Development of a multiskilling life cycle model

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Development of a multiskilling life cycle model

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Multiskilling is a mechanism by which companies can improve efficiency, reduce costs, improve quality, and increase production etc. Multiskilling was recently defined as 'a way of working where the traditional divisions between work areas and separate disciplines are removed, and individuals are given responsibility for a range of different types of task' (HSC, 1998). Typically multiskilling is not introduced with the aim of improving health and safety. A review of recent accidents and audit reports highlight the fact that poorly implemented multiskilling can have a deleterious effect on health and safety. This was verified in the six empirical case studies drawn from the rail, nuclear power generation, and chemicals manufacture sectors. On the basis of the case studies, literature review and recent accidents a life cycle model was developed. This life cycle model has been prepared to give practical advice to all those involved in the conception, planning and assessment, implementation and audit, and the ongoing skills maintenance & review of multiskilling. A series of checklists and guiding principles are included in this report to aid companies in the management of the whole multiskilling process.

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EXECUTIVE SUMMARY

The introduction of multiskilling within organisations is typically carried out with the aim of improving efficiency, reducing costs, improving quality and increasing production. Recent research reports that the majority of the case study companies had used multiskilling as part of their process of reorganisation. The companies that had adopted multiskilling were from a range of sectors. Typically these types of change are motivated on financial and business management grounds, with a danger that health and safety is overlooked.

This report aims to:

- find evidence of the safety impacts of multiskilling;
- give examples of how the health and safety aspects of multiskilling are managed in a number of case study organisations;
- develop management and implementation guidance based on empirical research
- ascertain adequacy of current HSE guidance.

The study involved:

- carrying out a review of the multiskilling research and published guidance, and identifying the role of multiskilling in a selection of major incidents and accidents;
- conducting an investigation into how multiskilling is managed and how multiskilling is implemented within a selection of case study organisations;
- developing an explanatory framework for the life cycle model of multiskilling, from inception through to implementation and sustained use;
- developing guidance based on the empirical research, and identifying the critical success factors, which affect the safe and effective use of multiskilling.

Main Findings

The review of research, accident reports, audits and case studies in Section 2 provides a comprehensive view of the potential risks associated with multiskilling and how to manage these. On the whole the empirical data from the case studies show companies recognise the risks of multiskilling, and have proactively managed the process of multiskilling their craftsmen and process workers. The exception to this was the case study where multiskilling occurred by default as a result of radical downsizing reducing the number of personnel available to carry out the tasks. In the main the companies studied showed a number of best practices in terms of risk controls and mitigating the deleterious effects of multiskilling on health and safety. The risk controls included:

- **detailed planning process**, including consultation with the staff concerning appropriate tasks to multiskill and ensure that risks are identified, and adequate and appropriate controls identified and implemented;

- **participative methods** to ensure workforce buy-in;

- **rigorous training** and **competency assurance systems**, including regular training needs assessment, a balance between on-the-job and off-the-job training, methods and standards of competence for staff to demonstrate their abilities against, including an awareness of their operating bounds;

- ensure that staff feel **comfortable** and **confident** to competently carry out the tasks, with the bounds of the formal competency assurance method;

- use of **performance reviews** and **task/competence frameworks** to ensure skills individuals are competent and confident in their job, as well as identifying any training or retraining required;

- **management understanding** of the capabilities of their staff, including the limits of their abilities;

- ensure that all staff are provided with **regular opportunities to use their skills**, otherwise these skills may degrade. This will include both their newly acquired skills and their core skills;

- **use of log books** and record keeping to ensure that records of practically carrying out tasks are kept, as a way of ensuring that skills are current;

- provide a **suitable context for organisational change**, including time for training, financial incentives for additional skill acquisition as well as flexibility during the transition period;

- ensure that **training is carried out** before any downsizing commences;

- In addition, other risk controls typically used by organisations to ensure safety is not jeopardised e.g. safety management, operating procedures, selection criteria etc.

Section 3 summarises the potential impacts of multiskilling on safety, and highlights the main issues for consideration, which include:

- Quality of work and the likelihood of error;

- Quality of supervision, task coordination and error detection;

- Workload;

- Resource flexibility, and;

- Job satisfaction and morale.

As can be seen from this list most of the issues are associated with the 'peripheral' aspects of multiskilling. From this it became apparent that the implementation of multiskilling initiatives is no different from any other sort of organisational change. Section 4 builds upon this and describes three aids developed to assist management in the initial proposal and conception stages, the aids are:

- A list of the 'Do's and Don'ts' of multiskilling;
- A characterisation of good and bad practice; and
- A manager's checklist.

Section 5 describes the lifecycle model of multiskilling and uses this framework to describe a detailed checklist of the issues to consider in the implementation of multiskilling. The life cycle is comprised of the following elements:

- Starting out;
- Planning and assessment;
- Implementation;
- Implementation Check;
- Ongoing review and Maintenance.

The section ends with a description of some of the methods that can be used to assist in the process of multiskilling. Examples of these include, task analysis, checklists, task competence frameworks etc. The next section reviews the main business reasons for multiskilling and the frameworks within which multiskilling would fall. There are two main reasons that multiskilling will be implemented, the financially motivated BPR and downsizing route, and the human resources Investors in People route.

Conclusions

This study describes a life cycle model based upon empirical case studies and a review of previous published material, and provides a series of checklists and guidelines to assist companies in their implementation of multiskilling. Findings from this research suggest that multiskilling is typically introduced as part of a series of changes aimed at reducing costs within the organisation, and therefore care is required to ensure that potential safety oversights are avoided. Previous incidents and audit reports show that safety can be jeopardised as a result of poorly implemented and managed multiskilling. The case studies reported highlight instances of best practice and show that multiskilling can be implemented in a systematic manner that does not jeopardise safety.

1 INTRODUCTION

1.1 BACKGROUND

Multiskilling is part of a raft of changes that organisations might introduce with the aim of improving efficiency, competitiveness, reducing costs, improving quality, increasing production and so on. 'Business re-engineering and health and safety management: case studies' (Wright, 1996) reports that eight out of the ten companies studied had used multiskilling as part of their process of re-organisation. The companies that had used multiskilling included: power generation, rail, chemical manufacturing, and aircraft maintenance.

The aims of the present study was prompted by:

- The fact that no previous research had been carried out which identified the health and safety impacts of multiskilling;
- A wish to consolidate existing research on multiskilling and related management practices.

The Oil Industry Advisory Committee produced a booklet entitled 'Multiskilling in the petroleum industry' (HSE, 1998). The booklet reports on good practice but does not provide information on the impact of multiskilling on health and safety, and did not provide case studies detailing the practical implications of multiskilling. This research provides an opportunity to check that the guide is comprehensive, and whether the best practice can be extrapolated to industries other than petroleum. Therefore this study aims to provide an empirical base for new or revised guidance on multiskilling.

This study focuses on the health and safety aspects of multiskilling in hazardous industries, such as chemicals manufacturing and oil refineries, although the findings and models may be of equal relevance to other sectors. Indeed, the case studies and accidents described in this report are drawn from the rail, marine, general manufacturing and nuclear power generation sectors.

1.2 OVERVIEW OF REPORT STRUCTURE

Section 1 provides an overview of the research rationale, along with a summary of where multiskilling is used, and a discussion of the relevant nomenclature.

Section 2 provides an overview of survey findings. This includes a review of the literature, a discussion of recent incidents and audit reports where multiskilling was criticised, and a discussion of key learning points found in the contemporary case studies.

Section 3 summarises the potential impacts of multiskilling on health and safety.

Section 4 provides management guidelines on how multiskilling is introduced and implemented.

Section 5 describes the life cycle model for multiskilling, as well as how multiskilling can be integrated into normal business planning and management.

Section 6 discusses the HSE's current assessment and guidance advice on multiskilling. New checklists for use by industry is offered in Appendix C. Whilst Appendices A and B is the question set used within the case studies and the detail from the case studies.

1.3 DEFINITIONS OF MULTISKILLING

The Engineering Employers Federation (EEF) defines multiskilling as 'the acquisition of additional skills, supplementing those already achieved in a given craft' (EEF, 1993). Whilst the Oil Industry Advisory Committee (HSC, 1998) defines multiskilling as 'a way of working where the traditional divisions between work areas and separate disciplines are removed, and individuals are given responsibility for a range of different types of task.' Incomes Data Services state that multiskilling is where workers are trained to undertake 'a limited range of functions in other trades, with due regard to safe working practices' (IDS, 1996). Furthermore they assert that it is not about making employees competent in two disciplines, but equipping staff with additional skills relevant to the efficient running of the business.

These definitions are skewed towards multiskilling craftsmen, which reflects the most common and widely recognised form of multiskilling. However, as will be highlighted by the survey findings in this report, multiskilling is also apparent amongst process operators and supervisory staff.

Fundamentally multiskilling can be considered as:

- increasing people's skills and competencies, and
- enabling and allowing them to carry out tasks previously or traditionally carried out by another function.

Organisations typically multiskill with the intent of removing functional barriers and increasing the flexibility of the workforce; it is rarely about the 'ideals of job enrichment and empowerment' (Economist, 1991) advocated by certain humanistic organisational change specialists. Multiskilling in the UK can be considered to be essentially job enlargement and 'skill broadening', using people to cover a larger proportion of production activities, with the intention being to reduce labour costs (Cockrill and Scott, 1998).

For the purposes of this review we consider multiskilling to fall into the following categories as defined by Cordery (1995).

1.3.1 Vertical Multiskilling

The extent to which supervisory or administrative support tasks are learned by individuals. For example a worker takes some element of management, e.g. production scheduling, quality control, purchasing etc. This could be a team leader or a member of a self managed team. It can be considered as a form of empowerment. This can also take the form of supervisors/team leaders taking on some of the skills and tasks of (say) fitters.

1.3.2 Horizontal Multiskilling

This is learning skills from another discipline or function within an organisation. For example an electrician learning some mechanical tasks or a process operator learning some maintenance skills. Horizontal Multiskilling can be considered as two main types:

- Skill broadening – where minor elements and tasks are learned on top of the predominant activity (major task). So expertise is maintained in the major task with elements added to increase efficiency. For example, a mechanical engineer may learn how to isolate and disconnect a motor to avoid the use of an electrician.

- Cross skilling/dual skilling – where another major activity is learned in addition to the main craft and a person is considered competent to carry out any activity in these two main disciplines. For example, multiskilled craftsmen considered competent to carry out both mechanical and electrical tasks. Typically some limits will be placed on the types of safety critical work that can be carried out.

1.3.3 Depth Multiskilling

This is the acquisition and application of more complex, specific skills within the same trade or discipline, for example a mechanical craftsman acquiring specific skills, such as expertise in hydraulic systems. Depth multiskilling may be used in companies where operators are multiskilled to carry out simple maintenance tasks. This frees time for maintenance craftsmen to carry out more complex activities. This type of multiskilling was not examined in detail during this study.

1.3.4 Multiskilled Teams

A multiskilled team is a group of individuals who collectively have a range of skills.The intent being to have a team, which is competent in all of the skills required to complete a job (IDS, 1997). There are two main types of multiskilled team, those composed of traditional single skilled individuals collected into one team and managed by one supervisor, or a team of multiskilled individuals. The intent is to have a team where the strengths and specialisms are combined, which increases the range of skills available to tackle certain issues.

1.3.5 Typical examples of multiskilling

Typical activities that staff are trained to carry out are briefly listed out here.

Multiskilling operators or process workers, for example, can involve equipping staff with the skills to:

- Help craftsmen with repairs;
- Move equipment using lift trucks;
- Collect spares/tools;
- Inspection and lubrication tasks;
- Troubleshooting.

Traditionally craftsmen learnt just one trade, for example being a mechanical fitter, or a control and instrumentation engineer, or an electrician. Multiskilling craftsmen can take a number of forms. Cross-skilling would be where, for example, an individual is trained in the other main discipline, and would be competent in both electrical and mechanical skills.

So an electrician would learn mechanical skills such as:

- pipework skills;
- basic manual handling;
- check monitoring;
- bearings and seals;
- basic access.

Whilst mechanical fitters may learn electrical skills such as:

- lighting;
- isolation and restoration;
- resets.

Other elements of multiskilling could be in the areas of instrumentation and laboratory testing. These types of multiskilling predominantly operate under normal working conditions.

Some organisations also multiskill to ensure that **incident management** is adequate and appropriate. In these situations individuals are equipped with adequate skills and knowledge to competently handle an abnormal or emergency situation. This type of multiskilling is used in incident management scenarios, where where it is imperative that there are the appropriate skills

to manage an incident or event at all times. This means that there has to be flexibility within the team to ensure competent cover for lunch and other breaks, as well as for training and holidays. Multiskilling staff in emergency management shares elements of vertical and horizontal multiskilling, where staff may have to assume a more senior role than their status traditionally allows because of the incident scenario.

1.4 SCOPE OF THIS STUDY

1.4.1 Aims

This study aims to:

- Find evidence of the safety impacts of multiskilling;
- Give examples of how the health and safety aspects of multiskilling are managed in a number of case study organisations;
- Develop management and implementation guidelines based on empirical research;
- Ascertain adequacy of current HSE guidance (e.g. HSE, 1998).

1.4.2 Approach

The approach to the study has involved:

- Carrying out a review of multiskilling research and published guidance, and identifying the role of multiskilling in a sample of major incidents and accidents;
- Conducting an investigation into how multiskilling is managed and how multiskilling methods are implemented within a selection of case study organisations;
- Developing an explanatory framework for the life cycle of multiskilling, from inception through to implementation and sustained use;
- Developing guidelines based on the empirical research, and identifying the critical success factors, which affect the safe and effective use of multiskilling.

2 SURVEY OF MULTISKILLING

The intent of this section is to identify a number of information sources to assist in the development of the lifecycle models for multiskilling and the management of health and safety to develop guidelines and information to assist companies in the implementation and management of multiskilling. This section reviews the literature, published incident reports where multiskilling was implicated as a causal factor, and case studies carried out to investigate contemporary approaches to the use of multiskilling.

2.1 PAST RESEARCH

2.1.1 Introduction

The literature was accessed through searches of international occupational health and safety databases. The key terms used to guide the search included: multiskilling, skill broadening, cross skilling, cross training, flexibility, minimal trade demarcation, competence, job enlargement. The databases searched were: HSELINE, CISDOC, NIOSHTIC, ABI/INFORM, SOCIAL SCISEARCH, SCISEARCH, PSYCHLIT, OPAC, MHIDAS, MICSEARCH.

The research found few studies that explicitly or specifically considered the health and safety aspects of multiskilling. Consequently general management literature was also reviewed with the aim of identifying generic issues and lessons learnt that may also apply to health and safety performance. The business literature considers many issues relating to the efficacy and success of multiskilling, which we believe could impinge on the integrity of health and safety in the workplace. The review considers the general effects of multiskilling with the aim of :

- Identifying the problems from multiskilling which may impact on health and safety
- Consider the drivers of multiskilling as it influences the approach and required focus of health and safety controls.

When considering the issue of management of occupational health and safety and multiskilling, certain other factors need to be considered, such as, safety culture, and the role of multiskilling in latent failures; as these impinge on the way in which the parties involved approach and regard workplace health and safety.

Finally the literature review is structured to reflect the multiskilling lifecycle as follows :

- Initial conception
- Imagining change
- Planning and enrolling support
- Implementation and Operation

By structuring the review around the lifecycle, findings can subsequently be fitted into practical management guidelines.

2.1.2 Safety Implications of Multiskilling

The literature includes a number of case studies of organisations that have multiskilled. These include surveys by Incomes Data Services, and the Engineering Employers Federation; as well as research by Wright (1996) and Lardner (1999) which examined organisations as part of research studies on business process reengineering and self managed teams. As previously mentioned, the general nature of past research means there are few firm findings specifically on multiskilling.

BP Baglan Bay, reported in IDS (1992), initially introduced both vertical and horizontal multiskilling in the late 1980s. It was not effective and did not achieve any productivity improvements. They relaunched the initiative, due to internal pressures for the site to remain competitive. A number of mechanisms were used to ensure that safety was not jeopardised as a result of the poor implementation of multiskilled teams, namely:

- Individuals only learn tasks which they will have to perform on a regular basis;
- The individuals will be rotated around the jobs in each team to ensure they keep their skills up to date;
- Stringent criteria are used to select appropriate people for multiskilling. Factors considered, included: experience, skills, qualifications, adaptability and attendance.

No health and safety performance measures were defined in the case study; however it was reported that the number of hours worked by staff had decreased, which potentially has a number of health benefits.

‘Paying for multiskilling’ (IDS, 1996) and ‘Multiskilling’ (IDS, 1994) both describe a series of case studies. Health and safety is mentioned as a key issue in the training and assurance of competent staff, however with the exception of one case study, health and safety is not used as a performance measure. British Steel at Scunthorpe, as reported in IDS (1994), found that their number of injuries fell by nearly a third. However this figure also matches a reduction in the site headcount by a third, so the impact of multiskilling on accident rates is unclear.

Performance measures typically used to assess the effectiveness of multiskilling, as gathered from the IDS reports, include:

- Productivity
- Absenteeism
- Speed of working
- Overtime
- Workforce attitude and motivation

- Customer complaints
- Delivery times
- Downtime, etc.

The IDS reports tend to indicate a positive change in performance, e.g. better productivity, and less absenteeism. A number of these performance measures are possible indicators of health issues, linked to stress, fatigue and overload. The implications of these improvements could be enhanced safety performance as stress is a known causal factor in accidents.

Wright (1996) carried out some work on business process reengineering (BPR), and carried out a series of case studies within companies undergoing BPR. Of these ten case studies, all but 2 had multiskilled as part of the process of reorganisation. However, as the intent of this work was to look at the safety aspects of BPR, the picture is unclear with regards to multiskilling and its effect on safety.

The HSE Offshore Safety Division commissioned work on the implications on health and safety of self managed teams, as reported by Lardner (1999). Under our definitions of multiskilling, self managed teams can be considered a form of vertical multiskilling. Four case studies were reported, one of the objectives of which was to gather information on the effects of their implementation on health and safety performance. Two of the case studies reported that safety performance remained unchanged, whilst one identified some health and safety improvements, but could not state whether this was a result of the introduction of self managed teams. The final case study had only recently introduced the change and could not assess the impact on health and safety. Opinion voiced by the managers and team members of the case study organisations was that safety had improved as a result of the introduction of self management, and believed this to be due to the increased involvement by the workforce.

2.1.3 Initial Conception

There are a number of reasons why organisations decide to multiskill; these predominantly fall under the following headings:

- Organisational flexibility;
- Reduced labour costs;
- Reduced downtime /Streamlining maintenance activities;
- Human Resourcing Issues.

This section reviews the motives for management carrying out multiskilling and discusses the potential effects of this upon health and safety. The potential health and safety impacts are identified by inference from more general psychology and human factors research, and are offered as the researchers' opinion. It is important to understand the motives for multiskilling as the organisational objectives for multiskilling will affect the approach and potential health and safety impacts.

Organisational Flexibility

An EEF survey (1993) identified employee flexibility as one of the key benefits of multiskilling. This is supported by work by Kogi (1995), IDS (1997), and Parker & Wall (1998). Flexibility, in the form of multiskilling, is where individuals are competent in several tasks, and therefore can move from job to job to provide cover for absence and training. As in all forms of multiskilling this is linked to the reduction of functional demarcations, and it can encourage individuals to gain more individual skills, leading to a more highly skilled and adaptable workforce. IDS (1996) report that Eastern Group extended 'limited senior authorisation' so that craft employees perform certain authorisation duties previously carried out by engineers. Linked to the issue of flexibility is the importance of companies recognising that it is inefficient and expensive to have operators skilled in all tasks. Additionally IDS (1997) report that the companies they surveyed recognised the safety implications of individuals not using their skills frequently enough.

There are a number of potential health and safety impacts that can be inferred, including stress and loss of competence in the key tasks. Efforts must be made to ensure that individual's skills and competencies are current, and that individuals understand the competence limits within which they can operate. It is also important to ensure that efforts are made to ensure competence is maintained in all tasks. Furthermore organisational flexibility should not be at the expense of individual health through overloading and a perceived lack of control and competence. Working beyond ones' limits is a known stress factor.

Reduced Labour Costs

As IDS (1994) identified, one of the tangible benefits from multiskilling is that companies can reduce their headcount. Multiskilling, by equipping personnel with the skills to carry out a greater variety of tasks, means that employment levels can be reduced. This is also the case in organisations where multiskilling was not a deliberate organisational strategy, for instance where the company has reduced its headcount, and multiskilling, therefore, is a necessary consequence of 'organisational coping'. Cockrill and Scott (1998) report that multiskilling is often a reaction to a reduction in personnel rather than a deliberate strategy. Cross (1986) found that the direct labour costs were reduced by between 20 and 25% following organisations' implementation of multiskilling. A further benefit of multiskilling and reduced labour costs is the widely cited reduction in overtime (Brinley et al, 1999; IDS, 1994; EEF, 1993).

If reduced cost is the main motivator for multiskilling there is the danger, as highlighted in accident and audits noted later in this report, that the necessary planning and investment will not be made, and training and retraining could be inadequate and inappropriate for individuals to safely and effectively carry out their jobs (e.g. Cockrill and Scott, 1998). This is of particular concern in high hazard organisations where the consequences of poorly executed work on safety critical tasks are high. Furthermore it is possible to infer that as companies reduce staffing levels there is a danger that individuals become overloaded, and that stress and occupational ill health could result.

Reduced Downtime/Streamlined Maintenance Jobs

Multiskilling of operators in simple maintenance activities is frequently carried out as a proactive way of reducing downtime (IDS, 1996). Process staff may be taught how to inspect their equipment at the start of the shift as well as basic fault detection, lubrication and troubleshooting. In this way process operators are reducing the likelihood of downtime, as well as actually reducing downtime by assisting maintenance personnel to carry out maintenance tasks. Furthermore, a multiskilled craftsman can carry out the isolation, disconnection, repair, reconnection and recommissioning of motors and pumps. Previously this might have involved the attendance at some stage, of both an electrical and a mechanical craftsman. Now a multiskilled craftsman, whatever their original core trade, is able to undertake the task, again limiting waiting time. Cross (1986) reported that multiskilling improved the speed of application of a correct response to frequent, short duration faults, which added between 5-17% more production time.

When organisations multiskill with the aim of decreasing downtime there is are potential safety issues linked to:

- Issuing permits to work. Traditionally permit to work systems require supervisors to issue permits to avoid protect against error and negligence. It is important to verify that the system is robust, and that independent checks are still carried out following multiskilling (IDS, 1996);

- ensuring there are adequate and appropriate checks and balances in place so that work is carried out to an adequate and appropriate standard;

- increased effort to ensure that skills are adequate and staff competent in their multiskilled role.

Human Resourcing Issues

There are a number of other human resources issues that motivate multiskilling. These include personnel development and enhancing skills sets, empowerment initiatives, increasing job security, reduction of trade demarcations, and weakening the power of trade unions. When multiskilling is introduced with the intent being a positive step to improve individuals quality of working life, there is some evidence that suggests that better mental health and increased job satisfaction among employees will result (Parker & Wall, 1998; IDS, 1996). Furthermore it has been reported that:

- multiskilling and the introduction of multiskilled teams can provide job security and identity for employees at a time of major change (IDS, 1997).

- some companies report increased ownership and employee involvement in the production process as an additional benefit to multiskilling (IDS, 1994).

It is unclear how this interacts with increased workload and the other criticisms levelled at multiskilled organisations. Osaka (1996) states that:

> *"Although such organisational changes have usually been introduced at the initiative of the employer, they contain elements which satisfy workers' aspirations to more fulfilling work because they tend to replace organisation based on monotonous, repetitive and fragmented work by organisation relying on employee initiative and versatility."*

Thus Human Resource driven multiskilling may offer positive health benefits, but increased workload and a reduced headcount may reduce these.

2.1.4 Imagining Change

Once the decision to multiskill has been taken the next step is to imagine change, which involves considering how multiskilling will affect the organisation. Kinnie and Staughton (1994) define three possible approaches to implementing change, and considering the impacts on the organisation:

- 'wait and see'
- 'learn as you go'
- 'predict and pre-empt'

The first option, 'wait and see', is fundamentally reactive. It involves dealing with implementation, in a fire fighting ad-hoc manner, handling problems when they emerge. Research carried out by Kinnie and Staughton (1994) found that companies who adopted this approach typically demonstrated:

- Lack of ownership by the workforce;
- An unwillingness to invest resources in the change process;
- Lack of recognition of the importance of training staff, and inadequately trained staff;
- The characterisation of troubleshooting and a lack of interest in the system when problems arose.

'Learn as you go' is basically about developing rules of good practice based on the basis of experience as you implement. So there is an absence of thought out strategy. This method requires good communications and feedback strategies. Kinnie and Staughton (1994) describe a company which successfully introduced multiskilling in this way. Management deliberately took a long term cultural view, seeking workforce attitudes amenable to change, which meant there was widespread ownership of the scheme. Furthermore the 'learn as you go' approach limited the start-up costs of implementing the system.

‘Predict and preempt’ is the final approach where the emphasis is on implementation and the content of the changes involved. Fundamentally the company has in place a series of facilitating measures covering education, training, payment and staffing. This scheme also aims to create ownership of the issues.

This work by Kinnie and Staughton (1994) highlights the different approaches that can be taken by companies and the problems and issues that can result from failing to adequately envision the effects of change on the organisation. Key decisions to be made therefore concern:

- vision/imagination – what are the things that the company wants to achieve ?
- risk taking – what are the levels of risk that the company is prepared to accept, to : health and safety, to the business, to the site ?
- persuasiveness – how can the workforce been persuaded to participate and be involved in the process;
- perseverance – recognise that the process of change will be long and that a concerted effort over a number of years will be required.

Of the approaches to change, proposed by Kinnie and Staughton (1994) ‘predict and preempt’ appears to be most consistent with the notions of risk assessment and safety management. This is of particular importance and relevance on major accident hazard sites where control of the hazards is essential to prevent accidents occurring, which involves the systematic identification and control of hazards. Control of hazards is frequently linked to the competence of the staff, and therefore carrying out the predict and preempt should ensure that a multiskilling initiative is adequate and appropriate and does not jeopardise the safety of an organisation. The ‘wait and see’ approach is completely inconsistent with the idea of systematically managing and controlling risks, and would appear to violate the legislative framework.

2.1.5 Planning and Enrolling Support

The next stage following the decision to multiskill is the detailed planning stage. An essential component of this is enrolling support and consulting with all relevant parties. This typically has a number of elements:

- Consider the wider context
- Consult the workforce and enrol support for the process

Enrolling Support

Consider the wider context

The wider context needs to be taken into account during the detailed planning stages. This involves considering how the multiskilling initiative will fit within the organisation and operating environment. This therefore involves considering:

- Human Resource agreements;
- Organisational Culture;
- The context of proper communication of multiskilling aims and the importance of buy-in by stakeholders;
- The technical and social systems and whether they are consistent with the proposed multiskilling.

In companies with union representation it is important for union agreements to be in place to ensure that changes to work organisation can be made. When ICI Chemicals multiskilled they had an agreement with the initial aim of 'a fundamental change in the approach to getting work done in a safe and effective way, moving from traditional attitudes of work ownership' (IDS, 1994). Furthermore IDS state that a multiskilled programme necessitates the consent and commitment of employees and may only be achieved after exhaustive negotiation between management and unions. A number of companies surveyed and reported by IDS (1994) state that enabling agreements were put in place first, and that some of these incorporated safety aspects. Annualised hours is a change in working conditions that a number of firms had introduced alongside multiskilling, as it provides time for training (IDS, 1997).

Consultation

Enrolling support is basically about convincing individuals within the organisation to cooperate and participate in the proposed changes. Enrolling support will be more effective if the consultation process has meant that the decisions made are perceived as adequate and appropriate. The EEF (1993) state that 3 strategies are required to persuade employees and unions to accept multiskilling, these are: full consultation, incentive schemes, and an understanding of the economic climate. They state that the former is the most effective way of achieving successful implementation. Linked to this though is the importance of the workforce understanding that multiskilling is not just a means of cutting jobs, as pointed out by IDS (1997), which means that fear will need to be overcome.

Crucial consultation elements are:

- Organisational awareness;
- Encouraging participation;

- Empowering the workforce;
- Feedback to the workforce concerning the outcomes of the consultation process;

If these steps are carried out then it increases the likelihood of ensuring that the workforce will participate in the changes, and that the changes will be effective. These recommendations concerning consultation and support are entirely consistent with the consultation requirements advocated by 'Successful health and safety management' (HSE, 1997b).

Detailed Planning

Guidelines for job redesign with respect to multiskilling and the detailed planning mirror traditional human factors guidelines for work redesign (e.g. Hackman & Oldman, 1980; Kirwan, 1992).

Specifically concerning multiskilling, Cross (1986) defines the factors that need to be considered when planning, as follows:

- Complexity of tasks
- Working environment/conditions
- Duration of tasks
- Frequency with which tasks must be undertaken
- Skills and knowledge required to undertake tasks competently
- Number of tasks
- Work allocation and supervisory procedures
- Method of progressing interlinked tasks
- Required speed of response to tasks arising in order for them to be done
- Human resources required to undertake tasks
- Variety of tasks arising
- Additional resources required to undertake tasks
- Health and safety regulations and restrictions
- Physical size of the plant on which tasks arise
- Accuracy and precision with which tasks must be undertaken
- Impact of incomplete and/or poorly undertaken tasks

- Frequency with which technical advice and assistance is required to undertake.

Other elements to consider include:

- Identification of tasks that are routine and non-routine tasks, as well as activities carried out under normal, abnormal and emergency conditions.
- Optimise the technical and social systems in the work design (Butera and Thurman, 1984).
- Define the knowledge and skills required for multiskilling (British Steel used Task Analysis to achieve this (IDS, 1997)).

These issues should be considered when carrying out the detailed planning in consultation with the workforce to ensure the multiskilling initiative is adequate and appropriate.

2.1.6 Implementation and Operation

Training and Competence

Following the detailed planning stages of multiskilling, one of the first steps in implementing is to train staff up in the requisite activities, and then ensure that the training has equipped individuals with the necessary skills and knowledge to competently and safely carry out the tasks. In terms of training and competence, the available published material all highlighted the role of safety. Unison (1997) states that for multiskill programmes to be effective, employers must invest in training programmes which encourage staff to set their own training objectives and identify their own needs through personal development plans.

Key elements for the successful training and assurance of competent staff include:

- Definition of what needs to be trained;
- Off the job training, perhaps selecting NVQ units, or designing around the required skills;
- On return to the workplace use log books to record activities carried out;
- Following a period of on-the-job training, an assessment and validation of competence is made;
- Refresher training
- Review of training programme for adequacy.

From the case studies published (Wright, 1996; IDS, 1994, 1996, 1997) these seem to be common elements to the majority of firms implementing multiskilling. The manufacturer CPC (as reported in IDS, 1994) incorporated an additional stage, where following off the job training,

trainees were given an induction programme. This provided an opportunity for trainees to discuss the training received to date, the safety standards required, as well as being given a guided tour of the factory to become familiar with the areas and equipment in which they would be able to work when fully trained.

The IDS (1994) state that the extent to which an individual feels able to apply their newly acquired skill may in reality be a question of confidence as much as ability. They also emphasise that a crucial part of training is for an 'individual to know the limits of their skills and abilities: safety is always paramount.' A crucial element of effective multiskilling is linked to the organisational culture and the workforce feeling empowered and confident that they can refuse to do work, which they do not feel competent to perform. Furthermore staff will not be experts in their new skills and therefore must have a good understanding of the limits of their new abilities and skills.

From these guides it can be stated for the safe and effective implementation of multiskilling, it is important that:

- staff are trained,
- and are independently assessed (e.g. by management) as competent in terms of using their skills, and being aware of appropriate safe systems of work,
- and staff feel confident in using their newly acquired skill;
- understand the bounds within which they work;
- regular use of skills;
- updating of skills and refresher.

Ongoing Management

Following training and the determination of competence it is important that skills are used and maintained to avoid stagnation and deskilling. This involves ensuring that individuals carry out the tasks which they are trained to perform. An element of this is ensuring that supervisors and first line managers are fully aware of the new skills acquired by the workforce and make sure that staff use them. A mechanism used by Birds Eye Walls and BP Chemicals had supervisory management attending training courses and therefore being aware of what was taught (IDS, 1994). This enabled supervisory management to have an understanding of the skills and competency of their team, and to more effectively allocate work according to skills and abilities.

To assess the effectiveness of multiskilling it is important that a mix of subjective and objective performance measures are used. Wall and Clegg (1981) suggest using some of the following:

- Job satisfaction
- Motivation

- Organisational commitment
- Mental health
- Performance
- Turnover
- Skill variety
- Health and safety
- Financial Performance

Measuring performance is crucial to ensure that lessons can be learned and modifications made in the light of this. Again this is consistent with safety management guidance (e.g. HSE, 1997b) and the profile they place on active and reactive monitoring systems.

2.1.7 Conclusions

Very little information was found in the research literature which looked at the effects of multiskilling on health and safety. Also, much of the research and management guidance fails to address vertical multiskilling, and the potential implications of this on health and safety. A number of case studies are described in the literature which highlight the importance of emphasising health and safety when training staff.

The review also indicates that the type of potential health and safety problems are dependent on the business motives for introducing multiskilling. Accordingly, it is important to understand the motives for change as the choice of control measures should match these motives.

The review of management guidance also suggests that there are many analogies/commonalities between ‘good’ business planning of multiskilling, and ‘good’ health and safety management. Accordingly it is reasonable to suggest that those ‘good’ management techniques should also apply to the health and safety aspects of multiskilling.

Finally the review identified some distinct phases of change against which guidance can be matched namely:

- Initial conception of multiskilling, including an understanding of the management objectives;
- Imagining change, the next step whereby the implications of multiskilling on the organisation is expanded;
- Planning and Enrolling support – the importance of ensuring that stakeholders are consulted and that the detailed plan is developed in association with the workforce;
- Implementation and Operation – covers the key issues concerning training and the ongoing management.

- Review of Implementation – covers reviewing the effectiveness of the whole multiskilling process and modifying where appropriate.

Notwithstanding the limitations of past research, the review indicates that potential problems linked to multiskilling initiatives include:

- Individuals not competent to carry out their appointed tasks;
- Organisational culture whereby staff are expected to carry out tasks regardless of whether they feel adequately equipped to do this;
- Overloaded and overworked staff, potentially resulting in occupational ill-health and stress, and an increase in the probability of mistakes;
- Failing to ensure that staff carry out the activities that maintain skills and knowledge;
- Inadequate administrative safety controls.

2.2 LESSONS FROM ACCIDENTS

2.2.1 Overview

A sample of major accident reports has been reviewed to identify if and how multiskilling contributed to the incident. Before moving to consider those incidents involving multiskilling it is pertinent to note that:

- There has always been an element of multiskilling, such as shift managers acting as incident controllers.
- Errors on the part of "traditional" operatives, such as fitters, have contributed to a series of major accidents, such as Piper Alpha. Obviously task specialisation does not remove the risk of error.
- Supervision, training and competence problems are associated with both multiskilled and "traditional" teams.

Also, it can be noted that the multiskilled train drivers/staff involved in the 1997 Eurotunnel HGV fire performed reasonably well whilst the multiskilled Railway Control Centre staff made mistakes mainly due to the overly complex procedures, poor equipment layout, lack of emergency exercises and inadequate staffing levels. Multiskilling did not appear to contribute to the RCC mistakes.

Nonetheless, the review of past accidents does indicate that the introduction of multiskilling has been associated with a number of serious safety problems. These problems relate to:

- Workload problems arising from the reduction in staffing "made possible" by multiskilling:

- The loss of co-ordination, error checking and supervision arising from deficient team work within multiskilled "leaderless" teams:

- Failure to support introduction of multiskilling through appropriate staff training and performance monitoring.

Thus, the problems arose from either the way in which multiskilling was implemented or by changes "made possible" by multiskilling, rather than by individuals committing errors in tasks previously completed by other trades / disciplines. Accordingly, it could be argued that the problems are due to a failure to handle the team-working / supervision / competence issues created by a new form of workforce organisation rather than with multiskilling per se. The introduction of multiskilling (especially vertical multiskilling) leads to a new set of issues that are not always recognised or managed effectively.

Finally, the investigation into the Kegworth aircraft crash shows that as technology becomes more complex there may be a need to narrow the range of tasks a person is expected to perform. The report cast some doubt on the possibility of increasing pilots' technical knowledge in line with the increasing complexity of aircraft and cautioned against attempting to broaden their expertise. This observation suggests that the level of technical complexity may impose a limit on the extent of multiskilling.

2.2.2 Southall Rail Accident

The failure of the Automatic Warning System (AWS) was a contributory factor to the Southall collision on the 19th September 1997 (Uff, 1999). A fault with the AWS had been reported on the 18th September: the AWS signal would not cancel. However, testing at the depot did not reveal the fault and the train was passed into service. The AWS in the London end of the set subsequently failed and was isolated by the train driver. The train subsequently went through a signal at danger and collided with a freight train.

It was discovered after the accident that there was an intermittent fault on the AWS, namely polish was found on the AWS reset plunge switch. The failure at the depot to replicate and correct the fault occurred for many reasons, most of which appear unrelated to multiskilling. Firstly, there was no test available at the depot to detect this particular type of fault at the time. Therefore, even if depot staff had correctly applied the fault-testing procedures designated at that time, the fault would have remained undetected. More generally, the inquiry found that GWS Trains did not attach sufficient importance to the AWS/ATP. This attitude contributed to a series of unsatisfactory practices, including failing to:

- withdraw from service trains with faulty AWS,

- ensure a working circuit test box was available at the depot,

- develop a complete set of AWS fault detection tests and;

- train all maintenance staff in ATP.

Also, the training of depot staff on the specifics of train maintenance was weak in that there was no competence assessment and, whilst staff possessed the necessary trade qualifications; train specific maintenance training did not augment this. The inquiry revealed that whilst some staff were aware of the need to complete two AWS tests (a magnet and circuit test), some staff believed only the magnet test had to be completed before a train could be passed back into service. Competence "assessment" was reactive. A problem would be declared only if the number of defective trains increased.

Notwithstanding these points, depot staff committed a series of errors and omissions that the inquiry related to the introduction of multiskilling. Whilst these failures did not contribute directly to the accident, they did constitute errors in the completion of safety critical work and hence indicate how multiskilling has the potential to contribute to a major accident. They failed to:

- Complete a circuit test on the AWS - a magnet test was completed but the required circuit test was not (although this would not have detected electrical resistance problem);

- Replace the defect book in the train cab – the defect book (that allows faults to be communicated to depot staff and other drivers) was full and should have been replaced with a record of any faults in the train cab;

- Place a seal on the AWS isolation unit – five seals were found in the train cab at the accident site suggesting that someone simply forgot to apply one;

- Complete a "work arising sheet" or a maintenance log - this would have given GW Trains the opportunity to realise that there was a recurring intermittent fault on the AWS;

- Sign off the log counterfoil.

This meant there was no record of the fault or work done, nor was it communicated to the train driver.

In addition, the AWS test work was not started until other tasks had been completed. Accordingly the test was delayed until well into the shift, allowing time pressures to arise on the AWS test. The test was delayed in part by the late discovery of the fault report in the defect book and other factors such as the general lack of concern over AWS. However, the inquiry inferred that the test work was delayed in part by the work overload (busy night and person off sick).

GW Trains aimed to increase the productivity of the depot from their estimate of 50% to 60% (where fitters are busy for only 50 to 60% of a shift). Accordingly they designed and ran a pilot team trial at the depot. This included:

- reducing job demarcations;

- introducing multi-skilled teams, and;

- reducing the number of fitters from 6 to 4.

As part of this the supervisor became a team leader and would assist in (fitting) completing work (as a team member) when required. Also, in theory other members of the multiskilled team could help out.

The inquiry identified a series of concerns and problems with the way in which multiskilled teams were introduced and how they subsequently operated.

Reduction in staff "made possible" by multiskilling, i.e. fewer fitters.

In theory there were enough staff to complete the work. However, the inquiry contested whether, with four instead of six fitters, there were sufficient staff to handle peak workloads and / or allow for staff absence. Staff reported at the inquiry that they had raised fears about the pilot scheme, including lack of training, work overload (especially on busy nights) and insufficient allowance for people being off sick. The issue therefore is about ensuring there are systems in place to recognise workload peak and performance shortfalls, and modify operations accordingly.

Deficient supervision due to "vertical multiskilling".

The inquiry noted that:

> *"Mr Francis (the supervisor), as a result of working with the fitters, had difficulty in carrying out his supervisory duties as well as completing the paperwork" (p68).*

The inquiry noted that the supervisor was still working on a train at the end of the shift whilst other staff were ready to clock off.

Lack of training required to facilitate multiskilling.

The team leader had not been trained in team leadership despite a risk assessment concluding that such training must be done as team leader was a safety critical role. GWS Trains stated that team leader training was optional.

Lack of monitoring of team trial.

There was no active monitoring of the depot performance at all. GWS Trains declared the trial a success just so long as maintenance work was completed on time and there were no reported major defects. There was no monitoring of the quality of work. Staff (according to GWS Trains) had the "opportunity" to give feedback but were not prompted to do so.

It is inferred that:

- As the team leader was also a fitter the team lacked co-ordination and supervision. In particular, the standard of error checking and checking that tasks had been completed was inadequate.

- Proper supervision of work, including checking that tasks have been completed and paperwork done properly, would have captured these omissions and perhaps prioritised work in accordance with its safety significance.

- The reduction in staff levels created workload problems.

- The failure to "enable" multiskilling through proper training and monitoring contributed to performance problems.

2.2.3 Explosion and fire at the Texaco Refinery, Milford Haven.

Process upsets led to an overload of the flare knock-out drum (HSE, 1997a). The overfilled vessel forced liquid into a (corroded) discharge pipe that broke at an elbow bend, releasing 20 tonnes of highly flammable hydrocarbon, which formed a vapour cloud and exploded.

Whilst many factors contributed to the incident, staff attempted to keep the unit running rather than shutting it down. The investigation reported that was because they failed to take the necessary overall perspective, concentrating instead on local, immediate symptoms.

The failure to take an overall perspective occurred for a number of reasons. One important factor was the control system design. There was:

- no overview of the process,

- a deluge of alarms,

- wrong signals from controls (e.g. a false signal that a valve was opened).

Control panel graphics did not provide process overviews and there was no view of the process mass balance. The process was broken up into discrete sections with one panel/screen per section.

However, the HSE report of the investigation also found that the way that multiskilled teams were introduced contributed to staff behaviour:

> *"The flexible, multiskilled team on the FCCU contained individuals capable of fulfilling more than one job function. In upset conditions it was normal for all levels within the management structure to 'help out' in the control room. This flexible approach to operating control systems can be beneficial, but raises some potential control problems. Where more than one operator is working, an increased emphasis on communication is required to ensure that each is working with the team, and contradictory operations are avoided.*

There was the risk in this serious upset that, as people at senior level helped out, they took on operating roles rather than an overview of the whole process. Decisions were made on an individual, too reactive, rather than a fully co-ordinated basis" (p26).

"Some managers and supervisors were involved in 'hands-on' operational matters instead of performing a strategic and diagnostic role. This resulted in action being concentrated on the symptoms of the problem, and not the causes" (p35).

Thus, the manner in which multiskilling had been introduced had eroded teamwork/co-ordination, i.e. there was insufficient supervision of the response with no one individual "standing back" to check that the event had been correctly interpreted and an appropriate response was being enacted.

Subsequent to the accident, Texaco completed training on the roles and responsibilities of operators, supervisors and managers and employed situational analysis techniques to assess manager's ability to cope with upset conditions.

2.2.4 Collision of the mv Sand Kite with the Thames Flood Barrier

On the 27th October 1997 the mv Sand Kite, a 98m long dredger with 3,000 tonne of sand and gravel, struck the Thames Barrier whilst travelling up-river in thick fog. She was holed, started to take on water and subsequently her bow sank and came to rest on the riverbed on top of the housed barrier gate.

The investigation concluded that the accident occurred as a result of a navigational error by the master (DETR, 1999). This was partly caused by poor bridge management. In particular, the master had overloaded himself by failing to have sufficient personnel on the bridge. In addition, there was nobody in a position to monitor the master's navigation.

Despite the known presence of fog, the limitations of the master's pilotage exemption certificate (which was not valid for this part of the river) and the limitations of the equipment, the watchkeeping routine for the pilotage up the river remained unchanged from that generally operated in clear visibility. The norm is for two persons to man the bridge, one to navigate and one to take the wheel and steer. At the time of the accident the master and the senior mate manned the bridge. The mate, in addition to steering the vessel, acted as lookout, as best he could. The master's attention was focused on navigation and giving helm orders to his mate as well as monitoring the VHF, maintaining a lookout and performing more general duties as both the master and the pilot.

Due to poor visibility the mate on the helm was reliant on directions from the master, i.e. they were navigating "blind". The master though did not have a direct line of sight of the radar and the map display on the VDU was insufficiently accurate to be used for safe navigation.

The evidence in the investigation revealed that the master failed to:

- Recognise the probability that he would not see the barrier lights until 0.2 miles range;
- Ensure the lookout was posted forward;

- Appreciate his order to “come slowly to port” was insufficiently precise bearing in mind the helmsman had little or no other information;

- To appreciate the slowness of the turn.

As the mate was being used as the helmsman and lookout, he was unable to contribute fully to the navigation of the vessel. This was not the best use of his expertise and left the ship exposed to errors by the master.

Notwithstanding explicit instructions for a lookout to be posted, the master considered there was little value in having a lookout as the river had narrowed and the last fairway buoys had been passed.

Why didn’t the master make use of a seaman?

The master had no confidence in the general ability of the watchkeeping seaman to steer the vessel well. As hand steering is very seldom used on vessels with autopilots, the seaman had not been generally used as a helmsman. Normally seamen, when not required for lookout duties in the wheelhouse, are employed about the vessel. The investigation noted that:

> *“Where minimum numbers are employed to operate a vessel it is essential for each person to maintain the basic skills of the job. Had the master been able to rely on the steering skills of the seaman watchkeeper he would have had greater flexibility in organising his bridge team”*.

Thus, the failure to maintain the seaman’s skills contributed to the limited manning options in the bridge.

It should be noted though that the master was also reluctant to keep the seaman and an off-duty (junior) mate on the bridge due to their long watches (two 8 hour watches per 24 hours). The junior mate could have been used as a helmsman and the seaman as a forward lookout, allowing the senior mate to assist the master with navigation.

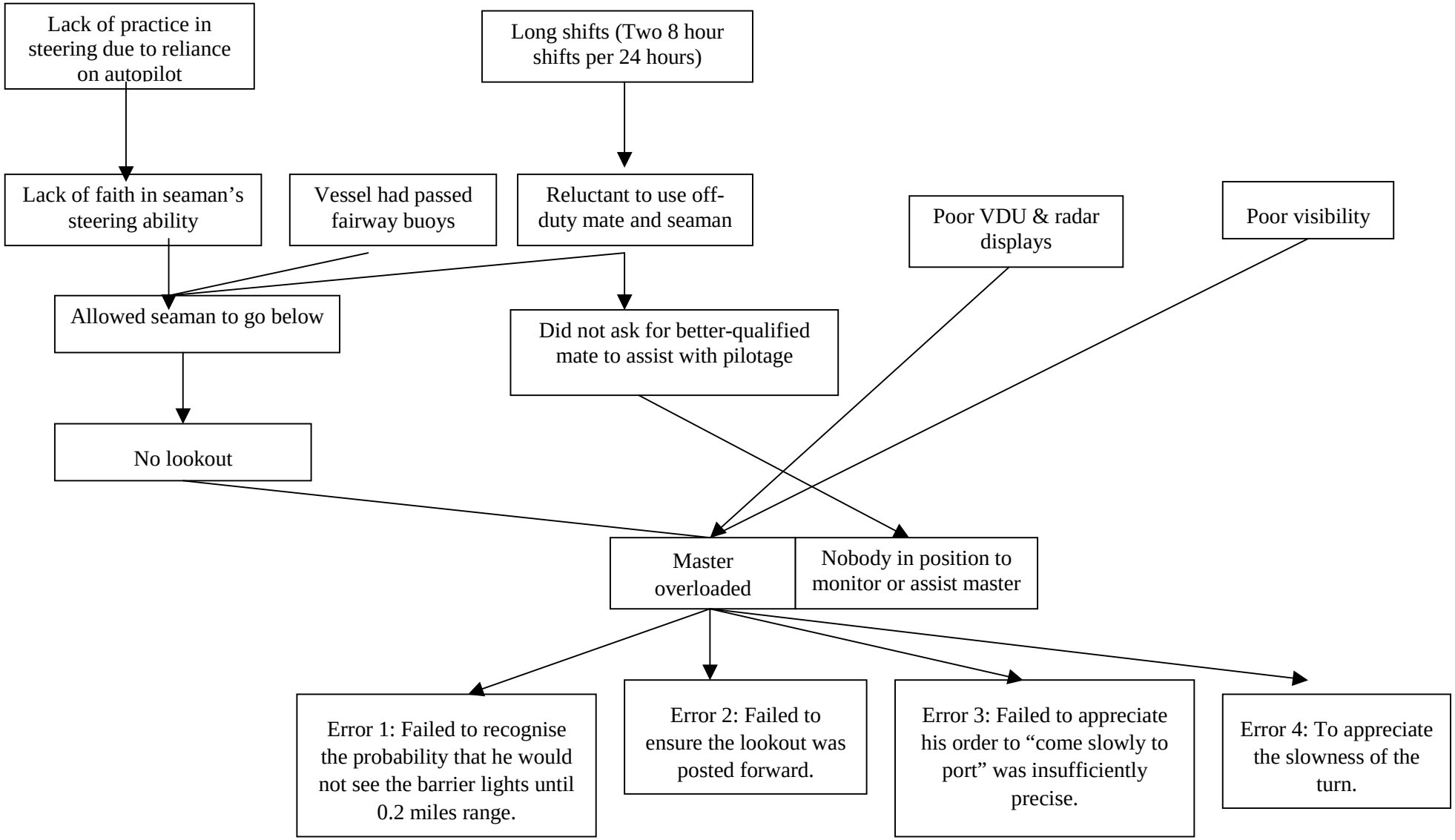


Figure 1: Overview of error causation

2.2.5 Hickson and Welch fire & explosion

Whilst the HSE report on the 1992 fire at Hickson and Welch does not refer explicitly to multiskilling, review of the report indicates that the Area Managers (AM) had been assigned responsibility for production as well as maintenance rather than just production (HSE, 1992). Also, Hickson and Welch had introduced "teams" of (leading hands) process and engineering technicians with team leaders.

The incident involved a fire in a process vessel that was being cleaned out. The vessel contained (unknown to the cleaners) highly energetic materials that upon heating started a self-heating (exothermic) runaway reaction. The staff heated the material to loosen it up and hence allow it to be raked out.

The Area Manager authorised the clean out without doing a risk assessment. The team leader devised the cleaning method. The team leader had just been re-assigned to the plant without refresher training but was authorised to do the Permit to Work. The Area Manager did not check the PTW. It was subsequently noted that the Area Managers had significant workloads.

People in the organisation knew the hazards associated with this vessel but neither the team leader nor Area Manager referred to them.

It can be inferred that the workload problems arising from merging the production and maintenance management roles may have been a contributory factor.

2.3 HEALTH AND SAFETY EXECUTIVE AUDITS

2.3.1 Overview

Two published HSE audits of BNFL and British Energy provide some insights into potential impacts of multiskilling and the importance of the management process. It is pertinent to note that the main concerns raised about BNFL are similar to those noted in accident reports, namely;

- the possibility of supervisory problems arising from vertical multiskilling;
- resource problems arising from staff reductions made possible by multiskilling;
- inadequate planning and assessment;
- and failure to support multiskilling through training etc.

The British Energy audit does take the point further by relating these types of problems to the integration of safety management into corporate business decision making, i.e. ensuring that corporate business plans make proper allowance for staffing and workload considerations.

On the other hand though, multiskilling of operators is also reported to offer positive morale benefits.

2.3.2 British Nuclear Fuels Ltd

It is noted in the HSE audit report that BNFL had intended to remove the post of chargehand between that of shift team leader (equivalent of a foreman) and team members (HSE, 2000). The functions of the chargehand were to be undertaken by a suitably qualified and experienced team member, or by enhancing the skill base of the team so as to reduce the supervisory demands on the shift team leader. A number of concerns were noted regarding this proposal:

> *"…at lower management levels additional tasks are being imposed without an adequate analysis of workload being undertaken beforehand…" (p16).*

> *"…BNFL is introducing a process of post-specific technical and behavioural competencies, but does not require the workload of a given post to be analysed. We consider this to be a key parameter for post dilution. We were concerned that BNFL does not appear to have evaluated or monitored the potential negative effects on safety that could arise from the introduction of multiskilling increasing the workload on individuals. Neither has it considered the loss of in-depth experience or the dilution of skills that could arise through the introduction of multiskilling…" (p21).*

> *"…in order to assess the effects of change to organisational structure or staffing levels, the licensee needs to have defined its baseline resource requirements. The baseline is that level of resource which at a particular point in time is adequate to enable a nuclear licensee to demonstrate that it can operate safely and has the necessary supporting infrastructure in place. The resource analysis should include a clear definition of safety-related tasks and use processes such as task and functional analysis, post profiling and training profile techniques." (p21).*

It is equally pertinent to note though that the introduction of multiskilling was applauded in one instance, as noted below.

> *"We noted a relationship between the age of the plant and the working practices adopted. In some of the more modern plants, there was a flexible approach to worker skilling and the basis of allocating tasks to individuals. We understand this flexibility was possible because staff had been trained and encouraged to build up actual work experience in different skills from those for which that were originally trained or that their jobs formally required. We observed in some of the older plants, the practice was to retain an approach of almost single skill areas for process workers and skilled trade positions. We found that the staff in these areas in general felt less valued than those in the areas of more flexible working." (p29).*

The audit report does not link the latter feeling to any specific safety problem. However, self-esteem, job satisfaction and morale are known risk factors. For example, the poor ergonomics of

the MOX fuel pellet quality confirmatory check contributed to the falsification of data by process workers.

Subsequent to this audit BNFL suspended deletion of the chargehand role and have undertaken a baseline resource analysis.

2.3.3 British Energy

The HSE audit suggests that multiskilling was implicitly being introduced as part of a wider downsizing exercise (HSE, 1999a). Posts were merged and tasks previously completed by redundant persons were taken on by remaining staff.

The main concern related to the way in which downsizing was being managed. In particular, the NII found that many "enablers" were not implemented prior to changes. For example, work methods were not changed to allow fewer staff to manage the work, and retraining was not completed before staff took on a wider role. Also, compensating measures had become the norm. For example, contractors were used instead of reducing the amount of work.

In addition, it was found that BE had not gauged the extent of the workload problem accurately. Staff were completing an excessive amount of overtime, much of which was often unreported. Similarly, there was difficulty in accurately predicting the forward workload, especially the level of "emergent" work, which again meant staff were over loaded.

As with BNFL, HSE found that there was no clear definition of the requisite skills base needed. Consequently downsizing was taking place without knowing the overall limit or the minimum necessary skills base that should be retained. In places the downsizing had led to reliance on individuals (singletons).

As with BNFL, these points do not indicate that multiskilling per se creates a risk. Rather, they indicate that the introduction (implicitly or explicitly) of multiskilling can be impaired by the manner of implementation in the same way as any other revision in human resource management. The audit indicates that these problems came about due to a variation in the standard of management across BE. Whilst "good" practices and criteria had been applied in some areas, this was not consistently achieved. It was judged that a corporate policy was required and that an effective process of implementing company policy needed to be achieved. It was also indicated that there was a need to ensure business plans are matched to the in-house staff capability and workload.

2.4 CASE STUDIES

2.4.1 Introduction

The case studies reported here identify how contemporary organisations have implemented multiskilling. The case study organisations were selected on the basis of the following criteria:

- The number of employees, to cover a range of sizes;
- A variety of industry sectors, including chemical processing and manufacturing;
- A range of different types of multiskilling.

The organisations are:

- Nuclear power generation;
- Rail operator;
- Gas Separation Industry;
- Chemicals manufacture and testing;
- Sugar Manufacturer.

The list of companies to be approached to participate in the study was agreed in consultation with the Health and Safety Executive.

The aims of case studies are to see how multiskilling is managed in contemporary situations, and to complement the material gathered in the literature review and in published incident and audit reports.

Survey method

A visit was made to each site. A cross section of personnel were interviewed at each site from the management down through the workforce, including where appropriate maintenance and operational staff. Interview participants typically included:

- Operations and Maintenance Management
- Health and Safety Representative/Advisor
- Members of operational and maintenance staff.

The interviews were usually conducted in a quiet room, with interviewees leaving their normal work setting. However some interviews were carried out on the shopfloor when it was difficult to remove an individual from their job.

The questions were open ended, with the aim being to elicit information on the application of multiskilling within the company. The broad question headings were:

- Background of company, number of employees, nature of business.
- Multiskilling facts – what type of multiskilling is used, what activities are multiskilled
- Organisational Objectives – what motivated the company to multiskill, what were the intended benefits and have these been achieved, etc.
- Planning – what actions were taken to carry out multiskilling in the organisation, what was the workforce's involvement in this etc.
- Training and competence – what did the company do to ensure that people were adequately trained and competent.

The complete question set used is included in Appendix A. It was used as an aide memoire and was not rigidly kept to. The questions were modified according to the level of person being interviewed.

2.4.2 Summary of individual cases

Company A

Company A is a rail company. This case study examined one business unit with Company A, namely the control centre which is responsible for the central control and monitoring of all rail operations. Its role is to control and monitor all activities under normal, abnormal and emergency operating conditions. There are six posts in the Control Centre. Multiskilling was introduced as a means of providing cover within the team for lunch and other breaks on shift, without having too many under-utilised staff in the team. A number of changes have been introduced as a result of a recent incident and its subsequent formal investigation.

For multiskilling, Company A use the same processes of selection and training as those used to initially equip personnel with their primary skills. For example, those personnel recruited for higher ability posts with stringent selection criteria can be multiskilled in any task, whilst personnel in other posts will only be multiskilled in less complex tasks. The training provided is the same as that for originally learning the roles. Management formally assesses an individual's competence by means of practically demonstrating the skills. Refresher courses are run, and all posts are re-certified every 3 years by means of an exam and practical assessment.

The key safety issue for Company A concerns the competence of staff and handovers between posts on shift. Competence is assured by providing identical levels of training for the additional

skill and identical competency criteria, as for the single skill. Rigorous training, refreshers and re-certification are the chief mechanisms to achieve this. Due to the multiskilled person providing cover in the team, critical to the continued safety of the concession is the quality of this handover. This is recognised and a formal mechanism is used to ensure that handovers are properly carried out. During the survey the importance of handovers and the crucial role of the log to document all issues was emphasised.

Company B

The Company employs approximately 55 people on the site. It provides support to the main production facility on a geographically separate site. There are two groups on this site: Specialities and Operations Group.

The Operations Group runs 7 test bed cells carry out engine and vehicle tests. The group also has responsibility for site maintenance. Some of the test beds are contracted out to engine manufacturers, and oil companies. Specialities is part of the Research and Development/Corporate Technology Group. They carry out laboratory work, quality assurance, and product support services for the rest of the company.

To a certain extent multiskilling within Company B is an inevitable consequence of their size and their recent history of radical downsizing. The application of multiskilling has been ad-hoc with few formal organisational controls in place. The research could not identify whether the informal strategy had any mechanisms for avoiding inadvertent errors, and avoiding the fairly obvious desire in small companies of a ‘can do’ attitude, which possibly has safety implications.

Company C

Company C separate air out into its constituent parts (e.g. oxygen, nitrogen and argon). These are provided to industry. The site provides gases by tanker, but also operates a number of unstaffed satellite sites, where gases are piped directly into the customer plants. The site (including satellites) employs 80 people, approximately half are drivers. 33 people actually run the gas separation plant. The emphasis, particularly in light of their high profile customers, is on continuity of supply and high quality products.

The company originally started multiskilling about 20 years ago with the aim being to equip engineers with sufficient all-round skills to be able to address most of the issues arising at the satellite sites. Multiskilling is being pushed forward now within the main site to improve organisational efficiency and responsiveness, in part this is linked to the increase in organisational demands and a recruitment ban. All staff have a Training Needs Schedule every 12-18 months which provides an opportunity for the management and workforce to identify training needs and skill gaps. The schedule lists the skills and knowledge required for each job and its constituent tasks. Training is typically on the job and supported by a log book documenting practical experience. Competency decisions are made by management against a schedule and discussions held with the trainee about their confidence in their skills and abilities, as well as competence at executing them.

Company C ensure that risk assessments are carried out for all activities, and through this ensure that only competent individuals carry out certain activities. Particular emphasis is placed on individuals understanding their personal competence limits, and they are encouraged to stand back and think about a job before undertaking it.

Company D

Company D is a sugar beet factory which produces granulated sugar, and animal feed. Sugar is produced from sugar beet between September and February each year. This period is known as the 'campaign' during which time the factory operates continuously. The rest of the year the factory carries out maintenance tasks to ensure reliability and continuity of operation throughout the campaign. The factory has 110 permanent staff, which is supplemented by casual labour and reaches 180 during the campaign.

Multiskilling was carried out as a way of ensuring that process workers were effectively utilised out of campaign. This has involved process staff being trained in maintenance activities and allocated to a specific area of plant as part of a larger team to carry out maintenance. The initiative has been in place since the early 1990s and now appears to be well accepted and received by the workforce. Originally the company had difficulty implementing the scheme due to workforce resistance. The management process appears to be well established, and the company has heavily invested in training the workforce. Training has been done off-the-job, and followed by on the-job training, before eventual signing off as competent. Competency is agreed between the individual and their line manager based on the individual's confidence and satisfaction with their capabilities.

Company E

Company E is a nuclear power station. Nuclear power generation is highly regulated in the UK, and their activities are closely monitored and scrutinised by the Nuclear Installations Inspectorate. The multiskilling initiative was commenced in 1997.

The management and staff of Company E believe that there is the attitude that they 'won't do anything involving danger'. All staff are multiskilled in health physics, and are also equipped with other supplementary skills.

Three distinct maintenance disciplines are maintained and follow the 80/20 rule to avoid the loss of skills. This principle is that only those jobs where less than 20% of the task is carried out by another discipline will be multiskilled, to ensure the maintenance of core skills Furthermore Health Physics monitors are involved in higher skilled activities and their role has not diminished as a result of multiskilling the rest of the workforce. Training is thorough, an exam has to be passed following completion of formal training. Competency is then assessed following several weeks on the job, and involves observation and a decision is made jointly between the individual and their manager.

Company F

Company F produce agricultural chemicals and their intermediate components. The site employs about 600 people. Historically the site employed a large number of craftsmen across a wide range of disciplines, from plumbers and joiners, to riggers and electricians. There was rigid demarcation of these disciplines, and an inflexible workforce. Change was initiated in the early 1990s with work by some change consultants. As a consequence the number of supervisors was reduced, as were the types of skilled personnel. These were organised into a group composed of single trades coordinated by one supervisor (e.g. a multiskilled team). A Local Working Arrangement was negotiated between management and the trade unions, in consultation with the workforce, which provided the framework for multiskilling. Multiskilling was viewed as a way to decrease staff, and to increase utilisation of existing staff through flexibility.

A list of activities was identified in the engineering function, the intent being to decrease delays and the number of craftsmen being required for jobs. A full partnership approach was taken to identify these tasks. Multiskilling was compulsory, all staff were balloted and signed up to the approach. It was locally implemented where training was agreed between the workforce and their supervisor. Experts provide training in the training school. Following training a trainee has 'skills practice', where an individual is paired up and has to carry out a number of examples of the task. When the individual feels comfortable and competent they will be validated. A trained validator witnesses a task from preparation through to carrying it out, and clearing up. Trainees will be passed/failed. When passed certain conditions may be defined, e.g. the review period, certain operating limitations. During the annual appraisal the supervisor is asked whether they are happy with the skill and how it is used.

Initially multiskilling was used broadly across all on the site and there was pressure for all staff to become multiskilled. There is no evidence to show that injury rates increased as a result of multiskilling.

2.4.3 Overview of Case Study Organisations

Table 1 provides a summary of the key findings from the case study organisations. It details the main health and safety implications from multiskilling in these companies and summarises the controls that the companies have implemented to ensure that safety is not jeopardised. It is worthwhile to note that the controls also have allied business benefits in terms of people being competent to carry out their jobs, and ensuring negative outcomes are avoided.

Table 1 – Overview of Case Studies			
Company	**Type of Multiskilling**	**Safety Implications**	**Controls**
Company A Rail Approx. 50 staff in the Control Room, with about a third multiskilled	Control Room staff Horizontal Multiskilling Multiskilled from start of the company. Purpose: • Flexibility • Competent cover for staff breaks	Highly demanding job where consequences of mistakes is very high and therefore there is a need for competent staff	• The same levels of training are provided whether its an original skill or an additional skill • Refresher courses are run every 3 months • Skills are recertified every 3 years.
		Danger of degradation of skills	• Staff are rostered to carry out a whole shift in each of their skills every shift cycle.
		Staff not up to the training and could be overloaded.	• Competence assessments are made, as well as rigorous recruitment and selection criteria. • The original skill and selection process dictates what level of skills the workforce can acquire.
		Multiskilled staff feel undervalued.	• Management are aware of this, but feel that provision of a full time permanent spare per shift would be more under-utilised and feel less valued.
		Ensure clear lines of responsibility and independent oversight	• No vertical multiskilling to avoid possibility of supervisor getting involved in the detail of an incident rather than maintaining an independent overview.
		Use of multiskilled staff and the breaks has increased the number of handovers, and the problems associated with increased handovers.	• Have formalised the handover process, and handover for breaks is treated in the same way as inter-shift handovers.
Company B Chemicals manufacture and testing. 55 employees.	Horizontal multiskilling Flexible multiskilling Entire maintenance function is multiskilled. Security staff are multiskilled to carry out a range of different activities Purpose: a consequence of downsizing.	Competent staff to carry out activities	• Learn off an organisational expert. A supervisor will then determine competence based on observing and testing performance. • A performance review is carried out each year with every employee, where courses and refresher training needs are identified. • Job descriptions exist for staff detailing the skills in which they are competent. Supervisors issue work due to their understanding of individuals abilities.

Table 1 (cont.) – Overview of Case Studies			
Company	**Type of Multiskilling**	**Safety Implications**	**Controls**
Company C Gas Separation About 80 on site, with about 20 multiskilled	Multiskilled control room staff and facility engineers. Horizontal Multiskilling Purpose: • Improve response to supply issues on satellite plant. • Increases skill set available at any one time on plant due to size of team, and the continuous process.	Low staffing levels	• Increasing the skill set of employees increases the likelihood of safely resolving issues that arise.
		Loss of core skills	• Staff work for one week out of the six week shift cycle in their core discipline.
		Competent staff	• Capable, proven staff are selected for the premium multiskilled posts. • A training needs schedule is carried out annually, and lists the requirements and skills for each job. • Trainees are allocated a mentor and complete a log book. Then in conjunction with a supervisor a competence assessment is made.
		Workforce carrying out tasks which they are not competent to do.	• Limits are specified to individuals competences. • An organisational culture was described which supports individuals asking questions and not carrying out tasks which they are not competent to perform. • Risk assessments are carried out for all activities, these detail the skills required to safely do the task. Permits and method statements support risk control.

Table 1 – Overview of Case Studies			
Company	**Type of Multiskilling**	**Safety Implications**	**Controls**
Company D Sugar Beet Processing 120 staff, the majority are multiskilled	Horizontal and Vertical Multiskilling. Process staff are multiskilled in engineering activities. Engineering function staff are multiskilled either between themselves or with the process function. Self directing teams are being implemented. Purpose: • The development of its staff • Reduced numbers of shift engineers due to the enhanced capabilities of the workforce.	Provision of competent staff	• A mix of formal training courses, and on the job training. A log book is used to store operational experiences. • Career planning interviews for all staff ensure individuals receive the training that they require to effectively do their job. • Checklists exist for tasks, and are used to assess competence. • Competence is agreed between the trainee and supervisor using the checklist as a guide. • Company recognise and place emphasis on individuals recognising the tasks which they are not competent to perform.
		Ensure tasks are carried out safely	• Assessments of competence and attitude. • Staff sent on a 'Managing Safety' course. • Staff are only trained in tasks which they will use to ensure skills are current and staff competent. • Operating procedures exist and are used for many activities.
		Adequacy of the execution of safety critical tasks	• Tasks are allocated to individuals displaying key competencies. These individuals are named in a 'responsibility list', which is consulted, for safety critical tasks. • Operating procedures exist for all safety critical tasks, against which individuals are trained.

Table 1 (cont.)– Overview of Case Studies			
Company	**Type of Multiskilling**	**Safety Implications**	**Controls**
Company E Nuclear Power Generation Employ approximately 800	All staff are multiskilled to carry out radiological self monitoring. Furthermore most staff are cross trained to carry out other tasks. Purpose: • Streamlining operational tasks • Reducing the headcount.	Importance of workforce ownership and involvement in nuclear power generation.	• Ran a suggestion scheme for staff to identify those tasks where 80% was done by them, and the remaining 20% by other disciplines. • Steering group, comprising of management and unions, review the job and determine appropriateness for multiskilling. • A union agreement and 'monetary carrot' aided workforce buy-in.
		Radiological safety not jeopardised as a result. Need to ensure competent staff and monitor the effects of change on performance.	• 3 weeks of classroom training, followed by a test with a 75% pass mark, and a practical demonstration. Spreadsheet record a T (Training) on the matrix held at the Health Physics issuing station. Following several weeks on the job the person is assessed and if deemed competent a 'C' is recorded. This sheet is used by Health Physics staff when issuing monitoring equipment. • Individuals are trained against specific Radiological Safety Procedures. • The organisation has monitored the radiological cleanliness and contamination reports to ensure that health and safety has not suffered as a result of multiskilling.
		Degradation of core skills	• The bounds for multiskilling were set at 80% core skill, 20% other. So core skills will not be degraded as the majority of the time is spent using the core skill.

Table 1 (cont.)– Overview of Case Studies			
Company	**Type of Multiskilling**	**Safety Implications**	**Controls**
Company F Chemicals manufacturer Employ 600 people	All staff are multiskilled to a certain extent. Horizontally and vertically multiskilled. Purpose: • Flexibility • Streamlining tasks	Importance of competent staff to carry out safety critical activities.	• Off-the-job training, skills testing and validation later to ensure the competence of staff. • Validation process also involves agreeing competence limits, operational restrictions, recertification period, • Training is undertaken by agreement of staff and supervisor
		Under-utilised skills	• This was recognised as an issue when multiskilling was first introduced, now greater effort is made to ensure that people are equipped with skills that they will regularly use. • Refresher training did not appear to be given, but there was no evidence that the workforce used skills which they did not feel competent in.
		Loss of core skills	• Multiskilled staff still primarily carry out their main task both within process and engineering.

2.4.4 Case study discussion

Do the case studies indicate that firms accept the potential for safety problems to arise from multiskilling?

A number of the companies surveyed explicitly recognised the potential safety problems that could arise from multiskilling. Notably these were the highly regulated companies, such as Companies A and E where all their activities are scrutinised and any organisational changes justified to ensure that safety is not jeopardised. In fact Company E had consulted with their health and safety inspector before the multiskilling initiative was progressed.

Companies A, C and E had all deliberately considered the safety implications of multiskilling and had put in place mechanisms to ensure that the process was effectively managed. Companies B and F did not appear explicitly to have considered the health and safety implications of multiskilling. These sites varied enormously in size and complexity and show that it is possible for smaller sites to multiskill successfully, and conversely that larger firms will not necessarily safely and successfully implement multiskilling.

What are the main sources of safety problems noted by firms, such as adverse business pressures versus lack of methods to assess training needs?

The main source of problems identified from the case studies was the difficulty in maintaining and assuring competence. Some companies had applied multiskilling widely and realised that individuals were not using these skills, and that they quickly degraded to a point of incompetence. Company F stated that when multiskilling was first introduced a lot of training was carried out with little forward planning as to the utility or business need for the training of these additional skills. This was exacerbated by the method adopted to monitor the success of the programme which measured the amount of training given. As a result a lot of training was given which was not used and the skills degraded. Company F stated that individuals would not carry out tasks unless they were comfortable and competent, no formal framework existed for this. Company D had methods in place to ensure that training was only given to individuals when those skills would be used.

Company A multiskilled as a means of providing the breaks required to ensure alert staff, as a result there is the potential for improper handover for these half hour lunch periods. However this was recognised and the methods for managing handover formalised, and assigned the same priority as inter-shift handover.

Competence assessment varied widely between the companies. For example, Company C had a formal description of the skills and competencies required for each task, a task/competence framework. This was used both to identify training needs, but also as a method for assessing the workforce's competence in carrying out certain tasks. Companies B and F did not have a method for the systematic identification of skills required for successful multiskilling, and it was done on a task basis with experts determining the training requirements.

Company F stated that as a result of multiskilling some ‘tips of the trade’ would be lost. These tips are the skills that build up over time and would constitute best practice for a job. An example was given of greasing bolts before tightening, so that next time the job will be easier. Typically these are informal activities which would not be documented in task descriptions.

Do firms recognise all the different forms of multiskilling?

Two of the case study organisations had vertical multiskilling, although several had teamwork in place, with team leaders. This process had been managed in a different way from multiskilling. The companies selected represented the range of horizontal multiskilling, from skill broadening, training in selected additional skills, through to complete cross training. A range of companies also had multiskilled staff who had specific roles if an incident or emergency situation arose. Company A have staff in place specifically to handle emergencies. In this situation supervisors were deliberately not multiskilled, as it was recognised as important that someone had an independent overview and could oversee the management of an occurrence. Company F had multiskilled teams, which were managed by a single supervisor and comprised of single disciplined craftsmen and some multiskilled craftsmen.

To what extent do they adopt a systematic approach to managing safety aspects of multiskilling?

Most of the firms surveyed had adopted a systematic approach to managing the safety aspects of multiskilling. In particular, the high hazard companies A, C and E, had very rigorous and systematic programmes for the design, and subsequent management of their multiskilling programmes. Company E and F also consulted the workforce particularly when setting up the organisational framework for changed working conditions.

In what way do methods differ between case studies and why?

The companies differed significantly in the approaches taken to multiskilling. Only one of the companies had multiskilled incidentally, and that was Company B where multiskilling was a necessary consequence of the reduced head count on site, and the pressures for operational targets to be met with fewer staff. The consequences of this were potentially to the occupational health and safety of the workforce with no off site consequences.

Most of the other companies had multiskilled to meet a number of targets, and were managing the process systematically to avoid jeopardising safety. Company E managed the process in a bottom up sense, carrying out widespread consultation with the workforce, which ensured buy-in as well as an understanding of the rationale for multiskilling. Training and competence assessment was then a mix of off-the-job, including tests upon completeness, with competence assessments determined following a few weeks on the job and in consultation with the worker and the employee.

Is it reasonable for SMEs to adopt these practices?

Company C can be considered a SME, as they managed their whole multiskilling process independently from the corporate body. Their systems for multiskilling were of an equally high standard to some of the larger organisations (e.g. Company E) examined during the course of the research, and appeared to be systematic and well thought out. Some resources were drawn upon from corporate headquarters to support specialist activities. Company B, a similar sized plant to Company C, did not appear to have any formal decision-making mechanisms, or a structured systematic process for multiskilling. In part this might be linked to the differing rationale for multiskilling. Company C was driven by operational efficiency and quality targets, whilst Company B multiskilled as an incidental consequence of the downsizing process.

2.5 DISCUSSION OF SURVEY FINDINGS

To what extent can we confidently develop a model approach to managing the safety aspects of multiskilling based on the survey? Are the findings robust, consistent and comprehensive?

The findings from this section support the notion of developing a model approach to managing the safety aspects of multiskilling. The case study organisations had used a number of different methods for multiskilling but all shared similar core elements, including the decision-making process for multiskilling, the planning process, and then the training and competence and ongoing management and assurance elements.

The findings from the case studies and other sources are all consistent and robust. It is apparent that the underlying rationale for multiskilling does affect the style of implementation, and the types of planning carried out.

What are the common themes within past research, accidents, audits and case studies?

Many of the issues which emerged were linked to reduction in headcount, staff who were not competent to carry out their requisite activities, an organisational culture which supported risk taking and potentially 'macho' and 'can-do' culture. It does not appear that well implemented horizontal multiskilling presents a problem. However vertical multiskilling may cause problems, in terms of:

- lack of independent oversight;
- changed roles and possibly demotion;
- overwork and stress.

The themes emerging from this survey for multiskilling, include:

- maintenance of skills and knowledge;

- demonstration of competency;
- importance of training being relevant, and providing skills that are necessary;
- provision of skills that will be practiced and regularly used. If the skills are not regularly used methods need to be in place to ensure that abilities are maintained;
- consulting with the workforce to gain participation in all stages of the process;
- workforce buy-in;
- importance of ensuring a human resources framework which supports the multiskilling process (e.g. union agreements, pay and conditions etc.)
- multiskilling initiatives are frequently packaged with other changes, such as the introduction of annualised hours and salaried staff.

What are the main risk controls advocated by the survey?

The main risk controls advocated by the survey:

- detailed planning process, including consultation with the staff concerning appropriate tasks to multiskill and ensure that risks are identified, and adequate and appropriate controls identified and implemented;
- participative methods to ensure workforce buy-in;
- rigorous training and competency assurance systems, including regular training needs assessment, a balance between on-the-job and off-the-job training, methods and standards of competence for staff to demonstrate their abilities against, including an awareness of their operating bounds;
- ensure that staff feel comfortable and confident to competently carry out the tasks, within the bounds of the formal competency assurance method;
- use of log books and record keeping to ensure that records of practically carrying out tasks are kept, as a way of monitoring that skills are current;
- management understanding of the capabilities of their staff, including the limits of their abilities;
- use of performance reviews and task/competence frameworks to ensure skills individuals are competent and confident in their job, as well as identifying any training or retraining required;
- ensure that all staff are provided with regular opportunities to use their skills, otherwise these skills may degrade. This will include both their newly acquired skills and their core skills;

- provide a suitable context for organisational change, including time for training, financial incentives for additional skill acquisition as well as flexibility during the transition period;

- ensure that training is carried out before any downsizing commences;

- Other risk controls typically used by organisations to ensure safety is not jeopardised e.g. safety management, operating procedures, selection criteria etc.

3 POTENTIAL IMPACTS OF MULTISKILLING

The horizontal and vertical multiskilling of people has the potential adversely to impact health and safety performance, if poorly managed, or add to the skills base and resource flexibility if well managed. As illustrated in Figure 2, multiskilling can impact many aspects of performance, namely;

- Quality of supervision, task coordination and error detection;
- Quality of work and the likelihood of error in completing tasks;
- Workload;
- Resource flexibility in team deployment, and;
- Job satisfaction and staff morale.

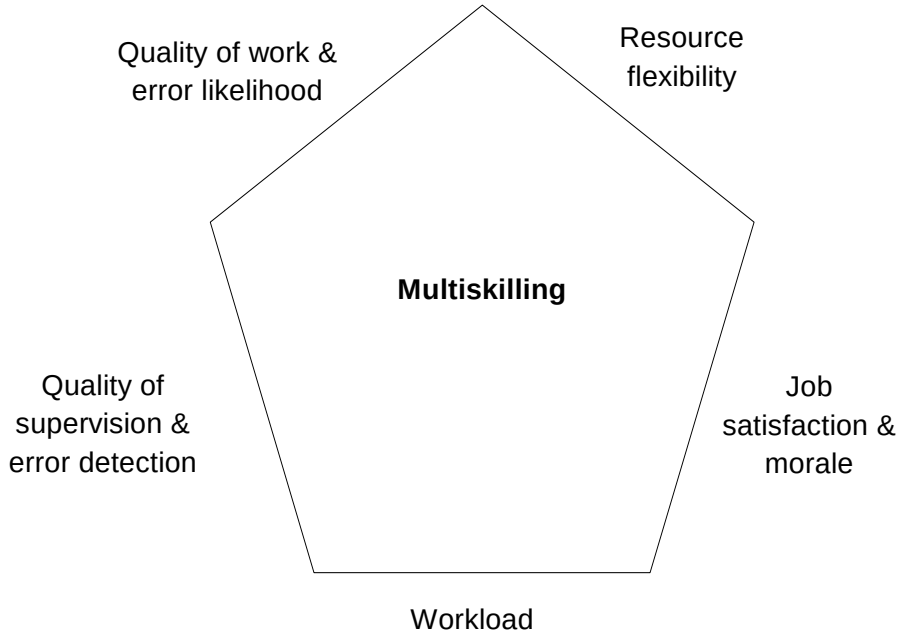


Figure 2: Overview of areas impacted by multiskilling

As can be seen these each have the ability directly or indirectly to affect health and safety. The potential adverse impacts are summarised in Table 2, and are derived from Section 2, as well as the systematic evaluation of multiskilling. As noted in Table 2, the adverse impacts of multiskilling can be traced back to one or another aspect of the management of change, namely:

- Failing to recognise that a change entails multiskilling;
- Allowing business criteria to drive changes without sufficient regard for health and safety implications;
- Making decisions on job mergers with an inadequate understanding of workloads and skill requirements;
- Allowing multiskilling to happen by default during downsizing and delayering;
- Presuming people will "learn on the job";
- Allowing methods that pave the way for change, such as retraining, to be perpetually deferred;
- Adopting a reactive (waiting for an accident to occur) approach to monitoring success, and;
- Overlooking the need to actively maintain rarely / infrequently used skills.

From the case studies and published reports it is reasonable to suggest that multiskilling per se does not necessarily pose a threat to safety. Rather the impact of multiskilling on safety performance depends on the quality of planning, assessment, implementation and monitoring.

Indeed, it is interesting to note that, in the main, few problems have been reported with the horizontal multiskilling of operators and maintenance staff. Those mentioned include the loss of best practice when carrying out activities, and the danger that tricks of the trade and effective labour-saving skills to be lost. This may be because the risks associated with this form of multiskilling are obvious, namely of people working outside of their core competence, that are easily recognised and resolved by training and staged on-the-job experience. The problems reported with multiskilling more commonly revolve around less obvious issues such as supervision, peak period workloads and long term skill maintenance. These "less obvious" issues may require more active management and forethought, and hence are in danger of being overlooked.

Table 2 shown on the following pages look at the potential health and safety impacts of multiskilling and the justification based on examples from the case studies, and the published incident or audit reports.

Table 2: Potential health and safety impacts of multiskilling

Aspect of multiskilling	Potential impact on health and safety	Examples
Breadth of individual technical remit	Job scope exceeds credible ability of individual to learn and carry out tasks – leading to error and task omission.	Company A
	Lack of multiskilling may lead to less self-esteem and boring jobs in companies where technical specialities are outsourced – which in turn can lead to poor performance and lack of commitment. This may lead to error and violations.	BNFL audit report Company D
Re-training for new wider roles	Failure to re-train staff mean they lack competence.	Companies A, C, D and E
Determining new staffing levels (number of staff reduced due to improved productivity of multiskilled staff)	Overloaded staff cannot manage workload and so make errors / omit tasks/ violations, especially during periods of high work, emergent work and staff absence.	Hickson & Welsh accident
	More overtime which can lead to fatigue	BNFL & British Energy Audit Reports
	Reliance on "singletons" and contractors. Loss of staff "redundancy" means vulnerable to loss of key individuals.	BNFL & British Energy Audit Reports, and Company B.
Vertical multiskilling	There is a danger that removal of the supervisor will result in a loss of checking for errors.	Company A & F
	Also a loss of independent oversight, either for competence of execution or during crisis management situations.	Milford Haven/Texaco Incident & Southall Rail Accident

Table 2 (cont.): Potential health and safety impacts of multiskilling		
Aspect of multiskilling	**Potential impact on health and safety**	**Examples**
Multiskilled teams	The whole team all "chip in" to carry out a task leaving no one to co-ordinate work (whilst previously roles were implicitly predefined by narrow competence).	Company F
	No one stands back to gain overview of the event during emergencies – leading to mind set and group think	Texaco Refinery
Performance monitoring	Lack of monitoring means performance problems go unnoticed.	Southall Rail Accident
	Incompetent staff carrying out safety critical activities.	Companies A, C & F
Skill maintenance	Insufficient practical exposure to task to maintain skill to adequate level leads to error, lack of competent staff, overload of those individuals who have maintained their skills etc.	Company A and E
	Loss of flexibility in deploying staff (who have not maintained skills) in minimum manning environment.	mv Sand Kite, and Company F

4 IMPLEMENTATION GUIDELINES

4.1 A LIFE CYCLE MODEL OF MANAGING HEALTH AND SAFETY ASPECTS OF MULTISKILLING

A life cycle model is described in this section. It was developed based on information from the case studies, as well as published material to describe the features that need to be considered at each stage of the multiskilling life cycle. The purpose of the model is to systematically consider the different elements of multiskilling to ensure that guidelines cover all the requisite elements at each stage in the process.

4.1.1 Introduction

There are two critical features of the life cycle model, namely;

- A management of change process that moves through planning and implementation to review and recommendations for improvement, and;
- An individual development process of job planning, training, assessment and skill maintenance.

Thus, there are, in a way, two "life cycles", the management of change cycle and the individual's skill development and job planning cycle.

In the context of change management, it is necessary to:

- Incorporate health and safety considerations into business plans;
- Assess and plan for the potential health and safety aspects of business driven changes to job delineations;
- Ensure appropriate resources and methods are applied to the management and implementation of changes;
- Define and apply safety performance indicators for use in gauging the success of changes.

In the context of individual job planning and skill development, it is necessary to ensure:

- appropriate health and safety factors are taken into account when redefining individual job descriptions, training and assessment needs;
- appropriate health and safety factors are taken into account when redefining team structures and supervisory arrangements in multiskilled teams;
- skill maintenance standards are sufficient to satisfy required health and safety standards.

4.1.2 The model

The model is illustrated in Figure 3 in the form of a chronology before, during and after the introduction of multiskilling. Each stage is defined below along with the key management objectives and issues at each stage. The issues are provided in the form of checklists in section 4.1.3. Guidelines on the methods that can be applied at each stage in the life cycle is summarised in section 4.1.4.

Starting out

This is the point in time when the prospect of organisational change has just been recognised and the form of such changes is being conceived. The management objectives are to:

- Recognise instances of multiskilling;
- Identify key risks and assess the criticality of these;
- Specify as a matter of policy / principle the need to ensure due account is taken of health and safety requirements during the multiskilling process, and;
- Define safety criteria and factors to be taken into account during the multiskilling process.

Planning and assessment

The next step following initial outline planning involves considering in detail the steps required to carry out prior to implementation. This is when decisions are being made on details of multiskilling such as:

- Which individuals will be multiskilled;
- Which tasks will be included in the remit of multiskilling;
- How will people be trained and supervised;
- How procedures and working practices are to be changed;
- Staff headcount reductions.

The objectives of this stage in the life cycle is to:

- Ensure that due account is taken of workload, competence, supervision and other factors when making specific decisions about multiskilling,
- Ensure that suitable and sufficient risk assessments are completed, and;
- Ensure changes are developed in a planned and systematic manner, including identification of all actions necessary to enable change to be made successfully.

Implementation

This is where changes are implemented, and the detailed planning turned into operational reality. Possible steps include staff being made redundant, retrained, new ways of working are introduced, and so on. The management objective is to:

- Ensure implementation is properly resourced, scheduled and organised – so that planned changes are carried out effectively;
- Flexibility is built in, so that unplanned changes training takes longer than originally anticipated.

Implementation check

This is the point following the implementation process, where changes have been completed, or are well underway. The objectives are to ensure planned training, supervision, etc has been carried out as intended and has achieved its required performance objectives. This stage provides an opportunity to modify implementation, and to take into consideration feedback and issues arising.

Ongoing skills maintenance & review

In the period following implementation it is important to:

- Ensure that skills are maintained at both an organisational and individual level;
- Detect any latent problems, and;
- Seek opportunities to improve safety performance amongst multiskilled staff.

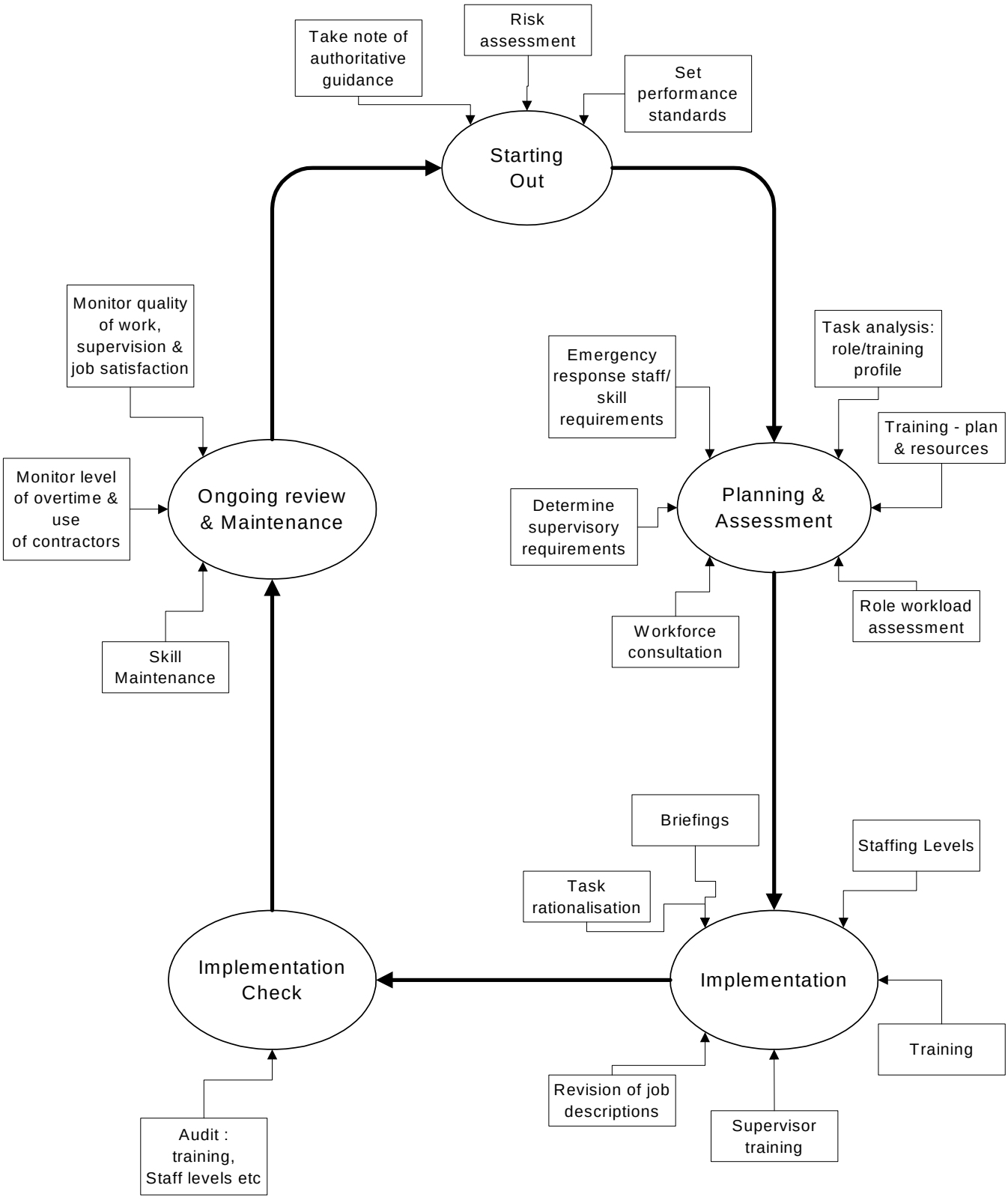


Figure 3: Life Cycle Model of Multiskilling

4.1.3 Life cycle model checklist

This checklist is directed at persons involved in making decisions on the detailed implementation of multiskilling and therefore which posts and individuals will be affected by multiskilling and how.

Starting out

1. Will the proposed organisational change involve:

   - Vertical multiskilling;
   - Horizontal multiskilling;
   - Multiskilled teams.

   This includes ad hoc / default forms of multiskilling where remaining staff take on roles of people leaving the organisation.

2. Have appropriate safety based limits been placed on the extent and form of multiskilling?

3. Are the competence standards for multiskilled roles sufficient to satisfy all health and safety requirements, including:

   - Process / operational safety;
   - Personal safety;
   - Occupational health, including stress.

   These standards should have regard for the safety criticality of tasks as well as the risk to staff.

Planning and assessment

Individual aptitude

1. To what extent do the individuals concerned have the ability to learn and take on a wider range of skills? Is it credible that even with a reasonable level of training and coaching that they will be able to perform proposed tasks to the required standard?

Synergy of tasks

2. To what extent do the tasks contained within a post form a meaningful and logical job? For example, does the range of tasks give the individual job variety, challenge and

opportunity? Is there synergy between the tasks or does the post comprise an ad hoc mix of activities?

3. Does the scope of individual posts give people a sufficient "perspective" on the interaction of their actions and decision on the safety of other inter-dependent activities and processes?

Technical complexity

4. To what extent does the technical complexity of the activities under consideration place limits on the range of tasks a person can credibly become competent in? For example, for complex control systems can people gather both the necessary breadth and depth of knowledge to carry out multiple roles effectively.

Feasibility of skill maintenance and Competence

5. Will there be a sufficient level of hands-on experience and / or refresher training to enable people to maintain a wider range of skills?

Workload

6. If staff numbers are reduced as part of the multiskilling process, will there be a sufficient number of staff to safely carry out safety critical tasks to the necessary standard? Account should be taken of emergent work, abnormal workloads, illness and absence and emergency events, as well as normal operating conditions.

Need for task independence

7. Is there a requirement to split tasks between two or more persons for the purpose of avoiding common mode errors? For example, splitting maintenance of safety devices between two people to ensure the same error is not made on all safety devices.

Team working and co-ordination

8. Is the task of co-ordination and work scheduling assigned to an individual who is not distracted by participating in this work?

Supervisory and task / error checking needs

9. Does the likelihood and consequence of error require that error checking is performed by an independent and competent person?

10. Do any of the tasks require someone to “shadow” work to detect and correct safety critical errors? Examples of this may include:

    - Performance of routine, but complex, operational or maintenance procedures;
    - Time pressured safety critical tasks.

11. Do any of the tasks require one or more persons to retain an independent (hands-off) overview of what is happening to prevent “mind set” amongst people? Possible tasks may include:

    - Detection, diagnosis and reaction to emergencies – especially where staff may be making decisions under stress;
    - Judgement-based decisions on safety management or engineering issues.

Avoidance of reliance on singletons

12. Does this task involve safety critical skill and knowledge for which the organisation should avoid reliance on any one individual, in case that person becomes unavailable due to (for example) illness, changing jobs etc?

Succession planning and management

13 Do the organisational changes impact on the flow of suitable new people with the necessary experience and competences

Training needs analysis

14 Have:

- Analyses been completed of the skills and knowledge required for each task / post?
- Skill / training profiles been drafted for each task /post, including qualifications, on the job experience and skill maintenance needs?
- Competence standards been set that reflect the required level of safety performance?

Individual assessment

15 Has the competence of individuals been compared with the task / post profile for the purposes of:

- Considering if that individual can take on a wider role, and;
- Defining individual training and coaching needs.

Certification

16 Has a system or register for recording suitably qualified and experienced people been developed?

Staff consultation

17 Have staff been consulted and involved in the proposed changes and given an opportunity to raise concerns and queries?

Implementation

Action planning

1. Is there a plan for the implementation of multiskilling (even where this is part of a wider reorganisation plan)?
2. Have all necessary safety issues been incorporated into business plans?
3. Do plans include methods to aid implementation, such as task rationalisation and new ways of working?

Resources

4. Has sufficient allowance been made for re-training and assessing staff in terms of time, costs and experienced trainers ?

Scheduling

5. Has sufficient time been allowed for all necessary facilitating steps to be completed prior to implementation of multiskilling? The intent is to ‘ease’ multiskilling in without

too much organisational disruption. If the implementation process is long, are skills learned early in the process being maintained prior to the opportunity to apply.

Consultation and briefing

6. Have all pertinent staff been briefed and consulted?

Organisation

7. Do all concerned understand their roles and responsibilities concerning the implementation of multiskilling ?

Implementation check

1. Have all planned organisational changes, training, briefing and procedural changes been implemented?
2. Is staff feedback on the standard of implementation positive or negative?
3. Are supervisors confident that performance standards are being met?

Ongoing skills maintenance & review

1. What evidence is there of the following:
    - A decrease in the quality of work;
    - An excessive increase in overtime;
    - Reliance on singletons;
    - Workload imbalance between multiskilled and specialist work;
    - Unforeseen or unplanned reliance on contractors / temporary staff;
    - Decreased staff morale and or increased stress;
    - Inability to complete work within scheduled time (without omitting tasks or taking short-cuts);
    - An increase in errors, re-work, incidents or injuries;
    - Skill decay, especially of rarely used skills;

- Staff complaints or adverse feedback.

2. Skill maintenance.

   - Have minimum levels of "on the job" experience / re-fresher training been specified for people to maintain competence?

   - Does job rotation and task allocation systems allow for skill maintenance?

   - Is adherence to skill maintenance requirements checked?

3. Continuous improvement

   - Has the task of identifying improvements to the performance of multiskilled staff been assigned to someone?

   - Is there a clear process by which improvements will be identified, such as by performance review and staff consultation?

4.1.4 Assessment, Planning, Implementation and Review Methods

Many of the methods noted here are common to other organisational changes, such as downsizing and self-managed teams, both of which are associated with multiskilling. As far as possible we have highlighted the application of these methods to the particular issues raised by multiskilling, drawing on the case studies and audits findings reported in this study.

Assessment and planning

1. Baseline resource needs analysis. This entails determining through a process of informed judgement and analysis, the minimum number of staff and management required to carry out operations safely. This typically involves a judgement of the number of people needed to perform specific tasks, aggregated up to give a total resource need. The results can be used to judge the number of people needed and hence guide decisions on how many people can or cannot be "let go" through multiskilling. Account should be taken of emergent work, peak loads, emergency situations, staff absence etc.

2. Task analysis. This is a method for describing work in terms of subtasks and defining for each subtask the requisite skills, knowledge and workload. It is typically applied to complex tasks such as control rooms and emergency response where it is difficult to reach conclusions based on judgement alone. It can also be used to guide the development of the task/competence requirements.

3. Checklists / lists of factors, such as those given in this report, may be used to aid decision-making.

4. Criteria may be defined for limiting the extent of multiskilling. For example, it maybe decided that only tasks which people will do fairly regularly are suitable for multiskilling.

5. Register of suitably qualified and experience staff. This is a record of which individuals have the requisite skills and knowledge to perform specified tasks.

6. Task Competence Framework. This is a listing of the skills, qualifications and competence needed for a post (based on an analysis of the tasks and requisite skills/knowledge needs).

7. List of safety critical posts / tasks for which the organisation should ensure it has more than one member of staff, to ensure availability of skills in all reasonably foreseeable circumstances.

8. Definition of minimum refresher/ hands on experience required to acquire and maintain skills, such as 1 day a month on task x.

9. Development of experience / training based limits on the range of tasks that people are allowed to do, such as a minimum of 6 months "on the job" supervised experience before a person is deemed competent to work unchecked.

Implementation

10. Formal certification of training and competence through, for example, formal tests, on the job assessment, simulator based assessment.

11. Experience and maintenance of competence by staff.

Review

12. Define and monitor performance indicators:

    - Overtime;
    - Use of contractors;
    - Staff morale / attitudes / stress;
    - Quality of work.

5 MANAGEMENT GUIDELINES

From the previous work reviewed and the case studies reported here the implementation of multiskilling initiatives can be seen as no different from any other sort of organisational change. Many, if not all, of the adverse impacts of multiskilling are rooted in how these changes are managed, particularly how they are planned, implemented and monitored. Some particular examples of omissions include:

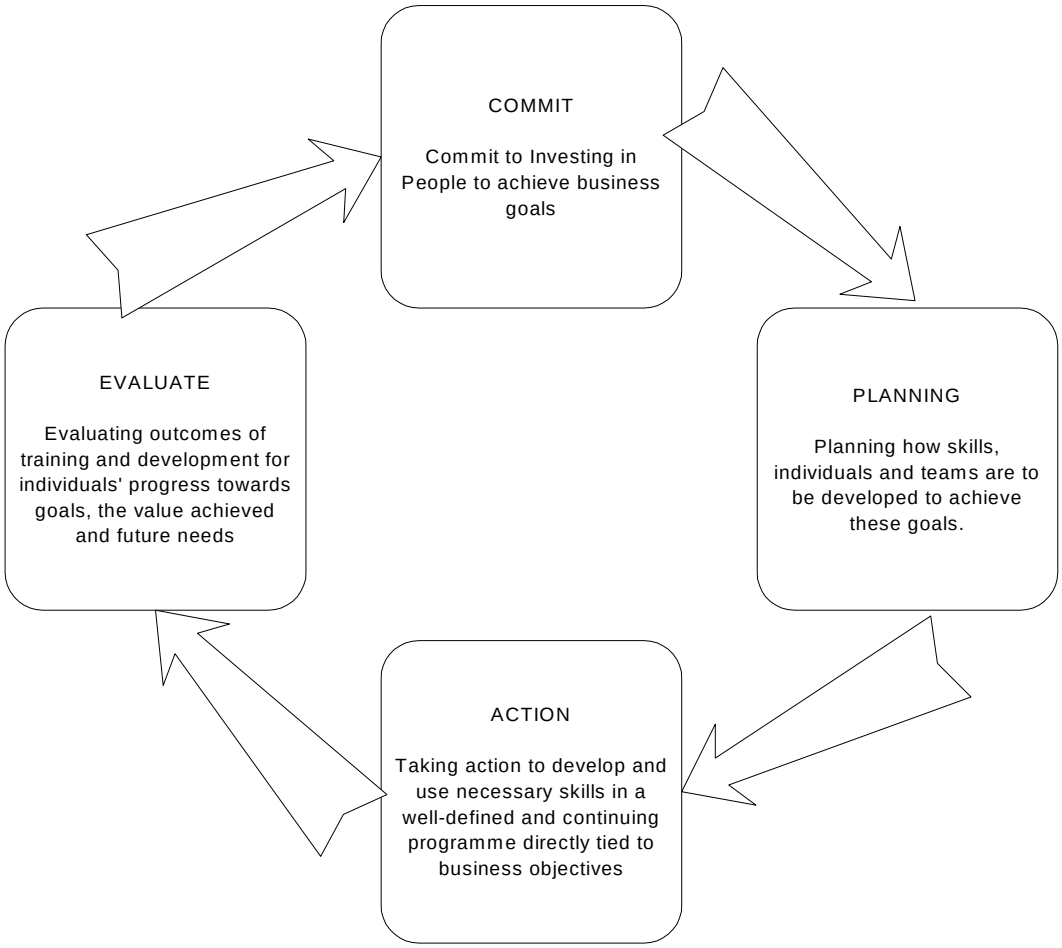
- Failing to recognise that a reorganisation or downsizing proposal includes or necessitates (implicitly) the multiskilling of individuals;
- Using business or cost reduction objectives to "drive" decisions without adequate consideration of health and safety impacts;
- Leaving site or department management to determine standards without guidance, thereby allowing standards to be decided by local "politics" with the result that inconsistent standards emerge;
- Failing to take note of or implement health and safety recommendations;
- Allowing resource constraints to delay implementation of (for example) training, and;
- Assuming that the absence of major problems, such as a serious accident, means that multiskilling is operating safely.

Accordingly, it is vital that persons responsible for conceiving multiskilling proposals, developing reorganisation proposals and implementing changes are aware of how their actions impact safety and take account of the potential safety impacts at each stage in the change process.

As multiskilling is often introduced as part of wider business plans it is useful to show how health and safety issues fit in with business planning process. This has been done by considering two common approaches, i.e. Investors in People and downsizing. These represent the two routes into multiskilling, one is done with the intention of improving the skills base, and the second where skill enhancement is secondary to the main objective of cost reduction. As stated in the literature review the underlying motive for multiskilling will affect its implementation and ultimately its efficacy.

5.1.1 Investors in People

The Investors in People (IiP) standard sets a level of good practice for training and development of people to achieve business goals. The standard has four principles, as follows:



Each principle is supported by a number of indicators that define best practice in planning, setting and communicating business objectives and developing people to meet these objectives. The process is intended to be cyclical and should engender continuous improvement. Achieving the standard entails:

1. Review current practices against the standard to identify gaps.

2. Making a commitment to meet the standard and communicate this to all members of staff.

3. Planning an action plan.

4. Implementing the action plan to bring about change.

5. Bring together the evidence for assessment against the standard.

6. Achievement of recognition as an Investor In People.

7. Continuous improvement.

None of the firms reviewed actually used the Investors in People approach to multiskill, however the guiding principles for proactively changing the organisation are directly relevant, and compatible with the checklists and guidelines provided in this report.

5.1.2 Downsizing and delayering

The primary aim during downsizing and delayering is to save cost and improve productivity by reducing the number of staff. Multiskilling assists the achievement of these objectives through:

- Reduced job demarcations, allowing people to do other work which allows you to do same work with fewer staff;

- Upskilling staff so that they can perform a wider range of tasks;

- Introducing multiskilled teams so that they can work together more effectively and efficiently;

- Vertical multiskilling, such that supervisors can help out when staff are busy, and remove first line management.

Downsizing may be introduced alongside some form of business process re-engineering wherein individual and team roles are re-defined to match the tasks required to manage a process from end to end rather than focus on one function / task within that process. This is intended to give individuals a greater understanding of the whole process, a more meaningful role and a greater customer oriented focus, when compared with a technical or task based role. For example, a manager and associated staff may acquire responsibility for the maintenance as well as the operation of a process.

The potential problems that may arise from this include:

- Health and safety considerations are omitted (overlooked) from commercially driven re-organisation plans.

- Central corporate commercial pressures override locally (well) managed multiskilling, pushing site to extend multiskilling beyond own good judgement.

- People are let go and remaining staff take on their tasks, leading to an ever increasing workload and multiskilling by default. Such multiskilling by default continues until operational or safety problems become obvious.

- Instead of training people before someone leaves organisation, the person is trained afterwards to compensate for their loss and the resultant lack of skill within the organisation. This also means that there may be no direct handover period.

- Work processes are not re-organised so as to reduce the workload before posts are merged.

- Staff are not briefed on their new range of responsibilities or change in work methods before task integration.

- Insufficient allowance is made for emergent work, illness, absence and peak workloads when deciding on the level of productivity that can be achieved from multiskilling.

- The range of tasks merged into posts is decided on the basis of BPR principles without sufficient account being taken of the ability of individuals and teams to maintain and apply the requisite range of competencies.

- The only limit placed on the process of multiskilling and associated downsizing is the occurrence of "undeniable" performance problems.

5.2 MANAGEMENT AIDS AND GUIDELINES

Three aids are provided to assist the management of multiskilling, namely;

- a list of the Do's and Don't of multiskilling;

- a characterisation of good and bad practice, and;

- a manager's checklist.

These aids are shown in the subsequent pages and are derived and developed from the findings and outcomes from the literature review, previous accidents and the case studies. They were developed to assist those responsible for making decisions on multiskilling, in particular those responsible for planning and implementing organisational changes.

Table 3 : The do's and don't of multiskilling

Do	Don't
Develop and implement a company wide policy to the management of the health and safety aspects of multiskilling.	Let the standard of health and safety management become the victim of local business/safety management haggling.
Give staff a role in planning and implementing changes.	Ignore the valuable insights from those who actually do the work.
Ensure individuals' jobs form a coherent whole that maintains morale, self-esteem and motivation.	Limit individuals' jobs so that they lack challenge & career opportunities.
Ensure that you have a full understanding of the level of staffing and mix of skills required to operate safely, and use this when agreeing cost reduction plans.	Set cost reduction targets solely on the basis of financial considerations.
Have a planned approach to job mergers and redundancy, ensuring that you understand what tasks need to be performed and what skills they require before planning job mergers and allowing people to take redundancy.	Implement an unlimited voluntary redundancy process, with multiskilling by default amongst the remaining staff.
Have the option to retain key people and skills in particular during the transition phases	Reduce staff before ensuring that the skills and expertise continue to be available during the transition.
Think about the necessary skills and experiences to ensure the relevant mix of expertise is still available within the company.	Multiskill without considering the impact on succession management.
Ensure you have an accurate estimate of peak and emergency as well as normal workloads when determining how many posts can be eliminated by multiskilling. It is important to maintain flexibility at the start of any initiative to ensure core skills are not lost. Also, ensure that it is possible for teams to possess all the necessary skills, as well as a balance of novices and experienced staff .	Base resource estimates solely on "normal" workloads.

Do	Don't
Ensure that staff competencies cover the full range of tasks within their remit by an appropriate mix of training, assessment & coaching, as well as refresher training.	Presume that people will "pick things up" as they go along Presume that professional or trade qualifications alone are sufficient – without hands-on site-based experience.
Assess and train staff on new tasks before widening their remit. Define a policy for overtime and monitor levels.	Allow compensatory measures, such as overtime and agency staff, to become the norm.
Audit implementation of these facilitating methods and mandate their prioritisation.	Allow steps required prior to multiskilling, such as training in new tasks, to be deferred.
Ensure that an effective process of task co-ordination, work planning and error checking is retained within multiskilled teams. Do allow team leaders time to carry out work planning.	Presume that team members will "sort themselves out"
Ensure team leaders / supervisors are competent in the management of multiskilled teams / staff.	Overlook that multiskilling introduces staff management issues.
Ensure someone has the role of "standing back" and taking the wider perspective, especially in emergency management.	Forget that "group think" and "tunnel vision" can blind people to their mistakes, especially under stress, e.g. emergencies.
Include the vertical and horizontal merger of management and supervisory posts within your review of multiskilling.	Fail to realise that merging management and supervisory roles is a form of multiskilling.
Set competence and workload limits on individual remits. Monitor the workload.	Keep on piling on tasks until people are overloaded.
Schedule hands-on experience, job rotation, refresher training, and competence assessment.	Ignore or forget the need for people to practice their skills
Proactively monitor the performance of multiskilled staff and teams.	Wait for an accident to happen before accepting that there are performance problems

Table 4: Characterisation of good and bad approaches

Poor practice - Waiting for the pain.
Multiskilling is brought about by default – as people leave the organisation their tasks are taken on by other people. It may not even be recognised that people are being obliged to become multiskilled or, at least, the potential impacts are either overlooked or not acknowledged. Individuals' new range of responsibilities may or may not form a coherent and appropriate whole. Decisions on how posts should be delineated are taken without an understanding of what tasks need to be performed and what skills / knowledge these tasks require. The numbers of staff are reduced, on the grounds that other people can take up their work, without any consideration of workload demands on people – peak loads and unplanned work is not adequately factored into resource planning. This is continued until performance problems become manifest. What was originally presented to be essential pre-requisites for multiskilling are either made optional or omitted with other temporary compensatory measures, such as using contractors or allowing more overtime, becoming the norm. No one asks staff whether they can cope with their broader remit. Staff must complain to get their concerns heard. It is assumed that staff can cope as long as a major problem, such as an accident or plant failure, does not occur.
Good practice **A planned and conscious approach to widening job roles in co-operation with staff that carefully considers health and safety at every step**
Senior management has developed an understanding of how multiskilling proposals may potentially impact health and safety performance and factored appropriate measures into their business plans. As a matter of policy, decisions on multiskilling take account of: maintaining adequate levels of staff competence and supervision; avoiding excessive workloads; maintaining job satisfaction and morale; and minimising stress. Key stakeholders, particularly employees, have been consulted on multiskilling proposals and their concerns and suggestions have been taken into account. Risk assessment is fundamental to the whole multiskilling process, from decision-making through to planning, implementing and ongoing management. Persons responsible for managing change have a clear view of what comprises multiskilling and have systematically identified all instances of multiskilling. In each case, appropriate standards have been set regarding the limits to be placed on the roles and responsibilities of individuals, the requisite level of training, assessment and skill maintenance. Limits on the extent of an individual's multiskilling take account of individual competence, the need to retain an element of supervision and spare capacity (e.g for illness), the technical complexity of tasks and the practicality of maintaining a broader skill set. In the case of multi-site firms, these standards have been formulated into a company wide "policy" or standard which is disseminated company wide.

In addition, an understanding of what skills and how many staff is needed to operate safely is used to inform decisions on the range and form of multiskilling. This includes an estimate of resource needs in peak load conditions, allowances for emergent work and staff absence and a profile of the skills needed for each safety critical post. Planning tools such as task/competence frameworks are used to guide and monitor staffing decisions. Enabling actions, such as training, reduced workloads, team-building etc are included in business plans and their implementation is audited. In addition, guidelines are laid down regarding the level of practice and refresher training etc required for individuals to remain "competent".

A set of performance indicators are defined and monitored, such as the level of overtime or quality of work, before, during and after the introduction of multiskilling to detect any changes in performance. The results of monitoring are used to guide decisions on changes in training, supervision and individual job scopes.

A checklist for implementing multiskilling

This checklist is directed at those decisions and responsibilities that are likely to reside with management and the implementation team, and in particular those responsible for planning and implementing organisational change.

1. Has the implementation team recognised which organisational and staffing changes entail (intentionally or otherwise) the horizontal or vertical multiskilling of staff involved in safety significant work?

2. Has the implementation team acquired an understanding of how multiskilling may impact (adversely or positively) both occupational health and safety and process / operational safety?

3. Has the implementation team taken account of HSE and other pertinent guidance on the regulatory requirements regarding multiskilling, such as staff competence and supervision etc?

4. Have staff been consulted by management on multiskilling proposals?

5. Has the implementation team formed a view (and effectively disseminated it) on the limits to which people should be multiskilled and what factors should be taken into account for individuals cases?

6. Has the implementation team ensured that sufficient staff time, calendar time and expertise have been made available to carry out necessary training etc?

7. Has the implementation team ensured that when multiskilling an accurate assessment of workloads, competence needs, and individual competence and supervisory needs has been used?

8. Has the implementation team used appropriate evidence to satisfy themselves that actions that will facilitate the implementation of multiskilling, such as retraining, and Human Resource framework etc, have been fulfilled?

9. What criteria/guidelines have been developed regarding the level of “on-the-job” experience, refresher training etc required for people to remain qualified in each skill / task area? As well as how this will be monitored and maintained ?

10. Has the implementation team used appropriate evidence to satisfy themselves that the new ways of working have not led to a reduction in health and safety standards, in particular during the transition phase?

6 ASSESSMENT AND INSPECTION GUIDELINES

6.1 INTRODUCTION

This section of the report discusses the requirement for new HSE guidance. First, the scope of the 1998 guide on multiskilling in the petrochemical industry is compared to the range of issues identified by this study, and recommendations are given for new guidance. Secondly, consideration is given to the format of guidelines for use by HSE inspectors.

A checklist is in Appendices C, based on the points laid out below.

6.2 INFORMATION SHEET

The 1998 HSE document on multiskilling in the petroleum industry covers many of the issues identified by this study. In particular, it gives a clear view of the training and skill maintenance issues related to multiskilling. However, there are two sets of issues that could benefit from greater attention, as outlined below:

1.The management of change

As previously discussed, multiskilling is often introduced as part of a wider set of organisational changes, such as downsizing and self-managed teams. As these changes are driven primarily by business requirements, it is important that HSE guidance on multiskilling is placed in the context of organisational change, particularly how the wider process of re-organisation may impact the efficacy of multiskilling.

2. Vertical multiskilling and multiskilled teams.

The 1998 HSE guide focuses on the most common form of multiskilling, namely horizontal multiskilling. This study indicates that performance problems are reported at least as frequently, and possibly more so, with vertical multiskilling and multiskilled teams. This suggests that the focus of guidance should be adjusted to reflect more closely the source of problems rather than the more common forms of multiskilling.

None of the case study organisations had consulted this guidance or any other published material on the specific issue of multiskilling.

Other useful HSE publications that will provide useful information to companies undergoing multiskilling are ‘Reducing Error and influencing behaviour’ (HSE, 1999b), and the ‘Guidance on Competence Management and Assurance’ (HSE, to be published).

6.3 INSPECTION GUIDELINES

The inspection guidelines need to satisfy several objectives, namely:

- It should be compatible with other guidance used for assessing the standard of safety management;
- It should help inspectors “test” the standard of performance, including the standard to which changes have been managed as well as the performance of multiskilled staff;
- It should be applicable to small and medium sized firms as well as large ones;
- It should be applicable across a range of operations.

Accordingly, it is proposed to structure a set of questions around the model in HSG65, particularly the Policy, Planning and Organisation, Monitoring, Audit and Review framework, as this is the “standard” for HSE audits. The guidelines should also contain questions that can serve the purpose of testing performance, i.e. performance indicators. Finally, the questions and performance indicators should be sufficiently generic to apply to all types of organisations. This is shown in Appendix C.

7 CONCLUSIONS

The compilation of research, accident reports, audits and case studies in this report provides a comprehensive view of the potential risks associated with multiskilling and how to manage them. Firstly, the potential adverse impact of asking people to work outside of their limits is (usually) clear and recognised. This is most clearly shown by the case studies where multiskilling of tradesmen and operators is approached in a planned and systematic manner, as it is recognised that staff cannot reliably carry out work without the requisite skills. Indeed, case study firms placed clear boundaries on the extent of tradesmen / operators multiskilling and, in some cases sought to multi-skill teams rather than individuals because of the recognition of individuals ability to take on wider remits. Similarly, a large proportion of previous research and guidance focuses on horizontal multiskilling of operators and tradesmen.

Secondly, most problems appear to be associated with the "peripheral" aspects of multiskilling, such as workload and supervision. This appears to be partly because these issues are less obvious and, as such, are more vulnerable to poor management of change. Such "peripheral" issues can be overlooked during "business driven" reorganisations, such as downsizing, where multiskilling is one part of a wider process. This suggests that guidelines should be refocused onto the change management aspects of multiskilling and greater attention awarded "peripheral" aspects of multiskilling, without downgrading the risks associated with horizontal multiskilling.

Thirdly, the case studies indicate that sites of all sizes can manage the introduction of multiskilling in a systematic manner. It is just the form of management that differs with smaller sites / firms relying more on verbal communication and less on documentation. However, even small sites / firms can develop task-based skill matrices, schedule "on the job" experience and place limits on individual's roles.

The study also indicates that the specific multiskilling risk controls vary according to many factors, such as task complexity, frequency, safety criticality etc. Accordingly, it is important that firms have an understanding of these factors and a systematic process for assessing and planning around them. Therefore, the guidelines in this document should be used by firms to guide their own risk assessment and development of risk controls. Notwithstanding the potential for adverse impacts, this research indicates that when properly managed, the introduction of multiskilling need not endanger safety.

Finally, whilst this study did not set out to focus on the adverse safety impacts of multiskilling, it has inevitably done so for two reasons. Firstly, multiskilling is most commonly introduced primarily for business reasons rather than to enhance safety performance. Accordingly, the focus of consideration has been directed towards potential safety oversights in business driven processes. Also, few studies have tracked safety performance, and have certainly not tracked leading indicators such as staff safety behaviour and attitudes. Consequently, reports on safety impacts are typically restricted to adverse events, such as accidents. Therefore, any further research could usefully adopt a different "starting point". That is, it could explore how multiskilling (or skill broadening) may offer safety benefits. Such research may help identify and prompt "safety driven" multiskilling. This would be of particular relevance in the case of safety critical tasks and posts, such as emergency management and operation of safety critical processes, where improved competence may offer clear safety benefits.

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APPENDICES

APPENDIX A: QUESTION SET

APPENDIX B: CASE STUDIES

APPENDIX C: AUDITORS CHECKLIST

APPENDIX A – Question Set

Background

Name of firm

Number of employees

Nature of business

Multi-Skilling Facts

What sort of multi-skilling has been carried out ?

- Vertical multi-skilling (e.g. some level of supervisor skills)
- Horizontal multi-skilling (e.g. cross disciplines)
- Depth multi-skilling (e.g. in depth specialisation)
- Skill broadening

What activities and personnel have been multi-skilled?

Organisational Objectives

What motivated multi-skilling ?

Were these changes part of an ongoing process of organisational change ?

When was multi-skilling first initiated ?

What stage has the organisation reached ?

Why do you do things the way you do ?

What are the indicators as to whether multi-skilling has been successful ?

What were the costs of multi-skilling to the organisation ? and what was considered when working out the costs ?

What were the intended benefits to this organisations of multi-skilling ?

- Productivity
- Reduced costs
- Increased employee well being
- Reduced trade demarcation
- Decrease role of trade unions
- Increased job satisfaction
- Organisational commitment
- Other

Planning

Please describe the process of multi-skilling as used in this organisation ?

- Initial conception
- Design roles
- Task analysis
- Core skills versus supported skills
- Recognition of formal vs informal ways of working
- Core competence
- Skills matrix
- Training – on the job
- Training – off the job

- New job description
- Risk assessment
- Involvement of workforce and trade unions
- Pay scales
- Training
- Subsequent management
- Other

How were the workforce involved in this process ? Role of trade unions ?

Was health and safety ringfenced ? What was negotiable ?

What measures were taken to ensure health and safety did not suffer ? both during the change process and once multi-skilled ?

- Permit issuing
- Safety critical work
- Maintenance
- Infrequent jobs
- Performance standards
- Consequences of error

Were there any health and safety issues considered vulnerable ?

Training And Competence

What is the aim of training ?

What training is given ?

How were the trainers trained ?

What was covered in the training ? e.g. decision-making, team skills etc

Was trainability considered ? Was it compulsory/self selected ?

How is competency assessed ? assured ? and maintained ?

What is the mix between on-the-job and off-the-job training ?

What is the focus of training ?

- Skill acquisition
- Knowledge acquisition
- Health and safety
- Understand limits of skills

Following training what opportunities are provided to use the skills acquired ?

Ongoing Management

Has multi-skilling achieved the anticipated benefits ?

Does multi-skilling work as anticipated ?

How are jobs allocated to multi-skilled workers ?

What has the impact been on health and safety

Does multi-skilling work in the way expected ?

How are core skills maintained ?

How do you guard against stagnation and de-skilling

How are one-off-jobs carried out

How is succession management planned ?

Are multi-skilled workers adequate ? Is their training and competence considered adequate and equivalent to specific individuals

Have you taken any steps in terms of the long term implications of multi-skilling on succession management etc.

Have you had an independent review from an external organisation ?

APPENDIX B – CASE STUDIES

COMPANY A

Business

The Control Centre is responsible for the central control and monitoring of all rail operations in the main tracks in the concession. Its role is to control and monitor all activities under normal, abnormal and emergency operating conditions.

The main activities carried out in the control centre are:

- Rail Traffic Management System (RTM) – which controls and monitors train movements, and primarily controls the signalling system. This is is a safety critical post.
- Equipment Management System (EMS) – monitor conditions and remotely control all other equipment e.g. ventilation, electrical supply, lighting, cross passage doors, cross over doors. This is a safety critical post.
- FDC – Fire Detection Controller– monitors all fire alarms in the tunnel. The FDC is a safety critical role.
- Quickshuttle Desk – a management information system, used to provide information to the business about operations.
- Supervisor – providing independent management oversight in normal operations and in case of an incident. The post is safety critical.
- Smoke Management Controller – backs-up the EMS Controller and advises during an incident. Tends to be a multiskilled Controller where possible. (Not a full time mandatory position).

General approach to multiskilling

All tasks, except that of the supervisor, are multiskilled to provide flexibility. However when the RCC was visited only a small proportion were multiskilled. The major tasks are EMS and RTM controller, whilst minor tasks are FDC and Quickshuttle. Less rigorous selection procedures were originally used to fill the FDC posts, and this is taken into consideration when multiskilling. Hence FDC would not be multiskilled up to either an EMS or RTM. Individuals are multiskilled between the roles. Hence an RTM could be multiskilled in EMS, Quickshuttle and FDC; whilst an EMS could be multiskilled in RTM, Quickshuttle and FDC, and FDC/Quickshuttle could be multiskilled between these. Two is considered to be the ideal number, three is satisfactory. Above 3 is considered too much. No one covers for the supervisor, as a single focus is considered essential for incident management.

Organisational Objectives

Provide cover for training/lunches and breaks. Under French law each team member has to have a thirty-minute break every eight hours. Multiskilled people are used as a means of providing cover within the team to allow people to take breaks, and comply with the law.

Multiskilling has provided the flexibility without having too many under-utilised staff.

Planning

Task Analyses were carried out for all safety critical activities. These analyses identified all the tasks along with the frequency with which they are carried out, and the competencies required.

Job descriptions are available for each position.

The multiskilled person within the RCC operates a different shift pattern to the traditional RCC team. Over any 24-hour period the multiskilled work two 8-hour shifts to provide maximum coverage for breaks. The normal shift team work 8-hour rotating shifts. There are 2 shifts for the polyvalent over the 24-hour period, which are offset by a couple of hours to ensure maximum coverage. The multiskilled person, therefore does not stick with just one shift team, and principally cover for breaks etc.

Training and Competence

It takes 6 months to train up to become either an EMS and RTM controller. The training is a mix of theory and practical. Over the six months the trainees are tested weekly, monthly and at the end of the six months have to pass a test and an on-the-job practical. The last two months of training are on-the-job, being observed by a qualified controller. The final two months allow the candidate to receive a lot of feedback from the supervisor and the existing qualified controller to hone their skills. There is a perception that it takes about 1 year to feel fully au fait and competent on the job.

The FDC requires 3 weeks training (2 in the classroom and 1 on the job). Whilst the Quickshuttle training is 3 weeks and Supervisor's training is 1 month.

When an operator becomes multiskilled in one of the other disciplines he undergoes the full training required for that additional skill. So for an EMS to become multiskilled they would need to train for 6 months to become multiskilled in RTM. Over the course there is a gradual blending of theory and practical, where the practical elements are increased over the duration of the course. Management makes the assessment of competence and subsequent certification.

Competence is assured by refresher training. This is currently 3 days every 6 months for single skilled operators. For multiskilled staff this is 2 days per discipline per 6 months. The time is used to review previous incidents, provide up-dates on new procedures etc. Separate from this is recertification every 3 years by an exam and practical assessment for each post.

The training process is audited. The competence of trainers and the process is assessed both in terms of paperwork and delivery. This is subject to external audit, also.

Health and Safety – Main Stages

The Rail Traffic Management controller can be a demanding and potentially overloading position. Whilst the Equipment Management System is more about monitoring than vigilance, however there are over 100 screens to navigate round, staff need to be familiar with these to get there quickly. It is important therefore that full competence is maintained as the posts are extremely demanding and, under crisis conditions, controllers need to quickly and competently respond.

The use of multiskilled personnel in the team to provide cover means that handovers are critical for the safety of the tunnel. So each break is preceded by a ten-minute handover of the post. However this means that Rail Control Centre is subject to many handovers during a 24-hour period, and that individuals have to be clear about what roles and position they are in at any one time. The handover process has been formalised, as there was recognition that increasing the number of handovers increased the likelihood of oversight and error.

There is also a danger that multiskilling can lead to the dilution of skills and the loss of abilities.

Ongoing Management

For maintenance of competence of the multiskilled disciplines they are rostered into their skilled posts for one shift per month per discipline.

The multiskilled or polyvalent workforce provides the rostering clerk with flexibility. They tend to be slotted in where cover is required. This means that the multiskilled do not work in the same team, and rarely get to work a whole shift occupying one role.

Costs/Benefits

Each extra certified skill means an increase in pay to the individual. It is therefore a valid route for pay and progression within the company.

Multiskilling provides an opportunity for the workforce to increase their job satisfaction by increasing the variety and challenges in their job.

There is a perception by some that it is very difficult to maintain full competence in two or more very demanding jobs with very deep skills and competencies. The current nature of Company A and the scarcity of multiskilled individuals exacerbate this, making it unlikely for a polyvalent individual to do a whole shift in one specific role. However as multiskilling is a mission for the organisation and therefore multiskilling of the workforce will continue this will possibly change.

Conclusions/Summary

Well planned process

Mechanisms in place to ensure those skills are kept up to date, through refresher training, rostering and recertification.

However the polyvalent perceive themselves as dogsbodies who are ‘floating’ rather than taking a real and important role in the team. At present provision of cover is not perceived as a valid team role.

COMPANY B

Business

Company B employs approximately 55 people on site. It provides support to the main production facility on another site. There are two groups on site: Petroleum Specialities and Operations Group.

The Operations Group runs 7 test bed cells where they do both engine and vehicle testing. The group also has responsibility for site maintenance. Some of these are contracted out to engine manufacturers, and oil companies. Petroleum Specialities is part of the Research and Development/Corporate Technology Group. They carry out laboratory work, quality assurance, and product support services for the rest of the company.

The company's health and safety record appeared to be reasonable, with no HSE reportable accidents over recent years.

General approach to multiskilling

Flexible approach necessitated by downsizing and reduction in headcount that means tasks still need to be completed by the remaining workforce. This has resulted in a large proportion of the workforce adopting flexible work practices to cover operational and maintenance activities.

The maintenance function, as a result of downsizing are all multiskilled, to cover the full range of activities from milling and turning, machining, general maintenance, buildings maintenance, welding etc. The foreman allocates tasks on the basis of individual's competence.

Security staff have been multiskilled to carry out a range of different activities, for example, safety inspection, checks on flame/smoke detectors, check fire extinguishers. Additionally all security are trained to be involved in the Emergency Response Team.

A lot of staff are trained to be involved in the Emergency Response Team.

Organisational Objectives

Due to the size of the workforce it is considered impossible to have staff dedicated to one job. People are put into roles, which are consistent with their competence and levels e.g. so an engineer would not be trained in laboratory based tasks.

Hence multiskilling provides flexibility to cover the requisite organisational tasks, as well as provide cover for leave and holidays.

Planning

The process is very ad-hoc. It is about craftsmen carrying out a trade rather than being fully trained and signed off as competent in that trade. So skills are picked up, but formal qualifications not granted.

For complex activities specialist contractors would be brought in.

Training and Competence

The majority of training on the site is carried out on-the-job by sitting with Nelly. Typically you learn from the organisational expert. A supervisor will then determine whether you are good

enough from observing and testing your performance. This method is used both for normal training, as well as for multiskilling.

Emergency Response is tested monthly and is used as a training exercise for the workforce where breathing apparatus, fire control and spill response is covered. A formal 2 day course on fire is held for the Emergency Response Team, but the rest of the training is on the job.

Training records are part of the quality system. A performance review is held every year with each employee, where courses and refresher training is identified.

Health and Safety – Main Stages

The company has a safety policy, which empowers the workforce to stop work on health and safety grounds. The staff spoken to would be happy to use this policy to refuse to do work they did not feel safe carrying out. They perceived that safety was an organisational priority. A number of formal and informal mechanisms exist for safety concerns to be addressed, including:

- Regular formal safety meetings;
- Working sections ad hoc formal and informal discussions on safety;

The company believes that individuals will raise issues with their supervisor or safety rep, and that a safety concern will be addressed before it escalates.

Permits-to-work are still issued by supervisors, to avoid mistakes and short-cuts.

Ongoing Management

Due to the size of the workforce and hence the teams, supervisors are aware of their teams strengths and weaknesses and issue work accordingly. Job descriptions exist for all individuals detailing the skills in which they are competent.

Costs/Benefits

Multiskilling has allowed the company to be more flexible and deal with the reductions in headcount. This has resulted in reduced costs.

A benefit of multiskilling is that it gives the workforce opportunities to enhance their CVs. Furthermore the workforce perceive it as making the job more challenging. A balance needs to be sought, however to ensure that staff do not become stressed and overloaded, especially when dealing with long term sick and holidays. Furthermore there is a danger that individuals may carry out tasks that they are not competent to carry out ‘just to get the job done’, as well as over the long term a loss of corporate skills.

Conclusions/Summary

To a certain extent multiskilling within Company B is an inevitable consequence of their size and the recent history of radical downsizing. The application of multiskilling has been ad-hoc with few formal organisational controls in place. The research could not identify whether the informal strategy had any mechanisms for avoiding inadvertent errors, and avoiding the fairly obvious desire in small down sized company of a ‘can do’ attitude which possibly has safety implications.

COMPANY C

Business

Company C is a major basically separates air out into its constituent parts (e.g. oxygen, nitrogen and argon) to provide to industry. The site provides gases by tanker, but also operates a number of unstaffed satellite sites, where gases are piped direct into the plants. The site (including satellites) employs 80 people, approximately half are drivers. 33 people actually run the plant. The emphasis, particularly in light of their high profile customers, is on continuity of supply and high quality.

General approach to multiskilling

Multiskilling was introduced about 20 years ago to equip the satellite sites with staff to deal with any issues that emerge during operation. Multiskilling company wide though has been pushed forward over the last 2 years.

The Facility Engineers are the staff that manage the satellite sites. This is a well-established role with all of the engineers multiskilled. Their role involves dealing with day to day operations on the remote sites e.g. permit to works, isolations, trips, running repairs.

In the control room at Motherwell all the staff are multiskilled. Their role involves dealing with safe systems of work, issuing permits, contractor induction, method statements, status monitoring, equipment checks.

The Storesman is trained to deliver contractor training due to a reduction in his workload over recent years.

Multiskilled teams are also in place, where efforts are made to ensure that there is flexibility within the team, and a balance of appropriate skills within the team.

The engineering discipline is still organised down traditional lines, such as electrical, instrumentation and mechanical.

Organisational Objectives

The aim of multiskilling was to increase organisational flexibility. Due to low staffing levels multiskilling enhances the skill set of people on site, increases the chances for resolving issues, or acting as an intelligent customer out of hours. The site manager believes that multiskilling has created an intelligent customer (i.e. the process side of the business can accurately describe their maintenance needs to the engineering function) which makes the whole initiative worthwhile. On the satellite sites multiskilling increases the likelihood of resolving the issue on site, and therefore decreases the impact of delays and quality issues to the customer.

Company philosophy is to carry out more work with fewer staff. Multiskilling supports this objective.

Planning

Tried to design the team to have a mix of skills within the works team, as well as multiskill the existing staff.

In 1994 in association with the unions set up a partnership deal which supported the multiskill initiatives.

The company is developing rapidly, and due to recruitment constraints and the importance of flexibility, succession management is now based on multiskilling. Deliberate efforts are made to ensure that key skills are not lost, by providing opportunities for staff to continue working in their original skill discipline (for one week out of the 6 week shift cycle).

The philosophy appears to be about boundary crossing, and encouraging people to extend their skills. Staff volunteer for skill broadening.

Training and Competence

Training is a mix of on-the-job, computer-based simulations (where available), and classroom sessions. The majority of training tends to be sitting with nelly, and learning in the form of 'watch this and then do this'. Usually a mentor is allocated who accompanies a trainee for three months. The supervisor and manager agree the training requirements and the time to become competent. It is recognised though that the time required is flexible and depends on the individual. BOC recognises the importance of building confidence. On the whole only capable people are recruited. Recent new recruits have been agency staff moved to permanent positions following a period of demonstrating their competence.

For all staff a Training Needs Schedule is completed every 12-18 months. This provides an opportunity for the management and the workforce to identify training needs and skill gaps. The Training needs schedule lists the skills and knowledge required for each task. The list covers: health and safety, quality, any management/ supervisor skills, as well as the specifics of a job (e.g. safe systems of work, plant operation etc.). This is reviewed in light of peoples' experiences, and gaps identified and training provided where appropriate/available.

The most capable and competent staff are recruited for posts on satellite sites. This in part is due to the high profile customer-facing nature of the role. Typically they are well motivated and technically competent. Currently BOC are pursuing succession management and have recruited some service technicians who will over time be competent Facility Engineers. Training provision is on the job. Half of the service technicians time is in the new role shadowing the existing engineers and the other half carrying out maintenance tasks at the main Motherwell site. They are trained to do stop/starts of the plant safely, trouble-shoot, and take logs. Basically the technicians are allocated a Facility Engineer mentor who they shadow and observe doing the tasks. Each technician keeps a log book of the tasks they have observed and carried out. Each trainee has a probationary period. The decision on competency is made by management against a schedule and discussions held with the trainee about confidence in skills and abilities, as well as competence at executing them.

The control room staff are also multiskilled. They tend to be recruited from one of the major trades, and then learn control room tasks by working closely with a competent operator.

For on the job training trainees can switch shifts to learn from other individuals within the team, and for wider exposure of experiences.

Log books are used to define activities carried out, which is then used to support assessments of competence. Limits are defined for individuals to determine competency limits.

Health and Safety – Main Stages

Efforts put into teaching people the limits of their competence, and tasks that they are capable of addressing and those where further expertise is required. Staff stated that they would always ask and that organisational experts are always willing to help.

Stress is an issue with the multi- Engineer post. This however seems to be linked to the high expectations associated with the post rather than the multi-skilled aspects of the position.

The company has well documented procedures for plant activities. Risk assessments are carried out for many activities. Electricity is an important hazard for BOC. Only authorised competent staff work on switchgear. Logs are kept to ensure that only authorised and competent staff are allowed to work on the switchgear.

There is a call –out system for out-of-hours to ensure people only carry out work for which they are competent.

Ongoing Management

Control room staff & plant technicians spend 20% of their time maintaining their original core skills.

At the corporate headquarters technical expertise exists and is available to support activities either over the phone or in person if required. Procedures exist for all main activities. Risk assessments are carried out for deviations from typical work activities to identify safe methods of working, and work is preplanned. Permits and method statements support hazardous work.

Significant efforts are made in ensuring the workforce feel valued. The organisation is non-hierarchical and communications strong. Email is available to all staff and is used to communicate a lot of company information. An intranet is being developed to support operations on site.

The workforce are trained to understand their personal competence limits and are encouraged to standback and think about a job before undertaking it. There is some evidence of production pressures and a desire to get the job done, however those interviewed stated that safety would always be considered.

Costs/Benefits

Staff feel valued and believe that it makes their jobs more secure. This has positive effects on morale and on stress levels. However the workforce perceive multiskilling as a way of decreasing overheads for management, whilst the facility engineers find their role particularly stressful. If multiskilling is used as a means to reduce manning levels, stress and mistakes may result.

From an organisational perspective multiskilling helps individuals to recognise what is going on, basically the more informed staff are the better it is for the organisation. This is particularly the case on the unmanned satellite sites where staff are called in to deal with issues.

For out of hours work and problems at the satellite sites multiskilling has meant a reduction in delays incurred from calling out engineers. Savings are therefore made in call-out costs, and also reductions in downtime, which enhances customer satisfaction.

Conclusions/Summary

Multiskilling at Company C was initially carried out to equip staff responsible for satellite sites to be mainly self sufficient in terms of the day-to-day routine running of plant. Over recent years other members of staff have being going through a multiskilling process, this is mainly staff in the control room. Training is predominantly on-the-job, and is initiated by annual appraisals where training requirements are identified. Competence is agreed between the individual and a mentor on whether they have the skills and the confidence to safely carry out a task.

COMPANY D

Business

Company D is sugar beet factory which produces granulated sugar, and animal feed. Sugar is produced from sugar beet between September and February each year. This period is known as the 'campaign' during which time the factory operates continuously. The rest of the year the factory carries out maintenance tasks to ensure reliability and continuity of operation throughout the campaign. The factory has 110 permanent staff, which is supplemented by casual labour and reaches 180 during the campaign.

The company has a safety management system that is awaiting accreditation.

General approach to multiskilling

In the late 1980s the factory tried to multiskill electrical and mechanical tradesmen. This never got off the ground due to a number of human resource issues, and was abandoned.

In 1990 staff development was introduced in conjunction with a union agreement. The changes included a move to annualised hours and salaried pay, as well as multiskilling initiatives. It is a corporate expectation that everyone will be multiskilled, and is a condition of employment for most staff. Staff aged 50 or over do not have to multiskill.

Types of multiskilling carried out include:

- Electrical craftsmen – have the option of instrumentation / process / mechanical appreciation.
- Mechanical craftsmen – have the option of electrical appreciation or process skills.
- Process staff – have the option of electrical or mechanical appreciation.
- Instrumentation craftsmen – do instrumentation plus where additional skills within the same discipline due to the high demands on instrumentation staff.

In mechanical appreciation they learn how to maintain gear boxes, conveyor rollers/bearings. Whilst electrical appreciation covers being able to carry out resets and basic electrical work. Process staff are trained in proactive maintenance, e.g. vibration analysis, oil samples and trying to catch breakdowns before they occur.

Organisational Objectives

State that the company's objective aim of multiskilling was the development of its staff, however they recognise that it has decreased labour costs. Five years into the initiative they reduced the workforce by 35.

There are fewer engineers now on shift due to the enhanced capabililites of the rest of the workforce.

Multiskilling provides flexibility within the team for individuals to carry out some maintenance activities. Areas are allocated to particular teams, especially out of campaign, which encourages ownership of a particular area.

The site focus is on production and maintenance of production during the campaign. Whilst out-of-campaign planned routine maintenance is carried out to ensure the reliability during

campaign. Typically only essential maintenance and running repairs are carried out in campaign.

Planning

Team mentors are used as an interim measure in the transition to multi-skilled self directing teams. The mentor's role is to get across management values as the role of supervisor is removed. Linked to the transition of self directing teams is the idea of ownership of bits of plant out of campaign.

Workforce would not participate initially. It was the principle of change that people were against.

Flexibility is about equipping individuals with enough secondary skills to be able to carry out their task, e.g. some level of mechanical activities to allow a predominantly electrical job to be completed. This is known as enhanced skill units, the company developed a list of these activities. The aim is to ensure that activities are streamlined and additional skills trained.

Training and Competence

Traditionally competence was assumed following training. However individuals are given a log book which is signed off by the supervisor, had to have requisite amount of time on jobs. Typically competence is agreed between the supervisor and an individual agreeing whether they feel competent and confident that they can adequately carry out the task. The company wants to encourage individuals to enhance and develop their personal skills. However acknowledge that one of the key things is to ensure that individuals understand what they are not competent to do.

An external organisation provided training on the basics of engineering. This was primarily education. Individuals then on-site had to learn applications all over again through sitting with nelly. The aim is for people to learn to use their skills safely. Most difficult to train is electrical safety, as the hazards are invisible. A lot of material in the original training was irrelevant and it subsequently has been tailored and focuses more on the factory requirements. Safety very strongly stressed.

Multiskilling was offered to craftsmen or grade 9 process staff – i.e. already fairly skilled and competent staff.

Part of the downsizing process was to make sure that people employed were up to the job. This was known as 'Operations Focus' and considered individual's competence and attitude assessment. Basically the workforce were regraded and paid more for more responsibility or skills.

For ownership of maintenance tasks all staff have been sent on a 'Managing Safety' course. The emphasis is placed on risk assessment and the safety element, with a belief that everyone is responsible for safety.

Have a career planning interview ever year talk about the job, the training, safety and future needs and discuss requirements, and if it is consistent with the business need then will receive requisite training. There is now more thought in terms of what is trained, to ensure that skills acquired are practiced. This should help ensure that skills are relevant and will be used. Lots of courses are offered and are available, for example on risk assessment, manual handling, safety, multi skill modules. Training checklists exist against which competence and training is carried out.

Health and Safety – Main Stages

More people in this multiskilled environment carry out safety critical tasks. However tasks are only allocated to people exhibiting certain key competencies. For example a 'responsibility list' is used, which lists the authorised and competent individuals for certain tasks. This is mainly for permit issuing, and what you are and aren't authorised to do. It is about matching competence and the need to do the job. The site use a complete suite of permits (mechanical/electrical/hot work/ chemical/confined space/height). Traditionally the supervisor issues these but self-directing teams will be taking responsibility for this. They will not allow self authorisation.

Accidents and their investigation reports are circulated via email to ensure corporate learning.

All those interviewed said that they believed that safety came before the process, and that they would happily overrule the production manager in the interests of safety.

Ongoing Management

Operating procedures are in place. Individuals are trained against these, and they are also a measure of competence.

Efforts are made to ensure that skills trained are used. Furthermore individuals will not be expected to carry out tasks they do not feel happy doing.

Some process staff initially lack confidence in carrying out multiskilled tasks. The culture is that these individuals will ask and double check before carrying out these activities. Additionally the team is multiskilled, so that each team is composed of people possessing the requisite skills.

Workforce appear to welcome and embrace the dual nature of their jobs, from during the campaign process jobs, through to out of campaign and ownership of maintenance tasks. Out-of-campaign the teams were selected on the basis of the skills required for that team. The teams were selected on the basis of training records, and are stable due to the low turnover of personnel.

In terms of succession management British Sugar are currently taking on apprentices and multiskilling them. Have process technicians responsible for each bit of plant.

Costs/Benefits

Huge culture change

Increased flexibility of the workforce. Provision of cover for sickness.

Increased ownership of areas of plant by the workforce.

Increased job satisfaction for process workers during the out of campaign months.

There is a danger of a 'can-do' culture developing where individuals are keen to demonstrate their worth and potentially do tasks which they are not competent to do. The organisation stressed that safety would not be threatened and that individuals were aware of their limits.

Conclusions/Summary

Multiskilling at Company D was carried out as a way of ensuring that process workers were effectively utilised out of campaign. This has involved process staff being trained in maintenance activities and allocated to a specific area of plant as part of a larger team to carry out maintenance on plant. The initiative has been in place since the early 1990s and now appears to be well accepted and received by the workforce. Originally the company had

difficulty implementing the scheme. The management process appears to be well established, and the company has heavily invested in training the workforce. Sign off of competence is done in agreement with the individual and a line manager.

COMPANY E

Business

Company E is a nuclear power generator. This industry is highly regulated, and their activities are closely monitored and scrutinised by a Nuclear Installations Inspector. The multiskilling initiative was commenced in 1997.

General approach to multiskilling

Any job where you're involved 80% of the time but 20% of the task involves others.

So mechanical and electrical craftsmen are multiskilled to do some elements of the other. Instrumentation staff are not multiskilled (with the exception of Health Physics work)

Operators do minor maintenance work, e.g. trained to be able to recognise good or bad work, and record keeping.

Security staff are cross trained to do safety checks out of hours, as well as some lighting work.

All staff are multiskilled with radiological work to do self monitoring.

Organisational Objectives

Chief motivator was the realisation that many jobs were 80% one trade, and the remaining 20% another which lead to increased costs and delays. The aim was therefore to streamline jobs and reduce the headcount.

A fully auditable process to assure stakeholders and regulators that multiskilling was safe and effective.

The site, as a means of meeting the corporate downsizing objective, locally derived the process.

Planning

Prior to embarking on the multiskilling process, the safety engineer investigated the processes used by INPO in the US as a means of identifying best practice. The process used in the US was top down, which Company E believed was culturally inappropriate for their site. As a result the strategy they purposefully adopted was bottom-up. The site Nuclear Installations Inspector was consulted and involved in the process to ensure that safety was not jeopardised as a result of multiskilling.

Set up a task group with the aim of skill broadening. The first task was to run a suggestion scheme where the workforce was asked to identify 'any job where you're involved where 80% of the job is done by you and the remaining 20% you have to wait for others', with the overall aim of getting staff to identify where savings could be made.

A steering group then reviewed these activities, comprised of the management team and union reps. Every job was considered and agreed that transfer was feasible. All training requirements were discussed and noted. This meant that there was agreement concerning whom could best carry out each task, and sign on within the company. A union agreement is in place, which allowed a skill broadening discipline to be created, and provided a 'monetary carrot' for those doing the task.

The Health Physics tasks were then put onto an excel spreadsheet, which identified what individuals can and can't carry out. Stringent steps were taken to ensure compliance with health physics standards.

Training and Competence

3 weeks of training was given to operators, and 2 weeks to electrical and mechanical craftsmen. The one week difference was due to the maths capability and competence of the workforce. Company E negotiated this course with senior management as they viewed it as essential for health and safety that individuals had full knowledge and competency. Everyone received the same basic foundation, and then on the job it was tailored and targeted for specific jobs. A matrix was developed which detailed all of the Radiological Safety Procedures and the jobs for which individuals were considered competent. In the training itself individuals had to attain a 75% pass mark (some of the questions have to be answered correctly), and pass a practical test. This was recorded as a (T) on the matrix. Following several weeks on the job this was changed to a (C) if the individual passed a reassessment and were personally satisfied with their competence. If an individual did not feel competent they would not be forced into reassessment.

Other multiskilled tasks

This is a mix of formal and on-the-job training, involving shadowing and mentoring. The workforce tend to be trained against procedures, where they exist. A mock-up typically is used to assess for competence. Certain core skills are taught:

- Electrical and mechanical rule refreshers
- Plant safety reports
- Electricity at work regulations
- The role of human error
- Pressure systems regulations.

Health and Safety – Main Stages

Multiskilling courses, especially on health physics raised awareness significantly of radiological safety and housekeeping issues.

Core skills are maintained because of the 80/20 rule.

Both leading and lagging indicators have been used to investigate whether multiskilling had effected safety. No evidence has been found of an increase in near miss reports (lagging Indicator) or of an increase in contamination reports, which provide an indication of the quality of housekeeping and radiological cleanliness of the site (a leading indicator), that safety has suffered as a result of multiskilling.

Health and safety was ringfenced. Individuals were specifically trained and certified on Radiological Safety Procedures (RSPs). Certain specific tasks are given only to qualified people.

Multiskilling has not affected the permit issuing process. Permits-to-work are issued by a function separate from maintenance to ensure the integrity of the process.

Ongoing Management

For Health Physics a spreadsheet is used to ensure that when issuing equipment for certain jobs that the individual is competent. This involves a spreadsheet to carry out a certain job before the equipment is issued, and proof of identity (to ensure the person is who they state).

When maintenance or engineering jobs are issued, the team leader allocates them to the main discipline required to carry out that task, but is comfortable that everyone knows how to carry out certain tasks. Within the engineering function, the workforce believes that people will not carry out tasks that they don't feel competent with, and that they will raise these. The team provides support so craftsmen can always get help and advice.

The company aspires to complete a job task analysis for every person leaving the company to ensure that expertise and competencies are not lost. Also have plant systems engineers to avoid the loss of specific skills, they are used as a mainstay in an evolving role.

Costs/Benefits

Multiskilling has decreased people's frustration with their jobs

There have been large cost savings to the power station. These are calculated monthly. One job, pressure transmitter calibrations involved 8000 routines for an electrician and a health physics monitor a year. Multiskilling the electrician in health physics saved 1600 man hours per year. Certain lighting jobs used to involve 2 electricians and a maintenance operator to use the cherry picker. Training electricians how to use the cherry picker has reduced the team size by 1.

Benefit was the increased understanding of the different hazards and tasks required.

Working in teams has increased the overall flexibility of the workforce.

Conclusions/Summary

Culturally at Company E management and staff believe that there appears to be the attitude that they 'won't do anything involving danger'.

Company E see the benefit of maintaining 3 distinct maintenance disciplines and following the 80/20 rule to avoid the loss of skills. Furthermore Health Physics monitors are involved in higher skilled activities and their role has not diminished as a result of multiskilling the rest of the workforce.

COMPANY F

Business

Company E produce agricultural chemicals and their intermediate components. The site employs about 600 people, and is part of a large multinational organisation. The company's health and safety record appears to be good, with no HSE reportable accidents over recent years.

General Approach to Multiskilling

Historically the site employed a large number of craftsmen across a wide range of disciplines, from plumbers and joiners, to riggers and electrical. There was rigid demarcation of these disciplines, which was maintained by the trade unions. Change was initiated in the early 1990s with work by some change consultants, which resulted in the recognition that process operators were only utilised for 70% of their time. As a result of this the number of supervisors was reduced, as were the number of skilled personnel, with only electricians, control and instrumentation engineers, fitters, riggers and plumbers being retained. These were organised into a multiskilled group coordinated by one supervisor. A Local Working Arrangement was negotiated between management and the trade unions in consultation with the workforce, and this provided the framework for multiskilling.

Organisational Objectives

Multiskilling was viewed as a way to decrease staff, and to increase utilisation of existing staff through flexibility. The organisational objectives were therefore to:

- Decrease the workforce;
- Increase the flexibility of workteams
- Decrease downtime
- Reorganise the maintenance and engineering function to increase the responsiveness of the organisation.

Planning

A list of activities was identified in the engineering function, the intent being to decrease delays and the number of craftsmen being required for jobs. A full partnership approach was taken to identify these tasks. Multiskilling was compulsory, all staff were balloted and signed up to the approach. It was locally implemented where training was agreed between the workforce and their supervisor. Experts provide training in the training school. Following training a trainee has 'skills practice', where an individual is paired up and has to carry out a number of examples of the task. When the individual feels comfortable and competent they will be validated. A trained validator witnesses a task from preparation through to carrying it out, and clearing up. Trainees will be passed/failed and with a pass certain conditions are defined, e.g. the review period, certain operating limitations. During the annual appraisal the supervisor is asked whether they are happy with the skill and how it is used.

Initially multiskilling was used on all and there was pressure for all staff to become multiskilled. This is highlighted by the management indicators of the success of multiskilling which focus on the quantity of training given, and the number of multiskilled staff. Organisational benefits of

multiskilling include, a reduction in the headcount, the time to do jobs was reduced, and there was more efficient use of personnel, and long term an increase in morale. No evidence was found to show that injury rates increased as a result of multiskilling.

Training and Competence

The training and competence process was in three stages:

- Off-the-job training given on site by organisational task experts
- On-the-job skills practice, and
- Task validation.

There was a gradual transition into multiskilling, with training being acquired gradually on the various skills. Several introductory courses were developed for electrical work, due to its hazardous nature. Most of the tasks on site are linked to mechanical fitting, and therefore greatest benefits were achieved from this.

Health and Safety – Main Issues

Company F state that their organisational culture is such that safety always comes before production. The company developed a flowchart which individuals are meant to use to guide their decision concerning execution of safety related tasks.

No deterioration in health and safety standards was noted as a result of multiskilling. In fact some believe that creating closer links between process and engineering has resulted in closer ownership of issues.

Ongoing Management

Originally too much training was carried out. This resulted in the acquisition of skills that were not used. Now a business case is required to justify additional skills.

The whole process of job allocation is self managed, with individuals stating that they would not carry out a job unless they felt competent in carrying it out. The workforce state that top management will support their refusal to do work.

Costs/Benefits

Multiskilling has reduced the amount of downtime on plant, increased morale and ownership of plant and its production problems, and increased the flexibility of the workforce. It has streamlined the whole maintenance process.

Conclusions/Summary

The company introduced multiskilling in all its forms throughout the 1990s. They do not report any significant health and safety concerns as a result of multiskilling.

APPENDIX C - Auditors checklist

Policy

Question 1: Has the organisation recognised the potential beneficial and adverse impacts of multiskilling on health and safety performance?	
Examples of good practice	Senior management declares that health and safety standards are to be maintained during and after organisational change.
Performance indicators	When asked senior management can outline how multiskilling may impact health and safety performance.
Question 2: To what extent are the potential impacts of multiskilling on health and safety performance factored into general business decision making organisation?	
Examples of good practice	Management operates a management of change process that includes definitions of organisational change and prompt risk assessment. Definition of multiskilling covers vertical and horizontal multiskilling, and "incidental" as well as planned instances of multiskilling.
Performance indicators	When asked senior management recognise examples of where multiskilling is an incidental or unintended side effect of (say) delayering and downsizing. The ability of staff to take on additional workload incumbent upon downsizing is considered. The risks of making decisions on staffing solely on financial grounds are recognised (i.e. arbitrary targets ignore staff ability to manage workload etc).
Question 3: Has the organisation developed & disseminated a policy / guideline on multiskilling safety related tasks?	
Examples of good practice	Written company standard on multiskilling produced, or multiskilling incorporated into wider competence / Management of Change policy.
Performance indicators	Extent to which HR/ operations / safety management can give a consistent & coherent explanation (that matches good practice) of the company's approach to multiskilling. The HR framework supports multiskilling. Is multiskilling approach consistent across sites?
Question 4: Did the organisation refer to authoritative guidance on multiskilling before finalising proposals?	
Examples of good practice	Read HSE guide and/or applied planned process to change. Regulatory requirements and codes of practice have been identified and assessed. Benchmarked against other sites/ firms, sought advice from HSE / consultants.
Performance indicators	Ability to cite key points noted in authoritative guidance and explain how these relate to their decisions on multiskilling.
Question 5: Has the organisation developed & disseminated performance standards to guide decisions on multiskilling and related issues?	
Examples of good practice	Qualitative guidelines on the need to maintain quality of safety critical work, avoid staff over load and exceeding of staff competence.
Performance indicators	Extent to which documentation defines performance standards. Ability of key decisions makers to explain limits / criteria that have a bearing on introduction of multiskilling.

Question 6: Were key stakeholders consulted on multiskilling proposals?	
Examples of good practice	Staff, regulators and middle management were all consulted on the aims, method and implementation of proposals.
Performance indicators	Extent to which stakeholders express satisfaction with the level of consultation.

Organisation

Communication

Question 7: Were all staff briefed on new roles and responsibilities?	
Examples of good practice	Job descriptions have been updated. Departmental and / or one to one briefings. Could use departmental and one to one briefings in absence of records
Performance indicators	To what extent can staff give a valid and comprehensive explanation of their roles and responsibilities?

Question 8: Are staff consulted at each stage of the multiskilling process?	
Examples of good practice	Formal programme of consultation is agreed with staff.
Performance indicators	Can staff cite examples of being consulted before during and following the introduction of multiskilling?

Competence

Question 9: To what extent the level and scope of training is guided by a task / job profile, with safety critical tasks identified?	
Examples of good practice	Post profiles are used to list the skills and knowledge required for a role, with training needs thereafter derived for individuals.
Performance indicators	Can those responsible for implementing multiskilling define the skills and knowledge required for each post.

Question 10: To what extent are the abilities and limits of individuals taken into account when deciding who should become multi-skilled?	
Examples of good practice	Same recruitment and selection criteria are used for multiskilling as for other recruitment. The importance of attitude is also recognised. Supervisors and individuals cooperate to determine training and level of multiskilling.
Performance indicators	Well defined criteria for selection and recruitment. Consultation with those involved to ensure trainability and motivation.

Question 11: Did staff get requisite / planned training before being assigned new tasks?	
Examples of good practice	Minimum levels of training and on-the-job supervised experience are specified for staff to become qualified in a task / trade etc, such as 6 months for control room roles. The organisation does NOT assume that people will ”learn on the job”.
Performance indicators	Can staff cite examples of training received before taking on new responsibilities?

Question 12: Is there an appropriate balance of experts & less experienced people of each trade in each team?	
Examples of good practice	The membership of teams is designed explicitly to include experienced personnel in each trade / skill area.
Performance indicators	Does examination of duration of experience of team members indicate a balanced team?
Question 13: To what extent are team leaders / supervisors team leadership skills developed such that they can manage multi-skilled teams?	
Examples of good practice	Team leaders are trained in coaching, co-ordinating and mentoring roles, with specific instruction on leadership of multi-skilled teams. Team leaders recognise the limits of their skills and the need to defer to experts within the team.
Performance indicators	Team leaders understand when they need to "step back" and lead rather than chip in and know how to elicit advice / participation from colleagues.
Question 14: To what extent are the methods of competence assessment suitable and sufficient?	
Examples of good practice	All staff involved in safety critical tasks are formally assessed. The confidence of staff is taken into account when assessing an individual's ability to take on new duties. Assessment methods are matched to task complexity and safety criticality, with formal tests for (say) technician / engineering duties, as well as on-the-job assessment against pre-defined criteria.
Performance indicators	Are there any documentary records of assessment? Can staff state when they were assessed and/or given feedback on their performance? Do formal methods exist to define competency standards ?
Question 15: Do staff have sufficient access to specialist expertise?	
Examples of good practice	A pool of specialists is available for ad hoc support.
Performance indicators	Staff / supervisors can cite examples of where specialists have been called on to assist.
Question 16: Do multi-skilled staff have sufficient opportunities to practice and maintain their skills?	
Examples of good practice	Minimum periods of on-the-job experience are specified for staff to retain permission to perform said task. This is regularly reviewed, in for example annual performance appraisals.
Performance indicators	Efforts are made to ensure core skills and additional skills are maintained. Staff can cite regular experience / job rotation and / or refresher training in each of their skills.

Control

Question 17: Do multi-skilled teams have processes / arrangements in place to ensure they can work as a team?	
Examples of good practice	All team members understand their respective roles and are trained in team working.
Performance indicators	Team members can clearly explain who would perform what role during an operation.

Question 18: Has an element of error checking and supervision been retained in multi-skilled teams?	
Examples of good practice	An independent check is completed of safety critical work.
Performance indicators	Can the firm state who checked work on specific tasks when questioned? Do staff, supervisors and management give a consistent explanation of who does checks?
Question 19: Do multi-skilled teams have an adequate process of work planning and co-ordination?	
Examples of good practice	Work schedules are specified each shift with safety critical work appropriately prioritised.
Performance indicators	How often is safety critical work assigned an inappropriate priority or left to the end of a shift?
Question 20: Have individual roles in emergency response situations been defined, especially "overview" role.	
Examples of good practice	At least one person is officially assigned a hands-off overview role during emergencies.
Performance indicators	Can the organisation cite who would maintain an "overview" hands-off role during emergencies?
Question 21: Checks on staff competence for a task	
Examples of good practice	A register of Suitably Qualified and Experienced Personnel is used to check which tasks individuals are competent to perform. Staff carry registration cards.
Performance indicators	How many examples of unqualified staff completing tasks can be found? Examples of sub-standard work.

Co-operation

Question 22: Does the organisation seek to avoid a "can-do" culture, whereby people will accept additional work without question?	
Examples of good practice	The organisation has a clear philosophy of avoiding risk taking by individuals. Individuals are supported when refusing to carry out work.
Performance indicators	Frequency of occasions when (for example) staff work excessive hours or do novel tasks without prior instruction or advice.
Question 23: Does the organisational culture encourage people to work within their limits?	
Examples of good practice	Is it accepted by all that staff the potential adverse consequences of working beyond one's limits outweigh the temptation to "get on with" the task? It is explicitly stated during training that individuals should not work beyond their sphere of competence.
Performance indicators	Staff perception of extent to which they are pressured to work beyond their limits.

Planning & Implementation

Question 24: Was a risk assessment completed of how multiskilling may impact health and safety performance?	
Examples of good practice	Qualitative consideration of impact. Level of assessment should reflect task safety criticality, with task specific assessment for high-risk tasks.
Performance indicators	Scope of risk assessment covers all multi-skilled roles, including examples of vertical multiskilling and merger of management roles. Risk assessments identify key safety management controls for multi-skilled activities, such as permit systems.
Question 25: Has an effective management of change process been used to identify instances of multiskilling and manage them according to company policy?	
Examples of good practice	A (general) management of change process is applied to all organisational changes.
Performance indicators	How often have organisational changes been challenged on safety grounds? Have jobs been merged without realising people are being multi-skilled by default?
Question 26: Is the merger of management tasks and /or vertical multiskilling recognised as a form of multiskilling?	
Examples of good practice	Management of change process covers all safety-related posts.
Performance indicators	Do risk assessments only consider trade level multiskilling.
Question 27: Were decisions on which posts can be merged and/or how many staff can be "let go" guided by an understanding of workload?	
Examples of good practice	Comprehensive baseline resource needs assessment. Key role and staff denoted and limits placed on who can be "let go", and at what time.
Performance indicators	Extent to which managers can demonstrate knowledge of staff workload prior to introduction of multiskilling. Frequency of staff being overloaded. Frequency of redundant staff returning unexpectedly as contractors / consultants due to demand on their expertise.
Question 28: To what extent was experience elsewhere reviewed?	
Examples of good practice	Shared experience with other sites / firms. Reviewed HSE audits and guidance.
Performance indicators	Did not consider lessons learnt from introduction of multiskilling elsewhere (e.g. HSE audit reports)
Question 29: Were multiskilling proposals piloted prior to widespread introduction?	
Examples of good practice	Multiskilling trialed at one or two sites / departments before introduction across the site / company. Proactive performance measures used to assess success, such as quality of work.
Performance indicators	Can the firm outline how they checked / tested the multiskilling proposal before site wide or company wide implementation?
Question 30: To what extent was a task analysis – post profile drawn up?	
Examples of good practice	A matrix of tasks and / or posts and competence's is drawn up for all tasks that may impact safety.
Performance indicators	Can management outline the skills required for each safety critical post and explain the training / qualifications required for each post?

Question 31: To what extent were limits placed on the extent of multiskilling according to range of competence – task complexity and other safety requirements?	
Examples of good practice	Post profiles used in conjunction with staff skills matrix to check people are not asked to work beyond their competence. Posts that must remain independent are noted as such. Posts that require "shadowing", independent error checking (due to risk posed by error) are highlighted.
Performance indicators	Do multi-skilled staff express fears about the quality of work and / or personal safety? How many people can the firm state can be relied on and be made available to complete task or provide technical advice in each area of speciality?
Question 32: Was a plan of action developed and used with enablers and pre-requisites on it?	
Examples of good practice	Action plan developed guided by a checklist of possible requirements. Plan covers task rationalisation, training, staff briefing, revision of job descriptions etc.
Performance indicators	Documented evidence of action plan. Ability of staff and supervisors to cite action plan.
Question 33: Have enough staff resources and time been allowed for training staff in new skills?	
Examples of good practice	Training programme for staff reviewed for purpose of estimating level of training resource / on-the-job coaching time needed.
Performance indicators	Examples of training being postponed / omitted.

Monitoring

Question 34: Have checks been done on the quality of work completed by newly multi-skilled staff?	
Examples of good practice	Sampling of work by independent auditor
Performance indicators	Ability of organisation to cite examples of independent checks on quality of work.
Question 35: Did the organisation develop some measures / checks to proactively monitor the health and safety standards achieved by multi-skilled teams / individuals?	
Examples of good practice	Proactive measures - such as audit of compliance with operating and safety procedures, level of overtime and staff attitudes such as self-confidence rather than relying solely on reactive measures, such as awaiting accidents, staff complaints, incomplete work etc.
Performance indicators	Can the organisation provide examples of measurement / scores, audit results or outline main points of feedback from staff. Examples of where the organisation is "surprised" by an incident caused by error related to multiskilling.
Question 36: Does the process of staff performance review detect / verify ability of staff to maintain a multi-skilled role?	
Examples of good practice	Annual staff performance checks ability of staff to retain full span of roles (i.e. have staff skills decayed in any area?)
Performance indicators	Examples of where annual review has indicated need for retraining / revised job role.

Audit

Question 37: Did someone check that the early steps, such as training, were done before implementation of changes?	
Examples of good practice	Implementation of documented training plan checked. Not allowing experts to leave the organisation before all training is carried out and competency assessed.
Performance indicators	Inconsistent practice of allowing some people to go untrained.
Question 38: Did someone check that recommendations made in the risk assessment have been enacted?	
Examples of good practice	Formal sign-off against an action plan.
Performance indicators	Can management cite examples of when and how recommendations were implemented?
Question 39: Did someone check that an adequate assessment of workload was done before redundancies "made possible" by multiskilling were enacted?	
Examples of good practice	Production of a baseline resource level needs assessment covering planned, unplanned and emergent work.
Performance indicators	Is the level of over time & use of contractors excessive? Do staff report that there are there "busy" periods when the quality of work is threatened?

Performance Review

Question 40: Does the actual standard of work, staff feedback and work practices indicate that multi-skilled staff / teams are able to maintain health and safety standards?	
Examples of good practice	Improved morale, staff feel more valued, staff believe they are now more competent and able to work more safely, better team working, more career opportunities etc
Performance indicators	Adverse feedback from safety representatives. Lots of compensatory measures, e.g. use more contractors, lots of over time, staff complaints, poor quality work, jobs not done on time. Staff feel company is less committed to safety.
Question 41: To what extent does the organisation proactively seek out opportunities to improve the standard of health and safety performance of multi-skilled staff and/or performance of multi-skilled staff in safety critical work?	
Examples of good practice	Ongoing process of review actively seeks opportunities for improvement, such as by soliciting suggestions from staff, bench marking with other firms etc.
Performance indicators	Examples of changes in multiskilling arrangements with aim of improving performance.

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