming into contact with the edge of wires, particularly at head and neck height, it could easily cut flesh or propel a person into another hazard. It is not sufficient to rely on warning notices - you can't read them if you slip!

Figure 20 Pick up guard.
Note that guards should comply with BS EN 294: 1992. It should not be possible to access dangerous parts through the guard or use it as a climbing frame



Showers

- If access to high-pressure needle showers is possible, particularly from underneath the machine, then you will need to provide fixed guarding to prevent approach.
- Provide a readily accessible means of isolation and lock off for carrying out maintenance.

Access to the wire

- Platforms crossing the wire should have handrails, intermediate rails and kick plates on both sides. (See also 'Safe access to plant' in the 'General guidance' section.)

Chemical cleaning

Cleaning requires a safe system of work that will include:

- restricting the area to those involved in the operation using suitable barriers and warning signs;
- appropriate personal protective clothing - usually this will be a full chemical suit for those involved;
- proper training for all those involved;
- exhaust ventilation of the area to a safe place;

-
- proper consideration of other risks, including safe means of access and isolation of mechanical, or electrical power. Machines should only be moved at crawl speed during cleaning if absolutely necessary under a proper system of work;
 - a proper system for dealing with chemical spills.

TRANSFER TO PRESS SECTION

Hazards

- In-running nip between couch and carrying roll (also known as lead or wind roll).
- In-running nip between wire and pick up roll/felt.
- In-running nip between first felt and felt roll.
- In-running nip at first press roll, particularly if the transfer of the web is done by hand.
- Falling into underwire (couch) pit.

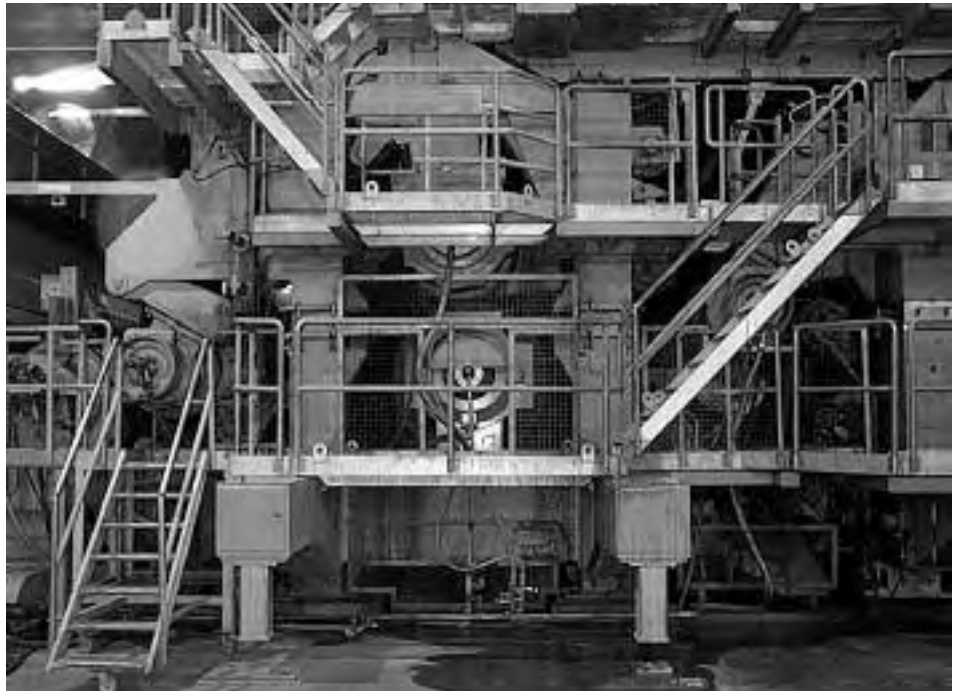
Action

- Avoid hand transfer of the web from the couch to the felt. Use an air 'blower' if practicable. (See also 'Web feeding systems' in the 'General guidance' section.)
- Guard the in-running nip between the wire and pick up roll/felt.
- The paper carrying roll and couch roll should be at least 120 mm apart. If not, fit a guard to prevent access to the nip.
- Guard the in-running nip between the first wet felt and roll. (Accidents at this point can occur when carrying out manual straightening of felts.)
- Provide fixed fencing to prevent anyone from falling into the pit.

SECTION 4: PAPERMAKING MACHINE - PRESS AND DRYER SECTIONS

PRESS SECTION

Figure 21 Where practicable guards should be extended to at least 850 mm from nip and prevent access from both above and below the felt



Hazards

- In-running nips at the press rolls.
- Intake between the doctor blade and roll when doctor is raised out of position.
- Falling onto felt and being carried into press rolls.
- In running nips at felt stretch or bow rolls.
- Entanglement on protrusions, eg nuts or capscrews on ends of press rolls.
- Manual handling problems while changing press rolls and felts.
- Slipping on oil emissions.
- Splashes from felt showers.
- Falling from cross-machine walkways and platforms during normal running and during felt changing.
- High levels of heat and humidity towards the top of the press section.

.....

Action Guarding

- Guard the in-running nip between the press rolls at both the front and back of the machine. The guard should, where practicable, extend at least 850 mm from the nip and prevent anyone reaching up to the nip from either above or below the felt.
- Provide a guard with a smooth surface over any parts sticking out from the ends of rolls to prevent clothing being caught up.
- If stretch rolls and felt carrying rolls are accessible, you need to guard the in-running nip from the sides or, if they can be reached from under the machine, across the whole of the nip.
- Prevent access to high-pressure showers.
- Remember - where do people go to work and what do they do when they get there?

Figure 22 Provide safeguards to prevent access to dangerous parts



Safe access

- Provide slip-resistant flooring around extended nip presses. Make the area around the nip press a priority area for cleaning. (See 'Housekeeping' in the 'General guidance' section.)
- Provide working platforms across the machine to make the cleaning and changing of doctor blades easier.
- If walkways are removed when changing felts and rolls, make sure that temporary barriers are provided. Chains are not sufficient.

.....

Safe systems of work

- Provide a written safe system of work for changing press rolls. This should cover the procedures for isolation, safe lifting, access arrangements, replacement of guards and cleaning (particularly with caustic washes).

Heat and humidity

- Carry out an assessment and adopt working practices in accordance with the PABIAC guidance *Prevention of heat stress in paper and board mills*.

DRYER SECTION

Figure 23 In some mills, interlocked distance guarding is being developed

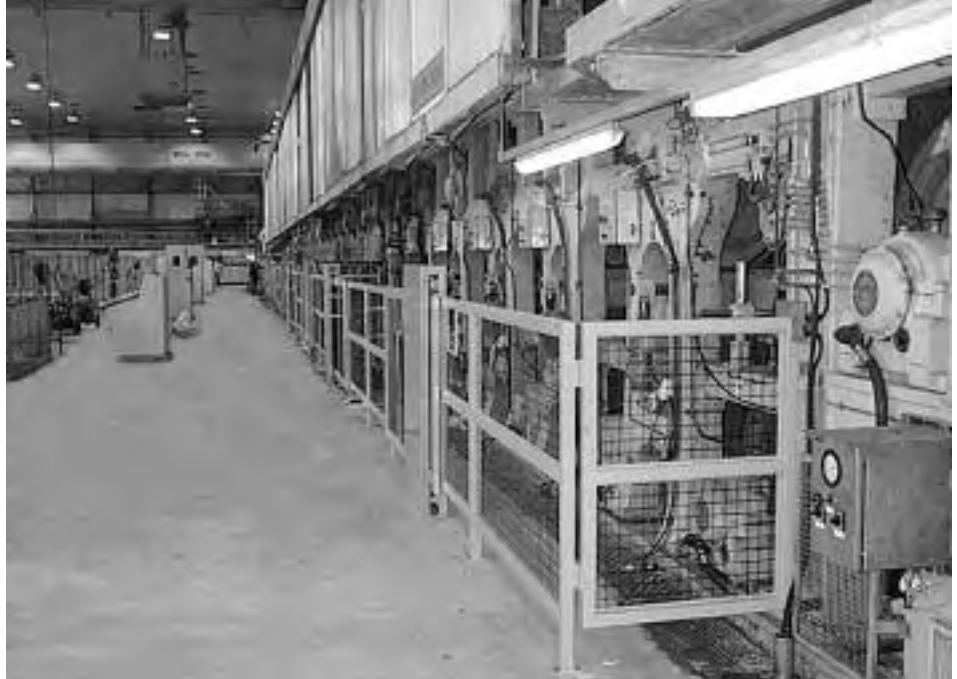


Figure 24 Guarding should be as close as practicable to the machine to prevent whole body access between the guard and machine frame



Hazards

- Confined space inside cylinders.
- In-running nips between cylinders and felts/felt carrying rolls and Sheahan ropes and pulleys.
- Burns from contact with cylinders.
- Falling into machine or under-machine pulper from cross-machine passageways.

- Heat stress working inside machine hoods.
- Failure of lifting mechanism for machine hood.
- Lacerations from doctor blades.
- Hazards associated with clothing changes.
- Replacing Sheahan ropes.
- Safe access/working in pits.

Action *Confined space*

- Drying cylinders are confined spaces as defined in the Confined Spaces Regulations 1997 and all entry should be in strict conformity with these Regulations. (See 'Safe work in confined spaces' in 'General guidance'.)

Guarding

- Safeguarding against the arm being drawn into the in-running nips between cylinders and felt rolls (and between any other pairs of counter-rotating rolls) is achieved if there is a gap between the rolls of at least 120 mm. If a nip can be reached by the whole body, then the safety distance between the rolls must be at least 500 mm. (See 'Principles of machinery guarding' in the 'General guidance' section.)
- The same safety distances apply to running nips between rolls and fixed parts of the machine. Safety distances can be used, for example, to safeguard the gap between the first drying cylinder and the hood.
- If the safety distances cannot be achieved (as may be the case on old machines) you will need to prevent access to the nips from the front and back sides of the machines with fixed guards. The guards need to be carefully designed to allow for broke removal and for cleaning and changing doctor blades.
- A recent development on newer machines is the use of interlocked guards on drying cylinders. A distance guard, 2.5 m high, is fitted along the drying section with hinged gates at each point where access is needed. The gates are either interlocked using a trapped key system or have guard locking; both of these systems ensure that the gates can only be opened when the machine is stopped. A facility is provided to permit the machine to be operated at crawl speed, for example for removing broke. However, while the machine (or machine section) is running in this mode, only one guard may be open and the operator must be able to see whether there is someone inside the guarded area. This system has long been in use for newspaper printing presses and the technology is well known.

- Nips between felts and felt rolls accessible from the front and back sides of the machine should be guarded by fixed guards mounted close to the wrapping point.
- If nips on rolls can be reached from cross-machine passageways, provide guarding across the machine.

Safe access

- If there is a risk of falling into a machine pit or basement from a passageway across the machine, provide railings 1.1 m high with intermediate rails and kick plates. (See 'Safe access to plant' in the 'General guidance' section.) Where dangerous parts could be reached by someone standing on the railings, provide fencing which does not permit a foothold. If it is foreseeable that people will still be able to reach up and make contact with dangerous machinery then additional guarding should be provided.
- Sheer-sided fencing, or other fencing which does not give a foothold, must be provided for passageways above under-machine pulpers, to a minimum height of 1.1 m. Any gaps in the fencing at floor level for feeding broke should be as narrow as possible, but should not exceed 300 mm. (You should be aware that new machines may be provided with feed gaps of up to 400 mm.)
- Provide working platforms where necessary for cleaning and changing doctor blades.

Pit access

- Where a machine is sitting over a pit, access to the pits is by means of steps or ladders located within the area of the machine. In these cases the provision of individual guards may be impractical and some form of gate, preferably interlocked, but at least locked, should be provided. If a lock is used then the key should be under the control of a responsible person and only released under a strict isolation procedure.

Machine hood

- The distance from any location under the hood and the nearest door should be no more than 15 m.
- Failure of the lifting mechanism for the machine hood should not allow the hood to fall under gravity; provide devices which limit the fall.
- An audible pre-start warning should be given before the hood is lowered.
- Any trapping points between the hood and first machine roll should be

.....

eliminated by design, eg by maintaining a gap of at least 500 mm.

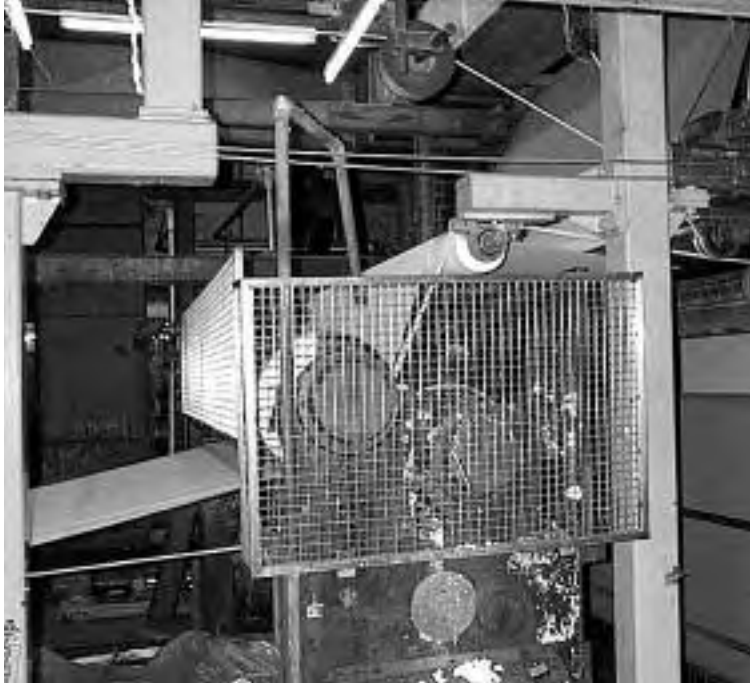
- Any work inside the machine hood is liable to expose operatives to heat stress. See also 'Safe work in confined spaces' in the 'General guidance' section.

Replacing Sheahan ropes

- Replacing ropes should only take place under a safe system of work that is strictly enforced - wherever possible the work or parts of it should be carried out with the machine stationary. Only if it is necessary for the machine to be in motion should work be allowed on a moving machine - and then only at a maximum of crawl speed.
- Safe access will be required to all pulleys to re-feed the ropes, and guarding provided should be replaced after the operation has been completed and before the machine is run up to full speed.
- Ropes that have failed should be replaced before the next web-feeding operation. It is NOT acceptable to manually feed a machine designed to be rope-fed.

SIZING AND COATING UNITS

Figure 25 An example of a size press



Hazards

- In-running nips between coating/sizing rolls.
- Entanglement and drawing-in during inspection and cleaning.
- Burns from splashes of hot or caustic size press mixes or coating colours.
- Automatic opening of roll nips when a break occurs, increasing the drawing-in hazard.
- Cuts from doctor/coating blades.
- Slips, trips and falls.

Action **Guarding**

- Guard accessible in-running nips between the coating rolls. On size presses, provide guarding to prevent someone reaching the ends of the nip from the front and back of the machine. If the nip can be reached from a cross-machine passageway, it must be guarded across its whole width.
- Fixed nip bars are acceptable. Interlocked (trip) nip bars tend to impede feeding up and are not usually appropriate. (Trip bars are also unlikely to be able to stop the machine before nip is reached.)
- If fixed nip bars are impracticable, one method of guarding is to fit interlocked gates with guard locking at the cross-machine walkway to ensure that operators can only get access when the machine is stopped. The actuators for the interlock and the control system should meet the

.....

performance criteria of Category 3 of BS EN 954: 1997. (See 'Safety-related control systems' in the 'General guidance' section.)

- Where roll nips are designed to open when a web break occurs, beware of additional in-running nips which this can create. Design nip bars so that they protect the nip created by the rolls in both the open and closed positions. (Also, make sure that the gap between the nip bar and open rolls does not exceed 8 mm.) Check that the distance between the rolls in their open position and any other rolls or fixed part is not reduced to less than 120 mm. If so, guarding for the nip created by opening the rolls will need to be provided.

Safe access

- Make the area around the press a priority area for cleaning. (See 'Housekeeping' in the 'General guidance' section.). Eliminate the need for close access to moving rolls during cleaning by either stopping the rolls concerned or providing automated mechanical cleaning devices. In principle, all rolls on a machine should be capable of being stopped and this should be the aim if close access is required. However, stopping machines for cleaning may create additional hazards or problems, such as moving the rolls by hand. In these circumstances, automatic cleaning devices or remote cleaning methods such as water jets should be examined to distance the operator from the moving machinery.
- Only if the machine cannot be stopped and/or automatic cleaning equipment cannot be fitted should cleaning take place on moving rolls. Under all circumstances, roll speed should be reduced to a minimum - preferably crawl speed. Even so, reducing the speed is only a risk reduction technique. In all such cases a thorough and effective risk assessment should have been carried out and the outcome recorded. All additional measures that are required to further reduce the risk should be identified, set out in operating instructions and implemented. Examples of such additional measures might include using water jets, long-handled tools, a written safe system of work - including details of the speed at which the activity will take place, effective and recorded training, supervision and regular review.

Doctor/coating blades

- Use proprietary devices for removing doctor blades. Suitable gauntlets should be provided to prevent cuts and the edge covered as soon as the blade has been taken out of the machine and the whole blade placed in a storage box. Do not leave them on walkways!

Protective equipment

- Suitable protective clothing should be provided and worn. Consideration should be given to eye protection or a full-face visor, and other suitable clothing to reduce the risk from splashing.

CALENDERS AND SUPER CALENDERS

Machine calendars

Hazards

- In-running nips between rolls.
- Open nips at lifted rolls.
- Entanglement in drive shafts.
- Entanglement in sheet between last rolls and the reel-up.
- Pressure loss at hydraulic lines.
- Cuts from doctor blades.
- Burns from hot surfaces.
- Entanglement during cleaning.
- Static discharges.
- Falling down under floor openings.
- Strains due to manual handling.

Action ***Machine feeding and guarding***

- Tail feeding systems should be installed on these machines.
- Access to all in-running nips should be prevented by guarding designed in accordance with the standards set out in the general section of this booklet. Nip bars, where fitted, should be regularly checked to avoid excessive deflection across the width of the machine and to ensure vibration has not loosened the securing bolts.
- Where rolls are lifted during breaks, beware of additional nips that may be created. The gaps between all rolls should be at least 120 mm or additional guarding should be provided.

Replacing doctor blades

- Use proprietary devices when removing or replacing doctor blades. Suitable gauntlets should be provided to prevent cuts and the edge covered as soon as the blade has been taken out of the machine and the whole blade placed in a storage box. Do not leave them on walkways!

Removing broke

- Under-floor openings for broke feeding should be kept as small as possible and should not exceed 300 mm.

Cleaning

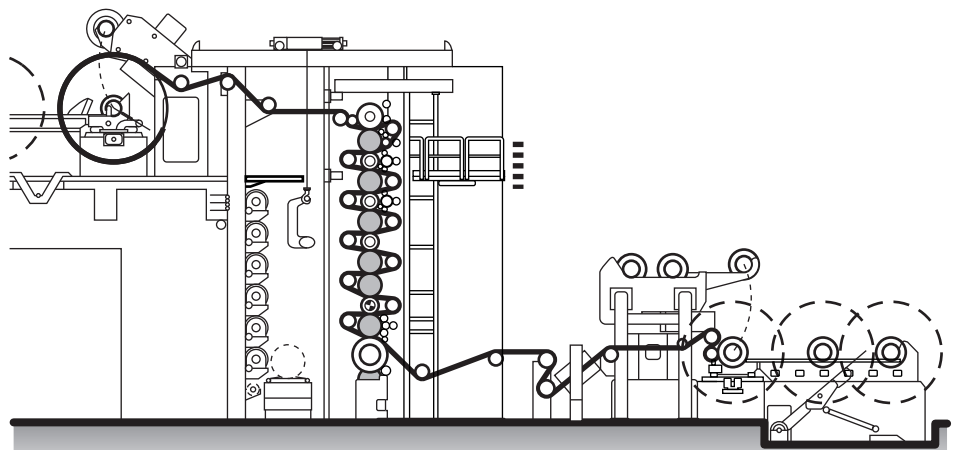
- Cleaning should always be carried out according to a safe system of work - preferably with the machine stationary using an appropriate remote cleaning device or tool. Flammable liquids should not be used.

Static electricity

- Suitable earthing and discharge systems should be provided and maintained.

Independent calenders

Figure 26 An independent calender



Hazards The following are in addition to those identified for machine calenders:

- Entanglement in in-running nips between unreeling and reeling reels.
- Falls from travelling working platforms.
- Trapping underneath the descending travelling working platform.
- Working beneath suspended loads.

Action The following are in addition to those identified for machine calenders.

- On machines wider than 3 m, nip bars may become impractical due to excessive deflection. In these cases enclosing guards should be provided to prevent access to dangerous parts.

-
- Travelling work platforms should be properly installed, maintained and examined in accordance with the requirements of the Lifting Operations and Lifting Equipment Regulations 1998. All travelling work platforms should also be fitted with:
 - interlocked gates - so that they cannot be moved unless the gates are shut;
 - a trip device on the underside that, if activated, brings the platform to a halt;
 - overrun protection at both ends of travel;
 - controls on the platform.
 - Mills should also refer to the section on 'Safe access to plant' from the 'General guidance' section of this booklet for further information.

YANKEE CYLINDERS

Figure 27 Yankees can fail catastrophically



Hazards

- Failure of the cylinder. This can be caused in several ways:
 - 'crevice corrosion cracking' which opens joint between the head and shell;
 - cracking of the shell due to differential temperature or pressure, eg during heating up and cooling down;
 - continual distortion of the shell due to over-pressure by the press rolls;
 - over-pressurisation by steam;
 - thinning of the shell, due mainly to frequent regrinding of surface, so that the cylinder no longer meets the design parameters for temperature and/or pressure.
- In-running nips between the press rolls and the cylinder and between doctor blade assemblies and cylinder.
- Burns and scalds from high pressure steam leaks.
- Entry into confined space.
- Contact with doctor blades.

.....

Action *Inspection and testing*

- Make sure that a 'head-tilt test' to detect crevice corrosion cracking is carried out at appropriate intervals as specified by a competent person.
- Check the integrity of the head bolts on older yankees using non-destructive testing (NDT).

Steam and condensate removal system

- Check routinely for steam leaks - a mirror on an extended handle can be used - and fix leaks as soon as possible to prevent steam cutting into the head/shell joint and setting up localised stresses.
- The pressure-relief valves on the steam system should be set with an appropriate safety margin and should be overhauled and recalibrated at least annually.

Hood

- The heating system for the hoods needs to be interlocked with the movement of the dryer. As the consequences of failure can be catastrophic, the control system should be to at least Category 3 of BS EN 954-1: 1997. (See 'Safety-related control systems' in the 'General guidance' section.)

Pressure rolls

- You need to monitor the loading on the Yankee applied by the pressure rolls - load cells which give an ongoing measure are recommended. You should be aware that the likely introduction of shoe presses may increase pressures on the Yankee cylinder.

Heating up and cooling down

- Make sure that the systems of work for starting up from cold and for cooling down a Yankee cylinder are written down and operators are trained in them. Check that even the experienced personnel continue to follow the correct system of work.
- Make sure that all operators are aware that cold water sprayed on to a hot cylinder can lead to catastrophic failure due to thermal shock.

Entry into cylinder

- Yankee cylinders are confined spaces as defined in the Confined Spaces Regulations 1997. Follow the guidance in 'Access to pulpers' in the 'Stock preparation' section, and 'Safe work in confined spaces' in the 'General guidance' section.

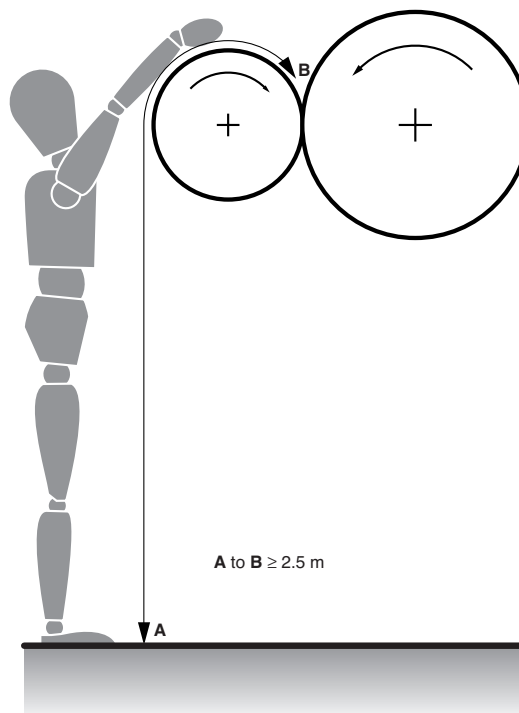
-
- Note that in some situations, steam and condensate can be back-fed into the cylinder from condensate 'flash vessels'; if this is possible, the steam/condensate return line will also need to be isolated.
 - Use purpose-designed scotching devices to prevent movement of the cylinder under its own inertia while a person is inside. Do not rely on doctor blades to prevent movement.

SECTION 5: REEL-UPS

Figure 28 Drum (Pope) reel with guard at under-machine pulper



Figure 29 Measuring the height of a nip at a reel-up



Hazards

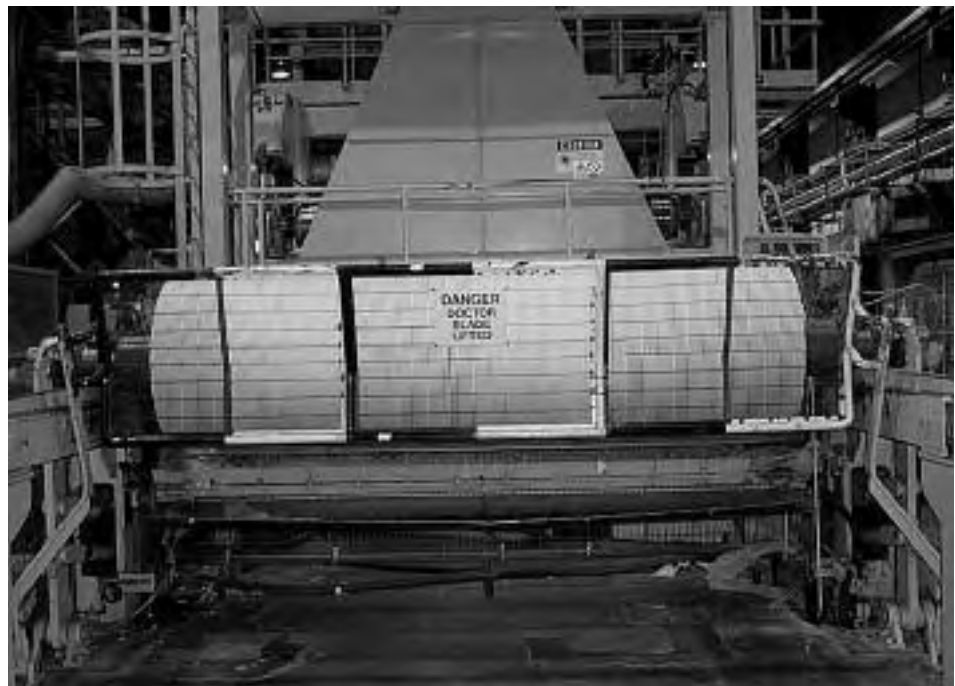
- In-running nip between shell/reel and drum.
- On reel-ups with storage for full reels, crushing between ejected reel and a full reel.

- In-running nip between web and reel (on higher grammage papers).
- Feeding web into the nip.
- Entanglement with primary/secondary arms.
- Falling into under-machine pulper.
- Working beneath the suspended load.

Action Guarding

- The in-running nip between the drum and the reel shell, throughout the range of movement of the shell, should be out of the operator's reach. This requirement is met if the distance measured from the nip over the newly transferred shell (ie in its lowest position), and vertically down to the floor or standing level is at least 2.5 m (see Figure 29).
- If this distance cannot be met, an automatic front face guard is required to prevent anyone reaching the nip (see Figure 30). The gap between the guard and reel should be at least 120 mm but not large enough to allow a person to stand between the guard and the reel.

Figure 30 Automatic front face guard which travels with the growing reel



- If the nip can be reached from raised platforms at the side of the machine, provide fixed fencing at the sides of the reeler. The height of the guard, its distance away from the nip and how far it must extend either side of the nip can be worked out from the relevant tables in BS EN 294: 1992.
- If the drive gears to the primary arms are accessible, they should be enclosed by fixed guards. The atmosphere inside the guard may be slightly pressurised to prevent the ingress of dust.

- Fit steel braking systems into the rails to halt the rotation of ejected reels. (If a rotating reel is lifted by a crane, it subjects the crane to dynamic loading for which it is not designed and can cause the crane to fail.)
- On reel-ups with storage facilities for full reels there is a risk of trapping between two reels, and particularly between a stationary reel and a moving reel which has been ejected from the reel-up. To avoid this hazard, a minimum gap of 500 mm should be maintained between two full reels on the rail. This can be achieved by holding the reels at individual brake stations, with the gap between stations designed to accommodate two maximum diameter reels, plus 500 mm. If the storage rail is 2 m or more above the floor, the gap can be reduced to 300 m.
- Where the ends of shells are shaped to fit into the re-reeler brake couplings, the rotating shaft ends should be guarded.
- If there is a broke pit or conveyor under the reeler, fit guarding to stop anyone falling in. The gap in the barrier at floor level for feeding broke should be as narrow as possible but should not exceed 300 mm. (You should be aware that the gaps under guards for feeding broke on new machines may be up to 400 mm.) The guard should be designed to prevent someone standing on it, for example to reach broke.
- When reeling up heavier grades of paper there have been incidents of people being drawn into the nip between the paper and the winding reel and being carried around the reel. Automatic cross-cutting devices may reduce the risk. If your risk assessment identifies this as a hazard, prevent access to the wrapping point from the sides of the reeler.
- Equipment for handling full reels should be suitably designed and properly maintained. When full reels are lifted off the machine, they should be raised high enough only for clear transfer. Reliance should not be placed on the overtravel cutout switch on the crane crab to stop the lift. Failure of the overtravel output switch can result in the hoist rope breaking and the load and lifting gear failing. Where practical it is advisable to fit two overwind limit switches. The first limit switch may be self-resetting, but the ultimate switch must not be.
- The risks of an accident or dangerous occurrence can be reduced by:
 - redesign of the actuating arm of the limit switch to ensure that it cannot be bypassed - a hoop or forks may be more suitable than a straight arm;
 - robust construction of the mechanical parts;
 - modification of the limit switch so that it requires manual resetting to discourage the practice of crane drivers relying on the limit switch; or

-
- routine testing of the limit switch at low speeds by the oncoming driver on each shift, together with planned and regular examination of the limit switch mechanism.
 - Mills should be able to show that shells have been examined regularly using, for example non-destructive testing techniques, to minimise the likelihood of failure in service.

.....

.....

APPENDIX 1: UPDATED INFORMATION ON DESIGN AND IMPLEMENTATION OF SAFETY-RELATED ELECTRICAL CONTROL SYSTEMS

IMPORTANT NOTE

The information in this Appendix supersedes and updates the guidance on safety-related control systems for papermaking machines published in paragraphs 31-47 of the first edition (2001) of *Part 6: Making paper safely. Managing safety in the papermaking process*.

This Appendix provides a technical framework that can be used by mill engineers for the design and implementation of safety-related electrical control systems that are used to carry out safety functions at papermaking machines. This is drawn from published standards and other sources that take a systematic approach towards the specification, design, installation and operation of safety-related electrical control systems so as to achieve safety performance requirements derived from a risk assessment.

What is a control system?

1 A control system responds to input signals from the machine, or from the operator, and generates output signals, which make the machine operate in a desired manner. So if, for example, an operator presses a start button, the control system may respond by closing a contactor and energising a motor.

2 Control systems can be implemented in a range of technologies, but this guidance is mostly concerned with electrotechnical systems employing electrical, electronic and programmable electronic technologies.

What is a safety-related control system?

3 A control system in a papermaking machine should be regarded as being safety-related if it contributes to reducing any risk to an acceptable level or if it is required to function correctly to maintain or achieve safety. The functions carried out by a safety-related control system are termed 'safety functions'. Safety-related control systems should be designed and configured to:

- be reliable enough (bearing in mind the consequences of any failure); and
- perform the necessary functions to achieve or maintain a safe state or mitigate the consequences of a hazard.

4 For the purposes of this guidance, a distinction can be drawn between those safety-related systems that use programmable technologies (such as a programmable logic controller (PLC) or microcontroller) and those that do not use programmable electronic devices (such as systems that use

.....

electromechanical components). The main purpose of this subdivision is to help the designer decide which of the two main standards that address the design of safety-related control systems to use - BS EN 61508: 2002 *Functional safety of electrical/electronic/programmable electronic safety-related systems*³¹ or BS EN 954-1: 1997 *Safety of machinery. Safety-related parts of control systems. General principles for design*.

5 Regardless of which standard is used, the design must take full account of the level of risk reduction that the system is required to achieve. This is because, in principle, the required level of risk reduction will have a significant influence on the design techniques needed for reliability and tolerance to faults.

General principles of safety-related control system design

6 The design characteristics for reliability and fault tolerance of a safety-related control system must stem from the basic risk assessment carried out on the machine. This assessment will identify aspects of the machine's operation that create risks that may need to be reduced to an acceptable level.

7 Designers may employ a range of techniques to reduce the level of risk, many of which will not involve the use of safety-related control systems. For example, the use of fixed guards will prevent access to dangerous parts, and the provision of platforms and walkways will reduce the risk of falls from height. However, in many cases risks cannot be reduced to acceptable levels without incorporating safety-related control systems. In this case, the designer needs to understand and assess the contribution that these systems make to the reduction of risk, and the consequences for system reliability and fault tolerance. The more critical the role played by the safety-related control system, the more reliable and resistant to faults it must be. This property is known as the safety integrity of the system, which is a measure of how well the safety-related control system will perform the required safety function(s) under all stated conditions within a stated period of time. An adequate level of safety integrity may be achieved by a combination of:

- the reliability of the hardware and software; and
- the way the parts are combined in the design of the control system; and
- the use of diagnostic and testing techniques.

8 The designer should identify all the safety functions to be performed by the safety-related control systems and then specify their required safety integrity. This is known as the safety requirements specification and is of fundamental importance for achieving safety by design. The overall process is illustrated in Figure 31.

9 In designing a safety-related control system to achieve an appropriate level of safety integrity that is commensurate with its contribution to risk

reduction at the machine, consider the following:

- the reliability of the equipment that comprises the safety-related control system;
- the use of techniques such as redundancy and/or automatic diagnostics;
- how to prevent, as far as possible, faults in design and manufacture of hardware and software (eg software 'bugs' or faulty wiring);
- how to incorporate design features which may help the control system to recover from faults during operation (eg programme sequence monitoring);
- the behaviour of the safety-related control system under fault conditions (failure modes) and the desired reaction to these fault conditions;
- how to test the safety-related system(s) initially to show, as far as possible, that there are no design, or manufacturing or installation faults before the machine is put into operation;
- how to design periodic test and inspection procedures for the safety-related system(s) that can be applied periodically throughout the lifetime of the machine to show that no part (including both hardware and software) has changed or deteriorated beyond reasonable limits.

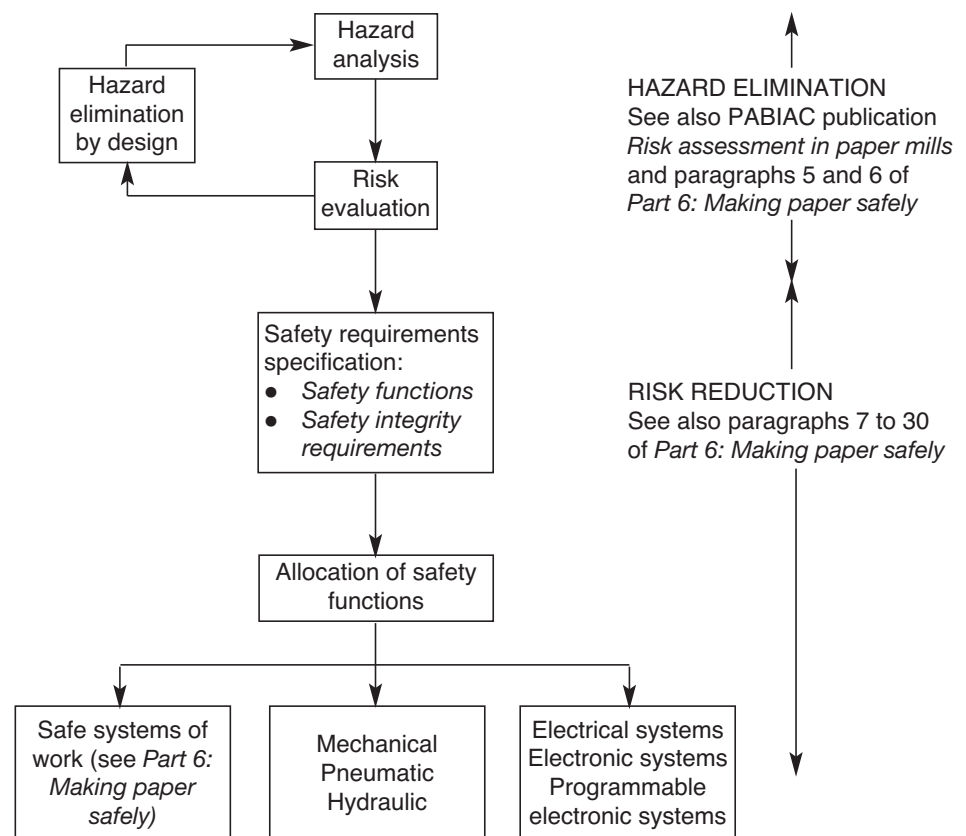


Figure 31 The risk control process

.....

10 These issues must be taken into account for all parts of the safety-related control system including hardware, software and the way that parts are combined during integration. Remember that the safety-related control system comprises everything necessary to carry out the required safety function (eg sensors, control logic and brakes).

Designing safety-related control systems

11 The following points aim to help the process of designing safety-related control systems:

- As part of the risk assessment exercise, determine which of the measures relies on a safety-related control system.
- For each safety function, determine the contribution required from the safety-related control system to achieve the necessary level of risk reduction.
- Draw up the safety requirements specification that relates the required safety integrity to each of the safety functions.
- Design the system, including the safety-related system.
- Validate the design to ensure that it meets the safety requirements specification. This should include consideration of the consequences of failures and may require the application of failure mode and effects analysis (FMEA) to the control circuits to determine the behaviour under fault conditions. (In the simplest form of FMEA the question 'What happens if a particular part fails to function as intended?' is asked.) The design should consider failures within purpose-built control units, such as electronic motor drives and any external to the drives. There are a number of standards on safety-related systems available that provide relevant guidance, the main two being BS EN 954-1 and BS EN 61508. It is essential that designers are familiar with these standards and are competent to apply their principles in practice.
- Document the process so that anyone who needs to can understand how and why the system meets the safety requirements.

12 These points are applicable to new machines, machines being refurbished to present-day standards and to older machines being reassessed for the purpose of improving safety.

Use of standards for safety-related control systems

13 The transposed harmonised standard BS EN 954-1: 1997 *Safety of machinery. Safety-related parts of control systems. General principles for design* provides requirements by which the safety-related parts of control

.....

systems of all operating media can be categorised in a qualitative manner according to their reliability and performance under fault conditions.

14 Guidance on the processes and procedures appropriate to the design and development of electrical, electronic and programmable electronic technology based safety-related control systems is set out in the basic safety publication BS EN 61508: *Functional safety of electrical/electronic/programmable electronic safety-related systems*. It provides guidance on all aspects of the design, development and use of safety-related control systems using the Safety Lifecycle Model (explained in BS EN 61508-1) to indicate the measures that should be applied from the conceptual design phase through to decommissioning. It describes quantitative and qualitative methods of control system analysis.

15 Machinery designers and/or control systems integrators should decide on the appropriate standard that can be applied to the safety-related control circuits (see Figure 32).

BS EN 954: 1997 *Safety of machinery. Safety-related parts of control systems. General principles for design*

16 This harmonised standard includes requirements by which the safety-related parts of control systems can be categorised in a qualitative manner according to their performance under fault conditions and where the behaviour of the system under fault conditions can be completely determined by analytical and/or test methods.

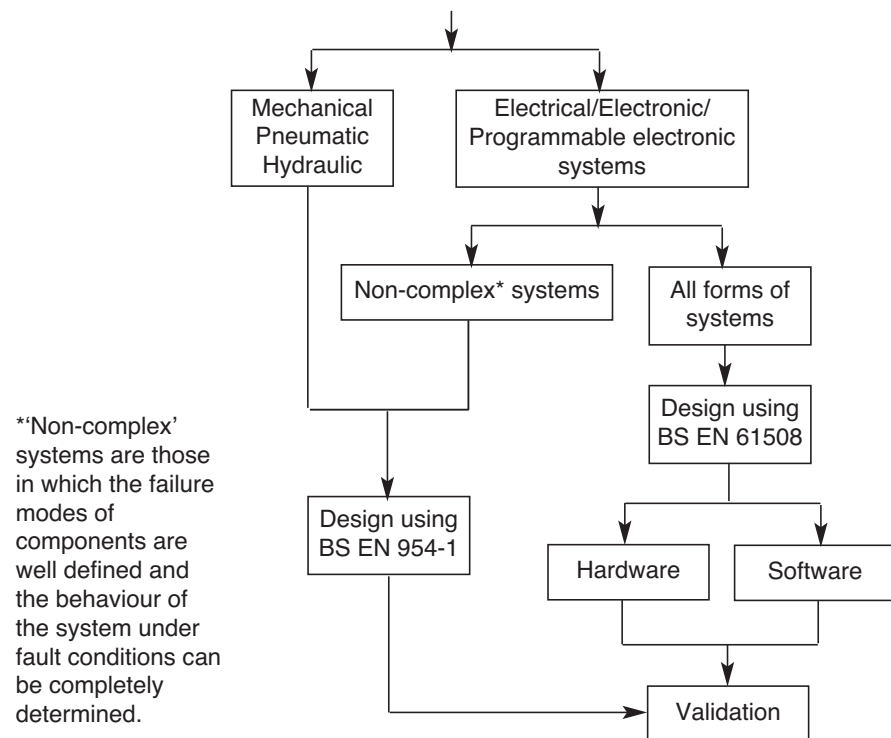


Figure 32 Use of standards

.....

17 The categories provide a basis for system design (in total or in part) according to the system's ability to resist the occurrence of faults and whether it will continue to perform its safety function after a fault has occurred. Fault resistance may be achieved by the reliability of the hardware and the way the component parts are combined in the design of the control system.

Categories of control systems used in BS EN 954-1: 1997

18 There are five main categories of performance of control systems in accordance with the standard, which are broadly:

Category	Basic requirements
B	Use of good engineering principles
1	Use of well-tried components and principles (reducing the probability of failure)
2	Incorporates a safety function check at machine start-up and may also be checked periodically (safety monitoring). A single fault may lead to the loss of the safety function
3	A single fault will not cause the safety function to fail (redundancy of hardware)
4	Two or more faults will not cause the safety function to fail (redundancy and monitoring)

Application of BS EN 954-1: 1997

19 It is important to bear in mind that safety-related parts of control systems may not neatly fit into a single category, particularly if they use different energy sources - a control system can incorporate electrical, electronic, programmable electronic, pneumatic or hydraulic devices.

20 The categories should not be regarded as hierarchical with regard to safety. For example, a single positively operated safety switch element, manufactured to a published safety standard will, itself, meet the requirements of Category 1 but not the criteria for higher categories. However, its level of safety performance may be considered at least as reliable as technologies that meet Categories 2 and 3. Therefore, the selection of categories for the safety functions on papermaking machines is a matter of judgement that should be based on the risk assessment and failure analysis.

21 Additional information can be found in BS EN ISO 13849-2: 2003 *Safety of machinery. Safety-related parts of control systems. Validation*³² on the validation of safety-related parts of machinery control systems that have been designed in accordance with BS EN 954-1: 1997 and published document PD CR 954-100: 1999 *Guide on the use and application of EN 954-1: 1996*.

.....

**BS EN 61508 Functional safety of
electrical/electronic/programmable electronic safety-related
systems**

22 This standard is a basic safety publication in the IEC and has been formally adopted within Europe but not harmonised to a specific Directive. It is regarded as the authoritative good practice in this field.

23 BS EN 61508 contains advice on the system hardware and software architectures aimed at achieving an adequate level of safety integrity. A quantitative analysis concept in BS EN 61508 is that of safety integrity levels (SILs), which specify the failure rate (for high demand and continuous mode safety functions) and probability of failure on demand (for 'on demand' safety functions) for each safety function. SILs range from SIL1 to SIL4, with the latter having the highest level of safety integrity. The failure rates allocated to SIL values are shown in the following table; this definition of SILs is most appropriate in machinery safety applications. The initial risk assessment process determines the SIL of a safety function, the analysis of the machine's safety requirements and the level of risk considered acceptable in the specific application. It is essential that a competent person carries out this analysis.

SIL	Dangerous failure rate of the safety function (per hour)
4	$\geq 10^{-9}$ to $< 10^{-8}$
3	$\geq 10^{-8}$ to $< 10^{-7}$
2	$\geq 10^{-7}$ to $< 10^{-6}$
1	$\geq 10^{-6}$ to $< 10^{-5}$

24 A SIL is assigned to each safety function in a safety-related control system and has a strong influence on the requirements that have to be taken into account during its design and integration. These measures, together with the calculation of failure rates for the safety-related control systems, are an integral part of the process of achieving a safe design.

25 Part 5 of BS EN 61508 gives examples of methods for the determination of SILs for allocation to safety functions. Note that the examples given in BS EN 61508-5 only illustrate general principles and should not be used directly without development to take into account the risk factors (especially tolerable risk) associated with specific applications.

26 A machinery sector implementation of BS EN 61508, IEC 62061, has been approved for publication as both an international standard and European Standard. IEC 62061/EN 62061 will provide machine designers with guidance on how to develop and validate safety-related electrical, electronic and programmable electronic control systems. It is likely that EN 62061 will have the status of a transposed harmonised standard under the Machinery Directive (98/37/EC). It is anticipated that it will be available as BS EN 62061 by mid-2005.

.....

Comparing SILs and categories

27 The fact that categories in EN 954-1 and SILs in BS EN 61508 both have allocated numbers 1 to 4 does not mean that there is a direct relationship between them. Both standards are written from different perspectives so SILs and categories are not comparable measures. Categories are not to be assumed as hierarchical measures for all applications but SILs are hierarchical because they relate to probabilities of failure.

28 As an approximation, the relationship between the required categories and SILs assigned to safety-related control functions to be implemented by electrical, electronic or programmable electronic safety-related control systems at a typical machine may be considered to be:

Category of safety-related control function in accordance with BS EN 954-1	Target failure measure for safety-related control function in accordance with BS EN 61508
1 or 2	SIL 1
3	SIL 2
4	SIL 3

29 It is very important to note that this approximation can only be used when considering the entire safety function that will be implemented by a safety-related control system at a papermaking machine. It does not apply to only a part of a safety-related control system.

Testing and preventative maintenance

30 To maintain safety integrity, all safety-related control systems should be tested regularly as part of a preventative maintenance strategy. For any particular safety-related control system, the frequency of testing should be determined taking into account the required safety integrity, the demand rate on the system, the degree of fault tolerance, and the diagnostic capabilities of the safety-related control systems. For example, consider a machine with an overspeed detection and protection system in which failure of the system could lead to injury in the event of the machine exceeding its maximum speed. It is likely that the demand rate on the safety function (ie prevention of speed above a set value) will be very low in normal operation and its design may be such that a potentially dangerous fault could remain undetected until a demand is placed on the system. In this type of safety-related control system, the overall safety integrity could be improved by arranging for the safety function to be tested as part of a routine maintenance programme at a frequency recommended by the designer, with instructions on the maintenance regime being included in the machine's documentation.

.....

Modifications to safety-related control systems

31 Typical reasons for modification of a safety-related control system include changes to the conditions of use, incident/accident experience, and modification of the machine or its operating modes. The following points are applicable when modifications are being made:

- The proposed modification should be assessed to determine the contribution that the modified safety-related control system will make towards risk reduction. The proposed modification should then be analysed to establish the impact on the hardware and software elements of the safety-related control system. This should include an appropriate review of the failure modes, particularly new failure modes that may be introduced by the modification, and their consequences for safety at the papermaking machine.
- Where it is agreed that a modification can be made without an adverse impact on safety, hardware and software changes to the safety-related control system should be processed within a structured work programme incorporating, as appropriate, specification, design, integration, installation, commissioning, and validation.
- The changes made to the safety-related control system should be documented and marked with appropriate version numbers and dates.
- Before re-instating the papermaking machine into normal operation, it is recommended that the modification work be reviewed by a competent person to ensure that the work has been properly implemented.

Programmable electronic safety-related control systems

32 In general, programmable electronic safety-related control systems on papermaking machines should make use of devices that have been specifically designed and assessed for use in safety-related applications. General industrial programmable logic controllers (PLC), or general-purpose computers and similar devices will usually not have enough safety integrity for safety-related applications unless additional measures are employed to protect against failure and the overall arrangements are assessed against relevant standards.

33 The safety integrity level (SIL) claimed for any PLC or similar device that has been supplied for use in safety-related applications should be equal to that of the most critical safety function that it performs. For papermaking machines, it is recommended that single PLCs and similar programmable devices used in safety-related applications should, in themselves, be capable of satisfying the requirements of SIL3 in accordance with BS EN 61508. This also applies to the application software (eg ladder logic, function blocks).

34 Programmable safety-related control systems contain software components so, as well as considering the design features needed to control

.....

the effects of random hardware failures, the designer must take steps to ensure that the software does not contain faults, known as systematic faults, that can lead to danger. Since it is generally recognised that software cannot be tested with enough confidence to detect all such faults, the preferred approach to minimising the likelihood of errors being introduced during the specification and development of the safety-related software is to ensure that the project is well managed within a structured framework, with progressive verification and validation of the software components throughout the development cycle including final development work during commissioning activities. It is strongly recommended that such work be carried out within a formal quality control system.

35 Within this structured framework, the accuracy and completeness of the initial specification for the requirements for safety performance in the control system is of fundamental importance. If the initial specification is at all deficient, the follow-on stages in the development cycle will not prevent systematic faults from being inadvertently introduced, regardless of how rigorously they are implemented.

36 A programmable safety-related control system at a papermaking machine may also include non-programmable technologies, such as electrical and electronic parts (eg gate switches, transposing relays etc). These parts normally have assigned safety performance categories to BS EN 954-1: 1997. Before they are integrated into a programmable safety-related control system it is important that the designer/integrator is able fully to determine whether their application will allow the safety function to achieve the appropriate SIL in accordance with BS EN 61508.

37 It is essential that work on the specification, design and development of programmable safety-related control systems is carried out by people who are competent in this particular field and who, in particular, are skilled in the concepts of capturing safety requirements, safety validation, safety-related system architecture design, hardware and software realisation, and project safety assurance. The Institution of Electrical Engineers, in conjunction with the British Computer Society, has published guidance on the competence requirements for people working in this field.³³

Non-programmable safety-related control systems

38 This type of safety-related control system does not contain programmable electronic parts, although it is recognised that systems implemented in non-programmable technologies may in themselves be quite complex in nature. They can include electromechanical relay-based systems, hydraulic and pneumatic systems, and mechanical systems that can be assessed using deterministic principles.

39 The general principles for the design of these systems are similar to those used for programmable electronic systems. This is because the requirements

.....

should be based on a fundamental assessment of the risks created by the machine and the extent to which the safety-related control system is needed to reduce those risks to an acceptable level, taking into account all other measures taken to control the level of risk.

Particular safety functions on papermaking machines

40 There are three particular safety functions on papermaking machinery that need to be given careful consideration - emergency stop, the speed-control system and pre-start warning device. There can be many other safety functions that will also need to be considered, including guard interlocking and hold-to-run control.

Emergency stop

41 The emergency stop function should be designed in accordance with BS EN 60204-1: 1998 *Safety of machinery. Electrical equipment of machines Part 1: General requirements* and BS EN 418: 1992 *Safety of machinery. Emergency stop equipment, functional aspects. Principles for design*. Stopping categories 0 or 1 may be used. Adequate environmental protection of the system hardware should be provided to reduce the probability of dangerous failures.

42 Since an emergency stop circuit can remain inactive for long periods of time it is important that the reliability and architecture of the design solution, and the maintenance and testing requirements, are such that there is a high confidence that it will function effectively on demand.

43 The emergency stop function should not be reliant on the correct operation of a machine control system that deals with other safety functions and where unrevealed failures in the control system would negate the operation of the emergency stop functions. In such cases, an independent emergency stop control system should be provided.

Speed-control system

44 The risks that occur in the event of overspeed at a machine arising from control system failure can be significant, particularly when the operator is working inside the hazardous area, for example to remove broke. The use of a hold-to-run or enabling device by the operator or an accompanying person will not eliminate the risks completely, so the control system should be designed, or modified, to minimise the risk of injury from:

- unexpected increase in crawl speed, hold-to-run speed or other pre-set low speed;
- unexpected start-up while machines are held at stop condition by the control system only, ie a Category 2 stop as described in EN 60204-1.

.....

45 Where reasonably practicable, to recognise a deviation from a set speed condition where danger could arise (including zero speed) design options should include one or more of the following:

- Monitoring techniques to enhance the safety features of the speed set point control circuitry and the reliability of the speed detection devices. Dangerous deviations detected by monitoring should initiate a safe stop.
- A speed reference tachometer/encoder/motion transducer or overspeed trip/detection device automatically set for use during slow speed or stop conditions. Activation should initiate a safe stop.
- Allow more time for machine operators to react by, for example:
 - modifying the acceleration or current limit control signals;
 - modifying inertia compensation control signals.

Pre-start warning device

46 Failure of a pre-start warning device could result in the machine being started before the waiting time has elapsed (ie people would not have enough time to leave a hazardous area on hearing the alarm) or the machine could be started up without a warning being sounded.

47 The aim should be to ensure that the pre-start warning system would have very high reliability and availability and be effective so that the warning signals can be recognised by all personnel who would be exposed to danger when machines are started.

48 The control system safety reliability considerations should include:

- monitoring of components so that recognised failures will prevent start-up;
- applying redundancy techniques to the safety critical parts of the warning system.

49 The effectiveness considerations should include:

- selecting the audible warning, or other warning indication device (including voice messages), so that it is easily understood by the workforce at risk, taking account of hearing impairment from medical conditions or use of hearing protection (PPE);
- where there are a number of separate machines, ensuring that each device dedicated to a particular machine is recognised by those at risk from the particular machine.

REFERENCES

- 1 *Working with ionising radiation. Ionising Radiations Regulations 1999. Approved Code of Practice and guidance* L121 HSE Books 2000 ISBN 0 7176 1746 7
- 2 *Buying new machinery* INDG271 HSE Books 1998 (Available free for single copies or in priced packs on ISBN 0 7176 1559 6)
- 3 BS EN 1034-1: 2000 *Safety of machinery. Safety requirements for the design and construction of paper making and finishing machines. Common requirements*
- 4 BS EN 1034-3: 2000 *Safety of machinery. Safety requirements for the design and construction of paper making and finishing machines. Winders and slitters, plying machines*
- 5 *Safe use of work equipment. Provision and Use of Work Equipment Regulations 1998. Approved Code of Practice (Revised)* L22 HSE Books 1998 ISBN 0 7176 1626 6
- 6 *5 steps to risk assessment* INDG163 (rev1) HSE Books 1998 (Available free for single copies or in priced packs on ISBN 0 7176 1565 0)
- 7 *Guide to managing health and safety in paper mills. Part 2: Risk assessment in paper mills* Part of PABIAC binder ISBN 0 7176 2942 2
- 8 BS EN 294: 1992 *Safety of machinery. Safety distances to prevent danger zones being reached by the upper limbs*
- 9 *Guide to managing health and safety in paper mills. Part 1: Application of the Provision and Use of Work Equipment Regulations to the paper and board industry* HSE Books 1996 ISBN 0 7176 1287 2
- 10 BS EN 954-1: 1997 *Safety of machinery. Safety-related parts of control systems. Part 1: General principles for design*
- 11 BS EN 60204-1: 1998 *Safety of machinery. Electrical equipment of machines. General requirements*
- 12 BS EN 418: 1992 *Safety of machinery. Emergency stop equipment, functional aspects. Principles for design*
- 13 *Guide to managing health and safety in paper mills. Part 5: Control of contractors in paper mills* HSE Books 2000 Part of PABIAC binder ISBN 0 7176 2942 2

-
- 14 *Safe work in confined spaces. Confined Spaces Regulations 1997. Approved Code of Practice, Regulations and guidance* L101 HSE Books 1997 ISBN 0 7176 1405 0
 - 15 *Safe work in confined spaces* INDG258 HSE Books 1997 (Available free for single copies and in priced packs on ISBN 0 7176 1442 5)
 - 16 *Guide to managing health and safety in paper mills. Part 4: Prevention of heat stress in paper and board mills* HSE Books 2000 Part of PABIAC binder ISBN 0 7176 2942 2
 - 17 *Safe use of lifting equipment. Lifting Operations and Lifting Equipment Regulations 1998. Approved Code of Practice and guidance* L113 HSE Books 1998 ISBN 0 7176 1628 2
 - 18 *Manual handling. Manual Handling Operations Regulations 1992 (as amended) Guidance on Regulations* L23 (Third edition) HSE Books 2004 ISBN 0 7176 2823 X
 - 19 *Guide to managing health and safety in paper mills. Part 3: Manual handling in paper mills* Part of PABIAC binder ISBN 0 7176 2942 2
 - 20 *Slips and trips: Guidance for employers on identifying hazards and controlling risks* HSE Books 1996 HSG155 ISBN 0 7176 1145 0
 - 21 *Workplace health, safety and welfare. Workplace (Health, Safety and Welfare) Regulations 1992. Approved Code of Practice and guidance* L24 HSE Books 1992 ISBN 0 7176 0413 6
 - 22 *Compressed air safety* HSG39 HSE Books 1998 ISBN 0 7176 1531 6
 - 23 *Lighting at work* HSG38 HSE Books 1997 ISBN 0 7176 1232 5
 - 24 *Personal protective equipment at work. Personal Protective Equipment at Work Regulations 1992. Approved Code of Practice and guidance* L25 HSE Books 1992 ISBN 0 7176 0415 2
 - 25 *Managing vehicle safety at the workplace* INDG199 HSE Books 1995 (Available free for single copies or in priced packs on ISBN 0 7176 0982 0)
 - 26 *Workplace transport safety: Guidance for employers* HSG136 HSE Books 1995 ISBN 0 7176 0935 9
 - 27 *Reducing noise at work. Guidance on the Noise at Work Regulations 1989* L108 HSE Books 1998 ISBN 0 7176 1511 1
 - 28 *Sound solutions: Techniques to reduce noise at work* HSG138 HSE Books 1995 ISBN 0 7176 0791 7

.....

29 *Noise assessments in paper mills* PBIS1 HSE Books 2000 (web only version available at: www.hse.gov.uk/pubns/papindx.htm)

30 *Noise mapping in paper mills* PBIS2 (web only version available at: www.hse.gov.uk/pubns/papindx.htm)

31 BS EN 61508: 2002 (Parts 1-7) *Functional safety of electrical/electronic/programmable electronic safety-related systems*

32 BS EN ISO 13849-2: 2003 *Safety of machinery. Safety-related parts of control systems. Validation*

33 *Safety, competency and commitment: Competency guidelines for safety-related system practitioners* Institution of Electrical Engineers 1999 ISBN 085296787X

FURTHER READING

Management of health and safety at work. Management of Health and Safety at Work Regulations 1999. Approved Code of Practice L21 HSE Books 2000
ISBN 0 7176 2488 9

Successful health and safety management (2nd edition) HSG65 HSE Books
1997 ISBN 0 7176 1276 7

Other British/European Standards

BS EN ISO 12100-1: 2003 *Safety of machinery. Basic concepts, general principles for design. Part 1: Basic terminology, methodology*

BS EN ISO 12100-2: 2003 *Safety of machinery. Basic concepts, general principles for design. Part 2: Technical principles*

BS EN 953: 1998 *Safety of machinery. Guards. General requirements for the design and construction of fixed and movable guards*

BS EN 1050: 1997 *Safety of machinery. Principles for risk assessment*

BS EN 1088: 1996 *Safety of machinery. Interlocking devices associated with guards. Principles for design and selection*

prEN 12437: *Means of permanent access to machines and industrial plant*

Part 1 - *Choice of a fixed means of access between two levels*

Part 2 - *Working platforms and gangways*

Part 3 - *Stairways, stepladders and gangways*

Part 4 - *Fixed ladders*

BS 4211: 1994 *Specification for ladders for permanent access to chimneys, other high structures, silos and bins*

FURTHER INFORMATION

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

HSE priced publications are also available from good booksellers.

British Standards are available from BSI Customer Services, 389 Chiswick High
Road, London W4 4AL. Tel: 020 8996 9001 Fax: 020 8996 7001.

Confederation of Paper Industries publications are available from
Confederation of Paper Industries, 1 Rivenhall Road, Swindon, Wiltshire
SN5 7BD. Tel: 01793 889600.

.....