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PSYCHOLOGICAL ASPECTS OF INDUSTRIAL SAFETY:

A REVIEW AND QUALITATIVE STUDY

SUBMITTED FOR THE DEGREE OF MSc

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1997



I, Elizabeth Athene Gordon, hereby certify that this thesis has been composed by myself, that it is a record of my work and that it has not been accepted in partial or complete fulfilment of any other degree or professional qualification.

Signed.

Date 11th August 1997.

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My parents for their encouragement, support and belief.

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ABSTRACT

The main purpose of this review and qualitative study is to develop a self report questionnaire for use within the British Nuclear Fuels plc plant at Sellafield. The research is concerned with employee attitudes and perceptions towards safety. These psychological aspects cover a wide subject group including organisational structure and relationships; personnel issues; risk management; general management and job satisfaction, i.e. the pervasive 'safety culture' or 'safety climate' (Zohar 1980) as perceived by BNF plc employees.

Measuring attitudes is a difficult task, questionnaires are a popularly used method but often reflect the interviewers' perspective as opposed to the interviewees'. In this case it was felt that questionnaire development would benefit from a 'grass roots' perspective. Five focus groups of BNF employees were convened. Under the guidance of a facilitator cum chairman the group members discussed their attitudes to the above subjects. Focus groups reveal the most important and pertinent issues for the members at that time. They provide a valuable gauge of the current trends within organisations.

The discussions were audio recorded and transcribed verbatim enabling the comments and remarks to be used within the questionnaire. These discussions coupled with a comprehensive literature review provide the foundations for the questionnaire. The design and the preliminary pilot stages culminate this review.

Unfortunately the literature in some areas is scant. More research needs to be undertaken to examine the relationships between improved management commitment; employee participation; job satisfaction and safety. Managers have yet to take safety on board their agendas for organisational growth. Employees have yet to become more than numbers. However, the literature reflects many of the views expressed in the focus group discussions.

Employers need to give their employees more autonomy within the workforce, there is a need for a more humanistic managerial approach if there are to be no further accidents like the Herald of Free Enterprise, Piper Alpha, Kings Cross and others.

INTRODUCTION

The aim of this study is to investigate the perceptions of risk by employees at all levels in a high risk industrial environment and their corresponding attitudes to safety.

Little work has as yet been undertaken in industry to discover how the perceptions of risk held by employees may be affecting accident rates. British Nuclear Fuel Plc in their nuclear reprocessing plant at Sellafield have initiated one of the first studies through the use of a self report questionnaire to investigate the perceptions of employees working within the nuclear industry in the United Kingdom.

There are large divergences between the public's perceptions of risk and "objective" measures based on accident statistics. For example working in a coal mine is a hazardous occupation, working in a nuclear power plant undoubtedly is also hazardous. There are inherent risks in both situations, yet our perceptions of these situations may well be different. People commonly perceive work in a nuclear power plant to be more hazardous than in a coal mine, yet in the ten years between 1972 - 82 there were 17 deaths directly attributable to nuclear power and in the same period for coal mining there were 179 deaths and 2,676 serious injuries. As Clelland 1977 (see "The Breeder Reactor" - Forest) states "the risk of the nuclear industry and its waste disposal component is less to the individual than many other common activities, smoking 1½ cigarettes, driving 50 miles by car".

Notwithstanding the nuclear industry often finds itself and its safety record under scrutiny. The media and in particular investigative programmes such as 'Panorama' ('Secrets of the Citadel' 14 June 1993) are keen to delve into the standards of safety of nuclear plants, presumably addressing (and probably amplifying) existing public concerns. One example was the 'Citadel' case, based on Aldermaston, but it could and has been any nuclear installation.

The advantages of this opportunity to investigate employees' perceptions of the risks they work with and their corresponding attitudes to safety, safe working practices and procedures should not be underestimated. It is hoped that through this exercise it should be possible to identify negative unhelpful attitudes to safety which may be linked to the accident syndrome.

If these are then properly addressed it should be possible to improve the safety culture. Kantyka (1977) estimated that over half of all industrial accidents could be attributed to psychological characteristics or to weaknesses in management and training. The Advisory Committee on Major Hazards (1984) and Layfield (1986) referring to the Sizewell Enquiry, emphasised management's responsibility in relation to safety in the nuclear industry. The present investigation aims to identify and describe weaknesses in the systems wherever they may lie.

The Wider Context of the Research

BNF plc are particularly concerned with

- the perceived risks of workplace hazards
- attitudes towards working procedures and practices.
- evaluations of both formal and informal safety matters and supervision.
- the relationship between these and job satisfaction.

The study was addressed to all organisational levels. This in itself was a considerable task and it required a questionnaire that would suit all kinds and levels of people in terms of socio economic and educational background. It was felt that the alternative, that is, to devise separate questionnaires for e.g. craft workers and managers would not only be divisive but would limit possible comparisons.

The preliminary stage of the questionnaire design was to hold five focus group meetings consisting of 6 - 8 individuals, randomly selected from

THORP/EP2 (effluent plant 2)

Site Technical Department

THORP Receipt and Storage

Magnox departments.

The group participants were able to provide a representative view from individuals working within Sellafield and they included all levels of management.

Five related topics were selected to provide some structure to the discussion:-

Organisation and Relationships

Personnel

Risk Management

Actions in Emergency

General Management

The aim of a focus group is to stimulate the members to express their diverse views and opinions in the back-and-forth interactive argument and discussion that invariably develops when people of different views and experiences are put together without constraints of time or, hopefully, authority. The Chairman acts as a 'facilitator; - probing and inciting, provoking and often mediating. Confrontation is not avoided, but every effort is made to ensure it is constructive. His main task is to steer the discussion to cover the full 'agenda'.

From the information generated from the focus groups, the questionnaire was designed. A preliminary piloting of a prototype questionnaire was then carried out on all members of the focus groups.

A full transcript was made of each group meeting and this was used directly to determine the range of issues to be covered by the questionnaire. In some cases the form of the question was taken verbatim from the manuscript to facilitate its understanding.

The reasons for this were three fold (1) to enable them to feel they contributed directly and (2) to judge whether the draft questionnaire covered all the points they felt to be important. Finally (3) to identify any questions that were not well expressed. This exercise gave an impression of how the questionnaire would be greeted by its target population.

Further modifications were made before the second main pilot. This involved 200 individuals systematically selected at a pre-set interval from the plant employment records to ensure a representative sample. One hundred and sixty one pilot questionnaires were eventually completed and analysed. This led, in a subsequent stage in the research, to the administration of the final questionnaire to over 5000 employees at Sellafield.

The present report covers the focus group studies and the resulting questionnaire .

A Historical Perspective on Psychological Aspects of Safety

The early research work concerning the psychological aspects of safety was mainly concerned with theories which proposed in various ways that accidents were the result of a psychological dysfunction - accident proneness. Viteles (1932) (see Murphy, Du Bois & Murrell, 1986; Crawford 1960) identified the “accident prone” employee as someone with low intelligence and retarded psychomotor co-ordination. Ghiselli and Brown (1948) continued this theme, concerned with ‘accident repeaters’ and the effects of working conditions on behaviour.

Research in the fifties moves the identification of “accident prone” personality types to the reasons behind accident as ‘events’. The United States Air Force (see Blum & Naylor 1968) identified 6% of accidents to be caused by personnel, not all of whom could have low intelligence or be poorly co-ordinated.

External factors were also being identified as possible causes. Sherman, Kerr and Rosinar (1951) (see Von Haller Gilmer 1962) proposed prostitution and “blighted living conditions” as possible links in the accident chain. Argyris (1957), (see Spector 1976) Pasmore & Friedlander (1982) Hill and Trist (1953) and later Verhaegan, Strubbe. Vonck and Van Abeele (1984) saw accidents as defence mechanisms. Verhaegan et al. investigated the three related issues of accidents, absenteeism and risk taking. Separating accident victims into active and passive, they found those who were designated active; agents in their own accidents were absent from work more often and seemed to take the most risks when at work. The employees, it was argued, used

their risk taking to withdraw from the situation. They “purposely”? took risks. Risk taking and absences are, they argue, the consequences of a negative attitude towards the organisation or the work situation and the safety rules. Modern parlance would label accidents of these types as violations.

The sixties saw the emergence of theories of stress. The goal-freedom-alertness theory and adjustment stress was believed to be responsible for up to 60% of all accidents. Lewin’s (1951) (see Katz & Kann 1966; Pasmore & Friedlander 1982) and classic field theory was behind this upsurge. Stress and accident factors were seen as the result either of a lack of the abilities needed to meet environmental demands - or of the environment itself failing to provide the outcomes necessary to meet the persons’ needs.

Argyris’ work also provides some support for the theory that accidents are a form of psychological withdrawal. Tuishfield and Bernan (1963) claimed that some individuals unconsciously seek destruction.

The seventies and early eighties focused particularly on unsafe working conditions, the need for ergonomically designed offices and factories. Mason (1973) (see Painter & Smith) Swain (1973); Haggelund (1976)(see Painter & Smith 1986) and Hansen (1982) perceived unsafe as defective working conditions, as presenting primary causal factors in many industrial accidents. The early eighties also saw a concentrated effort to determine “performance shaping factors” to incorporate into “human reliability assessment”. Swain and Guttman (1983) (see Graveling, Mason, Rushworth, Simpson

& Simms) and Embrey and Neill (1981) (See Graveling et al 1987) were among many others, considering the interdependent feedback loops existing between the operator and the machine. Wildblood and a team of researchers in 1987(see Graveling et al 1987) formulated a schematic representation of the factors affecting human performance within this system:- personal; organisation workplace environment; lay-out. They concluded with a proposal that better understanding of man-machine systems will lead to greater knowledge of the causal components of accidents.

The last decade has also seen a new focus, towards possible factors in the organisation, external to but also incorporating the individual, which may in some way be responsible for accidents. There is a growing recognition that the causes of accidents are often highly complex sequences, originating in many sources and involving many employees.

Reason & Mycielska (1982) (see Lee 1983) propose that our attitudes are derived from direct experience and media input, enabling us to create a unique cognitive schema for each hazard. The schema will have emotionally affective qualities, a directional property and facilitator approach or avoidance behaviour. Consequently we assimilate appropriate behaviour and store into a "skill schema" each time we perform a task, conditions will have changed and there is a need to direct more attention to provide a appropriate response. This adaptive diversion will be incorporated in the scheme.

It is proposed an error will occur when an external event occurs where there is no adequate response in the schemas repertoire or the appropriate response is not instigated. The researchers continue, accidents will occur when a chain of thought has been diversified from the current sequence or prompted by an external event, the result being the wrong action scheme, slips into place. Reason (1992) later went on to introduce the notion of 'latent' pathogens in organisations. These pathogens will divert thought and cause individuals to misconstrue external signals.

The Current Climate

Too many organisations have ignored careless everyday slips, passing them over as part of everyone's working life but slips can and often do develop into major accidents. Past events such as the Herald of Free Enterprise, the Clapham rail crash, the fire at Kings Cross and more recently the Severn Tunnel rail crash have illustrated the potentially fatal effects of sloppy working procedures. They have shown that 'slips' become accidents because of the wider conducive organisational context in which they occur.

Major accidents warrant great attention and duly become political stalking horses. Consequently they generate "enquiries", a contemporary socio-political phenomenon of considerable importance. Enquiries may isolate blame but they also aim to find out what went wrong in order to ensure it does not happen again. Of course it would be a perfect world if hindsight were to become prophecy. It is unfortunate that so many accidents could have been prevented if we had known what we know now. Hence enquiries purposefully set out to pinpoint the past failings.

These have tended recently to concentrate on the failings of management. Management may set up carefully constructed health and safety plans, sensible regulated working procedures and behaviour guides, with no consideration of or consultation with their employees. Safety policies are highly commendable and legally required but they are of little practical value if employees do not adhere to them, find them too complex to understand, do not know that they exist or feel perhaps that they

“don’t apply to me personally”. Enquiries have begun to emphasise the importance of managers in regulating health and safety. They are being told to pay more personal attention to their employees if they want to make their safety policies effective and produce accident records which reflect their commitment. An important step forward.

It appears that although recommendations, enquiries and legislation are laudable, they may mean very little in practical terms. Managers need to be trained and motivated to encourage their employees to work safely.

However, management texts have still to click on to this sentiment. From a review of many books on management, it was found that only a few focused on management aspects of safety and accidents in a related context. Arscott and Armstrong (1976) *Employers’ Guide to Health and Safety* gives a reasonably comprehensive guide to the employers’ duties and responsibilities and an action plan is suggested. Bethel, Atwater, Smith and Stockman (1962) approach safety in the plant from a mechanical and legal angle. The means of maintaining safety is seen as a matter of engineering. Brech 1974 concentrates solely on the role of the safety officer. However, admittedly, the context of these texts may be a reflection of the times. Safety rarely, if ever appears on the syllabus of leading management schools. Consequently new managers are often not aware of the effects of management practice and conditions to promote safety within industry.

A BRIEF OVERVIEW OF THE LITERATURE REVIEW

Introduction

The literature review covers a number of different facets of risk - definition and perception; the management factor within the workplace; the effects of management on working behaviour and job satisfaction. An attempt has been made to relate these subjects within the general theme of risk taking and attitudes to safety within the workplace.

Through examination and investigation of the research carried out in Britain and abroad it has been possible to see gaps in the work and problems to be overcome. The present research is an attempt to fill one or two of these gaps and to redress an imbalance. This research aims to show risk taking within the workplace as more than the problem of the employee who takes the risk. It is also a problem of management cultures that may ignore, allow or even encourage risky behaviour through a misguided or incomplete safety policy and lack of commitment.

The main inadequacies of current safety policies may be seen in their limitation to “unsafe” conditions” and/or “unsafe acts”. The former are thought to be solvable by technical fixes (after the event) and the latter by the further proliferation of regulations.

Attitudes to safety do not suddenly appear 'out of the blue'; they develop from experience, from expectations and from the environment.

How can we explain why individuals take risks? Is it simply a case of the benefits of the risk outweighing the costs of potentially adverse consequences. Taking the factors identified by researchers such as Fischhoff, Slovic & Lichtenstein (1978); Fischhoff, Slovic, Lichtenstein, Read and Combs (1978) it may become apparent why people take or accept certain risks. However, we may perceive the identification of possible factors as a passive explanation of an occurring behaviour. In hindsight, every situation will be viewed differently. So why not examine an active situation? Little research has looked at the active situation, few researchers have examined the "bird's eye view" from within industry and the corresponding risk-taking behaviour which may stem from these attitudes.

It is necessary primarily to identify what is meant by risk. Most research is concerned with the definition of risk, unfortunately each researcher has his/her own definition. Risk, for the uninitiated, at first appears to be a concept which means anything to anybody at any one time. Once it was possible to put forward a definition for actual and perceived (objective and subjective) risk, it was practical to move on to examining the actual act of perception. Research has focused on the physiological act, the endowing of stimulus sensation with meaning. Also with the behavioural and social background to this biological involuntary behaviour (Lee 1990; Slovic, Lichtenstein &

Fischhoff 1984). Perception, by definition involves moral, cultural (Douglas, 1985) environmental and political beliefs. Knowledge, emotion and behavioural dispositions all have an effect on the meaning endowed to the stimulus. Tversky and Kahnemann (1976) refer to the use of cognitive heuristics e.g. representativeness, readjustment and anchoring, personal immunity and availability, to explain why people perceive things the way they do.

However the risk concept is multi-faceted and components have been identified by researchers which are perceived to contribute to making up a “risk” and may even make a “risk” more acceptable to the populous. For example Fischhoff et al. (1978), Department of Environment & HSE Sunningdale Seminar (1979) and Rowe (1977) provide a comprehensive selection of factors inherent in the “risk” and which may affect acceptability.

Why do employees take risks?

Do they deny the hazards?

Can they not see the hazards?

Do they perceive the benefits of taking the risk and keep (for e.g.) a production conscious management happy as outweighing the costs, if something goes wrong

From the literature it is possible to find a definition for risk, to understand the concept of risk and to identify the facts which make up the risk but, it is difficult to find

empirical information to explain why people take risks. It is easy to hypothesise that dissatisfaction may lead to risk-taking to relieve the boredom of the situation or aid in withdrawal from the situation, or that managements' favoured production methods encourage risk taking to meet deadlines.

However, it is not easy to answer these questions. Using the established research on risk perception in an active context will enable us to see whether it can be translated and is applicable to an active setting.

Some research has investigated the public's perception of risk, for example Midden and Verplanken (1990) and Drotz-Sjoberg and Sjoberg (1990) investigated the public's perception of nuclear power. Slovic, Macgregor and Kraus (1987) investigated the risk perception of automobile safety defects. Later studies are however mostly concerned with the after effects of the Chernobyl incident.

Research has been in terms of past experience investigating the effects of heuristics and with respect to specific risks. Lichtenstein, Slovic, Fischhoff and Coombs (1981) investigated the judged frequency of lethal events. Dickson (1978) examined the perception of risk as related to choice in a two dimensional risk situation.

However, little research involving the public has involved risk-taking behaviour in relation to perception, or corresponding attitudes to personal safety. Most research

has been carried out to uphold definitions and give more emphasis to factors already proposed.

In terms of industry, the researchers have been lax in defining what they mean by risk, leaving the reader to assume definitions. Ostberg's (1980) research with fellers focuses on risk judgements of 'normal' working practices. He concluded that safety rules were broken as a result of poor production methods; lenient supervisors; "economy" of being unsafe; and equipment being ill designed. Ostberg concluded the focus of research should concentrate not on why the accidents happen but on new approaches to prevent accidents. This is all very commendable but if we are not sure why the accidents are happening we cannot promote and develop new approaches. (Violating safety rules was perceived within this study to be the equivalent of risk-taking). Zimolong's (1985) work with shunters, again, returns to the factors behind the risk rather than the behaviour the risk encourages or discourages. Shunters' tendency to overestimate the rare and underestimate the common risk, was found to be one reason why they take risks in their work situation. Singleton, Hicks and Hirsch (1981) concluded from their work with farmers, "misperception or lack of awareness of hazards are major factors in agricultural accidents".

So risk taking behaviour is not necessarily a purposeful activity but rather the byproduct of poor hazard spotting or misperception. The misperception is rooted in heuristics or in the underestimation of the likelihood of an adverse event occurring.

Rushworth, Best, Coleman, Graveling, Mason & Simpson, found the fewer hazardous incidents miners' experienced the more trustworthy of their own equipment and their own abilities they would become. This confidence tended to grow eventually leading to more risk taking and violation of safety rules. This work plus a similar study by Wilson (1973) (see Hale & Perussé 1977) is particularly relevant to the research currently being undertaken.

Where does the risk taking behaviour stem from? Denial and tolerance of risks Lewis (1977), acceptance that "nothing can be done about the risks in my job" Powell (1971); or, an adventurous streak within the individual (Levine, Lee Ryman & Rahe 1976).

It is then necessary to move from these concepts to risk averse/risk seeking personalities; the 'accident prone employee'; and the level of optimal risk that each individual homeostatically maintains. Several conclusions and theories have been proposed to explain the existence of risk taking behaviour within the workplace. Is any one theory current? This research aims to fill the gaps left from previous research and to examine the existing attitudes to safety within an active and potentially 'risky' industry. It aims to find out every avenue that can account for risk taking behaviour, instead of focusing on one point. The research will examine behaviour and attitudes with regards to the employee, as an individual, the organisational policy, the

prerogative of management, and production methods. Plus the safety culture which is prevalent within the plant.

Justification can be found for this research in the review of the literature, but more importantly, the purpose is to help industry improve its accident record, a worthwhile goal.

This is reflected in the aims of BNF plc:

- to investigate the perceived risk of workplace hazards.
- to examine the attitudes towards working procedures and practices.
- to evaluate both formal and informal safety matters and supervision
- to examine the relationship between these and job satisfaction.

From this work BNF plc hope to develop an action plan for safety that will result in an improved “safety culture”. Through worker participation and total management commitment they hope to gain full support for this program and consequently improve their accident record through positive safety measures, not induced by fear, but because “this is the way we do things around here”.

It was insufficient to review only literature with a handle on risk. As the empirical data on workplace risk perception was so limited it was necessary to include management issues and also because “management commitment” is vital to ensure safety.

Management is the base of every worker's life, they are an integral part of the organisation. They encourage and discourage certain behaviours, they impose and enforce regulations and restrictions, they create and formulate rules and regulations. It would be unwise not to consider the management factor when examining worker behaviour.

Hypothesising that management may hinder safe working by pushing workers to meet production deadlines or by not setting a 'good' example themselves, the literature review covers the effects of management on the workforce as well as the actions of the workforce.

In several of the text books examined, safety is not considered within the management realm of concern. It is not perceived as a managerial function. This does not correspond with the current research. However, some research has confirmed that management practice must have a profound effect on safety attitudes and safe working behaviour.

Nichols and Armstrong (1976).(see Dawson, Wiliman, Bamford & Clinton (1988) and Grunberg (1983) share the view that management concern for production and profit will lead to unsafe work behaviour. If the only way to get the job done on time is take risks rather than feel the wrath of management, employees will take risks. If being good at the job means meeting the deadlines and this leads to praise, employees will try

to meet deadlines at whatever costs. It may also be argued that an apathetic “laissez-faire” workforce (Powell 1971; Phillips 1977) is also a dangerous workforce. However an apathetic workforce will be this way for a reason, management’s treatment may be inhumane, they may “feel like a number”, that they are not thought of as people but as cogs in a machine. If management does not care for its workers its workers may stop caring for themselves.

Participation may also be vital within the work environment. Lagerloff (1977) (see Kjellen & Baneryd (1975) and Karasek (1979) found fewer constraints on decision making may encourage workers. Those who participated in the development of safety rules and working procedures were more likely to adhere to them.

A strong management commitment to safety is also important, Gaertner, Newman, Perry, Fisher & Whitehead (1987), Lauriski and Guymon (1989), Fiedler, Bell, Chemers & Patrick (1984). This commitment can motivate employees, affording a sense of pride and self worth, (Hatcher 1971). Management commitment should be visible in the “safety culture” of the workplace. The safety culture, the climate within the organisation, should promote safe working as the primary aim, the priority of the entire organisation. Although the CBI (1990) have provided a framework document for industry, it is not clear how many industries within Britain have specifically designed programmes aimed at an improved safety culture.

BNF plc hope to create and promote its own safety culture. Their aim is to ensure that every employee from management down should know what the safe procedures of work are and crucially, feel that it is within their capabilities to be safe.

The literature review covers information, available at present, with regards to safety attitudes within industry and includes research both on risk perception in industry and from work with the public. A literature review is a necessary measure in order to establish what has or has not been previously studied. The review also provides the basis for hypotheses and potentially new ways of investigation.

However, the literature is limited. Risk perception and complementary attitudes to safety have not been widely investigated either in the home or within industry. This does not mean that the option is impossible or unimportant, rather, research has taken other directions. The concept of risk has had to be thoroughly investigated and holistic and consensual definitions proposed before research could begin. Gaining access to the public is a lot easier than gaining access in industry. Consequently many research papers have considered the general public as distinct from those employed in differing occupations. The move into industry is the next step in the dynamics of research into risk perception.

RISK PERCEPTION

The concept of risk is difficult to grasp and many studies have found themselves in a quagmire of definition rather than empirical investigation. A multi-faceted concept, risk is best viewed as a state of mind too complex to be measured by uni-dimensional means. Risk is a manifestation belonging to a hazard - a property of human activities and environmental objects.

Perception is the process of endowing sensation with meaning. Sensory input and external information, is stored by the central nervous system, to enable the construction of an internal representation of our surrounding environment. Each representation is custom built and unique for each hazard experienced. Information is accommodated and assimilated all the time during every day; representations of hazards are being constructed and can be related to the perceivers past experiences, present needs, current environmental conditions, political, moral and social beliefs (Lee 1990).

The values and norms of cultural groups (Douglas and Wildavsky, 1982 and Douglas, 1985) i.e. the groups which we feel we belong to or the groups to which we aspire, are also related to the way we perceive. Perception is also influenced by the qualities attributed to hazards (nature of the hazard and the interaction which follows, Collinson 1976) and by the perceiver and cognitive heuristics (Tversky and Kahnemann 1976).

According to Tversky and Kahnemann, individuals base their judgements, assessment of probabilities and prediction of values (i.e. estimation of risk) on a limited number of heuristics to make their task easier. A heuristic is a kind of 'short cut' - a grossly simplified principle that can be used in place of a more detailed and laborious form of calculation when attempting to arrive at a decision. Some examples of these principles, relevant to decisions about risks are as follows:

Availability :- overestimate the overall frequency of events that are dramatic, sensational and more frequently experienced or alluded to. Dependent on the size i.e. impact and frequency of the event and ease of accessibility i.e. bringing events to mind.

Overconfidence :- belief in one's own essential rightness.

Personal immunity :- belief that "... such things always happen to the 'other guy' and no amount of statistical evidence can ever persuade him that they can happen to him" (Calabresi, 1978).

Representativeness :- where probabilities are evaluated by the degree to which A resembles B, to the cost of the other factors.

Adjustment and anchoring :- where different starting points yield different estimates which are biased toward the initial starting point.

Heuristics help us to organise and hence perceive risk, but they are ‘short cuts’ and due to the bias in judgement they create they can be frequently inaccurate. Tversky & Kahnemann (1974) found when they presented lists of hazards to different sub groups those with different needs exposed to different sources of information and constantly reinforced by group norms form glaringly different norms.

Perceived Risk

“ . . . the combined evaluation that is made by an individual of the likelihood of an adverse event occurring in the future and its likely consequences”
(Lee,1990).

Subjective measures of risk are intuitive and a process of induction without awareness (Lee,1990).

Dickson (1978) examined the relation of subjective risk to choice under conditions of reward and penalty for a task embedded with risk due to differences in expectancy of achieving a particular outcome (Lichtenstein et al 1978) and differences of level and variance of expected outcomes (Pritchard 1973). Varying the contexts of the task

between reward and penalty, Dickson set up a two dimensional design of reward and expectancy. Subjective risk was found to be related to the expected probability of gain or loss and not to the difference in expected value. Context is a critical dimension in a choice situation. The research also concludes that comprehension decreases with increasing complexity and leads to increased risk taking. The less one understands about a situation, the more one is likely to take a risk. This is a disturbing finding.

Perceived risk is generally measured by risk - rating (psychometric) exercises based on the comparative responses to a range of hazards or through the analysis of the schema of a particular hazard. The schema is a synthesis of cognitions and feelings, created through experience, giving each hazard a unique meaning and predetermining the attitude an individual has. The schema contains the repertoire of appropriate behaviour and enables the activation of approach/avoidance action from a subconscious weighing of costs and benefits (Lee, 1990). Complete cognitive schemas are difficult to elicit and evaluate and consequently risk - rating has been the more popular method of empirical measurement. Its particular advantage is comparative i.e. in comparing the perceptions of different people of the same hazards.

Fischhoff, Slovic & Lichtenstein, Read & Combs (1978) presented subjects with a list of 30 hazards, with a request to scale them according to their perceived riskiness. The subjective ratings were compared to the objective F.A.F.R 's (fatal accident frequency rates) of the same hazard. Fischhoff, Slovic & Lichtenstein, Read & Combs (1978)

found that risk judgments are related to hazards status; benefits provided to society; number of deaths caused p.a. and the maximum likely number of deaths possible in a disastrous accident/year. The judgements also reveal a perceptual gap between laymen and experts. This is often the main reason for the large expenditures on safety measures which have low cost effectiveness and the neglect of serious risks towards which the public appears relatively indifferent (Lee, 1990)

However the terms in which the risks are 'framed' may also have an effect on perceptions (Rescher, 1983). For example, risks from radiation may appear negligible when considering the "reduction in life expectancy for the population living within a certain radius of a nuclear power plant" but fearsome when translated into the equivalent number of "additional cancer deaths per year" (Rescher 1983). Perceptions may be influenced and sometimes deliberately manipulated by the frame of presentation.

Perceived risk also incorporates the concept of acceptable risk "a non zero level of profitability of occurrence of an accident below which the public as a whole is willing to accept the risk" mediated by the 'good enough' principle, a kind of plimsoll line.

"The acceptable level which is good enough where 'good enough' means you think the advantages of increased safety are not worth the effort of reducing the risk by restricting or otherwise altering the activity" (Slovic, Fischhoff & Lichtenstein 1980).

Acceptable risk is not something a risk possesses but something society bestows upon it (Rescher, 1983), a matter of society's decision making, a context dependent decision problem (Slovic et al, 1980).

Two caveats should clearly be entered ; firstly "accepted" does not mean "acceptable" (the threshold is set at the latter rather than the former). Secondly there are no universally acceptable options for any decisions. However it should be pointed out at once that the assumption that the risk calculations made by engineers and scientists are "real" and "accurate" by comparison with these perceptions has increasingly been challenged. It was pointed out earlier that risks are essentially multi-dimensional, whereas professional risk assessments are frequently uni-dimensional based only on the probability of mortality, although attempts have been made recently to include some measures of 'consequences'.

"Actual" Risk

"Actual" risk, then, is the statistical probability of an adverse event occurring and the consequences if it should occur; an "objective" measure calculated by experts.

The means of calculating actual risks include:-

PRA - Probabilistic risk assessments: a comparative and quantitative approach i.e. the number of accidents associated with a particular hazard. It can only stand up if the accidents are expressed against a unit of exposure (e.g. time or frequency). Fatal accident frequency rates (FAFR) are examples of this approach. The main unit

depends on circumstances and may not be an extant statistical base. As already mentioned it can be criticised for being strong on calculating fatalities and weak on morbidities and all other accompaniments of disasters which impinge on objective calculations.

QRA - Quantitative risk assessment

LD50 - Lethal dose to 50% experimental animals

HRA - Human reliability assessments, probability estimates of human error

Safety Factors - ratios of stress to strength as used by engineers

Objective measures of risk are relatively accurate, impersonal and concrete interpretations useful for research purposes and comparisons (e.g 'safety cases'; risk - rating). Slovic, Fischhoff and Lichtenstein (1984) point out that the measures are quantifiable and predictable. As many others have subsequently pointed out, this does not mean they are "correct".

How accurate are the experts?

Experts are not infallible; they are over confident and slow in the detection of chronic cumulative events. Fischhoff et al (op cit.) also claim that experts often show a failure to anticipate human responses to safety measures hence the perceptual gap. Their main fault, however lies not in getting the wrong answer but in failing to realise how great the possibility for error may be.

What is the accuracy of individual judgements?

Public risk estimates diverge from scientific evidence. For e.g nuclear power has an outstanding record of safety compared with other industries and energy systems. Yet nuclear power has an opposition of 40 to 50 % of the U.K. population (Lee 1990). Our reliance on heuristic principles, sensational media reports and an intuitive grasp of information does not aid our judgement.

What factors influence the risk taking decision?

The perceived qualities of the hazard:-

- concentrated, obvious risks are worse than diffuse risk.

- the 'catastrophic' value. For example, in the case of nuclear power, public attitudes are constructed from the potential scale of catastrophe if an accident should occur.

This is most likely associated to the destructive capacity of nuclear weapons. Nuclear power is also at the extreme of three dimensions which Slovic, Fischhoff & Lichtenstein (1980) claim are integral in affecting perception:

- dread

- knowledge

- personal experience

Dread, especially, is important when considering hazards. The higher a hazard scores on this factor the higher its perceived risk, the more people want to see its current risks reduced by strict regulations.

- risks to non beneficiaries is worse than to beneficiaries

- immediate risks are worse than deferred risks

- risk arising from secret activities are worse than those derived from open activities

- risks evaluated by groups suspected of partiality are worse than risks evaluated by impartial groups

- risk someone else pays to put right is worse than improvements paid for by the individual

- individual c.f. societal risks (Green, 1979) will affect the judgement the individual makes

- if the consequences could include a 'fate worse than death' (severe loss of mobility or brain dysfunction) a risk may be perceived as less preferable than one causing death

Volition

Rowe (1977) and others have drawn attention to the important role of volition in risk perceptions. Risks voluntarily undertaken are regarded more positively than involuntary risks. Nuclear power stations are consequently judged as dangerous because they imply involuntary exposure to risks; they cannot be controlled by the perceiver (Otway and Fishbein, 1977). Starr (1969) claimed that the pull towards voluntary risks will be 100% greater than involuntary. There is also support that changing the expected outcome, however slightly, will enhance the voluntariness and thus tend to make the risk more attractive. They also point out that the more important or attractive the intended benefits the less voluntary the choice becomes. O'Keefe (1977) (see Phillips 1977) says something similar, individuals will undoubtedly accept some risks to reap the benefits concomitant with the voluntary and conscious exposure. As in those who work for the nuclear industry, they must perceive the benefits outweigh the risks from the time they take up employment. Yet as Starr (1972), sums up " we are loath to let others do unto us what we will happily do to ourselves".

Controllability

Individuals can take active control of their situation or passively let someone else do so. Often, but not invariably, people opt for activities voluntarily because this means they retain control. But this is not always the case. An example would be military service. Accident probability is undoubtedly influenced by safety measures. Consequently activities can be carried out in either a safe or unsafe manner. Admittedly, this does depend on skills, the observance of regulations, appropriateness of required behaviour, or opportunities for error, recklessness and sabotage. However it may also depend on the decision to take control or the illusion of control the individual perceives he has. The more control an individual perceives he has the more likely he will decide to take a risk and this is a dangerous precedent for risk taking. So control depends on the effect of an individual's action to predetermine the consequences of any activity and also on the amount of prior knowledge he possesses about these consequences.

Benefits

Risks imposed for the benefits of others are perceived as less acceptable than risks undertaken for self advantage. The converse obviously applies to safety precautions. Risks that are isolated and not compensated for by corresponding benefits are regarded as less acceptable than risks obtained in a largely beneficial context. So far as distribution of consequences in time and social geographical space are concerned the

closer the immediacy of benefits and the further the delayed consequence the more positive the picture (Rowe, 1977).

Familiarity

The old idiom "familiarity breeds contempt" appears to be true with respect to the perception of risk. Unfamiliar, described by Fischhoff et al (1978) as "dread of the unknown", unnatural or new hazards are regarded as worse than risks from familiar, natural and often established causes. Others claim that it is this "tacit knowledge" which controls behaviour with little conscious awareness. The 'automatic pilot' scenario is similar to the skill schema precedent set by Reason and Mycielska (1982). Familiarity also lends power to the availability heuristic; "out of sight" really is "out of mind".

Several other factors have been put forward as being inherently important qualities: the degree of confidence in the experts/regulator; the social factors and the condition of the subject. The Sunningdale Seminar (1979) considering Fishhoff, Slovic and Lichtenstein's earlier work added : severity; origin; effect; manifestation; exposure pattern and necessity.

Vlek and Stallen (1980) summarise the concept of risk. They describe a "personal risk experience" as

"an assemblage of physiological behavioural and cognitive reactions",

systematically related to fundamental characteristics of the risky decision situation. Physiological reactions including muscle tension and behavioural reactions can illustrate revealed preferences, the approach/avoidance behaviour, the realisation of safety precautions and cognitive reactions. These are expressed behavioural preferences to use the terminology of economics.

These fundamental characteristics, if considered and evaluated properly, may enable the assessment of the risks to be realistic. Rescher (1983) proposed that the biggest pitfall of risk assessment is unrealism. Exaggeration, he claims is the most tempting form of unrealism. The evaluation of the hazards by means of their characteristics, must remain within the bounds of realism.

RISK PERCEPTION AND INDUSTRIAL SAFETY

There is a need to examine the relation between the two contexts of public risk perception and employee risk perception, and the relationship of both with safety management. Can the results suggested by researchers such as Fischhoff et al (1978) in the public field and Rushworth et al (1986) in the employee field of risk perception help employers and major industry manage safety to reduce, if not eliminate unnecessary accidents.

The concept of “perceived control” needs to be considered carefully, the more control an individual perceives he has over the situation the lower the risk evaluation. Also, the ‘catastrophic potential’ of risk taking in a nuclear/radiological environment, the effect of familiarity (which can breed contempt) with the risk encouraging the ‘experienced’ individual not to take the essential precautions because he knows the job so well, the weighing up of the costs and benefits involved in taking the risk or playing safe. The anxiety of the workers, communication between management and workers is often notoriously bad. Distorted messages circulate and rumours develop. Any anxieties regarding working conditions or task content may never reach those that could help, or conversely safety messages badly targeted may not have any effect. Effective communication may also go some way to destroy the myths which often form part of “machismo” (e.g.) “real men don’t wear safety goggles” which may be unique to individual skills and trades.

When examining attitudes towards and perceptions of risks it is necessary to take into account that this folklore will affect risk perceptions. The work of Fischhoff et al (1978) and the Sunningdale Seminar (1979) go some way to provide a coherent account of intrinsically individual factors, generally used as guidelines for decision making. However, different places of work will have different beliefs and traditions regarding the risks surrounding their environment. Principles may not be applied so easily to these situations. The risk perceptions will differ to a certain degree according to the workplace, industry and employer.

Inevitably the “it won’t happen to me” ideologies are dangerous, any form of complacency on the part of the employee or employer is deleterious to the development of safe working behaviours. To ignore hazards and hope that they will either go away of their own accord or that no one will have the chance to actually control the hazard, is dangerous.

To use the old expression, the situation could well become “an accident waiting to happen”. It is also fair to point out that complacency on the part of management when confronted with an accident will have a detrimental effect on their workers’ opinion of them. A management which ignores shopfloor demands or is content to let things slide but goes haywire when there is an accident tends not to develop confidence in their workers. Morale will be low and workers will be all too quick to emulate the “laissez faire” attitude of their managers. They will cease reporting hazards and they will stop

paying attention to safety measures. If management doesn't care about them why should they bother themselves.

Diverging slightly to the subject of voluntariness. Voluntary risk taking is apparently more attractive than having a risk inflicted upon you. This is related to the concept of choice and control. Volunteers engaging in risky behaviour are selective - they perceive that more benefits will accrue to themselves from their choice. Within the workplace, individuals who have high perceived beliefs of ownership, autonomy and have participatory style supervisors who enable them to make the decisions, are likely to be more satisfied with the precautions and less wary of the hazards.

Returning to the "machismo" attitude, it can never be repeated often enough that this attitude is dysfunctional. The flouting of regulations, however, is often not risky enough for the "macho" type. Some individuals are "adventurous" types, the high risk taker will often search out the biggest risks and get his 'highs' from this behaviour. Although gradually becoming discredited the macho worker is still alive and well, and quite common in some sectors of industry, e.g. in construction which has a poor and uniquely deteriorating record.

Some workers specialise in 'horseplay', not perhaps as dysfunctional as active risk seeking, but potentially as dangerous. Horsing around in the wrong environment may lead to a serious accident involving the initiators themselves or perhaps an unfortunate bystander who turns up on the scene when the perpetrators have left. Individuals may

need to horse around in an attempt to relieve some of the tension of a dangerous or tedious job. 'On the job' misbehaviour must be quelled by self or improved discipline or by better training.

Safety training can only be successful if the perceptions of the workers are known and are treated appropriately. It is necessary to find out why particular perceptions have occurred, before any training schemes are instigated. Otherwise it is doubtful if they can be successful. The roots of information distortion may be recovered and failings in work practises may be unearthed. Tailored training with consultative and participative design should be accompanied by communication levelled at the target audience and then channelled appropriately. This represents the first step on the road to improving safety in the nuclear industry.

Canter and O'Learnik (1988) attempted an empirical validation by means of a questionnaire survey to examine existing relationships between safety attitudes and industrial accidents within a British Steel plant. Significant correlation coefficients showed that accidents are directly linked to attitudinal issues. Therefore if safety attitudes are measured it should be possible to predict accidents. If you can change attitudes you can reduce accidents. So, workers within a high accident rate plant will tend to have less positive attitudes towards safety than those in corresponding low accident rate plants.

Zohar (1980) showed that the inherent safety attitudes reflect the organisational commitment to safety i.e. the 'safety climate'. The safety climate in low or medium accident rate plants was consequently found to be more conducive and pervasive than in high or medium plants.

Canter and O'Learnik's methods of analysis included mapping techniques, POSA, restricted to shopfloor and management division, and MDSA. Mapping techniques are used to analyse declared and attributed attitudes. The interrelationships between what individuals think and do themselves about safety within the working environment context is revealed and how they perceive similar actions in others. A multiple sorting procedure examined accident causation, whether the accidents are avoidable and the allocation of blame. MDSA, identifies the categories and systems of classification that the subjects used. Not surprisingly the gap between officially used categories and those which categorise meanings for the workers are apparent.

Canter and O'Learnik found workers tend to focus on consequence rather than causation. The type of injury, i.e. cut, burn or break was more meaningful than the preceding events culminating in the accident.

It is interesting to note that as in the study at the "Hawthorne" works of Western Electric, the safety researcher acted as a catalyst for improving the behaviour of the workforce. Someone simply paying attention to the workers, recognising their existence and questioning their working habits increases safety awareness and enhances

motivation for safe working. After administration of the questionnaire Canter and O'Learnik report the number of accidents dropped considerably especially the most serious ones. Taking part in a survey can lead to immediate reduction by influencing peoples' attitudes towards safety. Simply making people think may lead to behavioural change.

The factors which motivate people to pay attention and take precautions are, not surprisingly, financial and environmental. Potential reduction of earnings resulting from being involved in an accident has more effect on motivating people to pay more attention than disapproval of workmates or management. However Canter and O'Learnik point out that financial incentives and peer pressures are not being fully used to motivate workers to act safely. Individuals in the high accident group believed that taking risk shortcuts was likely to increase earnings whereas safe behaviour reduced them. They were also less motivated by management's approval for becoming involved in "hazard spotting". With regard to the environment, the most immediate area where the benefits of increased attention to safety are evident is that of improved working conditions.

Risk taking, for example, may not only be engineered into the machinery but also into the behaviour necessary to get the job done, to reach job deadlines, to keep up with production pressure. Nicholls and Armstrong (1976) (see Dawson, Williman, Bamford & Clinton 1988) found management's overriding concern for production puts adverse pressure on workers, Grunberg (1982) confirms that a conflict between the objective

of improved safety and improved labour productivity is inevitable given the excessive concern for profit or productivity (see Dawson et al). However it is only fair to point out the findings of Dawson, Poyner and Stevens (1984) who claimed that higher standards of line management safety were found in practice than those implied by Grunberg.

Powell (1971) identified, from 42 months of observation within factories, several of the main causes of accidents. He emphasised apathy, a 'we - they' divide between management and the shopfloor (probably due to lack of participation and communication) and an impotent "little can be done about the risks in my job" attitude. Phillips (1977), also found apathy inherent in poor safety procedures, "if you think about all the risks that go with this job you'll drive yourself barmy" (Powell, 1971).

As well as risk taking being necessary to meet production pressure, it is proposed that risk taking is not a demonstration of skill, but that there is overwhelming evidence that everyone is prepared knowingly to run risks in order to gain other rewards (Phillips, 1977). For example, higher bonuses; group approval; economy of time or effort. Concluding that society regards some rewards as legitimately traded against personal safety, Jones et al (1977) identify apathy as the greatest single obstacle to progressive improvement in safety issues. The Health and Safety at Work Act (1972) declares that health and safety is a matter of efficient management but not a managerial prerogative. Rather, as suggested by the Robens Committee 1972.

“The primary responsibility for doing something about the present levels of occupational accidents and diseases lies with those who create the risks and those who work with them”.

Lagerloff (1977) (see Kjellen & Baneryd 1975) found that worker participation in identifying risks and developing counter measures in forestry resulted in a 50% reduction in accident frequency in a two year period within a group of loggers. Karasek (1979) sees constraints on decision making as leading to job strain which may lead to risk taking to ameliorate the boredom and make up for the little interest the worker has in his/her task. Participation is an integral component for the eventual reduction of accidents.

Risk taking, Powell (1971) found, was explained in terms of carelessness, individuals showed little concern for minor injuries or their causes. Supervisors appeared unaware of the continuous effort required to improve operator safety. They also failed to realise that they could influence accident rates through their leadership. In the study the more closely supervised groups tended to have fewer accidents. Powell suggests a three prong attack :-

- Engineering
- built in safety mechanisms
 - machine guards
 - brief lucid instructions
 - tamper proof machinery

- | | |
|------------------------|--|
| Legislation | <ul style="list-style-type: none"> - H.A.S.A.W. - R.I.D.D.O.R. - N.A.D.O.R. - damage control scheme, whereby <u>all</u> accidental damage to the plant property and equipment is reported (McCullough, 1969). |
| Training and Education | <p>R.O.S.P.A.</p> <ul style="list-style-type: none"> - posters, publications, media designed to increase safety knowledge - risk anticipation training - diversion of high risk work from the inexperienced to the experienced. |

In conclusion of this section, a risk is an adverse event, by definition and therefore something to be avoided or minimised. There is some evidence, however that people may accept risks because of the pleasurable feelings this invokes. ‘Getting the adrenalin flowing’ has become part of common parlance. If we discount this aspect, however, the more basic response is to take precautions by modifying the environment, the equipment or the behaviour. Such measures can extend from a simple action like wearing a ‘hard hat’ up to the highly complex organisational actions involved in

improving a plant 'safety culture'. All such reactions to perceived actual risks are what comprise safety measures. Safety itself is a freedom from risks.

FACTORS OF ACCIDENT CAUSATION

Heinrich, the father of safety investigation, proposed four basic reasons why accidents occur:-

- * improper attitude
- * lack of knowledge/skill
- * physical unsuitability
- * improper mechanical or physical environment

He concluded that accidents are due either to unsafe practices or to unsafe conditions reiterating the supervisors' key role in accident causation. In 1931 he proposed four preventative methods:

Engineering

Persuasion and Appeal

Personnel Adjustment

Discipline

In 1971, the NIIP Study of 2000 accidents (Powell, 1971) reinforced Heinrich's views, as mentioned earlier. In the "domino effect theory" accidents are the result of a chain of events. More effective management was perceived to be the remedy, through

comprehensive health and safety programs; systematic reviews;’ constant management pressure and accountable management and supervision.

Later, in 1976 (see Weaver 1980) Adams produced a similar causation model visualised as five interrelated dominoes:-

1 Management Structure

2 Operational Errors -

“operational error has occurred whenever unplanned and undesired results stem from the acts of and decisions of supervisory management or the failure to act or decide” (Weaver, 1983).

3 Tactical Errors

4 Accident

5 Injury

There are other similar versions of the “domino theory” all of which incorporate management’s crucial role in the accident process.

Other work has concentrated on the importance of human error, the “missing or inappropriate response” to a situation (Haddon and Baker, 1978) (See Murphy 1981) and also on technical and engineering detail. Defective/unsafe working conditions have been identified as the primary cause in many industrial accidents, (Hansen, 1983; (see Painter & Smith) 1986) Mason, 1973; Swain, 1973; Haggelund, 1976) (see Painter & Smith 1986) These approaches all lead to the conclusion that the adoption

and enforcement of safety standards will not ensure safe work unless the job is adjusted to meet human needs and capabilities. Different researchers have come up with a variety of forms of evidence to support this general contention.

According to Beatson (1978), 50% of all incidents and accidents reported in a UK power plant resulted from human error in operation, maintenance or deviation from prescribed procedures. Ravelle (1980) (see Graveling et al 1987) claims 85% of all recorded accidents were a result of unsafe acts on the part of the worker and only 15% the result of unsafe conditions and equipment. Earlier work presents similar results, in 1956 the Cleveland Railway Company analysed the causes of 38 accidents over the previous year; 14 were caused by faulty attitude, 12 were due to failure to recognise potential hazards and 12 were due to faulty judgement of speed and/or distance. Similarly the United States Air Force found 61% of 'near miss' accidents were due to errors by personnel.

In the mid 80s the National Safety Council claimed 95% of all accidents had human behaviour as a major contributory cause. Accidents are not necessarily a result of lack of knowledge but rather the result of inappropriate human behaviour and interaction in the man-machine system within the environment. Grummon and Stilwell (1984) also argued that human behaviour can be identified as a major contributory factor in accident causation. This is not to say that all other factors are to be neglected - rather that each important element should receive attention.

How can accident figures be reduced?

It is rare to be able to remove hazards totally but substitution and/or modification is possible (Wrigglesworth, 1972/73). Unfortunately engineering modifications are not always coupled with appropriate behaviour change and this means that the modifications are not always successful. Workers may simply adapt their behaviour to the changes, their attitudes remaining the same. If a machinist perceives a machine guard as a hindrance she/he may remove or circumvent it.

Hazard Management

Improvements in industrial safety have been attributed directly to the introduction and implementation of a meaningful participatory safety and hazard management program, by Pope (1981). The author goes on to propose that to make employees participation work effectively, planning the system of management will work better than faulting the people involved in the accidents. This will also enable honest and accurate accident reporting. Workers need to be trained in hazard spotting, a conclusion Viteles considered as long ago as 1932, in a description of the 'accident prone' employee. Later Tiffin (1941), (see Murphy et al 1986) argued that the 'accident prone' individual suffers from an inability to recognise hazards. This may be caused by lack of experience.

(Shulzinger 1954; Saari and Lahtela 1981). (See Graveling et al 1987)

Hazard awareness and risk perception are two sides of the same coin, personal awareness is intrinsic to safe working practices. People need to make reliable risk

assessments, a task which they often find difficult (Lichtenstein, Slovic, Fischhoff, Layman & Combs 1981). When individuals try to think about hazards they can't, they often feel uncomfortable and inclined to suppress the whole subject (anxiety dissonance).

Simpson (1988) draws attention to three problems of "hazard spotting":

1. Individuals do not always believe something is really dangerous (even if they are told that it is) unless they have experienced it or it is on their list of risks (Hale, 1969). Often risks that are not directly perceptible or are masked by background noises are not perceived as real.
2. Often there is a long time delay between occurrence of the danger and the harmful consequence.
3. Individuals often simply do not have enough information to make a judgement about riskiness

Baddeley (1963) (see Hale & Perussé) also claims that people are poor at looking out for and spotting hazards which threaten them especially when they are concentrating on a task to which danger is peripheral and even more so if the task is highly practised. Too often employees place their confidence in the precautions taken by others to safeguard them (Wilson 1975; Williams 1976). (see Hale & Perussé) Employees also need to be able to identify safe as distinct from risky working behaviour. Andriessen (1978) asked construction workers to endorse short descriptions of safe and unsafe actions. The results led to the identification of two principal orthogonal factors:-

Risk Taking

Safety Initiatives

Workers recognised that carefulness would result in decreased accident rates but they did not perceive safety initiatives would have the same effect. If employees have an attitude of “it doesn’t help anyway” they will not use their safety equipment or pay attention to the advice given to them. This pattern of expectancy (Vroom 1964)(see Lindzey & Aronson) will affect the weighting of the benefits/costs of a particular course of action. Workers are aware of the instrumentality and the valence of certain outcomes. Consequently the expected reactions of the supervisor, colleagues or workmates to safe/unsafe working may become an important motivator for the way an individual works. Supervisors with positive attitudes, respect for their personnel and the capacity to convince their workers that working safely is effective will change the valence and instrumentality of the workers behaviour.

Andriessen found that employees tended to take into account the bother/hindrane of acting safely (the valence) and whether it would affect the work tempo (outcome). Risky situations became aggravated with “laissez faire” supervisors who had little perceived influence over their employees, who put production before safety and compelled this by pressure instead of setting a good example. Lack of group participation in the implementation of safety measures also had a denigrating effect. Andriessen concluded that management had the highest influence on the degree of

safety in work behaviour. Supervisors and managers who respect their men and appreciate their contributions lead to a safe working environment.

Canter and O'Learnik (1988) who studied worker's attitudes in British Steel, propose four basic principles for safe working :

1. Management encouragement
2. Emphasis on the importance and significance of foremen and supervisors to see safety as more important than production.
3. The necessity to use social pressures to change attitudes
4. An emphasis on 'positive total safety'

Canter and O'Learnik point out that punishment does not generate the desired safe behaviour whereas praise is more likely to do so.

Safe working patterns were not always followed for a variety of reasons:

Not all operations had written instructions

There was no consensus of opinion on safe working procedures for particular processes.

Certain safety procedures were only followed if they did not interfere with production pressure.

The commitment of senior and other levels of management might have prevented these problems. Frequent contacts should have been made at the shopfloor level with a direct and simple message to aid comprehension and avoid distortion of the safety aims.

The conflict over who is responsible for safety should be cleared up. This is a problem which has dogged the implementation of the 1974 Health and Safety at Work Act. The answer is simple - all levels are responsible, but all roads return to management, their style, their humanitarianism, their desire to involve their workers, in fact, the 'safety culture' they promote.

THE ROLE OF MANAGEMENT

On examination of thirty general management texts only a few mention management, safety and accidents in the same related context. Arscott and Armstrong (1976), Employer's Guide to Health and Safety, gave a reasonably comprehensive guide to the employer's duties, responsibilities and an action plan, but this is obviously a specialist as distinct from general management text. Bethel, Atwater, Smith and Stackman (1962) have approached safety in the plant from a mechanical and legal angle, hardly mentioning the organisational aspects.

Previously, employers tended to blame "unsafe actions" i.e. workers for accidents whilst workers tended to blame "unsafe conditions" i.e. management. Often due to these disparate views emphasis was concentrated on unsafe acts, because managers had more power.

Current research aims to produce a holistic representation of why "unsafe acts" take place. The emphasis has moved towards the organisational climate or culture encompassing:

- * size
- * production
- * individual factors
- * senior management commitment
- * manager - labour relations

- * manager - labour communication
- * employee - supervisor interaction
- * supervisory style
- * employee motivation and/or incentives
- * health and safety programs
- * training
- * industry commitment and participation
- * locus of control

INJURY RATES IN THE MINES OF INDUSTRY

A Comparison of Low and High Accident Rates

Extensive research has been carried out in the US by the mining federations of several states. The work of their researchers provides the main context of this review, a comparison of low and high accident rate mines with regard to their safety cultures and the above factors.

Size

Smaller mines (less than 50 employees) tended to have higher injury rates (I.R.) than larger mines (51 - 250 employees).

Less than 50 employees: I.R. = 3 x I.R. of mines with more than 250 employees

More than 50 employees: I.R. = 2 x I.R. of mines with 51 - 250 employees

(Smith, Cohen, Cohen & Cleveland 1978)

The reasons for these differences are not directly apparent, however, the I.R.'s are likely to be causally related to other factors such as labour management interaction which will be covered later.

Production Pressure

Pressure for production may lead to 'corner cutting', neglect of safety regulations and generally less careful work. It's origin may lie in managerial 'payment by results' scheme or a more general persuasion to meet targets.

The process may be self-reinforcing according to Sanders (1976). He claims,

“...production pressure appears to lead to an increase in disabling injuries which in turn results in an increase in production pressure”.

A vicious circle, employees perhaps taking risks to meet production deadlines, the risks resulting in injury and absenteeism and the production deadline becoming more pressing.

Kjellen and Baneryd (1975), working with employees in the explosives industry found 90% were chiefly motivated by their earnings. Kjellen and Baneryd interpreted their unsafe behaviour as resulting from a conflict between the production pressures, design and organisation of the safety systems and the employees' needs for independence and responsibility. The expert design system, they claim, restricted employee influence. The provision of safety incentive schemes may be seen as an attempt to convert the motivation underlying “pressure for production” into a positive force. Gaertner et al (1987) proposed a safety production incentive program. Although costly, they felt that the combination of increased earnings with safe production would be positive motivational force. The average rate of lost time injuries was reduced when the scheme was installed on an experimental basis.

Goodman (1985), however, found that the accident rate was not significantly affected by the introduction of a safety incentive program at any of the four different coal mines

he investigated. Evidence from other sources on the effectiveness of “reward” schemes is similarly conflicting.

Individual Factors

According to Goodman (1985) lack of familiarity with the job leads to more accidents. Evidence regarding familiarity is still inconsistent, some researchers claim ‘familiarity breeds contempt’ leading to increased slips and lapses of concentration. Others claim that familiarity and experience is important in learning how not to have accidents. Both are likely to be correct - the critical moderating variable being the complexity of the task.

More miners at high accident rate mines indicated that they were troubled by some of their co workers’ behaviour, (De Michiei, Langton, Bullock & Wiles 1982). The miners were able to spot potentially hazardous workers yet they were loath to take any action. This may well be associated with the lack of participation identified in high accident rate mines.

Role and Task Ambiguity

Here, the picture is less clear cut Pfeiffer, Stefanski & Grether (1976) report that miners in high accident rate mines spend more time working without well defined duties. Yet Althouse (1977) found miners in low accident rate mines reported higher levels of role ambiguity i.e. clarity of responsibility, and the certainty of their jobs was ill defined. However, Pfeiffer et al 1976 also found significantly fewer miners at low

accident rate mines, report that they are

“expected to do too many things in too little time”.

Absenteeism

Absenteeism has been identified as a substantial problem at high accident rate mines (De Michiei et al 1982), five mines with high accident rates had considerably higher absenteeism rates than the low accident rate mines. Pfeiffer et al (1976) reports miners in low accident rate mines take less care of absentees' jobs and perceive they get along better with each other and can depend on each other. Morale and absenteeism are situationally linked, perhaps.

De Michiei et al (1982) proposed that absenteeism could be reduced by a firm and fair absentee policy which took into account extenuating circumstances. A list of guidelines was later set out by Goodman (1985):

Better employee selection.

Employee assistance programs.

Recorded daily attendance.

Supervisors trained to look out for consistent absentees and establish the reasons why.

The use of positive reinforcement ensured consistent discipline.

There is a danger, however, that the effort to reduce absenteeism, though desirable in its own right, is like treating a symptom and not a cause.

Management Factors

De Michiei et al (1982) emphasises the importance of management planning. Poor management planning leads to increased accident rates, poor work results and low levels of morale.

Management need to:

- * Formulate, implement and enforce systematic mining cycles and standardised work procedures.
- * Develop a comprehensive approach for mine development.
- * Ensure mine plans incorporate the measures necessary to adequately control the physical environment.
- * Develop better programs for maintenance of equipment (Pfeiffer et al 1976).

De Michiei et al (1982) also notes:

Management at high accident rate mines showed less support for decisions made by section supervisors. The superintendents at five mines with high accident rates had no direct involvement in the mines health and safety program. Both represent serious impediments to the improvement of health and safety conditions.

Conversely, Shafai-Sahrai (1971) and Cohen, Smith & Cohen (1975) report that management at low accident rate mines has greater commitment and involvement in the promotion of safety. Acting as a motivating force, management also indicate to their employees their interest in their welfare. Both teams of researchers concluded there is a strong relationship between management efficiency in utilising resources and plant safety performance.

Management - Labour Relations

The National Science Academy (1982) concluded

“At all seven mines with low injury rates there appeared to be a co-operative attitude between management and labour; and adversarial attitude was observed in three of the five mines with high injury rates”.

De Michiei et al (1982) reported similar findings, concluding there were more conflicts, misunderstandings over directions and job assignments in high accident rate mines due to poor labour-management relations. Gaertner et al (1987) found mines with a negative labour relations climate had accident rates double the rate of mines with a ‘positive’ climate. Gaertner et al (1987) conclude that good management labour relations lead to a safer environment and better employee compliance with the safety rules. Good relations develop from co-operation and interaction.

Labour-Management Relationships

Identified in the nineties as a crucial factor in accident reduction, the mine studies give a valuable insight into how good relationships can develop between the workforce and their managers. The results, lower accident rates, safety compliance and a satisfied workforce must make the increased participation and consultation worthwhile.

Management-Labour Communication

Good manager-labour communication can be achieved in the following ways, according to the National Science Academy (1982) report

- * Open communication
- * Joint responsibility of health and safety
- * Active involvement by both parties
- * Labours' support of management
- * The installation of a sense of responsibility and accountability within the workforce
- * Managements' use of labour to correct unsafe conditions
- * Management review and solicitation of miners' views (De Michiei et al 1982)
- * The establishment of joint labour management safety committees (National Science Academy, 1982)

Supervisor-Employee Interaction

Differences in supervisor-employee interaction are prevalent within low and high accident rate mines. Supervisors in low accident rate mines have been identified as more "coaching" (Sanders 1976), (see Petels) "more often showing real concern for worker's welfare", Pfeiffer et al (1976). De Michiei et al (1982) found section supervisors in low accident rate mines received more support from safety personnel when reprimanding miners for unsafe acts, illustrating a healthy network of support within the mine. Conversely, supervisors in high accident rate mines tended to provide less instruction, guidance and support.

Smith et al (1978) formulated a process for supervisors to improve performance and understand behaviour, increase safe work behaviour and help the employee feel better about himself, his organisation and his job. The aim was to establish a work

environment which is positively supportive, emphasising praise (as positive verbal feedback) and training; and enabling supervisors to:

- Recognise unsafe behaviour
- Develop behaviour baselines
- Determine which behaviour to change
- Communicate behaviour change
- Shape behaviour
- Maintain a safe work pattern

Smith et al (1978) propose the use of social motivation and incentives to encourage safe behaviour. Extrinsic rewards and goals become part of safety performance. Supervisors need to be able to arrange conditions so that employees can achieve goals, determine the rewards that employees desire and make the rewards contingent on high levels of safety performance. This should ensure employees understand the relationship between safety performance and the receipt of rewards, whether they are extrinsic or intrinsic. Pfeiffer et al (1976), believes there is a need for jobs to be redesigned to provide for intrinsic need satisfaction, through

- Recognition
- Increased responsibility
- Variety of job tasks
- Positive enforcement programs
- Employee competitions (i.e. safety included in the criteria of good job performance)

These need to be incorporated in the day to day job experience of employees.

Health and Safety

In low accident rate mines, formal health and safety programs exist, they are effectively communicated to every employee and supported by a safety department empowered with sufficient authority to ensure the program works (De Michiei et al 1982). If the designated safety staff report directly to top management they will be even more effective in reducing injuries (Cohen et al, 1975).

According to Whonnock reported by Painter and Smith (1986),

“... beneficial and substantial improvements in industrial safety can be attributed directly to the introduction of and implementation of a meaningful participatory safety and hazard management program based on employee involvement”.

Participatory Safety Programs

Several researchers have investigated interventionist, participatory programs, Bell (1987) instituted team building and problem solving meetings to deal with organisational co-ordination; communication and co-operation. In the three years of Bell's program the average accident rate was 32.2% below the average of the three years prior to the intervention. There was also an increase in productivity. Edwards (1983) reported that the accident rate decreased for members of the 'quality circles' he established. Fiedler et al (1984) found structured management training intervention highly effective in the improvement of both safety and productive. The combination of

special accident investigations, safety and discipline policies and safety production incentives should result in decreased accident rates (Gaertner et al, 1987).

However, Goodman's (1985) evaluation of a safety incentive plan paints a different picture.

“The basic picture is that the safety program has had little effect on workers perceptions or motivation”.

Unless the program can change worker beliefs and behaviour it is unlikely to lead to major changes in accident reduction. Safety programme may fail because the worker, is the end as opposed to the means to the end. Good communication is essential, the employee needs to hear what s/he expects to hear in a direct and succinct manner. The communication needs to be based on confidence, requesting reasonable, specific, job oriented demands.

As discussed by Smith et al (1978) compliance with safety requirements can be increased with the use of frequent observations; contingent positive feedback and praise, (also Rhoton, 1980). Safety programs need to be based on humanistic principles.

Cohen et al (1975) found several factors unique to low accident rate organisations:

- Safety personnel and Managers had high regard; respect and sympathy for their employees.
- Discipline was moderate

- Individuals were transferred to less hazardous jobs by management in dealing with unsafe behaviour and safety rule violations.
- Communication was less formal
- The person with formal responsibility for safety knew most of the plant personnel by their first names
- Employee relations programs and extensive safety programs were in greater evidence

Training

Formal safety training for employees and supervisors is an area of safety programming which often needs improvement. However, the research findings are inconsistent. According to Cohen et al (1975) low accident rate organisations provided extensive training for both employees and supervisors but relied on employees and supervisors to interpret the training to suit their personal needs. De Michiei et al (1982) found in low accident rate plants a lot of time was given over to administering task training to subordinates; both classroom and on the job training was ensured.

Training tends to be rated higher in low accident rate mines, where emphasis is put on hazard spotting and adequate training in the use of equipment (Pfeiffer et al 1976). Conversely, in high accident rate mines lack of training in the correct use of health and safety equipment was identified as an important reason for not using it.

Training needs to emphasize hazard spotting, use of personal protection equipment and the importance of accident investigations and formalised safety reporting systems

(Cohen et al, 1975 and Shafai-Sahrai, 1971). A major deficiency in safety programs and training has been the failure to emphasise and investigate non lost time accidents and incidents.

Training needs to address the gap between knowing and doing through procedures of participation (e.g. tests, question and answer sessions etc.) communication and reward.

Industry Commitment

Safety needs to be an organisational (Pfeiffer et al 1976) and industrial goal. The National Science Academy (1982) suggest that the publication of ranks of organisations by their accident record would cause managers to stop and take a long hard look at the situation within their organisation. The publication of evidence which shows that productivity and safety can be positively related will also reinforce the value and importance of safety.

Participation

The importance of participation has been implicit throughout this review as an important means of instilling safe working behaviour by participatory safety programs. Participation and personal involvement is an effective agent for behavioural and cognitive change whereby employees are treated as the experts and presented with the tools to aid behavioural change.

Dar El and Young (1976) (reported in Kjellen and Baneryd 1975) see participation as an organised form of sharing activities in decision making processes with workers

whose basic tasks are not normally classified as managerial. The found participation led to better remedial actions, better acceptance of these actions and a chance for the individual to control and influence his/her own work. Karlsen et al (1975) (reported in Kjellen and Baneryd) in an investigation of 45 Norwegian companies reported that one of the most important contributing factors to a good working environment was worker involvement in health and safety.

Lawler (1976) (see Kjellen and Baneryd) found a positive correlation between the degree of workers influence and acceptance of safety measures. Those measures developed exclusively by senior management tended to be less well accepted by production managers and supervisors.

Hoiberg (1980) (see Chapman and Sheehy 1988) working with US Naval personnel concluded that

"...accident prevention is most effective when responsibility for safety procedures can be apportioned by the workers involved in their acceptance".

Painter and Smith (1986) investigated a cybernetic "systems approach", a participatory safety and hazard management program for Canadian forestry workers and loggers. Emphasising a primary, self regulatory role for employees and management in hazard management.

They formulated ten principles for competent hazard management:

1. A safe job is a healthy job
2. Control hazards not accidents

3. Hazard management is intrinsically a behavioural cybernetic process
4. A safe job is a human factored job; enforced safety standards will make a difference but they cannot ensure safe work unless the job itself is designed for the operators (Smith et al 1978, Smith Kent - Anger & Uslan 1978; Smith Colligan, Frockt & Laslo 1982; Smith. Lockhart & Smith)
5. Safety should be based on operational performance factors.
6. Self regulation should be promoted
7. Employees should be involved in decision making
8. Safety should be integrated into production procedures.
9. 'No fault' compliance provisions should be implemented.
10. Equal opportunities for safe work should be established

Painter and Smith (op cit.) emphasise the importance of self regulation and employee participation. By working together employees were able to point out problems within their working environment and to go on to suggest a new system for reporting 'near misses'. This was one of the most effective ways eventually developed to promote the identification of hazards. The authors conclude that employees should themselves be given direct opportunity to participate in making decisions about how those hazards are managed in relation to work operations.

In a later study, Kjellen and Baneryd (1979) working with forestry workers hypothesised that the introduction of worker participation and structured decision making would lead to :

Practical and accepted solutions to the risks present within the workplace.

A reduction in the conflict between safety technology and human needs and improved knowledge.

Improved knowledge.

Changed attitudes to risks and preventative activities.

Kjellen and Baneryd, set up worker participation groups where the employees met to discuss, identify and be briefed on salient risks within their working environment.

Worker participation groups were of mixed membership and met for three hours every fourth week for briefing sessions. Structured decision making processes were set up to identify risks within the current working environment of the employees. Kjellen and Baneryd collected the data by means of direct observation, interviews and completion of questionnaires. The results were positive. The employees identified 82 risks, of which only 59 were already known. For 34 of the 82 risks the employees developed, implemented and evaluated counter measures. The counter measures received a high degree of acceptance. The employees also made active efforts to remedy health and safety risks, the suggested remedial actions were generally accepted among the participating workers.

Kjellen and Baneryd concluded that although the universality of the results is limited, application of worker participation may be a long term solution to the conflict between safety technology and workers' needs for independence, empowerment and responsibility.

Sanders (1976) (see Peters) says

".....mines in which miners are given decision responsibility and autonomy tend to have a lower incidence of injuries than other mines".

Similarly, De Michiei et al (1982) claim section supervisors at high accident rate mines did not have as much freedom to make decisions concerning health, safety and production as did section supervisors at low accident rate mines. Braithwaite (1985) concluded that decentralisation of decision regarding safety is a characteristic that is common among the large mining companies with better safety records.

The autonomy, i.e. the amount of control, employees have over what happens on the job, and the extent to which employees see themselves as free to do what they want to accomplish their work and their perceived self determination is critically important in safety terms.

Workers need to feel free to exercise influence over their environment. Kerr (1957) identifies the following factors, related to worker autonomy as significant in the reduction of the accident rate;

Intra company transfer

Greater promotion probability

'Best suggestion' schemes

Individual work

Incentive pay schemes.

Participation has also been identified as an important part in encouraging the use of personal protective equipment (Zohar, 1980). Forty percent of all work accidents could be avoided if personal protective equipment were appropriately used according to Zohar (1975).

Several ways for encouraging people to wear the protective clothing have been identified. The clothing should be well designed and, where necessary, changes should be made to increase comfort. Notwithstanding, comfort should remain secondary to safety which is of paramount importance. Similar results have been shown in research in the mining industry.

(De Michiei et al 1982; National Academy of Sciences 1982)

So, participation may well be a vital ingredient to the recipe for a working, practicable and successful safety culture. However, managers who wish to introduce participatory programs need to be aware that people do not participate when:

- * The real decisions of the organisation are made elsewhere and their individual jobs do not require participative decision making.

- * Participation is not reinforced via personnel policies and practices.

- * Participative effort is managed in such a way as to discourage participative confidence.
- * Rank and status remain more important than competence.
- * Participation conflicts with non work roles and needs.
- * Workers have been socialised to avoid behaviours which threaten those in authority.
- * Participation challenges deeply held values and beliefs.
- * Past and present adversarial policies have led to a "look after Number one" philosophy (Neumann, 1989)

Collaboration, involvement and the sharing of knowledge are three ways to restore the employees' involvement, responsibility and power. These essential qualities which management generally monopolise and the workforce lack, often lead to passivity, fear, feelings of disempowerment, feelings of oppression, risk taking, high accident rates, low productivity and absenteeism.

For example, an outbreak of tenosynovitis in a manufacturing plant, was found to be stress related and a reaction to the work environment and not to the work itself

(Argyris,1957) (see Passmore & Friedlander 1982) The tenosynovitis represented a far wider range of problems. Management had made ineffective attempts at dealing with the problem. Interview data showed that the indirect causes ranged from a high production quota to tense relationships between workers and supervisors and an inability to deal with anxiety. Argyris proposed that for the non-assertive who wanted to keep their jobs whilst avoiding conflict with management, developing tenosynovitis may have been the only perceived means for communicating their unhappiness or withdrawing from the situation. As a solution, Argyris proposed co-operative problem solving with "co-appreciation". Co-appreciation entails participation, mutual respect and the equality of power. Perhaps this approach could help in the reduction of the number of cases of repetitive strain injury currently prevalent.

Participation may also be a solution to the other problems which arise out of organisational change (Spector,1978). It may have a leading role in helping individuals come to terms with a new safety culture. Coch and French (1948) (see Spector 1978) perceived organisational change as a mitigating factor in the development of frustration, which can manifest as risk taking behaviour. Change often heralds interference in task performance and in the abilities of individuals to maintain their goals and to realise their needs. Organisations experiencing industrial change may find that as their turnover increases, job performances decreases and production goals may be abandoned.

Participation may have the following real effects on individual frustration:

- a) By definition, participation in any change will let employees protect their needs and goals and restrict damaging decreases in task performance.
- b) If an individual understands the reasons for the change and is involved with it, feelings of frustration will be reduced.
- c) Finally many individuals have a need to control their work environment, lack of control whether real or perceived may cause them to feel frustrated.

White and Ruh (1973) (in Spector 1978) also argue that participation avoids frustration for individuals who feel empowered, alienated and estranged without some control over their working environment. Friedlander (1977) draws attention to the positive side of frustration in organisations. Organisational demands can serve as an impetus for organisational change. Individuals frustrated by the lack of safety measures may motivate their employers to do something about them, when the frustration begins to have a detrimental effect on productivity.

Locus of control

Rotter (1966) identified two types of individuals:

- a) Those who believed events were mainly contingent on luck, chance, fate and external factors (external perception of control).

Those who believed that events were mainly contingent on their own behaviour or on their own relatively permanent characteristics (internal perception of control).

He claimed individuals with an internal perception of control:

- Had superior cognitive processing abilities
- Had the ability to acquire more information when dealing with situations
- Made more attempts at acquiring information
- Were better at retaining the information they have
- Tended to be more difficult to satisfy, always searching for more information
- Were adept at utilising information, devising their own cognitive rules for processing and paying more attention to any cues in the background which appear useful to them
- Behaved in ways which appear to reduce the element of threat they face
- Developed strong self-serving biases i.e. they are ego protective, keen to maintain their own self esteem

Links between perceived locus of control and safety attitudes have been suggested. Wichman and Ball (1983) compared aviation pilots to a sample of the 'general population' on internal and external locus of control. Aviation pilots were more internal in locus of control than non pilots. Those pilots with internal locus of control held stronger self-serving biases than those with external locus of control. With reference directly to safety Wichman and Ball found 'internals' were more likely to

attend safety clinics, i.e. they took control, making the decision to be safe, preferring this direction to external regulation. Aviators with more experience and exposure develop strong self-serving biases, i.e. they will handle dangers by actively doing something about them.

Leather (1988) examined the safety performance of public and private sector construction workers. He measured six variables:

1. Individual care and attention
2. Workmates attitudes and behaviours
3. Foremen
4. Bonus payment schemes.
5. Employer status as a 'model'
6. Perception of experience i.e. does experience lead to safety consciousness or complacency and risk taking.

The main question posed by Leather was whether risk taking is an individual decision or an organisational necessity. He found private sector workers tended to have a more internal locus of control and public sector workers more external. Public sector workers perceived themselves to be more constrained by their working environment and private sector workers tended to be strongly influenced by their bonus incentive schemes. When given the choice, men preferred the relative security, safety and reduced pressure of public sector employment but not the lower pay.

Miller and Agnew (1973) examined the difference in accident rates of those who were qualified first aiders and those who were not. Their research investigated accident rates in several different situations - Ontario Northland Radio; International Nickel Company and in two unnamed shops. The results showed that those who had voluntarily taken the St John Ambulance First Aid course were significantly less likely to be involved in an accident than those who had not. Two explanations may account for this. Safety factors in a situation may reinforce themselves. The First Aid training reinforces the influence of other safety factors and by nature is reinforced by them. So the greater the number of First Aid trainees the greater the dynamic effect (Miller and Agnew, 1973).

Consequently the safety training has to be supplemented by relevant additional factors to produce the reinforcement which is vital in generating a safety climate. However the employees in each of the companies made the decision themselves to take the course. They possessed an internal locus of control and so this bias of self-selection may explain their lower accident rates.

Intrinsic/Extrinsic Orientation

The concept of intrinsic and extrinsic orientation is similar to locus of control (Saleh and Grygier, 1969) (see Tilley 1974 Edt Leadership and Management Appraisal) These authors attempted to predict task performance and satisfaction by considering the interaction between this individual difference i.e. intrinsic and extrinsic orientation and the variable of supervision (alone/supervised) and task complexity (simple/difficult).

Those classified as intrinsically oriented possessed a strong tendency to be independent and felt that they needed less guidance/reassurance than the extrinsically oriented. Intrinsically oriented individuals emphasised the performance of the task, extrinsically oriented emphasised the environment. Intrinsically oriented individuals experienced a degree of anxiety when they were supervised. Conversely those extrinsically oriented responded only to the presence of the supervisor. Perhaps results like this should be considered when tasks are distributed within an organisation. Varying personality attributes can have an effect not only on work behaviour and task completion but on safety.

LEADERSHIP STYLE

When safety has a low intrinsic interest to the workforce, interest may be cultivated and encouraged or effectively enforced by management, dependent on their behaviour and leadership style.

Bradford and Lippitt's early work (1945) (reported in Lindzey & Aronson (1969) identified four types of management and supervision:

"Hard boiled autocrat" - a rigid status minded disciplinarian who does not trust employees' initiative. This leadership style leads to insecure, tense, aggressive and egocentric work groups.

"Benevolent autocrat" - dominates all employees and is the originator of all standards. This leadership style results in a submissive and lethargic work group who show no initiative without checking with the supervisor. Employees become dependent on their leader, often demonstrating resignation to submission and dependency.

"Laissez-faire leader" - has no goals, takes no decisions and is regarded as an all round 'good fellow'. Sounds ideal, but Bradford and Lippitt found employees were unstable, sloppy workers with low productivity. Frustrated and insecure they were liable to 'scapegoat' the nearest individual when anything went wrong.

"Democratic supervisor" - shares group decisions, gives reasons for his own decisions and devotes time to planning. This work group is likely to be enthusiastic, satisfied, confident and secure.

Later Tannenbaum and Schmidt (1958) (Reported in Tilley 1974) catchily described four slightly different styles:

"Tells" - makes a decision and announces it

"Sells" - uses persuasive tactics to reduce resistance to his/her selling technique

"Consults" - presents the problem and his/her views, listens to advice and suggestions (which are welcomed and taken into account) and then makes a decision.

"Joins" - delegates to the group the right to make decisions. The leader has defined the problem and indicated the limit within which the decision must be made. Generally the decision reflects the majority group decision.

Sadler and Hofstede's U.K. study, 1965 - 1966 (reported in Tilley, 1974) used Tannenbaum and Schmidt's four descriptions of leadership styles to discover how workers and managers perceived their management. Each of the four descriptions were meaningful, that is, the majority of individuals could make a preferential choice. Three fifths preferred the "consultative" management style, but only one quarter of those interviewed perceived their management to be exercising this style.

Different occupations showed different preferential patterns. A perceptual gap may often exist between the perceptions of employees and those that managers have of themselves. However, employees' perceptions were similar to the managers' perceptions of their bosses.

Earlier, Hemphill and Coons (1951) (also Tilley 1974) using a 'Leadership Behaviour Description Questionnaire' found two principal factors emerged;

Consideration

Initiating Structure

Consideration of employees as people, not basic 'work horses' and initiating structure, their ability to initiate the work process through co-operation and participation. The most effective leaders tend to be described as high on both scales (Sadler and Hofstede, op cit.) . In leader-follower relations, consultation and participation are both vital. Workers are more likely to pay attention to safety measures when they have been involved in their development.

Andriessen goes on to report Vandenput (1967) and the European Commission for Coal and Steel warn that "laissez-faire" leaders who communicate via unclear directives will have a detrimental effect on safe behaviour. Similarly autocratic/"tells" supervisors who compel by pressure, make production their priority and do not consult with their subordinates will tend to increase unsafe behaviour.

Any distinctive leadership style is preferable to no style. Clear leadership hierarchies may result in better problem solving behaviour. A distinctive style is more effective in promoting confidence and satisfaction among employees (Tannenbaum and Schmidt, 1958). (Tilley 1974) The relative closeness and punitiveness of the supervision was found to be negatively related to productivity (Katz & Kahn 1966). Close supervision interferes with the performance of the task. The individual may be offended, as the closer supervision implies he/she is incapable of working alone. Punitiveness can interfere with goal attainment or maintenance. Some unscrupulous individuals may be more concerned with this effect than the other related effects (less work motivation; less originality; greater amount of 'on the job' aggressiveness'; more suppressed discontent; less friendliness and low group mindedness). The effectiveness is governed by the quality and execution of the participation and the time constraints imposed on it.

A distinction needs to be drawn between participation and "laissez-faire" styles of management. Very few workers are happy workers under lax management, workers respect a strict but fair disciplinarian. Consistent behaviour is also important. Rules should be applied equably. When looking into an organisation it is generally true to say that laxness in administration rules will be matched with lax safety rules (Brech, 1974). This can be attributed to laziness or perhaps a lack of understanding as to how to successfully impose rules.

Basically each employee should know:

What the rules are

Why the rules exist

What will happen if they break these rules

However, managers and supervisors need to be aware of some of the problems:

Rules may be too general or too petty

Individuals may consider the inconvenience/convenience of following/not following a rule.

There may be advantages/disadvantages in breaking/misinterpreting regulations (Dalton, 1959).

Dalton goes on to point out that rules can have an effect on accident reporting, individuals may distort the facts to protect the guilty. He claims the rationale behind this is that an individual perceives that all possible accidents have been experienced or foreseen, consequently rules have been created to prevent them happening again or at all. Therefore an accident can only occur if a rule is broken so the individual chooses a rule that may or may not have been broken as a means of explanation and protection. An accident investigation may not be able to see the wood for the trees. The real cause may never emerge (Dalton op cit.)

With regard to risk taking, Preston and Heinz (1949); Wehman, Williams & Goldstein (1977) found participatory leadership style more effective in reducing risk taking than supervisory leadership. Like Likert (1967), Wehman et al (1977) conclude that the absence of any clear leadership style caused greatest risk taking in groups, decreasing with a "laissez-faire", authoritarian and then democratic leadership styles.

Wehman et al also examined aspects of leadership style on an individual risk taking in groups, developing work on the "risky shift" by Stoner (1961); Clark (1971) and

Pruitt (1971). They concluded that individuals make riskier decisions in groups than when alone. Perhaps the participation in the group encouraged the individual to engage in the riskier behaviour. However, this may depend on the information the group has received and was using. Later work on the "risky shift" phenomenon showed that the shift in group conditions was not necessarily to risk but rather a polarisation towards either high risk or low risk.

Karlsen's (1975) research supports worker involvement in decision making. He showed that it was superior for the identification of risk and for the development of countermeasures. As Lewis (1974) (in Phillips 1977) points out, management needs to realise that getting the right decision taken, accepted and implemented in safety terms is more important than having their own way. Initiative must come from management and unions must 'jog' management along wherever necessary. Workers should be encouraged to be less tolerant and should assist management, facilitating safety through the free flow of information about hazards (Dawson, Willman, Bamford and Clinton, 1988).

MANAGEMENT COMMITMENT

In an earlier section, Canter and O'Learnik (1988) were reported to have emphasised the importance of the commitment to safety of all organisational levels. However, management commitment is obviously the prerequisite; without management support, encouragement and resources many safety initiatives will not leave the 'drawing board'.

Gaertner et al (1987) investigated the effects of management practice on coal miners' safety. Choosing five mining companies they identified the following variables as causes of low cost time accident rates: vertical integration of safety practices throughout the company; thorough and consistent accident investigation; communication and analysis filtering down to all levels and high commitment of top management to safety. The authors concluded that safety was a shared responsibility of management and labour. They argue it is all very well for management to establish and reinforce safety policies but these are only successful where there is widespread agreement on the importance of safe operation and shared commitment towards it.

Drucker's (1974) unfortunate dictum:

“Management must always, in every decision and action put economic performance first. It's second function is to make a productive enterprise out of human and material resources”.

is perhaps at last being questioned.

Similar studies by Lauriski and Guymon (1989), Fiedler, Bell, Chemers and Patrick (1984) have been concerned with the maintenance of safe production. Management structure needs to adopt clearly defined goals, be committed and capable of fostering safety awareness and provide the incentives to be safe. Employees should see safety as the number one priority, a shared responsibility of the entire organisation. Often safety rules and regulations are used to reinforce hierarchical management structures, imposed without any consideration of the pragmatic difficulties of persuading and helping people to change their behaviour, (Pasmore and Friedlander, 1982).

The established organisational structure should try to include:

Engineering (safe tools and equipment).

Education (safe methods and training beyond the laws' demands).

Enforcement (by maintaining accountability, careful monitoring, counselling and thorough inspections)

Employee involvement, with safety personnel who work with but not for management to promote safe working.

These requirements sound costly, but as Heinrich pointed out as long as 1932, safety is economically viable. A safe establishment leads to safe productivity which leads to a decrease in compensation claims and lost productivity plus increased morale and reduced absenteeism figures.

Work force involvement needs to be an adjunct to managerial action but not a substitute for line management responsibility (Beaumont, 1980). It is important that

line management respect their responsibilities and develop a positive commitment to safety, this they can do by providing clear job specifications and initiating safe working procedures. By setting a good example they will find their positive attitude reflected by the workforce (Barett, Brown and James, 1980; (Cohen, Smith & Kent - Anger 1979).

As Baier (1963) (repeated in Wehman et al) pointed out, the behaviour of the manager is more likely to be accepted as 'good for the company' than is similar behaviour on the part of the employee. Consequently managers who are more concerned with maintaining production than ensuring health and safety will find their employees following their lead.

Andriessen (1978) in a study of construction workers found:

Management had the highest degree of influence on the degree of safety in work behaviour.

Employees will work better with a supervisor who respects his men and their contributions and who is stimulated by a distinctive company policy on safety.

Andriessen concluded that it was critically important that employees should realise that working safely, works. Propaganda which distinguished between good and bad work techniques cleared up misperception and well co-ordinated work groups aided the promotion of the importance of safety.

Management commitment is also recognised as necessary for motivating employees and increasing their pride, morale and self worth. Hatcher (1971), formulated a cybernetic communication feedback loop as a means of co-ordinating management-worker co-operation to control hazards. An active system which boosted morale and improved employee- management relationships. Humanitarian concern, (Levitt, 1975) is effective in improving safety and decreasing risk taking. When employers care, employees are more careful.

This conclusion has been well expressed by the Robens Committee (1972),

“the primary operational responsibility for ensuring safe working must rest with management” .

and also by Attaway (1969),

“Management is the hub around which safety revolves”.

SAFETY CULTURE

The safety culture encompasses three cultural components:

- 1 The physical characteristics.
- 2 The organisational structure and politics
- 3 The aggregate qualities, values, beliefs and attitudes of the employees.

Developing a good 'safety culture' is a long term strategy, recognising health and safety as equally important as any of the organisations' other goals. The safety culture should permeate all levels of the employees everyday life:

Societal, through government commitment and regulatory bodies

Organisational, through self regulation, safety policies and adequate resources

Managerial, through training, rewards/sanctions, control of practice and audits

Individual, through the desire to be safe

The CBI claimed as early as 1972 in a report to the Robens Committee that:

“the root of the problem (i.e. increased accident rates) is human behaviour”.

In the late eighties they proposed a solution, the development of a 'safety culture' believing that the safety performance of industry was indicative of management competence. They identified line management as responsible, with the commitment of the chief executive as vital.

In 1987, following their first review of the Chernobyl incident the U.K.A.E.A. and later A.E.A. (1988) introduced the concept of safety culture. This was later defined in a C.B.I. report as follows:

“...that set of attitudes and attributes in individuals and organisations which ensure that safety issues, as an overriding priority receive the attention they warrant”

The details of this report are described later.

The concept of ‘safety climate’ (which preceded ‘safety culture’ but was clearly a similar concept) was tested in research by Zohar (1980). He measured the perception of employees (production workers) of twenty Israeli industrial organisations using a forty-item questionnaire. The organisational climate reflects employees perceptions of aspects of their organisation. The ‘safety climate’ is a summary of the molar perceptions the employees have of safety levels within their working environment, related to management attitudes to safety and its relevance to general production processes. The quality of safety climate was found by Zohar to be correlated with accident rates as judged by safety inspectors.

Schneider (1975) describes a guiding frame of reference for appropriate and adaptive task behaviours. Employees develop coherent sets of perceptions and expectations regarding outcome contingencies, based on cues within the work environment, and behave accordingly, (Fleishman, 1953 and Litwin and Stringer, 1968).

The potential determinants of and prerequisites for a strong safety culture, then, are a strong management commitment to safety with routine personal involvement by all

employees (Cohen, Smith and Cohen, 1975, and Shafai-Sahrai, 1971). Safety has to be given a high priority within the organisations' basic ideology; this may often entail safety aspects becoming an integral part of the production system (Smith, Cohen, Cohen & Cleveland (1978) and Shafai-Sahrai, (1971). Zohar (1980) also concludes that safety should be an integral part of the production system and should not be detached from general management responsibilities.

A high rank and status should be accorded to safety officers (Cohen et al 1975). Safety inspections should be frequent ; training must be an integral function (National Safety Council, 1969, and frequent communication links between workers (Cohen et al 1975) will also aid the nurturing of a safety climate. Job and organisation commitment will be vital in this development, (Edwards and Kahn, 1980).

Furthermore employees do not live in a vacuum, the informal pressures exerted by workmates, family and friends will affect perceptions and resulting behaviour. Successful safety programs sometimes involve families through 'fun' days and campaigns

Two Specific Aspects of the 'Safety Culture'

The Safety Committee

Several researchers have emphasised the vital role that the safety committee can play. Boden, Hall, Levenstein and Punnett (1984) investigating the effectiveness of OHS legislation and safety committees proposed several mitigating factors which could affect the success of the safety committee:

The frequency of meetings held.

Co-operative behaviour on the part of management and the trade unions

The resources for carrying out their recommendations.

The rank and file input

The degree of active feedback within the organisation

The effect of OHS, external to the committee

The regulatory environment, the industrial relations and economic climate of the firm and the commitment of management to reducing hazards were all perceived as important factors (Boden et al 1984). A supportive environment is important if the safety committee is to have a chance to flourish, often the attributes of the committee are less important than the commitment of management and employees in guaranteeing success. If, however, the safety committee is perceived as an effective body, objective measured and perceived safety may be increased.

Safety Officers

Some safety committees will have an impact and others may not, this may depend on the safety officers. The individual who must ensure that the committees' work is taken

seriously. To do this he must be taken seriously himself, he needs to be able to command respect and show sincerity of purpose, (Brecht 1974). The safety officers should be involved in routines inspections, training and accident analysis. Keeping his fingers on the pulse he has an active role.

Beaumont, Leopold and Coyle (1982) (reported in Beaumont 1983) found that of 33 plants, where they interviewed safety officers, many of those interviewed suggested that as a result of recession, production considerations tended consistently to outweigh health and safety matters as a priority in management calculations. With recession the cost of safety provisions may no longer be met (Nichols, 1985). The overriding concern for production increases pressure on workers to take risks, inevitably given the overriding concern for profit or productivity (Harastzi, 1977).

Dawson, Willman & Clinton (1988) also emphasises the importance of the company's safety policy. The Health and Safety at Work Act, 1974 made written safety policies a legal requirement in an attempt to shift the then current emphasis from external to self regulation. Safety policy design often tends to be inadequate with regard to information on hazards/procedures for hazard control, specification of management responsibility and the provision of safety training. Dawson, Poynter and Stevens (1983) point out that some companies have simply obtained a policy document from another company via friendly association or even payment. As the Health and Safety Committee (HSC) point out, an effective safety policy is the one being carried out, not simply the one written down. Implementation is conceptually distinct from the issue of consensus and motivation (Beaumont, 1983).

THE CBI (1989) REPORT

"People feel safe working for us"

"The major disasters of 1987 and 1988 have focused particular attention on the need for a better management of safety and on failures in this respect even among very large enterprises. The principles of good management apply equally in smaller firms and their importance is reinforced in high technology conditions where the human factor becomes critical".

(John Cullen, HSC Annual Report, 1988).

These remarks were one of the motivators that led the CBI to conduct a questionnaire survey of over 400 firms in 1989. Of the 400, 216 replied, and from their results the CBI formulated its own framework for a good 'safety culture'.

The CBI's framework for a 'safety culture' was further described as "...the way we do things around here", including care and concern for all those affected by the business. The 'safety culture' incorporates everything from "...keeping the team's eye on the ball" to "...being a good neighbour". The safety committee is presented as a virile part of a safety organisation and the safety policy as more important than the "... bare requirements of what the law might suggest".

Industries are advised to begin processes of safety selection, to invest in safety oriented people, thus eventually creating a self perpetuating situation. Individual safe work

habits becoming inherently the company's. This feeling develops into "... people feel safe working for us". Morale increases, productivity increases, absenteeism decreases and the frequency and duration of sickness and accident absence will also decrease. Safe working conditions demonstrate the company's commitment to looking after its work force and it will be rewarded. The CBI urge managers not to see safety as a 'bolt on' legislative requirement. They claim that along with higher productivity and increased quality of work the actual work environment will improve. Total quality management should be the ethos, everyone is a customer, everyone should be supplied with a risk free working environment.

The 'safety culture' should show how safety should be managed, setting down achievable and acceptable standards making the chain of responsibility clear. The aim of the organisation should be coherently specified with identification of the resources that will be made available for this goal. Money often tends to be a convincing factor in these situations. In conjunction, training should be provided for all levels and each new recruit should experience a form of induction training. Knowledge, the CBI feel, can be a motivator and provide a sense of identity through belief in and experience of the company's philosophy.

The CBI admits that selecting personnel for safety may be difficult for some sectors of industry to achieve. Nonetheless they emphasise the importance of employees and their roles. These are crucial to the shape and ultimate success of their 'safety culture'. Consequently, involvement, training and commitment of employees are vital. However, their resolution to be safe will depend on how credible they perceive

managements' commitment to be. Communication has a large role, consultative ventures such as safety circles are suggested to enable shared values to be communicated. Similarly, "cascade" briefings, the CBI feel, are a good means of ensuring information travels throughout the organisation.

In summary, eleven features of the 'safety culture' are proposed:-

Leadership and commitment should stem from the top.

Developing a 'safety culture' is a long term strategy which requires sustained effort and interest.

A policy statement of high expectations with a sense of optimism should be issued.

Health and Safety should be treated as seriously as other corporate aims and properly resourced.

1. Line management have the main responsibility for safety.
2. The 'safety culture' ideology should permeate all levels.
3. Realistic and achievable targets should be set
4. All incidents should be thoroughly investigated.
5. Consistency, once achieved should be maintained.
6. Deficiencies should be remedied promptly.
7. Management should be dispatched adequate up to date information to enable performance assessment.

(CBI Developing a Safety Culture - Business for Safety 1990)

RISK PERCEPTION IN INDUSTRY

Emphasis in the more recent safety enquires (e.g. Clapham; Herald of Free Enterprise; Piper Alpha) has shifted markedly towards management perceptions of safety and management responsibility for risks. A re-examination of risk in occupational settings has become necessary, as work practices and circumstances are changing.

Relatively little work has been undertaken that focuses specifically on risk perception in industry and its publication is widely scattered. The Human Factors Study Group of ACSNI (the Advisory Committee on the Safety of Nuclear Installations) recently assembled and reviewed a number of these studies in its 3rd Report entitled 'Organising for Safety'.

Ostberg (1980) asked his subjects, forestry workers, fellers, safety engineers and officers, supervisors, teachers and pupils), to make risk judgements. These were in the form of paired comparisons of ten situations representing a number of standard work tasks. Data, from this study, were unfortunately not available to allow a comparison with actual accident rates so the lesson to be learned depends on the wide divergence in perceptions between different operatives and managers. An attempt was made to introduce a 'standard' in the form of a hazard that would be perceived as the same by all groups of subjects. But this was of dubious validity (see below). Supervisors tended to estimate the risks as less serious than teachers by a factor of four. Operatives were closer in their estimates to supervisors and managers resembled teachers. This is alarming when considering how influential supervisors' attitudes are

in motivating safe working (Andriessen, 1978) and in ensuring that employees do not see safe working as bothersome, annoying and time consuming. An employee will often work unsafely when he does not know what a safe way is and/or when he is not able to work safely and/or when he is not motivated to be safe. Andriessen concluded that instruction, information and training were critical components of a safe organisation.

However, quoting the earlier work of Sundstrom-Frisk (1978) who has shown that frequency and severity of felling accidents decreased mainly as a result of changing from a straight piecework system, to payment by the hour, Ostberg concluded that accidents were not a result of worker mis-perceptions of the risks involved but of sub-optimally designed equipment, poor production methods, lack of consultation/participation and inadequate work organisation (see also Murphy, 1981).

Ostberg further concluded that safety rules were broken as a consequence of:-

- a) The production system.
- b) Lenient attitude of the supervisor.
- c) Unsafe methods being perceived as more economic.
- d) Equipment, tools and working practices not designed from the point of view of safety.
- e) Piecework, an inherently 'anti-safe' system.

The focus should not be on 'why accidents happen?' but on 'what new approaches can be taken to improve workers health and safety?'

However, as mentioned earlier the validity of Ostberg's conclusions have to be questioned. The "absolute" levels of risk were dependent on the effectiveness of an 'anchor' hazard independent of forestry, assumed to receive the same average assessment by the six groups. This was the risk of walking home along a forest road without "reflectors". It is doubtful if this risk was perceived equally by all groups and it is certainly doubtful whether it could serve as the basis for concluding that the work risks, which were compared with it, were accurately estimated. The main finding, it may be argued, was the wide difference in perceptions of risk between employees with different roles and the fact that those closest to production perceived least risk.

Zimolong (1985) (reported in Eberts & Eberts) gave six occupational groups of subjects a similar task to Ostbergs' asking them to rate places of work with the most potential for injury. However, in this study it was possible to compare the subjective measures of perceived risk with the objective accident data.

The results showed a mismatch; liability to injury was underestimated in situations with high risk probabilities and vice-versa. Employees were more likely to underestimate high risk situations if they had a long experience of the hazards.

This is what would be predicted by Fischhoff, Slovic & Lichtenstein, Read & Combs (1978), who also claimed that underestimation varies with occupational risk groups. Familiar work situations with high accident risks are underestimated more than the unknown with comparable risk probabilities. However, Hale & Hale (1972) reported in their review that some employees had a much greater appreciation of the risks involved in their work than others doing the same job regardless of their experience. A study by

Kirk (1988), in which students were asked to assess the areas they perceived in their campus environment as most dangerous showed that these were not statistically the most dangerous. Indeed there are many studies which actually look at perceived risk and compare to actual risk of event.

Dunn (1972) found from a study of chainsaw operatives that there was little correlation between subjective estimates and the objective distribution.

Zimolong (1979) working with shunters, suggested that their underestimation of minor, severe and fatal injury probability could be a reflection of faulty decision making. Accidents are most likely to happen when individuals feel there is less risk of an accident occurring than indicated by the objective measure.

The solution is clearly to ensure hazard perceptions more accurately represent the "real" world. By the introduction of "hazard spotting", individuals could estimate the relevant importance of certain hazards which would then be compared to the actual hazard ratings, so enabling individuals to see how accurate their perceptions really are. The difficulty with this laudable objective is that many "real" risks cannot be computed with accuracy. Even where substantial data is available from past practice for extrapolation, (which is rare) circumstances change. Within every working group a 'folklore' develops which may define the hazards within the group, via 'hearsay' and second-hand reporting. The hazards are defined with a little direct evidence in their support. Hale & Hale (1972) report that risks considered by workers to be part of the job tended not to be mentioned in formal risk assessments.

Singleton, Hicks and Hirsch (1981) concluded from objective and subjective risk ratings by agricultural workers that,

"misperception or lack of awareness of hazards are major factors in agricultural accidents".

In this case they were able to compare the perceived risk of ten types of accident during tractor driving with actual frequencies. Two of the risks were seriously misperceived.

Murphy (1981) examined the safety attitudes of farmers but claimed that their safety attitudes are inconsequential and of no relevance to the safety educators. Other factors, they claimed, were more important and more directly related ie. the hazards of the environment; the social image of the 'rugged farmer' and the low value attached to safety decisions. It might be questioned whether the earlier two are not simply more generalised expressions of risk taking (i.e. attitudes) as distinct from individual hazard perceptions.

Hale and Perusse (1977) proposed that risk perceptions vary with the degree of control the employee has over the hazard. Others argue that this depends on whether denial processes are in operation and whether the danger is "directly sensible". Nuclear workers were found not to be afraid of the harm of radiation, (although they knew the consequence of exposure could be serious) because they felt that their exposure was under their own control. Radiation cannot be seen, it is not directly sensible. People do not always believe something is really dangerous even when they are told that it is.

This may be due to their own experience creating a conviction of personal immunity. Risk perception changes with experience.

Rushworth et al. (1986), investigated risk taking in relation to coal bunker accidents and found the fewer hazardous incidents miners experienced, the more trusting they became, both of the equipment and of their own abilities. Familiarity, a major factor, caused them to discount risks, leading to shortcuts and other deviations from safe practice. It can be concluded judgement of safety is directed by the beliefs surrounding the hazard, trust of equipment, belief in innate abilities and correct usage of procedures to avoid hazards.

Management and T.U. relations can have considerable influence on health and safety perceptions and actions in the workplace (Walters and Haines, 1988; Grunberg, 1983 and Dwyer, 1983). Although the degree of autonomy exercised by workers is correlated with accident rates, a high percentage of workers are fatalistic in their attitudes and ignorant of their rights. Employees need to learn how to avoid risks (Powell 1971), they need to realise that "denial" may be fatal and that there are certain risk conditions under which they should not have to work. The NIIP report, edited by Powell 1971, points out that risks may be an integral part of a given work system, consequently the more work done, the more accidents there are. However, the risks which accompany each task are specific and can be changed by modifying task details or by teaching employees to avoid specific risks.

Acceptance or risk is different for employee and employer (Collinson, 1976), acceptance or tolerance of a potentially dangerous situation is wrong; it can lead to the stagnation of constructive thinking which might otherwise provide solutions. Unjustified and unwarranted contentment with the situation is likely to keep the accident rate high. Collinson suggests two possible solutions;

Minimise the risk taking by the individual.

Reduce the number of hazards in the environment.

However, workers should be very wary of programs which increase confidence that risk has been reduced when, in fact it is at the same level.

Kinaszcuk, Dodge and Mohler (1982) distributed a questionnaire to 141 members of the Dayton, Ohio Flying Club, asking respondents to rate 50 actions which should be carried out to ensure total safety. They found that high compliance with safety procedures indicated a positive safety attitude with experience resulting in higher attitude scores. Kinasuk et al concluded flight safety results from proper training, adequate pre flight preparations and self discipline.

Levine, Lee, Ryman and Rahe (1976) carried out a similar study which also included aviators. A total of 879 enlisted men and 156 pilots completed a 22 item questionnaire on attitudes towards risk. A factor analysis of the results identified 6 scales:

Adventurousness:

Logic

Discipline

Focus on immediate situation

Concern with self

Brashness (related to future accident chances).

The Adventurousness scale showed positive correlations with accident records, some selected items from this scale were "...it is exciting to take chances", "I enjoy skydiving" and "Motorcycling is more fun than simply a means of transport".

Adventurousness was shown to have the most significant association with personal injury and death among aviators. Levine et al (1976) op cit. concluded that their adventurousness scale can be seen as a valid measurement of risk taking behaviour. The particular importance of this study is that the attitude measures were made before an extended mission, during which meticulous records of accidents were kept.

Graveling et al (1987) makes an attempt at explaining why individuals engage in unsafe behaviour as well as denial of unsafe behaviour. Individuals may be totally oblivious to the hazards of their situation; expediency, urgency and conscience encourage them to take shortcuts; pressure for production may distract them from watching out for hazards, and they may be over confident.

Some miners perceived that the pressure of the work affected their opportunities for promotion and that extra overtime was dependent on their ability to reach deadlines. Their behaviour is governed by these and similar beliefs. This investigation within the mining industry found experience was also a major factor in changing perception. Trainers perceived bunker work to be riskier than did general skilled, shaft and supervisory staff; inexperienced bunker workers tended to possess a heightened perspective of the risks involved; often indiscriminately. One unfortunate finding of this study is that when individuals experience fewer hazardous incidents they often develop more trust in themselves and in their environment, leading them to take what they considered to be safe shortcuts. More deviations from safe working practice inevitably leads to accidents. On a positive note, Graveling et al (1987) propose several improvements. Training should maintain a high sensitivity to risk through refresher courses. The refresher courses should end with the awarding of certificates whenever possible.

Collinson (1979) emphasised the importance of training as an avenue for risk reduction, one of the best ways for assessing the effectiveness of training is an individual's changed perception of the risks he faces.

The present author feels that factor analysis is a particularly useful tool to draw out the important dimensions of attitude as shown by Levine et al. (op cit) rather than relying on individual items. The cognitive structure of the replies should also be examined by MDSA as in Canter and O'Learniks' (1988) study, to provide a fuller picture. However, Canter & O'Learnik themselves propose that intercorrelations between

perceived risks and predictor variables such as personality; physical work environment; participation; compliance with procedures and safety committee efficiency should be computed. It was also felt that more attention should be given to the risk perceptions of different task groups and of general risk taking tendencies in employees.

Rundmo (1992), examined risk perception in 5 companies and 10 installations in the North sea on behalf of the Norwegian Petroleum Directorate. Basing his research on the assumption that perceived risk influences behaviour and behaviour influences accident rates. He concludes that:

- * Familiarity with a task reduces perceived riskiness.
- * Anxiety over major hazards (i.e. fire, explosions etc)is greater than the anxiety of higher probability events i.e. platform workers are more concerned over the infrequent large accident than the much more common small one.

These results mirror findings from studies of the public perception of risk.

Rundmo went on to point out that those who perceive the greatest risk of major accident have also the least confidence in safety measures. More worrying is the fact that it was these personnel who had the most knowledge of safety and emergency procedures yet had the lowest confidence. This may be a reflection of an internal company problem rather than a general comment on safety precautions.

Job Stress

Job stress was also examined by Rundmo (1992) in the same context. He pinpointed 5 important factors affecting stress. Co-operation; perceived predictability of work colleagues; degree of participation in achieving tasks; lack of role ambiguity and absence of conflict. Hersey (1936) emphasises the role of the immediate supervisor. He claims that when looking out for or acting upon safety violations, the workers' emotional attitude should be taken into account.

"The mule requires not only the hay before his nose. The whip diplomatically administered is also necessary".

Murphy, Dubois and Hurrell (1986) in their historical review refer to Hersey, pointing out that his main study of 400 accidents found that 50% took place when workers were in low states (physically and emotionally). Kerr (1957) claimed that increased workers control and participation in decision making will reduce industrial accidents by reducing the 'negative distracting stress impinging on the worker'. Kerr proposed this as the main casual factor for 45% - 60% of all industrial accidents.

Murphy et al, report, Friend (1982) proposed this stress coupled with anxiety will lead to performance decrements. Hale and Hale (1972) concentrate on the 'u' curve relationship between performance and arousal to explain their findings. Accident rate is higher just before breaks compared to after; the accident rate for older workers is disproportionately high when work shift is increased by 30 minutes. However, they

also found more accidents occurred during peak production, one would assume that arousal and consequently performance would also peak at this time.

Murphy (1981) creates an accident aetiology separating those accidents caused by work environment, training and employing factors from those caused by hazardous work conditions, organisational factors and inadequate training . Stress Management Techniques, he claims, in the form of biofeedback, meditation and muscle relaxation techniques will enable individuals to deal with the stresses they encounter in their working lives.

In the review by Murphy et al. (1986) it is suggested that stress may influence "accident proneness" , a specific deficit in the capability of the worker. They offer anxiety, alcohol use and fatigue as mediating factors. Others suggest work overload/underload, deadline pressure, and role stressors. (Cooper & Payne (1978) (see Murphy et al 1986)

Lower psychophysiological arousal levels and worker conceptualisations of job stress may have a role in workplace accidents. Stress affects diverse areas of human functioning so it may well play a significant role in workplace accidents. Rundmo (1992) argued that stress will affect an individual's perception of the risk, the more stressed, the poorer the risk evaluation. Consequently, he believes the focus of future research should be on the organisational characteristics which create high job stress.

Alkov and Borowsky (1986) and Alkov (1981) showed in a study of aircraft accidents in the US Navy that personnel causally involved in accidents are more likely to have recent experience of a life change stressor such as marriage; divorce; moving house; bereavement etc. Each individual will manage stress differently according to the situation they find themselves in. Hill and Trist (1953) speak of incidents of psychological withdrawal from the workplace. A possible means of survival is to 'leave' the damaging situation and this half conscious desire may find expression in carelessness leading to an accident.

Risk Taking as a Personality Dimension

Oi (1977) suggests that workers do choose their jobs by weighing up the benefits of engaging in risky behaviour and so gaining higher pay, as opposed to the perceived costs of an accident. "A hedonistic calculus of pleasure and pain". The high accident rate of inexperienced and younger workers, Oi believes, can be explained by differing risk estimates. The relationship between age and experience is part of the explanation. Younger people are heavily represented among newly hired inexperienced workers. The young and inexperienced tend to perceive lower accident costs ie. they are less risk averse and more inclined to take the riskier jobs. Hence their higher injury frequency rates.

Schulzinger (1954) from the analysis of 35,000 accidents pinpointed 4 main causal factors:

Learning a new and unusually hazardous job.

Being aged in the early twenties.

Being male.

Being extremely inexperienced.

The young, however are lucky; as Oi points out their health and strength may protect them from serious injury. Those who are both old and inexperienced may not be so fortunate.

Apparently, despite the stress and high risks associated with jobs and within certain working environments, individuals appear to search out these riskier occupations. There will always be people who consciously/subconsciously seek risk in their jobs and there will always be risks. Therefore it is doubly necessary for safe working measures to be part and parcel of the working environment.

The need for Regulation

There is a need for a set of mandatory safety/health standards to be produced. However, organisations must be realistic enough to see that people will still unintentionally or intentionally violate some standards, often due to lack of awareness and because compliance may exceed their perceived estimates of the costs of non compliance. Regulatory programs need to set funds aside for enforcement activities. Generally compliance has been far from perfect due to inefficient enforcement programs and insufficient funds. (The nuclear industry, with its strict external regulation by the Nuclear Installations Inspectorate, is a possible exception to these

criticisms). As well as this, the mandated standards may be ineffective and operational standards which control some of the casual factors are not easy to design (Oi, 1977). Oi also points out the failings of engineering improvements; when the background is made safer, individuals often take less care to avoid an accident. This has become known as the principle of 'risk homeostasis'. Relinquishing control, they perceive there is nothing left for them to do. In conclusion, Oi argues that specific hazards should be the prima facie subjects of research and prevention programs rather than the vague general action or goals.

To conclude, risk perception is a vital component for the understanding of risk taking. Perception can be affected by many characteristics of the risk.

The three factors:

Knowledge

Emotion

Behaviourial Dispositions, all affect outcomes.

Also it is extremely important whether the benefit of the risk option outweighs the cost of possible adverse outcomes.

Perceptions of risk affect attitudes to safety, if a risk is identified and perceived to be serious, precautionary measures will be taken. These may be either collective - the creation of a 'safety culture' within industry or home, or individual - the wearing of hard hats or close adherence to the specified safety regulations. The result of non identified risks will be the evaporation of safety consciousness, and corresponding, poor attitudes to safety.

JOB SATISFACTION

“One must be aware of social scientists who say some jobs are dull. They may be dull to a college graduate but not to the people doing the jobs. To find out if a job is dull one must get out into the factory floor and interview those who live the life of the job”.

(Foulkes 1969 in Herriott, *Essential Psychology* 83-138).

Many researchers have followed Foulkes advice. The following represents an overall view of their findings.

“A positive emotional state resulting from the appraisal of one’s job or job experiences”, (Locke, 1976) in Glisson & Durick 1988)

“A disposition as a result also of the attitudes the employee has towards other related factors and towards life in general”, (Argyle, 1972).

Generally perceived as a unitary concept (Zaleznik, Christensen and Roethlisberger, 1958), job satisfaction itself is an affective response to the beliefs and perceptions employees hold in respect to the organisation they work for “(Mowday, Porter and Stears, 1982 and Williams and Hazel, 1986). Mowday et al.as reported in Glisson & Durick (1988) also emphasise the importance of ‘organisational commitment’ i.e. a strong belief in organisational goals and values, a desire to remain a member and willingness to exert an effort for the organisation, as a determinant of job satisfaction.

They also consider 'organisational commitment' as emphasising attachment and job satisfaction as emphasising the task environment. Many factors believed to be related to job satisfaction have been identified. An historical review seems the best way of describing these factors.

In 1932 Hoppock (Argyle 1972) surveyed 500 teachers. He found family influence, religion, successful interpersonal relationships and selected vocation were to each teachers' perception of their job satisfaction.

In the early 1940s work on job satisfaction was dominated by Siedman and Watson. In 1940 they identified recognition, friendly association and vocation as important factors. They also found variety was perceived to be more important than wages when factory workers explained what made them satisfied. Later, in 1943, Siedman and Watson added congeniality and social contacts. Social contacts were more conducive than wages and working hours to maintaining satisfaction. In 1949, Urwick and Brech carried out their famous "Hawthorne" studies, they found job satisfaction dependent on security/insecurity, fear, threat of change, loss of prestige and opportunities for advancement. They concluded employees should be treated as human beings not as means to produce. Employers were warned not to see their employees as one person at home and another at work. Job satisfaction involved the consideration of emotion not logic.

The fifties saw the gradual emergence of intrinsic (self) extrinsic (external) factors. In 1953, Handyside had questioned 1250 grades of manufacturing workers and concluded that psychological considerations were more important than physical ones. The emphasis of research became emotional needs rather than physical wants. Previously Katz (1950) (in Katz & Kann 1966) had identified satisfaction with wages and promotional opportunities; identification with the company; working conditions; ego involvement; belonging; responsibility; pride and the ability to contribute knowingly to worthwhile efforts, as the salient factors.

Morse (1953) (see Seybolt 1976) identified four indices of job satisfaction:

Content

Identification with the company

Financial and job status satisfaction

Pride in great performance

He concluded that job satisfaction was a combination of the level of aspiration/need, tension level and the amount of benefit returned from the environment. If both these levels were in equilibrium, it was predicted the individual would be satisfied with his/her job. Therefore job dissatisfaction is likely to arise when the return from the environment is less than the need of the individual. Zaleznik et al. (1958) similarly suggested an 'expects:realises' ratio. When this is optimal in six areas (Intrinsic i.e. Self; Extrinsic i.e. Environment; Supervision; Associates at work; Company and the Union) the individual is likely to be satisfied.

In 1957, as reported by Argyle (1972) Herzberg, Mausner, Peterson and Capwell put forward another list of related factors: Supervision/Management; Conditions; Wages; Advancement; Security; Social Aspects and Benefits. The most important factors were security and opportunities for advancement. Job benefits and ease of work were least important in creating a feeling of job satisfaction. Later, Herzberg, Mausner and Snyderman (1957) (see Argyle 1972) suggested that satisfaction was strongly correlated with motivation and hygiene factors. Motivators such as achievements, recognition and promotion were good experiences leading to satisfaction. Conversely, hygiene factors such as supervisors, fellow workers, company policy and working conditions could cause bad experiences and therefore lead to dissatisfaction.

The sixties and seventies saw more emphasis on intrinsic and extrinsic factors.

Spillane (1973) identified intrinsic factors as:

Abilities

Achievement (also Centers and Bugenthal 1966)

Responsibility

Advancement

Variety

Interaction

Autonomy

Extrinsic factors are:

Conditions

Salary

Policy

Colleagues/working relationships

Supervision

Security

Argyle (1972) expanded the concept of supervision to examine participation and consideration (i.e. the degree to which the leader shows warmth in personal relationships, trust and readiness to explain actions and listen to subordinates). Yet some researchers were not convinced by intrinsic factors. Child (1971) felt satisfaction was dependent on tangible rewards.

Pay

Benefits

Security

Promotion

Status symbols

Special awards ('perks')

Generally, however, it appears that intrinsic factors are more strongly related to general job satisfaction than extrinsic ones.

Once the factors had been identified attempts were made to explain the relationships. In the 1950s Maslow produced a hierarchy of different needs, claiming

individuals had a predisposition to satisfy the biological, first (i.e. food, warmth and shelter). Consequently job satisfaction would depend on extrinsic factors, such as pay before more abstract qualities such as self-actualisation. Vroom (1964) (see Lindzey & Aronson, 1969, Ch. 39) believed individuals “anticipated satisfaction form an outcome” similar to the ‘expects:realises’ ratio. Each component of an individual’s working life is supportive or non supportive of his desires.

Argyle (1972) provided a sociological viewpoint, the theory of alienation. He proposed employees often felt feeling of powerlessness, meaninglessness, isolation and self estrangement. These were further defined as follows:

Powerlessness: Lack of autonomy, lack of satisfaction and an inability to participate in decisions.

Meaninglessness: Depends on the nature of the task and the extent to which the work adds up to a meaningful whole. There is an inability to see the purpose of work or how it fits into the whole production process.

Isolation: Not belonging to the work group.

Self Estrangement: A failure to regard the work as a central life interest or means of self expression. Resulting in a depersonalised attachment while at work (also Seeman, 1959 and Blauner, 1964) - reported in Argyle 1972..

However Argyle concluded that employees could feel alienated but satisfied. Therefore it seems that intrinsic factors may be compensated by the extrinsic factors of good pay, reasonable hours and pleasant workplace conditions.

Glisson and Durick (1988) questioned 411 Polish underground miners and 104 senior managers on three main factors: job tasks; organisation and workers. Using a dispositional model i.e. employees are predisposed to certain attitudes. They found job satisfaction was independent of the needs/values satisfied by job characteristics and also independent of other situational characteristics. Conversely Herman and Hulin (1972) and O'Reilly and Roberts (1975) (Lee, Glisson & Durick 1988) suggest that attitudes are more closely related to the structural context of the workplace than to the individual characteristics of the worker. This is more closely similar to the social information processing theory as opposed to the dispositional model. Attitudes are constructed through social interaction with other workers in the workplace rather than predetermined by individual worker characteristics or objective job characteristics (Salancik and Pfeffer 1978) as reported in Glisson & Durick 1988. This distinction is highly relevant to the concept of safety culture.

Some Factors associated with Job Satisfaction

Occupational Levels: satisfaction increases the higher up the scale the employee is. The lower the employee is on the scale the more important is the security factor.

Income/Wages: satisfaction related to income is comparative rather than absolute. The comparability principle states that people doing the same work should be given the same pay regardless of where they are employed (Child, 1971 and Argyle, 1972). If individuals perceive equity in their pay compared to others doing the same/similar jobs they are more likely to be satisfied. Pay is simultaneously the most frequent source of dissatisfaction and the least frequent source of satisfaction according to Vroom (1964) see Lindzey & Aronson 1969, Ch 39..

Working Conditions: These make an equally low contribution to job satisfaction and job dissatisfaction. However an important exception, Gilmer 1961 found workers in hazardous conditions ranked safety conditions as the most important job factor related to satisfaction.

- Management - the higher the employee's skill level the greater satisfaction with management (Child, 1971)
- Hours - shift working leads to dissatisfaction (Argyle 1972).
- Communication - has yet to be identified as a reason for liking a job. Although Nichols and Armstrong (1976) found, when questioning workers, a prevalent "I like my boss he listens to me" attitude. However they also found workers understand less than 25% of what their managers think they understand; an alarming conclusion for those working in hazardous conditions.

- Organisation - many hierarchical levels (as distinct from a 'flat' structure) may lead to discontent (Child, 1971), especially for those at the bottom with little chance of advancement.
- Organisation Size - small companies lend themselves to satisfying their employees.
- Work Groups - are the linchpins in determining the morale and perceptions of the organisation, organisation commitment and ultimately job satisfaction.

Formation of the group and cohesiveness determine satisfaction (Van Zelst, 1952) and may also increase productivity (Gilmer, 1961) (see Spector 1978). Child (1971) found the position individuals perceive they have within the group is important, a central position with high status and autonomy results in stronger feelings of satisfaction, independent of age and occupational level. Zalesnik et al.(1958) found workers who were members of regular sub groups (being accepted by the group) tended to express greater satisfaction than workers who were members of deviant groups or who were isolates.

The size of the group, as with organisations, may also influence satisfaction, small groups generating greater satisfaction (Argyle, 1972). Beyond seven or eight members, there is a tendency for the groups to divide, with the formation of conflicting factions (Child, 1971). Work groups are more important in some kinds of work than others (Argyle, 1972), it could be assumed that in the nuclear industry where there is a

lot of team work and reliance on others, the work group is of considerable importance.

Variety: the importance of task variety in relation to job satisfaction differs between occupations. There tends to be a low level of satisfactions with repetition, number of operations and time to complete demands (Argyle, 1972). To quote Paul and Robertson (1970) (see Herriott 1976)

"... no amount of environmental improvement can compensate for task impoverishment. If we are concerned to motivate people we must look again at what we ask them to do".

Consequently several solutions have been propounded:

Job enlargement - horizontal expansion, leads to increased efficiency

Job enrichment - vertical expansion, reduces monotony and boredom (Gerhart, 1987; Dewar and Werbel, 1979 as reported in Glisson & Durick (1988). Enrichment is good for job satisfaction but people often prefer to go where there is more money than stay in an enriched job at less pay.

Skills and Abilities: Glisson and Durick (1988) found among the Polish mine workers less confusion about the responsibilities and abilities the more satisfied were the subjects. Similarly, Karaesek (1979) concluded that the 'requirement' of using intellectual skill and making decisions was perceived as an opportunity to exercise judgement, a form of autonomy, not a source of stress. Constraints on decision

making may be major obstacle to achieving satisfaction. The individuals with few opportunities to make decisions are often most subject to job strain. Work processes may need to be redesigned to allow increases in decision latitude for workers. Job strain could be reduced without affecting the job demands employees associate with output levels (Argyle, 1972). Consequently we can conclude that those individuals who are able to express themselves tend to be more satisfied

Age: job satisfaction tends to be higher when employees are young and to decrease through the last years, this tends to be most likely due to promotion/opportunities for advancement decreasing (Gilmer 1961).

Education: the higher the workers' education the higher the worker's expectations (Seybolt, 1976). Seybolt continues reporting Smith, Kendall and Hulin (1969) hypothesised three situations predicted to result in satisfaction:

Low pay, variety, complexity and low education

—————> satisfaction

Medium pay, variety, complexity and medium education

—————> satisfaction

High pay, variety, complexity and high education

—————> satisfaction

In an attitude survey of 380 job classifications within 4 major occupational categories in county and municipal government, Smith et al. concluded that the level of formal

education moderates the relationship between work environment characteristics and job satisfaction.

In conclusion job satisfaction will depend on the opportunity to use a variety of skills in performing job tasks and on the clarity of the requirements and responsibilities of the job (Glisson and Durick, 1988). This reinforces research which identifies task ambiguity and variety as the strongest predictors of satisfaction. (as reported in Glisson & Durick.

Does Satisfaction have any effect on employee behaviour or performance?

The only reason that some conservative employers may have for considering changes to improve job satisfaction is the possibility that dissatisfied workers are not working as hard as they could be. However, Longenecker and Pringle (1984) claim there is little evidence that a 'happy worker is a hard worker', reviewing research on satisfaction they do suggest that satisfaction does result in:

- Low turnover
- Less absenteeism
- High organisational effectiveness
- High morale level
- Improved union relations
- Easier supervision

Gilmer (1961) (see Spector 1978) did report that employees with positive attitudes towards the company tended to outproduce those with negative attitudes. But this finding has yet to be replicated and there are other studies with negative findings.

Considering whether satisfaction has an effect on safe working behaviour, it appears that little work of this nature has as yet to be undertaken.

THE THORP HUMAN SAFETY SURVEY

The Sellafield Safety Survey originated with and is part of an Action Plan for Safety, a new health and safety initiative to promote and develop a 'safety culture' in a newly commissioned plant - THORP, the Thermal Oxide Reprocessing Plant. This is designed to reprocess irradiated oxide fuel from Advanced Gas Cooled Reactors and Light Water Reactors. THORP is expected to deal with 4,000 tonnes of irradiated fuel during its first ten years of operation.

Employees for THORP are being selected from outside the nuclear industry and from other divisions within. Several hundred employees from Sellafield's Magnox division will eventually begin work at THORP, bringing with them considerable expertise but also their existing perceptions of nuclear risks and their attitudes to safety. THORP also hopes to promote more flexible working and flexible attitudes to safety. Sellafield's management wanted to ensure that THORP is not only technologically sound but also that its employees have correspondingly positive attitudes to safety, enabling it to start operation with the roots of a 'safety culture' firmly embedded. However, at a fairly early stage in the design of the investigation, it was recognised that any advantages that might accrue should be available also to the other divisions (of which Magnox is the largest) and the survey was accordingly expanded to the whole site.

Methodology

The first stage in the study was to elicit from those who know (i.e. employees at all levels and from all quarters) the main issues affecting safety on the site. The purpose of this focus group approach was not only to obtain information in its own right, but also to provide a 'free response' input to the design of the questionnaire.

The Use of the Questionnaire

Questionnaire surveys are a vital key to improved safety management. They elicit perceptions and attitudes and identify action points. The emphasis is on representatives and their coverage can only be extensive because the instrument itself is designed for rapid completion. It needs to be clear, unambiguous and structurally simple. But above all it needs to ask the right questions.

Those who criticise the use of questionnaires do so on two main grounds. The first is that the investigator imposes his/her own prejudices, preconceptions and limited knowledge in framing the questions. The second is that people will not answer honestly and frankly. Both of these acknowledged dangers can be minimised by adopting a participate approach in which the respondents are treated by proxy as it were, as the accepted experts - and their own knowledge and concerns are the basis of the questionnaire.

The Focus Group Approach

The focus group is a means of getting a hold on the views of a number of people in a short space of time, in much greater depth and detail than by other means. The interchange of thought and ideas and the expression of feelings are encouraged by the social situation that is created. The iterative exchanges that take place tend to "spark off" thoughts that remain below the level of awareness in normal conversation. They uncover material at deeper levels.

The discussions centred around respondent's knowledge of and attitudes towards working with BNF plc in terms of safety; their perceptions of their working life and the climate within which they work. Frank responses can only be guaranteed by watertight assurances of confidentiality and anonymity us therefore an absolute necessity. This in essence means that the focus groups can not be under control of line management of any other authoritative group. Consequently the focus groups were led by the research team. The members were selected, with the help of the Personnel Director, from all levels of the organisation, to give a balance of views, ages, departments and roles. About 20% consisted of supervisors and other managers including the Site Services Director.

The aim of the focus group is to let people discuss issues informally, to interact and exchange thoughts and ideas with others; to elicit attitudes, likes and dislikes with no

pressure or censorship on the expression of opinion. To elucidate general trends, avoiding a 'glossy' consultant approach (for which there is particular antipathy on the site) but creating a tailor made, custom built instrument.

Although the groups are named "focus groups", discussions are freely structured. The only focus is the topic chosen for discussion, open questions form the core. The topic can be discussed in more depth, the qualifications, intensity and implications surrounding each subject being broached. Individuals can talk freely around each subject or delve deeper. The aim of the chairman, who is aptly named the 'facilitator', is to ensure that the discussion moves along when a topic has been exhausted and to steer the discussion to include all relative issues.

Topics for Discussion

Five related issues were previously chosen to ensure a comprehensive coverage and to provide some structure to the discussion. The list was displayed at intervals on an overhead projector and occasionally consulted to remind the group of items still to be discussed. It was not an agenda.

The topics were:

Organisation and Relationships

Work roles and tasks

Effective communication between roles

Accountability for accidents

Personnel

Job satisfaction

"Square pegs in round holes" - are the right people selected for the right jobs?

Training

The physical environment

The social environment

Supervision

Risk Management

The identification of risks

The nature and severity of risks

The procedures for, and the recording of incidents

Actions in Emergency

The alarm systems

Effective training

Evacuation plans

Communication

General management

Relationships and trust

General standards of housekeeping

The gap between attitudes to safety and relevant safety behaviour

Anxieties about the work place

Guidelines to focus group Interviewing

To get the most benefit out of the sessions it is useful to adhere, where possible to the following guidelines:

- * The maintenance of flexibility is important
- * 'Give and take' is often necessary with the topics, discussion and the group members.
- * The discussion issues may not be followed in a specific order, but incorporated at logical points during the conversation. Some were brought up by the respondents and so did not need an introduction.
- * Not all issues will gain a response from the group, although some were brought up later once they had been considered further, or at more suitable points in the discussion.
- * No comment can be as important as comment.
- * Assent and dissent should always be recorded, also points of agreement, when met.
- * The discussion needs to be focused but not controlled, enabling respondents to develop their own trains of thought.
- * Control over the group is required to prevent it splintering into smaller groups.
- * Although it can be difficult, the focus group facilitator must be wary of stepping in too quickly to conclude the discussion of each issue. By doing this, deliberations at a deeper level may be missed. Respondents need to be allowed to develop themes at their own pace.

In some discussions it became necessary to mediate, when comment became directly personal, or led to arguments.

During the session, field notes were recorded simply as a means of determining the ambience of the session i.e. the impressions of the focus group members, their reactions to the issues and to each other. Whether there were any oppressive aspects of the environment, to establish whether the groups felt uncomfortable either physically or psychologically within their group and the setting. The field notes were referred to during the reporting of this information and throughout the creation of the questionnaire.

Occasionally individuals would begin to speak but stop and point out that they were a little wary of the tape recorder and how the information was going to be used. Some felt that their information and opinions could be used as a management lever against them. It was occasionally necessary to reassure them of their anonymity and confidentiality and point out that the discussions' aim was to improve conditions and not for media appeal or management control. However, most of the time the group members seemed oblivious to the presence of the tape recorder.

Sample

As mentioned earlier the occupations of the group members ranged widely from process workers to research and development specialists, at all organisational levels. They provided a broadly based, occupational, locational and organisational

representational of Sellafield viewpoints. However some of the members were especially selected, because they were thought to be well informed and to have something definite to say, whether positive or negative. In some cases, for example they were safety representatives or union officials.

Each member had received a letter of invitation, although no explanation was provided for having been chosen. Some members enquired about this and explanations were provided.

The focus group meetings were held in a large airy room in Summergrove, a residential staff hostel, owned by BNF. The building is external to the Sellafield site about 4 to 5 miles away, providing an informal and relaxed atmosphere. Refreshments were available to help people to relax and to feel more at home.

Two meetings were held during the morning. Starting at 09.30 both had to be finished by 12.15, by the intervention of the researchers, not the members, who appeared to have an unending stream of comments to provide. The other three meetings were held during the afternoons, beginning at 13.30 and ending only by 16.30.

The first meeting involved THORP/EP2 personnel (EP = Effluent Processing Plant), members included management and shop stewards, process workers and painters. A broad occupational group who, after an initial wariness, spoke fluently to one another rather than to the researchers.

The next meeting with the Site Technical Department met the same day, in the afternoon. STD includes research and development, a specialist group in some respects external to the other coherent occupational groups within Sellafield. Again, management and union officials were present, as were safety representatives and process workers. This group were very suspicious of all questionnaires and claimed that they tended to be ... filed in the bin".

THORP R & S (i.e. Receipt and Storage) met the following Wednesday afternoon. Foremen, managers, safety reps, supervisors, shop stewards and instrument mechanics all took part. An exceptionally broad range of occupational levels. The most difficult start subsequently led to one of the best discussions. (The group were very concerned as to why they had been selected, feeling they were owed an explanation of the aims of the meeting). They had little respect for questionnaire studies, due to past experiences of 'glossy consultant' surveys being inflicted upon them. They appreciated being approached to participate and once they realised that their views were important and that their questionnaire results would be used to improve working conditions and not to promote good press, they were very willing to help.

The following morning, Magnox personnel took part, including supervisors, shop stewards, safety reps and members from both industrial and staff trade unions. Some division between staff and industrials was apparent, for a short while, before the group settled down to communicate and listen to one another in a constructive way.

The second Magnox group met that afternoon. Again, a broad range of individuals, managers, shop stewards and foremen from process and chemical areas. A precise and succinct group who were slow to warm up but eventually willing to express themselves more than freely and openly.

Format

Each group consisted of 6 - 9 respondents. All the discussions were recorded on audio tape with full consent and co-operation of all members and were later transcribed by the author, verbatim. Field notes were also made during every session, focusing more on forbearance and demeanour, impressions and reactions. It was also seen as a back-up to the audio equipment. Individuals sat around the table, with the microphone in the middle and were reasonably relaxed. The researchers acted as observers and facilitators, bringing the meetings to order if members were diversifying too widely into other issues. Most groups spoke directly to one another and referred to the researchers for guidance and appreciation of their particular points of view.

Analysis of the qualitative data

A full transcription was made of each discussion. It is sometimes difficult to separate totally personal views from the consensus of group opinions when working from the audio record alone. This is especially true when personal opinions, vehemently expressed overpower the group. However, this separation was made wherever

possible, concentrating mainly on group rather than personal opinion, unless the personal opinion appeared to represent the group consensus fairly successfully.

The process was helped considerably by the observer's memory of the individuals involved and the roles they had played in the discussion. Much of the assent and dissent in such a meeting is necessarily communicated by 'body language' and close observation of this; combined with notes made at the time, was helpful in interpreting the audio record. To ease comprehension and to exclude irrelevant information, the data from the focus group interviews have been combined in order to provide a full picture of the attitudes and opinions expressed by all members.

Initially, five separate reports were written; however, it was felt that these were tedious to read and that the essentials might become submerged by the detail. Hence the most informative of the five reports was carefully selected to provide broad comparison and trends from all groups. Points of assent and dissent, agreement and disagreement are covered. Selecting is a difficult task but the aim is to minimise totally personal or idiosyncratic views and those that are specific to particular work areas. Hopefully, it enables the coherent provision of information and emphasises the general trends rather than the particular.

Each of the topics discussed by the focus groups is covered in some detail, including the structuring 'supplementary' questions. The transcribed comments are sometimes used to emphasise a point. It is more understandable and believable to hear points of

view in direct quotation form. By combining the groups and interrelating the transcriptions the identification of individuals, previously difficult, becomes virtually impossible.

Debriefing of Groups and the First Draft Questionnaire

After the focus group data were analysed, all members were invited to attend a debriefing session where they were asked to complete the first pilot questionnaire. There were several reasons for this, one was to let them see the fruits of their labour, letting them know that their effort was appreciated and that the questionnaire was the useful outcome. Secondly, and primarily, it was to ensure that the member felt that their main points had been included and that the questions were expressed clearly, unambiguously and in the kind of language suited to the work place as a whole. Finally this pre-test was used to check the range of times needed for its completion so that the length could be adjusted as necessary.

After the pre-test meeting, a number of minor changes were made in question wording in preparation for the full pilot testing.

The Pilot Study

The pilot study is an essential part of surveying attitudes. It is the main means of testing the questionnaire, to check from feedback whether it is acceptable and

practicable. Whether the issues are well defined and the frames of reference are within the respondent's experience. The wording can be examined to check comprehension, the content checked for acceptability to the respondent. Some questions may be at the edge of local social conventions but not fully appreciated as such by the researchers. However, the pilot study needs to draw on a representative sample of the main target sample. The questionnaire needs to be tried out on the people it is ultimately designed for. The respondents need to be aware that there are no wrong or right answers, rather that their opinion is important.

Some 200 people were selected at random, from the employment records to complete the draft questionnaire. The aims, as said above were:

To validate the questionnaire

To identify the problems associated with administering a questionnaire to a sample group which would eventually consist of over 5000 people. The questionnaire was successfully refined and validated. The final questionnaire contained 169 'attitude statements', with which the respondents could express agreement/disagreement on a seven point scale. The scale was based on the Likert rating scale. One neutral position and three strengths of agree/disagree. The scale was placed in a prominent position for referral and the direction of the scale was placed at the top of each page to remind respondents. The statements were all presented in exactly the same way to achieve greatest simplicity. It was hoped that all levels of the organisation would be able to address the same issue and thus allow maximum comparison.

The final sample of respondents were given detailed information on the background and aims of the research by means of a 12 minute video made for the purpose. They completed the questionnaire in the course of regular team briefings. Team leaders were given a detailed briefing to supplement the videos. The main part of the study eventually involved the completion and analysis of over 5,000 questionnaires. The study included all divisions and respondents were drawn from all organisational levels. The present report is limited to the pilot stages and focus group discussions.

PERCEPTIONS OF SAFETY BY SELLAFIELD PERSONNEL

Five Focused Discussions : Broad Comparisons

Five general issues were discussed by the focus groups.

The five issues were;

Organisation and Relationships

Personnel

General Management

Actions in an Emergency

Risk Management

These may be thought of in terms of a selection of issues giving rise to questions. For example, regarding Personnel, the groups were asked to think in terms of whether training was adequate. For Risk Management, whether risks were communicated effectively. These were only possible topics to provide some structure to the discussion. They were not concrete questions but guidelines. Consequently, some groups had more to say than other groups on certain items. Some items which had not been proposed found their way into the discussions.

For example, the "Selling" of the tea break, the obtrusiveness of the "whizzkids" and for group five, the short discussion on actual risk taking behaviour. The variation in group responses provided ample confirmation of the need to involve as many groups as is practical.

1. Organisation and Relationships

In the area of organisation and relationships, the groups discussed such questions as the extent to which peoples' work roles and tasks were clearly identifiable; the effectiveness of communication between roles and the procedures for accessing accountability for accidents.

1.1 The clarity of work roles and the definition of tasks

Generally, the groups were satisfied that the tasks were "... fairly well defined" everyone knew what their jobs entailed. However, the concept of roles was a different story altogether,

"Are we the achievers or the fixers or the goal keepers or the goal scorers?".

The members felt that their roles were not clearly specified but rather assumed over a period of time. Especially in safety terms, it was perceived that the lack of "pen pictures" left people wondering how they were 'to play the game', whether they had passive or active roles. This refers directly to a question of responsibility, is it an 'every man for himself' philosophy ?

Of course, members did not feel particularly strongly about this but would rather they were told who was responsible for whom and what. In the case of competent individuals, the role was to ensure

"... they do (work) within the rules we give",

but what of others?

For example, itinerants; who was responsible for them? This was discussed at some length, concluding that ultimately BNF was responsible, but should there not be a middle man?

1.1.1 Specific Roles

Uncertainty surrounded the role of the manager,

"I am not sure that even managers at Sellafield are aware of who is responsible for what and the actual procedures. Its just something that managers pick up as they go through their responsibilities so its not 100% clearly defined".

If the managers are not perceived as knowing their responsibilities the positions for others is complicated further. The point was strengthened when the lack of induction procedures was made apparent,

"Well, I've just gone into THORP now and I have just been here for six weeks and I haven't had anything explained to me about safety".

This poorly defined assumption of roles and tasks must be seen as an unsatisfactory position. Conflicting expectations about what each person is supposed to do ultimately leaves a gap where someone doesn't do something which is 'expected' of him or vice-versa and the result is an accident.

However, no one wants to have an,

"I'm paid to think, you are paid to work"

philosophy pervading the working environment, this only leads to a lack-lustre and resentful work force. It was disturbing to hear that one individual had experienced this potentially dangerous attitude.

1.2 Communications

It appears that the communication network of BNF is either via the shop floor grapevine that exists in every organisation in some shape or form, or by countless pieces of paper. The latter applies to such an extent that the deluge of paperwork is a demotivator and in some situations can even be perceived as a hazard to safety. The "mountains and mountains" dissuades people from wading through it. Safety rules, regulations and advice on avoiding hazards, become submerged by their sheer volume.

The philosophy of BNF was perceived as not facing the problems head on but,

"... (the) solution was more instructions... (there is) a mind set that the way to improve safety is to have a lot more paperwork which nobody reads".

The attitude towards the paperwork was not favourable, It is an offence to a craftsman, who believes he can look after himself, to be inundated with 'bits of paper' telling him exactly how to look after himself. It appeared that this attitude does not reflect a work force unwilling to take advice, rather, one that is dissatisfied with the bureaucracy, the technicality of the instructions, hindering rather than enhancing the safety of the plants. In THORP especially it was felt a strain was being exerted on the existing working relationships by the enormity of the bureaucratic red tape.

1.2.1 The Criticisms of Communication Procedures

The groups felt that instructions can be constraining, reducing the attitude of 'give and take' which is often required to enable working relationships to succeed. For example those who had recently moved to THORP claimed they felt scared by this attitude of more instructions rather than solutions. Too many chiefs and not enough Indians was

making life difficult. The chiefs are resistant to change. Individuals felt that more flexibility would help and avoid the current loss of natural teamwork. Interference by management was often resented as being unnecessary and simply a need to have over all control.

Members spoke of the pressure to achieve targets leading to a temptation to take shortcuts. However, it was made clear that this was from the workers themselves and not management. Management was held in high esteem with regard to safety protocol, in fact they were often perceived as over specifying and overdoing safety procedures. The shopfloor and management do not share the same perspective as to what is or is not safe. This issue is only touched upon at this point of the discussion, it will be developed further. The information is there and the systems are in place but attention needs to be drawn to them. The criticisms of communication are not levelled at lack of information but at the actual use of channels and the mediums. Information is not passing through the right channels. This is also aggravated by the presence of the itinerant workers. Communication between roles was not perceived as effective, either horizontally or vertically through the chain of command. As well as having an adverse effect on safe working, the communication was slowing down the production,

"...it can take ages to get anything done".

Although the communication procedures were criticised, no one ignored the advice of the health physicists, conversely,

"... it might be a case of I don't agree with health physics I don't think they are being severe enough with me".

Workers were asking for additional safety equipment which hadn't been specified.

The situation with regards to communication is contradictory although the safety standards were perceived as universal, well known and generally appropriate. The instructions or regulations were not.

1.3 The Accident Enquiry System

The accident enquiry system is hindered by "...(a) formal, rigid reporting procedure". All groups positively rejected the enquiry system as a mechanism of apportioning blame. But they were indecisive over the actual efficiency of the system. Some felt "... it works slowly but works well" and others, "... (its a) wonderful principle but doesn't work in practice".

It was also felt that information that would be useful to the work force is often withheld. This enables the shopfloor grapevine which thrives on rumour to distort facts, confuse situations and causes dissatisfaction. Often it was felt that no one really knew the truth about incidents which had happened.

"(It's) total misinformation all the time, therefore you tend not to believe anything you are told by anybody, from management to the shopfloor".

This attitude is applicable also to the feelings of trust within relationships, the perceptions of management and risk management which are covered later.

One other criticism that was levelled was a lack of independence from BNF. But the main bone of contention lay with the outcome of the enquiries, mainly the question of

the implementation of recommendations. This often doesn't occur. However, this was not wholly true for Research and Development, recommendations are,

"... flagged up and stayed flagged up until something was done about them".

Other departments were not so efficient. A lot of variation exists across the site in this matter and others.

1.3.1 Disciplinary Procedures and Accountability

Discipline is another thorn in the side, the proverbial "can of worms". Members called for a fairer system across the board. Disciplinary measures should be public and visible. Discipline on the shopfloor soon became public knowledge, the few breaches that did occur went down in history. Whereas with management, news rarely filtered down to the shopfloor, a pervasive 'hush hush' atmosphere prevails. As well as being visible, discipline should be unequivocal, it was felt that management were 'let off' with a 'talking to' "promoted, or at least moved sideways out of the limelight. This is succinctly put by one individual;

"... What is sauce for the goose (should be) sauce for the gander".

It was made clear that a lot of "unseen discipline" did occur but everyone wanted to know what had happened, not to glory in the misfortune but rather, to make sure that justice has been done and action taken to ensure that the incident is never repeated.

On the subject of 'cover ups', a heated debate ensued. It brought out the problems of how to define an incident or an accident, (covered later). In conclusion, it seems to depend on

"... What the consequences of bringing it out in the open are".

Individuals obviously would not make a deliberate effort to 'shop' a colleague, however, they would not cover up an incident if this would jeopardise the health and safety of others. It was also pointed out that concealment is technically difficult. Many plant abnormalities are registered on permanent records.

Accidents are accurately assessed and accountability, it was argued allocated fairly. However, the issue of scapegoating, although generally denied, was brought up,

"... there was a number of people, it was just a number of situations and they just happened to pick one person out and say it was him ... and it wasn't his fault. He was part of the situation, so were a number of other people".

Individuals should be made accountable, especially the 'right' people, but again management was felt to be hard to pin down. From the management point of view,

"... a "managerial framework" within which to operate (had been set up) and it hadn't been complied with by whoever".

This was considered reasonable, but who is accountable when an operating rule falls short of the situation?

1.3.2 The Reporting of Accidents

Accident reporting is a problem. There is no point having a competent system if it is not used consistently. The impression is one of a tedious and time consuming reporting system. The obligation to report an injury (for example) is not as easy as it

may appear on the surface. Surgeries may be a 20 minute walk away, transport is not readily available and replacements to keep the production going while someone is away is not readily available. When at the surgery, time is eaten up due to low manning levels and the fact that health physics monitors are often on call. They cannot respond immediately to unforeseen reporting due to other pressures. Audits are often constrained by plant size and available time. However the groups seem satisfied that enough were carried out, especially where the new buildings were concerned. The idea of external, 'no warning' inspections were greeted with general approval. People do want to be inspected as accurately and frequently as possible. This is similar to the desire for management 'walkabouts'. Members do want to be seen and are prepared to work harder in order to be seen in a positive light. So, accountability poses no major concern. It is rather the reporting procedure and the lack of implementation of recommendations that received unfavourable comment. The problem with reporting mainly occurs in relation to "near misses".

2 Personnel

In the area of Personnel the group discussed such questions as, is job satisfaction a problem?; are the right people selected for safety and is supervision a problem in relation to safety. Other issues covered include the physical environment, the social environment and training.

2.1 Job Satisfaction

"... good money, its a good job, its good conditions as far as I am concerned (but) our lads are bored to tears, they're bored stiff - can't give you an answer why, but they're bored".

The boredom theme was strongly apparent throughout the five discussions,

" the work is repetitive it isn't interesting ... its' bloody awful".

2.1.1 Where does this boredom stem from?

This is a difficult question. The lack of viable employment alternatives complicates the situation. Some members expressed themselves as genuinely "fed up" with the nature of the work itself and the repetitive 'permits to work'. Management received the blame for this; instead of giving the go ahead for new work they instructed people to patch things up. Individuals were aggrieved at what they claimed was the more interesting work going out to contract. This was felt to be a 'Catch 22' situation and one individual warned that it was "... between the devil and the deep blue sea", more relevant to old plants where resources were limited. It was eventually concluded that insufficient communication is to blame for boredom, members claimed they were often unaware that people were unhappy with the distribution of the work. It was also felt

that the work was not evenly distributed among days and shifts, nor were the mundane tasks mixed with the interesting ones. This potentially leads to safety and productivity problems, individuals failing to understand machinery when it is their turn to use it, for example when changing shifts.

Organisationally, problems arise from the 'halfway house' situation because the plants are not totally automated.

"We should have either men who actually drive the equipment all the time or you have it fully automated and you have the guy doing some other kind of watch-keeping job".

However, according to some, this doesn't solve the frustration that the highly trained operative suffers on demeaning tasks, or in doing tasks which don't need doing. On the more positive side, management are perceived to be cutting down on the routine work, trying to find a good balance. Through discussion the concept of boredom was defined as frustration in not being able to 'achieve' anything.

The lack of formal planning for jobs and the amount of paperwork were seen as demotivators. Variations exist between the old and new plants, but the time taken to gain the right documentation for a job could take anything from 15 to 45 minutes, which seems excessive. With better management and planning this could be avoided.

Frustration also stems from the lack of recognition and praise for a job well done, it may not alleviate boredom but may lead to individuals taking more care.

"The only time you get a pat on the back is if you do something wrong and it flattens you, when things are going well, there is nobody that bothers you, but if anything goes wrong..."

2.1.2 Boredom is relation to Accident Causation

Boredom is not a good explanation for accident causation. Rather the slips that occur are not a calculated conscious decision to take a risk;

"... not 100% concentration maybe, or a loss of concentration. A fitter can do a job 90% of the time - if its a routine job he doesn't have to think very hard".

Unfortunately, it is sometimes when the fitter switches off, that he has an accident.

2.2 The Physical Environment

2.2.1 Safety Officers

On the subject of safety officers, it was felt that there are too few safety officers. They were alleged to be "conspicuous by their absence".

"You only see them when you ask to see them"

Safety officers were perceived to be a management 'arm', not on view enough, not completely independent, as they should be. They ought to have a 'hands on' attitude. However, again, the paperwork was seen as a contentious issue, preventing the safety officers from becoming more involved in the ordinary everyday of the plant.

2.2.2 The Safety Standards

More optimistically, most argued,

"... the safety standards at Sellafield are second to none".

This was a clear seal of approval although the converse side was a feeling that the amount of expenditure on safety was less cost effective than other companies. This was soon dismissed as an argument. The safety aspect of the job had actually attracted some people who claimed that,

"... (you accept) the safety aspects of the job far more readily than you accept these other impositions".

This was a further reference to the excessive bureaucracy.

A salient issue that emerged was that buildings are designed with a safety priority, but designs change as do regulations. This means that buildings often may not be adaptable to the new standards.

This was acceptable as inevitable; buildings can only be 'up to date' "as far as is reasonable practicable".

2.2.3 Old versus New Plants

Safety standards will suffer if the environment where they are applied is not suitable. This is demonstrated by some problems BNF appear to have. It is difficult to marry the old buildings and new safety standards. This was generally accepted. However, often the new plants are no better and the flaws in the design are reprehensible.

"Most of the plants at Sellafield weren't designed around people".

This lack of attention to the "front line" not only makes people feel bitter and resentful but affects their motivation to be safe and this may lead to hazardous buildings. A potentially lethal situation can develop in this way. Faults in the physical environment

develop from the paper designs, no 'hands on' experience, no consultation and participation.

"I don't think the management give the workforce enough credit for their intelligence". Whether this is true or not, the group concurred. They concluded that this can ultimately affect job satisfaction and may lead to unsafe behaviour.

Admittedly the situation is changing. Workers are becoming more involved accompanying contractors to ensure a more practical and workable layout. However, it may be argued that the total absence of professional ergonomists on such a large site implies that BNF has a lot to learn with regard to man-machine interfaces. Another suggestion was that cross-sectional groups of management and workers should be set up to give the opportunity to resolve design problems.

2.3 The Social Environment

Two distinct problems became apparent from discussions about the social environment. First the sale of the tea break and secondly SAFIA - the Sellafield Accident Free Incentive Scheme.

2.3.1 The Tea Break

The tea break is a contentious issue. It was 'sold off' by the workforce in exchange for a financial incentive, but many were now missing their break.

The lack of break was causing dissatisfaction to some.

They are feeling "fenced in" and mildly claustrophobic in the active area. This frustration can have a detrimental effect on safety behaviour. If individuals can't have

a break when they need one and smokers become tense when they 'need' to smoke and can't it is fair to assume that accidents/incidents may take place which may otherwise have been avoided. It was admitted that the tea break had been abused by some, (the reason being boredom?), that it was disruptive and it did slow down production.

Conversely, workers in Windscale suits and those on difficult jobs need some relaxation time. The apparent clock watching of management was seen as bureaucratic; management should be more lenient, allowing for a little relaxation time. Better management will allay this problem. However, this is not so cut and dried as it may seem. It was felt that senior managers are constrained by the higher management. The tea break issue also brought into the open a staff versus industrials division. Individuals who felt "fenced in" are not overly enamoured by being told what to do by those who are able to walk about when and where they want.

2.3.2 The Sellafield Accident Free Incentive Scheme

Only one group argued this was a good idea,

"... it keeps the focus on safety; I think safety is something that you've always got to think up new incentives to keep at the forefront of people's minds and attention. I think everything you do is probably useful".

Other members were suspicious about the scheme, seeing it as a ploy to keep lost time accidents down and putting pressure on people to return to work when they were not fit. Management are taking an interest in those off sick for the wrong reasons.

The general consensus was that it reduces safety to a frivolous level. It could also potentially trigger off a snowball of non - or selective reporting of accidents. The

widespread expressions of disapproval demonstrated strongly the belief that cover ups would be encouraged. Aggravated by the lack of consultation, this "silly scheme" would not stop accidents but reduce the number appearing in the statistics. Some expressed moral objections. Even if the scheme was designed to give safety a priority it was not supported.

"It's ridiculous, you don't need gifts, that's not going to promote safety".

2.3.3 Other Social Aspects

Reviewing other aspects which could militate against safety it was claimed there was no form of deliberate risk taking. People may slow down production but no one would do anything to purposefully endanger the job. It was admitted that some of these actions could unwittingly lead to accidents. Yes, members admitted, there was a bit of horseplay to relieve pressure but never to endanger. The groups felt they were safety conscious and would not work with those whom they perceived as a hazard. This was a good example of differential safety responsibility.

"Some people recognise safety more than others".

Again the paperwork was pinpointed as militating against safety to a certain extent.

2.3.4 Job Training

Two schools of thought were apparent, those who felt the training was "tremendous" and those who didn't find it helpful at all. It appears that the on site training varies. THORP's own training department, which was tailor made to suit people, was greeted with whole hearted approval. The training was also received positively with regard to

apprentices. However, elsewhere, the stock response was "... there isn't any". Criticism was levelled at the lack of resources, manpower and on the site training within the company.

Again the question arose of providing more 'hands on' participation. The current reliance on the resources of the employees themselves is not conducive to safety. The safety reps. training was not perceived as comprehensive enough, relying too much on their working experience. It was pointed out that this negates the whole concept of training; people will tend to pick up bad habits as well as good ones. The emergence of large teams of new people and lack of training manpower may lead to a 'Chinese Whispers' scenario for the dissemination of instructions. Instructions may be altered, facts lost and interpretations become 'creative'.

The lack of monitoring and evaluation was also a sore point. Exam type questions should be asked or performances rated in some way and certificates expressing approval and indicating competence, issued. Currently it seems training relies too much on the motivation of the workforce.

2.3.5 Supervision

Supervision is also a problem, supervisors often feeling sandwiched in the middle between the shopfloor and management. Individuals wish to have more senior management support, their lack of visibility on the shopfloor can be excused, by the volume of paperwork they have to deal with, but it is still not good enough.

Safety reps. claimed that they often found it hard to find someone willing to listen to them until they made a nuisance of themselves. The response did depend on the immediate supervisor but as one of supervisors pointed out it wasn't a case of not wanting to hear but rather that issues become 'bogged down' within the organisational framework. Also a pressure of time, priority jobs and lack of manpower made life difficult.

Developing this further, there appears from the evidence provided by the group, to be a problem of interaction within the organisational framework. Managers claimed that "minor issues" were often lost, only serious issues making the distance up the ladder. It may therefore be conjectured that many managers are insulated from ordinary minor problems and only hear about the more important ones which, in some respects, seems sensible. However, it is often the minor incident overlooked which has accumulated over time to lead to an accident.

2.3.6 Production versus Safety

"Production will always come first at B30 in Sellafield and it'll never change".

This was a strong condemnation, but when its accuracy was questioned, it was simply reiterated "... it does without a doubt". However, the majority argued that the charge is unfounded. People can be ignorant of what is expected of them, with managers either not aware of the situation or unable to cope with it. A more realistic assessment was made by one focus group member.

"I think people will make a certain amount of judgement as to the safety of doing a particular thing against the urgency to do it".

However, the situation can become dangerous. If individuals perceive the goal is to keep production going no matter what, that is, in essence what they will attempt to do. It was also pointed out that much depends on where you are and whether the manager is alert. The variety of working attitudes on site make generalisations difficult when conditions, personnel and plant are so diverse.

An incident where a shop manager rode roughshod over the formal safety committee illustrates another angle of this problem. He took it upon himself to investigate an accident, without the involvement of anyone else.

Management must respect the safety committees. However, the crux of the matter is the preconceptions about safety attitudes and procedures and their priority within the plant. If productivity is perceived as the key emphasis it will be given priority. Referring back to the question of safety reps., if they are not given precedence, the belief that management is more concerned about productivity than about safety is reinforced whether this is management philosophy or not.

2.3.7 Team Working

What was clearly the 'hot potato' issue at the time of the discussions, flexible team working, gave rise to some interesting discussions. The management of THORP had declared an intention to introduce this system to the new Division and other Divisions could follow. It was claimed that morale problems could develop from selfish supervisors building up teams which they don't want anyone else to touch. with regard

to flexible team working, members felt this to be a difficult subject to grasp because of its 'fuzzy' definition. It was felt it could be safer in the long term. An individual would not be required to do only a certain type of job as he is now and jobs would not be held up waiting for the essential input of one person when several others were capable of providing it. The fact that flexibility is 'on the table' for negotiation was an added problem.

This suggestion of 'mixed trade' teams was viewed as being advantageous although members were not convinced that it would have a positive effect on safety. Although each person would have more varied work, this could result in particular tasks being carried out by less experienced workers.

2.3.8 "Whizzkids"

What are called, by the industrial workers, "whizzkids" are another bone of contention relating to the lack of participation within the organisation. The "college boys" were perceived to gain promotions ahead of people who are more deserving. If they possess some common sense it was conceded they weren't generally a problem, but as theorists they could be a handicap,

"... they write up the procedures which the practicalists rewrite later on".

The practicalists are perceived to be too useful on the shopfloor to be promoted. In answer to this argument it was pointed out that some people refused promotion, being satisfied with their lot. It was suggested by some that promotions should only be within departments.

2.3.9 Are the Right People selected for Safety?

The "square pegs in round holes" syndrome was discussed. Sellafield was not perceived as being adept at placing the right people in the right jobs, allegedly at every level within the organisation.

The result of wrong decisions by a person is not to admit the mistake, but rather,

"... (to) promote them to the height of their incompetence" as one individual sarcastically put it.

Safety is considered to be a relevant part of the selection procedure, but

"It doesn't enter it at all and certainly not in a structured or formal way".

No aptitude tests are undertaken so there is total reliance on the integrity of information from plant sources. This 'word of mouth' channel leaves information open to distortion; supervisors may bend the truth to enable the transfer of someone they are not happy with. Bribery was even mentioned in a semi-joking manner, symptomatic of the suspicions held in some quarters.

Rather than safety, some THORP members claimed that selectors were looking for a THORP 'superman'; someone who could do everything and do it fast. Management may need to revise their current recruitment policy for the new plant if they want the best and safest possible working attitudes.

3 General Management

In the area of General Management the groups discussed such questions as, are there relationships of trust between levels?; is the standard of housekeeping high?; are there anxieties about particular work areas? and is there a gap between attitudes to safety and safety behaviour?

3.1 Management Labour Relationships

The management were perceived by some to have a far from favourable attitude towards the workforce, "... they treat them like scum". Admittedly, the groups were composed of individuals with something positive to say and the assertiveness to say it. The extremity of this statement must be made clear and it was not given much support. However, the "I feel like a number" conviction was generally supported. A kind of love/hate relationship exists.

These feelings of alienation may result from several things:- distribution of work; lack of consultation; size of the large buildings. The attitude of pulling together has been somewhat diluted. It was claimed that the site as a whole has developed an 'us and them' attitude even within trades. Interestingly, it was argued that this could stem from the TU role as the traditional adversary of management. Once a wedge was driven, the automatic response was to criticise management.

Again this could be true but it did not gain whole hearted approval from the groups. Rather the problem seems to be a management who, though unlikely to have such a

low opinion of their employees, are not prepared or do not expect to have to do anything about telling them so. Praise is in short supply.

"We get a pat on the back, but its usually got a knife in it".

It would be difficult to improve working relationships when so little communication actually passes between the groups, this is further complicated by the lack of management visits. The visits, when they did occur, tended to concentrate on the newer plants. The members were all too aware that visits to older plants generally occurred if something untoward had happened or to "... dish out lashings". Management's role is to be visible, to praise, give credit and where necessary to reprimand fairly. The need for personal contact was largely being ignored.

Individuals need to know and believe someone is interested in what they are doing and their well being. Otherwise they will lose interest, pride and take less care in their work. the groups urged a more personal approach and a humanistic attitude.

Beyond this the groups discussed the problems of management, believing they weren't really allowed to 'manage'. Lower management especially were perceived to be stifled by rules and constrained by those higher up the ladder. In investigations, it was felt that the further up the information went, the more the lower levels were left out.

3.1.1 Trust

"I think there's mistrust especially on radiation and dose uptake ... they won't accept management's reasons at the present time".

Why is this the case? many groups believed that a lack of participation and consultation in decision making was partly to blame.

"I think management is always covering each others' backs, you've got to watch out for it because they're ambitious you see".

A lack of trust between individuals is perceived by some as endemic to Sellafield. "It's been bred in, mistrust at Sellafield". This is a strong point of view which should be defused by explaining that the general feeling was that the degree of mutual trust varies between the different Divisions and departments. Tensions exist in some areas and not in others; where they are present however, the fault is generally seen to be with personalities rather than roles.

In conclusion, there were generally reasonable relationships between and within the hierarchy except for isolated cases where particular individuals were distrusted.

Fortunately there were even fewer qualms with regard to safety.

"I wouldn't knock them on safety but (I) would knock them on day to day matters". However, it is evident in this discussion that there was an industrial/staff division, a mistrust simply because of the occupational differences. Members of the groups representing their extremes sometimes expressed strongly conflicting opinions and doubts about each others trustworthiness. The shopfloor, however, are not scared of expressing their feeling to management, they did not appear to be afraid of any 'comeback' they might receive. This may, unfortunately, be for the wrong reason,

"... at the bottom of the heap (we) can't be put down any further".

So, free talking exists within the organisation and this was confirmed by the frankness of the group discussions. But the workforce felt that their views were often lost within the 'spongy centre' of the middle management. Senior management may be exerting pressure on an issue in one direction and the shopfloor pushing in another, but there appeared (to the employee) to be a black hole which amounts to a communication problem.

3.1.2 Responsibility for Safety

At this stage in the discussion, the managers within the groups tended to become understandably irate, pointing out that with regard to safety issues management were under an immense amount of pressure internally from their own managers and externally from the Regulator (NII) and the law. They felt that "... the buck should stop at the person who has disregarded or deliberately flouted the system. The responsibility for safety is naturally everyone's to an extent, but it is also natural that individuals should assume that management are mainly responsible,

"... I can perhaps do as much as I can towards having a safe plant but if the attitudes wrong and people don't replace scaffolding boards back on the site and someone is seriously injured the works manager and the directors can actually be prosecuted".

3.2 Standards of housekeeping

Maintaining good standards of housekeeping has been a long standing problem. It is compounded by the sharp divisions between the old and new plants plus the 'visitor access areas'. Employees considered that the available resources to ensure safety are

not equally distributed around the plant. In some cases safety requirements had to be justified,

"if... you turned around tomorrow and you said I want, safety wise, something, you'd have to hassle for it".

This was compared to the VIP visits, as one individual shrewdly pointed out,

"I think what we could do with is Michael Heseltine coming about three times a year because the amount of stuff that has been shifted for his coming is absolutely immense".

There is also a problem in the resentment and dissatisfaction this creates,

"... if they can do it for him - they can do it without him".

This attitude exacerbates the "I feel only a number" philosophy.

3.3 The Influence of Media and Pressure Groups

There were some discussions about the effects of the media on the plant. Members were obviously fed up with the pressure they felt they were under, "... we are constantly under siege". Another source of this 'siege mentality' are Friends of the Earth, Greenpeace and the local pressure group (C.O.R.E.).

Basically the points of view were divided between those who thought the groups were made up of cranks and those who thought the opposition was healthy and useful. The most common response, although it may not reflect everyone, was expressed as follows,

" I think Greenpeace and Friends of the Earth and NII and a number of other people taken together have put pressure on the industry and I think it has accelerated improvements in safety, there's no doubt about that".

3.4 Attitudes to the Relevant Safety Behaviour

So many different points of view were made apparent from the answers to this question that it was difficult to decipher one from another.

Some members felt that there,

"... should be no excuse for bad safety at Sellafield because it is drummed into the lads".

Others were not as optimistic. A grey area was uncovered with people pinpointed as being poor on responding to safety, the technical support team were criticised as being "...a law unto themselves". However, they were the only group who had criticism wholly directed to them personally. Clearly,

"... you get people right across the board from process workers right through to managers who, actually, when you generalise, ignore the safety rules when they walk into a plant for whatever reason".

3.4.1 Why are safety rules sometimes ignored?

Lack of safety rules is not a potent factor, rather the sheer quantity of rules laid down appears to have an adverse affect, resulting in saturation. Other reasons may be that the existence of rules may be recognised but individuals feel that they don't apply to them personally. Having the rules is not enough, the perceptions of the subject

population have to be appreciated for the rules to work. However, safety consciousness is becoming more apparent on site.

"They are more aware of the implications of not being safety conscious. Whether they continue to take the risks, of course is a matter for an individual to decide".

3.5 The Accident Statistics

Why are they so high?

"The reason the number of accidents is so high is because everything is reported".

A pervasive factor in this discussion was the question of radiological versus conventional accidents. An apathy regarding the accident figures was apparently beginning to set in. People were weary of the attention paid to the 'minor' accidents. Claiming that with "every little scratch (going) into the statistics" it was no wonder Sellafield looked unfavourable in comparison to other industries; these, it was claimed are more selective of their reporting.

Previously,

"... the emphasis was always on radiological incidents, conventional safety very much took a back seat to this".

Now, conventional safety is gradually becoming more prominent, receiving greater resources (a good barometer) than previously. However, throughout the discussions it became clear that it is impossible to generalise,

"... different plants... are run stricter than other plants and buildings, not because the buildings operate the rules differently".

There is no universal standard of adherence to the rules.

4 Actions in an Emergency

In this area the members discussed questions such as, are the alarm systems reliable?, are the evacuation plans well designed?; and is the training effective in ensuring correct responses? The discussions revealed a universal respect for all emergency procedures, which were taken very seriously. Evacuation plans were seen to be well designed and training was adequate. There is only a remaining problem in getting people to pay attention, all the relevant attention/response procedures are in place. Overall, employees were satisfied. However, a few individuals used the opportunity of the group sessions to voice personal concerns. One individual was afraid of the telephone system crashing and needed to be reminded of the existence of alternative, 'back up' communication systems and this quelled his fear.

Another concern expressed was that alarms mean different things to different people. Contractors were especially pinpointed,

"I was there while they were working. I said why don't you get out, did you not hear it? 'Yes we heard it but we didn't see the flashing light'".

Because of the variety of alarms across the site, people have different perceptions of what to expect. If the situation does not accord with their experiences of expectations they may not act in the required manner.

Finally there had been problems in the past with false alarms. Certain alarms have a tendency to go off sporadically, eventually causing lack of response due to 'false positive' effects. It is necessary to modify this attitude to ensure that it is accepted that an alarm does not entail making a decision - rather it means prompt action - regardless.

5 Risk Management

In the area of Risk Management the groups discussed such issues as how good are the procedures for identifying risks?; is the existence and the nature of the risks effectively communicated to all those concerned? and are the procedures for recording incidents i.e. both accidents and 'near misses' effective and adhered to.

5.1 Permit to Work

The PTW was the subject of diametrically opposed views. Some saw it as "... a fundamental piece of safety work",

"Personally I feel safer working with a permit than working without it".

others as, "... the most dangerous document we've got",

"I don't think they need to simplify it, they need to throw it in a bucket. It's the most dangerous document we've got".

Obviously, widely used at Sellafield, the permit to work brings forth a cornucopia of conflicting views. Many complaints were aired but it is difficult to pinpoint their true origin. Members who opposed the use or over use of PTW's were also unable to suggest alternative methods or improvements. A common feeling was one of disillusionment, especially with the prolonged internal debate on the issue. Changes or alternatives to the permit to work have been discussed with as yet no solutions forthcoming. Everyone wants simplification without sacrificing safety.

5.1.1 The PTW, is it safe?

Dissatisfaction with the detailed imposition of too many safety rules is countered by confidence that safety procedures are in place and accountable and that responsibility has been ascribed.

5.1.2 What are the problems within the system?

Discussions on the PTW system were generally vague and long winded. This could be regarded as symptomatic in itself. An attitude problem seems to exist, some workers have lost sight of what the PTW functions actually are. They appear to visualise it as some kind of insurance policy, to fall back on if anything goes wrong. Some saw it as an instruction to carry out work. Basically, it seemed that the PTW could in effect mean "anything to anyone". The PTW is also felt to be applied inconsistently across the site and this lack of consistency affects the perception of its importance.

Some claimed that:-

"... it often is not completed correctly and may not have apt or adequate instructions", and

"it destroys the person's ability to think",

Some workers may not even look at the PTW because they are doing a job they have done many times before, endlessly and expect the PTW to be the same.

The permit to work was criticised for generating an excess of paperwork and as a poor form of communication. It is not helped by the fact that, very often the display of a PTW was poor. Visibility is important in enabling awareness of everything ongoing in different areas within the plant and changes that need to be communicated across shifts.

One supervisor summarised the problem of saturation,

"...(we are) writing far too many... which means we are not putting enough thought into the jobs that certainly do require them."

Supervisors were perceived as being under pressure of time and were often pressed by queues of people all waiting for permits.

"So, he'll have a queue of people from different areas of the plant wanting permits. He's there himself, now he's running the plant and yet he's got to raise all these permits and activities and he's got to be aware of the hazards and cautions to be taken".

Co-ordination was an added problem,

"... (confusion arises from) the fact that we have got people issuing permits to work, not even in the building they are issuing it for.

All these factors may seem like a list of grievances, however, they are undoubtedly affecting the effectiveness of the permit to work. They arise from the practical everyday execution of the scheme and not from its theoretical potential.

Training in the use of PTW was also criticised,

"... the training was atrocious".

Also the NII did not escape criticism. They had apparently reduced the number of days/consecutive shifts the permit could remain open for, from 21 days to 7. This "moving of the goalposts" was not helping the situation.

One remark, however accurate it might be an assertion, seems to summarise the many dissatisfactions expressed about the role of the permit to work in safety:

"... on every accident the problem was actually the permit to work, either the way it had been used or the way it had been interpreted".

5.2 The Approved Schemes of Work

The approved scheme of work gives permission to work over a range of tasks or situations, as distinct from an individual one, for which the PTW is issued. Discussants felt it was generally a good procedure but has to be made to work,

"... if it's well set up it can be geared for work".

It was felt that it should be used more often to avoid saturation with the PTW's and this received general agreement. However, it was explained that the ASOW's cannot be used to their full advantage because of fluctuations in contamination levels. The permit to Work is more amenable to situations of this kind because it is adjusted to the specific situation or task - "... they don't cover what you do if it goes wrong"

5.3 The Nuclear Installations Inspectorate (NII)

The views of the groups regarding the NII varied considerably. Some felt that they deserved respect, were helpful and agreeable and carried out a useful job in surveying the plant and alerting management to misdemeanours or potential hazards; a high

opinion. Some thought they were 'finicky' and finally, some didn't see the NII inspectors as normal people at all.

As a graphic example of the latter viewpoint,

"I think they are in the minority, though, the normal ones because some of them... they don't approach you, on the plant as a guy, like, they just approach you as a bloody dog, half the time".

Some people felt they weren't to be trusted. Their presence is certainly not seen as conducive to good working relationships. It is possible that their lack of popularity stems from their criticism of people for the way they do their job and if so, this is a normal and understandable dislike. However, it can lead to a vicious circle. This can occur if inspectors make a criticism and then come back later to find no change, so they point out the fault again, making themselves increasingly unpopular. This is especially likely to happen if they had picked on the wrong place in the chain to apply the criticism in the first place.

The perception of the NII could be improved by both sides, as one lady pointed out:

"... people come in (and say) we must do this for the NII.... they want to do it for themselves for their own safety not because NII are dictating to them and that is what is wrong with Sellafield".

5.4 Consultation and Participation

A topic which has been mentioned previously, a general lack of consultation, was mentioned by all the groups in the focus sessions and this may be an important issue with respect to the best way to get the safety messages across.

The numerous consultants that BNF employs are seen as often being surplus to requirements.

"(Sellafield) have got the expertise to do it themselves on the plant, but they won't".

Some group members expressed a lack of confidence in the quality circles and suggestion schemes.

Workers are aware that participation is valuable,

"... if you get people involved, I think the way forward in somewhere like THORP is to get them all involved and start thinking about safety then it'll come good".

A more humanistic approach is required. If you respect people they will respect you and they will respect your safety standards.

5.5 Lost Time Accidents

Management priority at the time of writing was to attempt to reduce the duration of lost time arising from accidents. The work force perceived this as simply a way of getting people back to work as soon as possible. Employees felt that people were being cajoled back to work when often they were not restored to full fitness. This often puts safety at risk because the unfit individual is a hazard to himself and likely to endanger others.

"I mean the amount of people you see running around that site now on crutches".

The motivation for this was viewed by some as a way to reduce the accident figures at the expense of concern for the well-being of the work force. The management pressure is seen as simply breeding more resentment.

Those off work receive a visit from a supervisor (or someone senior to themselves). This was not perceived by all group members as a symbol of common courtesy but rather as an instrument for checking up. The situation was often aggravated more by the presence of a member of personnel. The management believed this was fair play, the work force viewed it differently. However, the 'welcome effect' depends on the department, the individual and the relationship established

5.6 The Accident Prone Employee

The 'walking disaster zone' was a term applicable to that small percent of the workforce who were identified as having a large proportion of accidents. The notion of the "accident prone" employee still has some support in certain circles, although it has been generally discredited by statisticians.

5.7 Risk Perception

"When you are talking about radiation and contamination, it's not difficult at all because the lads are fully aware of the risks. When you are talking about safety, it's not difficult but we all consider the element of risk differently".

Everyone knows there are risks in working at Sellafield but differences in perceptions exist. The radiation risk is viewed as a serious threat to health. But employees do not take conventional risks to safety so seriously. Transition from home to work may

require an adaptation that some individuals are either not aware or incapable of perhaps anticipating. If you can cut yourself at home without any hassle, you can cut yourself at work with the same consequences. This may be a problem in the development of safe working practices.

"I think it's their perception again, I think that they would claim that they're not doing anything unsafe and I think people genuinely believe they are doing things in a sensible, safe way. It may be that they are actually breaking some of the written instructions or they don't realise, because of the amount of rules, that they're actually breaking one".

The work force may need to be taught to spot hazards, minor accidents would become more infrequent and the safety committees' job would be speeded up. It was agreed that hazard spotting was poor.

"I think the general workers aren't, I would say 'safety oriented' because they're all looking after their own safety but obvious things like that, they aren't looking for those things all the time. They're not looking for what could be a safety hazard "

The only opportunity to discuss the concept of "risk taking" as such came up with focus group 5. It has been included to provide an insight into how one cross-sectional group of employees perceive the issue.

"Well I think we as individuals like taking risks and if you can see the risk the adrenalin runs better and you like it better..... when you go to work you don't see the risk, so sometimes you don't accept that the risk is there. If you could see the risk, if you could see and you could say well, if I touch that it's going to chop my

finger off, you don't touch it. You might get close to it but you don't touch it.

When you go to work you don't see the risk”

A very important statement, one group member admitting that often denial of the risks takes place and often people can't see the risks of the situation they are in. Both these attitudes may have potentially serious consequences.

One person went so far as to suggest that perhaps if Sellafield accepted a death as the direct responsibility of the organisation instead of implying that the fault lay with the victim, people would wake up to the reality of the risks surrounding them.

“I think sometimes if Sellafield accepted, I know we're getting very political now, but if they accepted somebody's death, that would get everyone thinking ... If they were to say yes, we caused it, it would frighten everybody and make them aware”

This makes it appear that there is a passive acceptance of the risks inherent in working at Sellafield, which is exacerbated by the fact that no attribution of responsibility for a fatality has been levelled at Sellafield. Of course, no-one wants this to happen, but it seems that people may need to be shaken into action or, in fact shocked into action. It was also felt that in the past, people had been more 'dare-devil' in their working behaviour, taking risks by not wearing the proper equipment, a kind of macho ethos. These people were the ones that were suffering now, whereas newer workers are becoming more aware of the dangers, although the macho ideal was not totally dead. Generally the group believed that they had been told fairly and squarely of the risks within Sellafield. As one individual suggested,

“We accept the wages, we accept the dangers”.

5.8 The Role of Experience in Safe Behaviour

“So whilst I think management put a lot of emphasis on safety, all kinds of things happen and the person who is doing it, is doing it because he wants to get the job done, He doesn't feel under pressure to do it. It's just that some people feel that they've done this job this way hundreds of times before and nothing's happened and all of a sudden somebody else will do that job and there will be an accident”.

Shopfloor and management perceptions are different. The former resent being told how to do something, especially if they have been doing it for years. However, experience can be as dangerous as inexperience, people often become immune to the dangers surrounding the,

“I think people will use a certain amount of judgement as to the safety of doing a particular thing against the urgency to do it”.

How risk aware are the employees of BNF Sellafield?

It was felt individuals do use their common sense but may treat work like home. However the risks inherent in the situation at Sellafield may in many cases have more severe consequences. The gap between the perceptions of home safety and work safety could be fatal.

For example, the reporting of minor abrasions,

“people tend to apply their perception of common sense, at home they stick on an elastoplast, so they'll do the same at work”.

A fair enough comment on the surface but in the context, is it wise to make a layman's judgment on the severity of an injury. Admittedly we all do it, but the risks of serious damage will be higher than those in the home environment. Radiation contamination may be involved.

Two particular problems flow from the difficulty of distinguishing 'trivial incidents' from 'real accidents'

First decisions on what to report are difficult to make. Second, providing acceptable definition is difficult. Different people have different perceptions of what merits attention and investigation. Some perceive 'minor' accident reporting which leads to increased statistics as a waste of time. 'Minor' accidents are not seen as 'true' accidents but a way of life. Unfortunately this attitude shows no appreciation of the fact that 'minor' accident incidence is correlated with more serious accidents and accurate reporting of them could be a useful indicator.

A member of the discussion group had previously stated with regard to another incident,

“... it was a catalogue of little things that accumulated to be one big sort of incident”

5.9 Decisions about reporting incidents/ accidents

Major accidents seem to become “bogged down” when investigated and minor accidents were generally attributed simply to “carelessness”. The ones 'in between' received thorough investigation.

“It's the two ends of the spectrum you know that cause me personally more concern. Especially at the lower end (because they just tend to write) ... not investigated thoroughly”.

Some would prefer every incident to receive the same degree of attention, others feel discretion should be used over what does/does not merit attention.

However, surely every incident merits attention.

“The major ones tend to look after themselves everyone gets involved in a major one because everyone wants it sorted out! Minor incidents do not tend to receive the same amount of attention”.

Cuts and bruises when investigated were felt to be “blown out of perspective”.

5.10 Providing Acceptable Decisions

“..... we've just hit the crux of the matter. We are talking about accidents and accidents. An accident to me is a serious accident which I believe were covered correctly at Sellafield or wherever you are at, you follow procedures. These minor accidents I don't even class them as accidents”.

The concern for minor accidents seems exaggerated to some.

The question of responsibility is also bedeviled by problems,

“If somebody got blamed because an accident happened which could very well be that the manager did not identify what the hazards were, that the guy was going to walk in to and he went into them and he didn't know what to do with them because he was inadequately briefed.... I don't see anything wrong about disciplining somebody for that”.

This neatly addresses the questions of discipline, hazard spotting and the question of responsibility.

DISCUSSION

This work forms part of a larger study of employees at BNF plc site at Sellafield. It aims to provide a review of the issues which may affect employee perceptions of and attitudes towards safe working behaviour. Thus enabling the development of a measuring tool through the use of the literature and the focus group study.

The literature is scant on this area of research reflecting the relative lack of concern for human factors and organisational aspects of safety. Management texts especially should be criticised for the lack of attention given to the topic. When half of all accidents may be attributed to psychological characteristics/weaknesses in management and training (Kantyka 1977) why are managers not being encouraged to see safety as a major part of their responsibilities? Andriessen (1978) concluded that management had the highest influence on the degree of safety in work behaviour. Also the National Science Academy (1982) study concluded,

"At all seven mines with low injury rates there appeared to be a co-operative attitude between management and labour; an adversarial attitude was observed in three of the five mines with high injury rates".

With industrial accidents such as Piper Alpha and the Herald of Free Enterprise inflicting severe economic damage, steps must be taken to ensure that safety becomes a dynamic part of the work place. Participatory training programs, improved hazard management and 'safety culture' development need to have a place on every line managers' agenda.

Painter and Smith (1986) formulated 10 simple principles for hazard management, easily put into practice and requiring few resources. Simpson (1988) and Baddeley (1972) investigated 'hazard spotting' suggesting reasons why it may be poor. The faulty decision making of employees may be a denial process, a lack of recognition of the risks/lack of awareness (Singleton et al. 1981) or a belief that the safety rules do not apply. Ostberg (1980) claims it is ignorance on the part of the workers, Zimolong (1985) that it is due to underestimation of the risks. Whatever the reasons there are gaps in decision making.

A relatively unexplored theme, imported from research on public perceptions of technological hazards, is that perceptions of risks at work and perceptions of the effectiveness of safety procedures affect attitudes and are affected by them. Employees tend to feel "... nothing can be done about the risks in my job" (Powell 1971) or they would participate in collective measures to increase safe behaviour. If the work force are apathetic (Powell, 1971; Phillips, 1977) rely on others to be safe or sacrifice safety for productivity (Grunberg 1982; and Miller and Agnew (1973) accidents will continue to be part of working life.

A recurring theme in the literature, reflected also in the focus groups, is that involvement and participation may help to solve these problems. Workers are more likely to pay attention to safety measures when they have been involved in their development (Karasek 1979; Lawler 1976 and Hoiberg 1980). Lagerloff (1980) for example found participation lead to a 50% reduction in accidents in his group of loggers. Pope (1981) attributed improvements in industrial safety directly to the

introduction of participatory safety and hazard management programs. Autonomy may be a vital component in safe working,

"... mines in which miners are given decision responsibility and autonomy tend to have a lower incidence of injuries than other mines"

(Sanders 1976)

Humanitarian management and supervision, the 'consultative leader' (Sadler and Hofstede 1966) in Tilley 1974 is the preferred choice,. Consultation and participation are vital. However, work force involvement should not be perceived as a substitute for managerial responsibility, it is merely an adjunct (Beaumont 1983).

Job satisfaction is reviewed as a possible factor in developing safe behaviour. A discontented worker is more likely to 'cut corners' to be easily distracted or to commit violations of the rules. Most studies are concerned with whether satisfaction is dependent on intrinsic or extrinsic factors as opposed to whether work behaviour is dependent on satisfaction. Longenecker and Pringle (1984) claim there is little evidence that a happy worker is a safer worker.

From the focus group discussion it is possible to identify several prevailing trends. There appears to be poor management -labour interaction, the work force feeling alienated, "... like a number" within the organisation. They perceive management to be relatively disinterested in their safety and welfare. This is reflected in the perceived low standard of housekeeping; the lack of consultation; poor communication and the little merit given for a good job done.

"I don't think the management give the work force enough credit for their intelligence"

was a view popularly expressed and it sums up the current situation.

There appears to be no universal adherence to the rules and a lack of universal standards of safety within the site. The large size of the organisation and its wide geographical spread brings with it problems of interaction and co-operation. With the systems of the Approved Schemes of Work and the Permit to Work plus the ever watchful NII one may expect tension over differing standards. However, basic safety rules should be universally known, accepted and applied.

Hazard spotting was also perceived to be a problem. Some occurrences of faulty judgement were perceived to be the result of experience and the 'invisibility' of the risks,

"... don't see the risk so sometimes you don't accept that the risk is there".

There also seemed to be a tendency for passive acceptance,

"....accept the wages (therefore) accept the dangers"

Obviously some risks will always be present and may be accepted as such but passivity is a dangerous condition.

Production versus safety is an important issue, the focus groups gave a mixed response. Some respondents felt safety was sacrificed for production, others felt this was an exaggeration. It appears that often safety is sacrificed due to poor judgement

on both management and labour sides and due to poor communication. Most employees felt "bogged down" by the deluge of paperwork. The apparent alternative, the 'shop floor grapevine' is not providing a fully competent service, as would be expected.

Tasks and roles were not felt to be always clearly defined, causing difficulties and allowing gaps of responsibility to widen. Improved training may be an answer to this problem and also provide guidelines for hazard spotting. Individuals felt that more resources, manpower and on site training were required. More 'hands on' participation was also desired. Workers really want to become more involved. Safety, higher job satisfaction and organisational commitment plus increased productivity are benefits which no manager could sensibly ignore.

The focus groups felt that boredom caused by the poor distribution of work was leading to dissatisfaction. Some felt that those who were bored and those who had done the same job repetitively for long periods were more likely to be involved in an accident. The accidents, however, were perceived as 'slips' and not as calculated, conscious decisions. Generally it was felt that safety consciousness was improving but incentive schemes (SAFIA) were hindering progress. Workers felt that SAFIA reduced safety to a frivolous level,

"... you don't need gifts - that's not going to promote safety".

Conversely Canter and O'Learnik (1988) conclude peer pressure and financial incentives are useful in bringing safety to the forefront of thought. Although SAFIA

was unpopular few could suggest viable alternatives. Its effectiveness should certainly be subject to close scrutiny.

In conclusion, some individuals felt that,

"... you get people right across the board from process workers right through to managers who actually, when you generalise, ignore the safety rules when they walk into a plant for whatever reason".

The safety survey it is hoped, will reveal some of the reasons why the rules are sometimes ignored and how to prevent this comment from being an accurate description of the normal practice. Attitudes and perceptions are deeply embedded and resistant to change. This qualitative study is the first step down a long road for employees at Sellafield. Perhaps those who have taken part in this preliminary work and in the wider survey will consider their attitudes and behaviour more closely. Ultimately, this research aims to improve the safety culture within Sellafield.

POSTSCRIPT

From Autumn 1991 to Spring 1992, a questionnaire based on the present work was completed on site at Sellafield. A total of 5,295 questionnaires was completed by employees, providing feedback on 169 'attitude statements' and culminating in over 1 million interrelating data points. Principal Components Analysis was used to rigorously analyze the information to reveal a smaller number of deeper 'underlying' attitudes, ie. the prime causes for the attitudes. The 172 statements were grouped according to their contribution to these 20 underlying attitudes which were in turn further related to 9 key issues with regards to Sellafield related safety issues.

The 9 key areas were:

- 1 Safety Procedures
- 2 Risks
- 3 Permit to Work
- 4 Job Satisfaction
- 5 Safety Rules
- 6 Training
- 7 Participation
- 8 Control
- 9 Design of the plant

The underlying attitudes revealed by Principal Components Analysis were concerned with:

Confidence in safety procedures

Attitude towards risks

Perception of the level of risks

Perception of control over risks

PTW efficiency

Opinion of PTW

Necessity of PTW

Interest/boredom of job

Content/discontent with job

Working relationships

Praise for job well done

Comprehension of rules

Clarity of rules

Satisfied/dissatisfied with training

Effectiveness of selection

Level of self participation in safety issues

Source of safety suggestions perceived to be with workers/managers

Source of safety related action is predominantly self/others

Control over safety is exercised by self/others

Critical/uncritical of plant design

Correlation between attitudes were also revealed. For example the minority of people incautious towards risks are likely to :

- Believe permits to work are not effective
- Be opposed to the use of permits to work
- Be discontented in their job
- Have a poor understanding of the safety rules and procedures
- Have low participation in safety matters
- See others as responsible for safety
- Be sceptical about safety procedures.

Further analysis of these and other correlations will be carried out to establish further relationships, these results will be critical in the identification of areas for improvement.

Attitude differences have also been examined between working groups and occupations within the plant. In this analysis the key finding revealed a significant difference in attitudes scores of those involved in an accident and those who had not. Those who have not been involved in an accident have a higher degree of contentment with their job that those who have experienced accidents and indeed score significantly better on all but two of the attitude dimensions listed above.

There are opportunities for safety initiatives and improvement within Sellafield. The survey results indicate where these may lie. However, it is necessary to concentrate on those attitudes which can be directly adjusted and match closely with the likelihood of an accident. However, the attitudes which are not directly open to change/direct

influence have significant relationships with other attitudes. Analysis of these will identify the opportunities for improvement, direct the flow of influence and signal the priority of initiatives. For example, 'discontentment/contentment' is not directly open to change, however, as measured in the questionnaire it is related to other parameters, potentially more open to change.

The three highest correlations are:

- * Ability to influence plant design.
- * Confidence in safety procedures.
- * Personal understanding of safety rules.

Involvement in plant design; involvement in the control of safety; involvement in the control of plant risks and general satisfaction with working relationships have been identified as the four issues of greatest importance in relation to the likelihood that an individual may be involved in a reportable accident. It appears therefore that an atmosphere of consultative and participative working relationships need to be established as part of Sellafield's developing 'safety culture'.

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APPENDIX

Focus Group 5 Transcript

7 February 1991

Magnox Personnel

n=8, 7= male, 1=female

Organisation and Relationships

On the subject of roles and tasks, one person felt that tasks were,

"...fairly well defined, what people are expected to do, whether they are an operations manager or fitter".

However he saw roles as

"...something almost theatrical".

"Are we the achievers or the fixers or the goal keepers or the goal scorers?".

He was concerned that the part each individual has to play at Sellafield isn't always directly specified. Work tasks are clearly defined but the actual roles within the organisation were not so clear cut. He felt that it hadn't been discussed enough, especially in safety terms.

"I mean nobody has said to me 'your role as an operational manager in safety terms is this' and painted a pen picture. I know what my duties are, they're well defined. But how do I play the game? I have to work that out for myself"

He decided he was a "custodian", "a keeper of the rules". This is a reactive, perhaps even a passive role in some respects and perhaps this is not the position he is supposed to be in or is expected to have, perhaps his role is seen by the company as more active.

Generally, however, the group felt that if you were working with competent individuals your role is simply to ensure

"... they do it within the rules we gave".

'Is communication between roles effective?' was the next issue for discussion. One succinct comment was that communication is carried out "...badly usually".

This applies both to the channelling of information between roles and up and down the chain of command.

Permits to work; this subject was greeted with a very long and audible sigh. It seems that people are fed up with the 'permit to work' and are equally fed up with discussing it, to no avail.

One individual referred pessimistically to an ongoing review of the system and concluded that "...they wouldn't simplify it" which was greeted with an acrimonious reply:

"I don't think they need to simplify it, they need to throw it in the bucket. It's the most dangerous document we've got".

Someone obviously very concerned with the whole system. The group gave the impression, that in some respects they agreed with this rather extreme verdict, but what could they do to improve it to make a foolproof system? It seems that different PTW forms had been drafted but then pulled to bits. No-one it seemed, could come up with a better version, but they knew they were dissatisfied with the current system.

What are the problems? One member felt that it was a legally mandatory document, but the group disagreed and explained that under no circumstances can NII say they must have PTW. Then it was put forward that perhaps the supervisors did not have enough time to check the PTW out. This had been identified as a causal factor in several of the other groups. However, this group disagree,

"That's not true, he's got an index in the front. All he has to do is read it".

"Our problem is we've got six different foremen, six different locations of foremen...something like that and that is the co-ordination that is missing. The fact

that we've got people issuing permits to work not even in the building they are issuing it for".

So the size of the buildings may be a contributory factor and the lack of co-ordination and organisation whilst the permits are being issued. Another member agreed that this was a problem, but by the establishment of a "permit officer" they had alleviated some of their problems. However, it was felt that,

"There's a thousand and one things about the permit to work system that are not very good!".

Another concern was that people had lost sight of what the PTW was actually there for, what its main functions was,

"One of the things that worries me most is that some people on the shop floor have said to me that 'Ah well, you've got to have your permit to work because that is your insurance policy if anything goes wrong' and nothing could be further from the truth".

This person insisted that attitudes towards PTW had to be changed and explained that currently training courses were being re-run for this purpose.

"The only two reasons for having a permit are to make sure that the plant to be worked on is released in a safe manner, safe to the man who is going to work on it

and safe to the plant it has been withdrawn from, and secondly, to draw to the attention of the man doing the work what the hazards are, and the shape of the bit of paper and what's written on it, is, in a sense irrelevant...You could play around with the design of it forever, There are only two reasons for having it and I think a lot of the problems that we've talked about have detracted from the main purpose of the permit to work... we've been nagging people to play by the rules, this is all necessary up to a point, but I think it doesn't help with the basic attitude problem..."

So, perhaps there is an attitude problem which needs to be ironed out but it seems that there are different perceptions between management and workers, of the basic purposes of the document. Again, it was pointed out that sometimes it was no wonder the PTWs were not being read, because they were so long. Also,

"...every building is different... we need a different permit in each building. You don't need the same one in 229 that you need in 205. Calder has got a totally different one for a start because they are a very close-knit, tight little bit and they will not change it and every single person you talk to in Calder knows exactly how it works and what it is for. I'll bet they don't in Sellafield though. The PTW is anything to anybody and it's one of the most dangerous documents I have ever seen in my life. I'd destroy them and get rid of them, they don't contribute to safety, they in fact hazard it..."

So, as well as co-ordination, perhaps there is a degree of cohesion lacking, which could be created by giving each building its own system. The group, however, were

very critical and pointed out other flaws in the system, as they saw them. It was felt that they are often not filled in properly, don't have the right instructions and destroyed "...the person's ability to think".

It is possible to see a set of completely different perceptions even within this small group as someone else felt that the permit was not an instruction to do the job.

Finally, it was strongly argued that people often do not look at the PTW because they are doing a job they have carried out many times before and expect the PTW to be the same as it had been before. They also expected someone else to notify them of any modifications. This repetition of work under PTW has been mentioned before, the solution to it being more use of the Approved Scheme of Work.

It was felt that the ASOW should cover these instances:

"...exactly it should and that's where we have failed. We've failed to introduce enough Approved Scheme of Work".

However, it was pointed out that the ASOW

"...are even more lethal if they go wrong halfway through, because they don't cover what you do if it goes wrong".

However, would anyone ignore the ASOW?

"If you ignore it and there's an accident you are in trouble because you didn't work the Approved Scheme of Work. An approved scheme of work stops us needing a permit because it is a routine job...".

The safety paperwork is itself a hazard to safe working because of the amount:

"There's mountains and mountains and mountains of it"

which puts people off reading. One individual felt that instead of facing the safety problems ahead on, there had been a philosophy that,

"...the solution was more instructions. I think we've put ourselves into a mind set, though, in the past twenty years, that the way to improve safety is to have a lot more paperwork...which nobody reads".

So, the immense amount of instructions, whether PTW or ASOW, are a problem, plus the attitudes towards the instructions,

"I think that is what makes it difficult in a lot of ways, an offence to the craftsman that believes he can look after himself, to be inundated with bits of paper telling him exactly how he is going to look after himself".

Accountability for accidents; it seems that people are not satisfied with the limitations imposed by the accident form:

"I think the accident form is geared up so all I can write on the accident form is loss of concentration or more care to be taken in the future".

This, it was pointed out, was because in any case that was all you would be dealing with, minor cuts and bruises.

"You only have the odd bad accident which hopefully, maybe, is once in a lifetime when you see somebody either breaking a leg, breaking an arm..."

This individual went on to give an example of an accident he had been witness to which he was satisfied had been "...accounted correctly and accurately".

One of the concerns was that the recommendations are often pointless. It seemed that the group felt, as others have, that too much concern is shown for what they perceive as minor accidents.

"I think that what we've done here, we've just hit the crux of the matter. We are talking about accidents and accidents. An accident to me is a serious accident which I believe we've followed correctly at Sellafield, or wherever you are at, you follow procedure, these minor accidents, I don't ever class them as accidents".

So, it appears that accountability of accidents causes no concern, rather making out reports for everything, whether perceived as minor or major, causes the problem. It seems that different people have different perceptions of what merits attention and investigation. The information on minor accidents, it was felt,

"It's just a piece of information that no-one wants really"

adding to the mountains of paperwork already in existence.

Minor accidents seem to be a contentious issue:

"I accept we have to try and stop them because that's what is making our figures look so bad, you know, but it's how do we stop them, that's the only thing that baffles me, what do you do, how do you tell a lad he hasn't got to cut his finger...to actually do a report on every one...it's totally stupid".

It was felt that the safety book was full of 'cut hand, cut finger and grazed shin' entries with actions after them. This, it was felt, did not help anyone as the majority of these minor accidents are part and parcel of the particular trade the individual was involved in. It just produced more paperwork and higher accident statistics.

The fact that every accident was reportable made life difficult for everyone, especially in the case of a 'true' accident:

"...twisted ankle, where somebody slips off the pavement...but they're off work and we have the formal investigation and you're right, I mean, it feels terrible for the supervisor to go back to a guy and say 'well you, next time you'll have to be more careful where you put your foot".

There was no appreciation of that fact that minor accident incidence is correlated with more serious accidents and accurate reporting could be a useful signal. This suggests that perceptions may differ and be in need of attention.

Personnel

Flexible team working appears to be a popular topic. One of the groups had qualms about the concept because he felt that one man doing another man's job would surely lead to accidents:

"...but you have other people doing a job and not you and you can expect accidents to go sky high.. using different materials even!"

The rest of the group agreed with this point of view and, as one person pointed out:

"Most accidents happen at home with people doing DIY, don't they, and the people that aren't experts on what they are doing. They are doing a job they aren't trained to do and they have an accident".

However, other members felt that flexible working was more whether the individual could cross and work in "...certain grey areas".

It was felt that maintenance of mixed trade teams, mixed across the plant would be a good idea "...beneficial to all plants, both in safety and as the management want, making job deadlines".

It was felt that this kind of work base would be advantageous as "...teams always play better together".

However, although everyone agreed that team working sounded a promising concept, they were not totally convinced that it would have a positive effect on safety. It was something they felt may never be established one way or another. Also, one individual felt that the present system of working didn't strike him as being unsafe practice; having the different trades working in the same area at different times meant:

"...they can't get in each other's roads and drop spanners on each other and things like that. It's just impossible - they are not there at the same time".

On the possibility of flexible working affecting motivation, it was felt that,

"...they'll be less motivated, they're totally unmotivated most times"

And, on affecting accidents, and boredom,

"You're not bored when you are working and if you've got a plater working, he's working, so he's not going to have an accident with you while he's working. You might when he goes away and he gets bored sitting on his butt waiting for somebody else to produce a job".

On the subject of boredom generally as a factor in accident causation:

"...if I think of the serious accidents that I've seen and all the minor accidents, it's nearly always something of that order, a perfectly sensible bloke doing something that he is familiar with, leans too far in an effort to reach something, he's not consciously taking a calculated risk, he's just doing the job like we all do and he slips...So, I think I've never seen boredom as a contributory factor, to be honest, and we do contributory factor analysis on incidents and I don't think I have ever seen one that... it doesn't mean that there haven't been any, but I don't recall any".

It was felt that this was a true description and that well trained craftsmen could let their minds wander while still doing the job. It was felt that boredom was not a good explanation for the cause of accidents in Sellafield. Rather,

"...not 100% concentration maybe or loss of concentration...a fitter can do a job 90% of the time if it's a routine job, he doesn't have to think very hard".

However, although boredom may not be defined as a potential contributory factor, 'are people bored at Sellafield?' It was felt that job satisfaction varies in Sellafield but one individual was concerned with the current position within the plant.

"I think the trap we have fallen into in designing the plants is that we have not quite automated them. We've regarded the operator as a sort of intelligent, fairly necessary appendage to the machine, where the machine works most of the time on its own, but he's required every now and then to push a button to start the sequence...I think we've gone wrong in that respect. We should have either men who actually drive the equipment all the time...or you have the guy doing some other kind of watchkeeping job".

This individual felt that the 'halfway house' situation was not conducive to job satisfaction and going back to organisation and role and task clarification, it could mean that the individual may not be totally sure of his safety responsibility.

However, back to the thorny issue of boredom. Perhaps it is just as well that certain group members did not feel that boredom is a contributory factor along the accident chain because the group felt that people did get bored. It was felt that new projects held interest and motivated people but,

"..if you are going back to the same old job day in, day out, making the self same repair of something...a lot of the boredom is there because a lot of the

management's attitude is 'go and patch it up' instead of saying, 'okay, go back and make another one'...".

Perhaps this is not truly a reflection of management's attitude but it is perceived as such, at least in the old plants. It was felt that this did not happen in the new plants, so perhaps it is a question of resources. Whatever, perhaps more explanation could be given to the workforce.

However, this is another 'Catch 22' situation. Individuals get bored making their 200 brackets or repairs yet are discontented when work of this nature is put out to contract. As one man said: "This is between the devil and the deep blue sea".

It was also felt that there was often a lack of manpower to do the jobs and arguments over who should get the more interesting project jobs:

"We're always trying to give it to the workshop and they, nine times out of ten, refuse it and then you're left with 'Okay, send it out to contract' and then you'll come along and start bleating that he got the job. That's right...but the bosses have said 'send it out' so we send it out".

Perhaps this is the problem of communication. Managers do not realise when their workforce is dissatisfied with the work it has been given to do. Perhaps there is insufficient consultation with the workforce about who gets what job.

The office staff members of the group felt that it was easy to transfer if you were dissatisfied and that they themselves received a variety of work to do.

"I think at Sellafield, not just office staff, people get a variety of work; there's nobody like, piecework doing the same thing all the time".

The consensus of opinion was:

"It's like everything else. There are jobs you do like doing and there are jobs you don't like doing".

Are you right people selected for safe working?

"...down the line we are very good at picking the wrong people for the wrong jobs. In fact, we are excellent at it, if you have a good look at Sellafield. We've got some wonderful people in jobs at Sellafield".

This was felt to be at all levels in the organisation and

"...runs right through the firm from top to bottom".

"There's a vast number of square pegs in round holes - there are very few round pegs in round holes".

Generally it was felt that people who were in the wrong position were immovable and the only solution was:

"...to promote them to the height of their incompetence".

There was resentment that often people were promoted off tools (sic.) because they were unsuitable and the people who were good on tools rarely got the chance for a promotion. However, it was felt that it worked both ways - some people bad on tools did make good promotions and some people good on tools actually refused promotion.

A suggestion was made that promotions should be kept within departments.

"They throw it open to everybody on the site. The fellow might be excellent in one building and they promote him in another building, you know, and he doesn't know the work in the building. They are hoping he can pick it up and get away with it - it doesn't always happen".

Safety-wise, this may have dire consequences, so perhaps this system, although relatively fair, may be treacherous. However, it is distressing to miss out on a well deserved promotion.

It was also felt that Sellafield was not inundated with potential employees:

"It's easy when you've got ten candidates for the job and it's evident from the shortlist... people don't flood to come to work at Sellafield on the shopfloor. If they are going to do that they are going to come as contractors for big money and get out. So, you haven't really got the kind of labour choice you might have..."

On the issue of selecting personnel for safety, it was argued that it isn't part of the selection procedure, "In fact it doesn't enter into it at all" and certainly not in "...in a structured or formal way".

Individuals generally know whether the people they have working for them are safe, via word of mouth. No aptitude tests are used so the decision is left to the manager concerned to decide whether they can place people in a suitable position. This relies heavily on honest information from plant sources and it was admitted that supervisors may bend the truth to have someone they are not happy with transferred; even bribery was mentioned, in a semi-joking manner!

"...if the fellow gets too good a report you've got to look very, very, closely at it in case someone wants to get shot of him".

Turning to the physical environment, the divide between the old plants and the new plants was mentioned. It was felt by one person who works in a new plant that it was safe and, more important,

"I mean, you might still find odds and ends that aren't safe, but as soon as you find them they're modified and they have to be modified for everyone's safety".

The old plants, it was felt, were designed with safety in mind but designs have changed, making them not necessarily unsafe but out of date, safe only "...as far as reasonably practicable".

Internal to the plants, it was felt that Sellafield has more to learn with regard to ergonomics, having no professional ergonomists on site.

"I think we have a fair bit to learn still about ergonomics and the sort of man - machine interface, like I said before, how the man interfaces with the control system and the machine. If you are talking about the plant layout, heating and lighting, I think we do that fairly well, but ergonomics, no, I think we could learn".

In order to avoid more costly design mistakes, more thought was being put into plant design and machine layout, process workers accompanying contractors on their installation work to ensure that the layout is practical and workable. It was felt that the contractors tended to work from drawings and did not consider any other factors, often making simple but costly mistakes:

"Like panels with back access for maintenance up against walls and the contractor wasn't bothered, he would put it here because if you wanted it moved it's extra work and you pay him again".

It was claimed there were even some buildings on the wrong sites, hardly reflecting, to the workforce, a competent and consultative management as, surely, the people who work within the plants should have some say on their design and the design of the machinery they are to use.

The Social Environment

"I can see pressure coming on if they actually go through with the proposed plan on safe working. Actually saying if you don't have an accident for a million hours' work...there'll be a monetary reward or something, like that SAFIA. Yeah, I can see pressure on there to say 'look we've only three hours off a million, what the hell have you done, cut yourself'".

SAFIA was not popular in this group and again was perceived as a hindrance to safety. It was felt that it would encourage people not to report accidents, which could start a snowball,

"You see, it is encouraging people not to report the accident and once you start that then you set off saying, 'well I won't report the wee accident' and then you get one a bit bigger and you say 'well, I won't report that one either' and before you know where you are at, you're having major accidents...in which case someone could walk in after you and you get four or five people contaminated instead of just a little spillage".

It was felt that SAFIA was a hazard and brought being safe down to a frivolous level,

"I think it has made it a joke".

In reviewing aspects that might militate against safety, the group was asked whether there was any form of deliberate risk taking. The consensus seemed to be that although people may slow down production or lock out, box keys may go missing and other small items, no one would do it purposely to endanger the job. However, it was admitted that these action,

"...might indirectly lead to accidents but not deliberately...more to hold something back".

The group also said that there was always some clowning around but never on the job, an alternative to boredom but again never to endanger.

"It does really switch off once you go in, once you've dressed up and you go over the barrier you'll be surprised how things switch off and people change. Maybe it just relieves it when they come out, maybe it relieves the pressure when they come out and start bugging about again".

They also said that people would not work with others whom they felt were a hazard to themselves. There is a good ethos for safety responsibility. However, although the

group claimed that people really were safety conscious, they also pointed out that there are always exceptions:

"I think some people recognise danger more than others, you know. If a fellow doesn't recognise the danger ...when he's working and the others see that he is, they'll soon get him out."

But, generally it was not a big problem. The group felt that people realised the danger they were in. However, this will be examined further in the following sections.

Risk Management

Risks in Sellafield, the group believed, are apparent and generally each worker is aware of them,

"When you are talking about radiation and contamination, it's not difficult at all because the lads are fully aware of the risks. When you are talking about safety, it's not difficult but we all consider the element of risks differently. So, where we might think they're taking a risk because we're told 'you will not do this' the lad doing the job will say 'well, I've always done it this way' as I do myself, coming from being a fitter, so we don't necessarily see the risk as people coming from higher up do".

So, workers know there are risks but there seems to be a recognised difference in perception of the risks between workers and management. The workers, because they have done the work so many times before, tending to underestimate the dangers.

It was also proposed that the transition between home and work may require an adaptation that some individuals are either not aware of or are incapable of, perhaps anticipating that if you can cut yourself at home without any hassle, you can cut yourself at work with the same consequence. However, the group felt that individuals did tend to report their minor injuries.

"...say one of the lads do cut their hands, their workmates will tell them they've got to go to surgery and to report it, regardless, not just on the supervisors or managers, it's the lads of the shopfloor and lasses...exerted from the shopfloor to do it, so it becomes like second nature as soon as you cut your hand or your whatever, you are automatically off to the surgery because you know you are going to get pulled up anyway".

However, the transition was still thought to be a potential problem in the development of safe working practices:

"I think that we do demand a change of behaviour when people walk in the gates. People do, do jobs at home and yes they do cut their fingers and things, you know I'm a DIY man, but they actually achieve wonderful things outside work..."

There was also concern raised on the issue of lost time accidents. It was felt that the management, in its desire to reduce the number of these incidents, were pushing people to come back to work, often when they were not up to full fitness. It was felt that in this situation safety was put at risk, the individual becoming a hazard to himself and likely to endanger others.

"...the management have been putting great strain on to people to get them back to work. I mean, the amount of people you see running around that site now on crutches".

This was not the first time that this instance had been used!

It was also pointed out how potentially dangerous it could be,

"...running around on crutches and you turn around, you have a site emergency drill or something like that, or a fire drill... and all these foremen and managers are all going out there and badgering these guys to get themselves back into work, come there and they bring them in, in that state. I think it's deplorable".

One of the managers/foremen on the group agreed that the situation was unsatisfactory but that pressure was being exerted from a greater height, for every accident to be closely examined and individuals pressured to get back to work. It appears to be believed that paying attention to the accident and taking note will bring people back.

"Therefore, we are asking you as a manager to look at every case that is a lost time accident and I said 'well, why?'...again, evidence from industry is that if you pay attention to people who have had an accident, you know, if you ask them - 'why, when will you be back and what have you', then the accident rate goes down".

So, the main aim is perceived to be the lowering of the figures, already a contentious issue. The group then went on to discuss the 'visit' by the foreman when they were off sick. They felt that if the labour officer accompanies the foreman, it only antagonises matters further. The labour officer was not seen as a particularly friendly individual and it was suggested that if team working, as described previously, was introduced, one of the team members could visit instead, relieving some of the tension and likely resentment.

However, the 'welcome' of the visit depends on the department, the individual and the relationship established. It was also proposed that sometimes the labour officer was asked by the foreman to accompany him to help to ensure that the right approach is made. Unfortunately,

"...the workforce don't see the labour officer as fair play".

On the topic of enquiries and investigative procedure, it was felt that the system, currently thriving on rumour, needed shaking up. No one really knowing the truth about incidents, was believed to be, in some respects due to the confidentiality of the reports.

"...usually comes under security classification - confidential... depend son the accident, depends how serious it was. Very serious, it'll probably be in the papers, if it wasn't very serious, sort of middle ground, you'll probably never find out for sure, unless you were actually involved in it or were part of the section it was in, then it'll go round site as a rumour...".

The question was raised whether the rumours are accurate, and this elicited the following response:-

"No..., it gets steadily worse as it goes along until it's finished up that all the management have been fired but they all turn up the next day or the guy's been chucked out and he's at work the following morning... the problem with that is, total misinformation all the time, therefore you tend not to believe anything you are told by anybody, from management down to the shopfloor. You just don't believe anything that comes back".

So, the feedback of information is not occurring in a controlled and structured manner. A slight discussion then ensued over the aims of the procedure. It was proposed that to keep confidentiality it was difficult to freely publish or distribute complete reports.

"One thing that (it) does endeavour to do is protect the confidentiality of the individual who has given evidence to an what you want out of the investigation procedure if it is tell everybody on site what happened in a particular incident, in a

particular plant, then we would need a very different kind of procedure. We don't aim to do that. We aim to make recommendations that ought to prevent a recurrence and that they are implemented in the department where the incident took place and, where necessary, to draw attention to other departments who might have a similar problem, but we certainly don't aim to make everybody aware on site of every incident".

This statement explains one individual's view of the procedure and what it is for, but it was still felt that the rumours were dangerous and that a safety notice board should be put up to notify everyone of different occurrences - a 'forewarned is forearmed' philosophy:

"...you just have a simple accident notice board; if you want to read the accident notice board you go and read it. If you're so bored, you can't, then you'll never find out what happened".

However, this was not greeted with spontaneous approval by our advocate. He believed that the board was simply a list of 'cut finger' etc. He felt that this was no help and was more concerned with:

"...if something has happened of a very unusual nature in another plant that I ought to look for in my plant because there might be a comparable situation which may lead to a serious risk",

i.e. separating one form of accident from another appears to be the crux of the matter.

However, back to the 'cut finger' syndrome,

"But, if you need to publish a document to put on the board...you might get a sensible accident reporting system that says 'to hang with all that, that is totally irrelevant, let's not report those any longer and we'll tell whoever is in charge of it we're not going to report them any longer because they are just part of the trade, we will now define where an accident starts'".

So, there is an inherent problem with the reporting system, People are dissatisfied with the time taken and exaggerated concern with minor accidents but then again, perceptions of "minor" may be inaccurate and one minor incident may start the chain to a major accident. This was also seen to cause problems in the attribution of responsibility, what do you discipline someone for? It was felt that this question is bedevilled by problems.

"...if somebody got blamed because an accident happened which could very well be that the manager did not identify what the hazards were that the guy was going to walk into and he went into them and didn't know what to do with them because he was inadequately briefed. This famous permit to work didn't tell him or whatever I don't see anything wrong about disciplining somebody for that".

However, this type of accident was identified as a "pure" accident.

"You may start though with the fact that you have an accident, the guy fell down a six foot hole, yeah, but it's not an accident in the sense that an accident is something that you can't avoid, something that could have been avoided and some steps weren't taken, and I don't consider that an accident. Somebody has stepped out of sequence and somebody has done something wrong".

So, there are two schools of thought on the perception of an accident and it would appear that this needs to be cleared up before a new system for investigation and feedback is developed. The consensus, at least, is that,

"...well, that's why I think we should separate the likes of cut finger and hands on tradesmen; they shouldn't be classified as accidents and should be done away with".

The discussion moved next to the advantages and disadvantages of audits. There are certainly enough carried out, the group claimed, especially for the new buildings inspections:

"Inspections are better looked at now than what they were. Like the idea of where a plant manager and a safety rep goes round certain plants unannounced to see how people are actually working there and then and not giving the particular plant 24 hours, 48 hours notice so that they can clean up their act".

The fact that the buildings are inspected by people external to that building is an excellent idea.

"If you go around you own plant, you'll get a safety manager (who'll) say 'no one has fallen over that for the past 12 months, don't bother about it' so you don't but if you're inspecting someone else's plant you say 'oh, that's got to be shifted'".

So, rather than people not wanting to be inspected, they did, and as accurately and frequently as possible.

Production versus safety was not a major gripe. In fact, when questioned the group were more concerned with the infamous 'cut finger'.

General Management

On relationships between management and workforce, the management did not score very highly.

"This is the relationship the management have with the workforce, they treat them like scum".

When the subject of the lost time accident visit was discussed,

"But you would know what relationship you had with them, if you had that relationship with them at work but if you treat them like crap all the time, don't

expect to go out there and get a good reception - that's the way it is, it's their attitude".

This was a strong statement and was felt to refer to clashes of personality and to occur at all levels.

"Foremen, managers, right the way up, that's just departments where I've been, they have a love/hate relationship rather than a 'come on lads, let's all muck in, we are all in it together'".

It was argued that managers are not interested in,

"...them as people, they're interested in them as bits of work, whether they actually perform the task...they're not really bothered about managing, the only problem they've actually got (is) 'did he go home early, did he clock on, did he clock off, did he go for his beer early?' They're just like clock watchers, they make sure the man is earning his time, anything else, it doesn't really matter to them whether he does the job right or wrong, whether he's happy doing it or what".

The main problem appeared to be the distribution of work and the lack of consultation.

"You know, they haven't even had the decency to come and discuss with the lads and say 'look we're letting that go to contract', can't do it and then it's a laugh when

the lads are sitting there at home at the weekends and their mates who are contracting are coming in and doing the job and things like that..."

It was also felt that size wasn't helping, larger buildings having less of a 'pull together' attitude. It was felt that the site as a whole was beginning to develop an 'us and them' attitude.

"I mean, even trades are setting against each other now, doesn't matter who you are, it's the wrong trade and this is an attitude that's on site and we're fetching into our own group now and I'm sure THORP is going to have the same problem once they start. It's killing that attitude that's the problem".

A discussion then developed on the role of the trade unions, one individual feeling that this 'us and them' division stemmed from the TU role as a traditional adversary of management.

"So, I think it is a very complicated situation. I think there are actually very few managers who in their heart honestly believe the guys on the shopfloor are a load of crap".

However, do they ever tell the workforce any different?

"We get a pat on the back, but it's usually got a knife in it".

It was felt that as a site there are groups who do not get on with management, who had consequently tried harder to create a better working relationship with them. This applied to both large and small groups and it appears that often very little communication passes between the two sides.

Respect needed to be earned:

"I mean, I think I can respect a guy who has worked alongside (me), he's progressed, he knows the trade inside out and things. He goes up the ladder and he does that you know you believe that anything you are doing is nothing that he wouldn't ask to be done himself...I've put a lot of respect in someone's ability to do something, rather than just say 'do that' and you say 'how?', well, that's a different story, he's got to get another six managers to tell you how to do it".

There was also a little resentment that the whizzkids tended to gain promotion whereas the craftsman tended to miss out.

"...majority, if a lad is good on the tools he'll stop on the tools, his line of promotion has gone".

Although this was not rare, it was still a source of discontent and confirms the earlier point where people were promoted to avoid them having accidents. Obviously this makes sense, but the cost side is that promotion is not seen to be fairly allocated.

Senior management were believed to not visit enough, the explanation given as being their heavy workloads. However, managerial visits are sporadic and they tended to concentrate on the newer plants. Visits to the old plants are generally the result of something going wrong.

"If you see (x) walking into the active area, the answer is 'what the hell has gone wrong now that we haven't heard about?' That's the immediate reaction, where's the TV camera and what went wrong and you'll run for cover and then wait to find out".

It was felt that no one really expected the directors to pay frequent visits but that at least the works manager should walk around. The need for personal contact by the workforce seems to be largely ignored. People need to know someone is interested in what they are doing and their wellbeing, otherwise they will lose interest, have no pride and take less care in their work. A more personal approach, a more humanistic attitude was strongly urged by the group.

"It's your works manager you want, or his assistant, to show some interest in what you are doing. The interest level in 205, in particular stops at the shift managers and it only stops at them if what they want doesn't happen. If they're getting what they want, their interest drops off very drastically."

Managers should want to see their workforce whether things are going well or not. However, not everyone on the workforce wants to see the management and not everyone speaks their mind.

Generally, however, the group felt that management should walk around on the plant and show more interest in the day-to-day running rather than simply paying attention to the accidents.

"Let's be fair, the only time you see the management was...when there is something wrong. It's not often you see them when everything is going okay".

The subject of Michael Heseltine's visit raised two complaints of a different nature. One individual felt resentment at not being asked and others felt the same, that there was always a certain protocol and pecking order of invited guests, which rarely included minor characters. Also, the amount of money being spent on the visit,

"This is the thing that annoys me, a bloke like that comes, no expense at all spared, everything's going. You turn round and you want something, another box of spoons or something, sort of thing and it'll get denied".

Others agreed to a certain extent but believed that not that much money was spent really and that by having VIPs and treating them well, they would work for you too. This was understood but,

"We all appreciate that's what's going on... I mean if...you turned tomorrow and you said 'I want safety-wise something you'd have to hassle for it. That's all I'm saying and here's Heseltine coming and it's put on a plate, that's what I'm saying. I think at times we do get things out of proportion...I realise why we do it".

This puts a different reflection on things. It was felt that sometimes the resources were not equally distributed and to justify improvements or whatever was a source of dissent.

While talking about media pressure and public pressure from groups such as CORE (the local opposition group), the group mentioned Greenpeace and Friends of the Earth. They felt that it was right to have an opposition in this form and that they 'highlighted' the problems of the industry,

"...if you don't control these hazards, obviously we're doing a bad job".

So, although some members said these organisations are full of 'cranks', others saw them as healthy and useful,

"...I think Greenpeace and Friends of the Earth and NII and a number of other people taken together have put pressure on the industry and I think it has accelerated improvements in safety, there's no doubt about that . Whether it's right to single out one to praise, I'm not sure".

Risk Taking

"Well, I think we as individuals like taking risks and if you can see the risk the adrenalin runs better and you like it better...when you go to work you don't see the risk, so sometimes you don't accept that the risk is there. If you could see the risk, if you could see and you could say 'well, if I touch that it's going to chop my finger off' you don't touch it. You might get close to it but you don't touch it. When you go to work you don't see the risk".

A very important statement, one group member admitting that often denial of the risks take place and often people can't see the risks of the situation they are in. Both these attitudes may have potentially serious consequences.

One person suggested that perhaps if Sellafield accepted a death as their responsibility people would wake up to the reality of the risks surrounding them,

"I think sometimes if Sellafield accepted, I know we're getting very political now, but if they accepted somebody's death, that would get everybody thinking...If they were to say 'yes we caused it' would frighten everybody and make them aware".

This makes it appear that there is a passive acceptance of the risks inherent in working in Sellafield, which is exacerbated by the fact that no attribution of responsibility for a fatality has been levelled at Sellafield. Of course, no one wants this to happen, but it seems that people may need to be shaken into action or, in fact, shocked into action.

It was also felt though, that in the past people had been more 'dare-devil' in their working behaviour, taking risks by not wearing the proper equipment, a kind of macho ethos. These people were the ones that were suffering now, whereas newer workers were becoming more aware of the dangers, although the macho ideal was not totally gone. Generally, the group believed that they had been told fairly and squarely of the risks within Sellafield and often felt that any fatalities could be due to the risks but could not be sure. As one individual suggested:

“We accept the wages, we accept the dangers”

THE SELLAFIELD HUMAN SAFETY SURVEY

Robens Institute of Health & Safety
University of Surrey

Department of Psychology
University of St Andrews

PLEASE NOTE:-

1. YOUR QUESTIONNAIRE WILL NOT BE SEEN BY ANY OTHER EMPLOYEE OF BNFL UNDER ANY CIRCUMSTANCES
2. YOUR NAME IS NOT REQUIRED
3. THE AIM IS TO IMPROVE SAFETY FOR YOU AND ALL AT THE PLANT

BNFL is committed to the reduction and ultimately the removal of avoidable accidents. This survey is sponsored by THORP Division, forming an important part of its ACTION PLAN FOR SAFETY. The resultant information will be made available to other Divisions.

Accidents can cause great personal and family distress and remorse. A careless, everyday slip or sloppy way of working suddenly looks obscenely irresponsible *after* a bad accident. Recent events like the Herald of Free Enterprise, King's Cross, and Clapham have amply demonstrated this.

An *ACTION PLAN FOR SAFETY* has been devised and this survey forms an important part of it.

Much effort has been and is being made to accurately assess the technological hazards on the site and to minimise them. However, there remains a residue of improbable, but possible accidents, both industrial and radiological, that depends largely on *human behaviour*.

It is extremely difficult to predict such accidents. But behaviour does depend on the ways in which people generally look at things, on their perceptions, beliefs and attitudes. These *can* be measured.

We know that people's perceptions of risks and their beliefs about safety measures and safe ways of working are often different from expert assessment - so it is essential to find out from people directly.

So please take this enquiry seriously. It is not "just another questionnaire". The items are all based on the points raised during five 3-hour focussed discussion groups at Sellafield, involving industrial workers, safety reps, union conveners, supervisors and managers.

It will be analysed statistically in such a way as to identify the main underlying *attitudes* and to find out from you (i.e. from those who know best) areas of concern where improvement is needed in *communications, safety procedures or relationships*. **Please be frank and honest in your answers. It is in everyone's interest.**

All your replies will be treated as CONFIDENTIAL to the research team - your name is not required. Completed questionnaires will be sent direct to St Andrews for analysis.

BRITISH NUCLEAR FUELS plc, SELLAFIELD

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Office use only

Please give the following details about yourself and your job:
Do not be concerned that these details could, in some cases, identify you (by diligent search!) THEY WILL ONLY BE SEEN BY THE RESEARCH TEAM.

Please ring these numbers to reply

- | | | | |
|---|------------------------------|---|---------|
| Sex | Male | 1 | (6) |
| | Female | 2 | |
| Age (in years) | 16-20 | 1 | (7) |
| | 21-30 | 2 | |
| | 31-40 | 3 | |
| | 41-50 | 4 | |
| | 51-60 | 5 | |
| | 61-70 | 6 | |
| Length of Service with BNFL (in years) | 0-5 | 1 | (8) |
| | 6-10 | 2 | |
| | 11-20 | 3 | |
| | 21-30 | 4 | |
| | 31-40 | 5 | |
| | 41 + | 6 | |
| Your job at Sellafield: | Craft worker | 1 | (9,10) |
| | Process worker | 2 | |
| | Office/Admin work | 3 | |
| | Supervisor | 4 | |
| | Junior manager | 5 | |
| | Middle manager | 6 | |
| | Senior manager | 7 | |
| | Technical specialist | 8 | |
| | Others:
(Please write in) | | |
| | | | |
| Do you work Days or Shifts | Days | 1 | (11) |
| | Shifts | 2 | |
| How would you describe the type of work you do? | Office/Administration | 1 | (12,13) |
| | Laboratory | 2 | |
| | Maintenance | 3 | |
| | Industrial | 4 | |
| | Managerial (Line) | 5 | |
| | Managerial (Specialist) | 6 | |
| | Other
(Please write in) | | |
| | | | |

Have you had any accidents resulting in time off work for three days or more while working for BNFL?

Yes 1
No 2

(14)

If YES, approximately how many?

.....

(15,16)

Building

.....

(17)

Department

.....

(18)

Grade

.....

(19)

You are asked to record your agreement or disagreement with a wide range of statements about safety.

Please use the following scale:

- 1 = Disagree strongly
- 2 = Disagree
- 3 = Disagree slightly
- 4 = Neither Disagree/Agree
- 5 = Agree slightly
- 6 = Agree
- 7 = Agree strongly

Almost all the questions can be answered by everyone.

In a few cases you may 'opt out' of a section (e.g. if you do not work in the active area).

Otherwise, please try to answer every question, even those where you have only limited experience (we can take this into account).

If, however you have no knowledge or experience please leave the answer blank or put "N/A"

Put a circle round your choice, so

1 (2) 3 4 5 6 7

If you change your mind - put a line through the wrong choice, so:

1 (2) 3 4 (5) 6 7

You will note that you are sometimes asked to agree (or disagree) with a positive statement and sometimes with a negative statement.

This is to ensure that you think about each item individually.

1. Your feelings about your job		◀ Disagree - Agree ▶							
a.	I am sometimes made to feel I'm not paid to think.	1	2	3	4	5	6	7	(20)
b.	My work is boring and repetitive.	1	2	3	4	5	6	7	(21)
c.	A lot of people in my place of work are doing work below their ability.	1	2	3	4	5	6	7	(22)
d.	I feel I am just a 'number' at Sellafield.	1	2	3	4	5	6	7	(23)
e.	Consultants and whizz kids are always telling me how to do my job.	1	2	3	4	5	6	7	(24)
f.	I do my job only for the money.	1	2	3	4	5	6	7	(25)
g.	If I didn't take a risk now and again, the job wouldn't get done	1	2	3	4	5	6	7	(26)
h.	What I really enjoy is a job with a spice of danger.	1	2	3	4	5	6	7	(27)
i.	There is plenty of scope for satisfaction in my job.	1	2	3	4	5	6	7	(28)
j.	There's very little I can do, personally, to improve safety	1	2	3	4	5	6	7	(29)
k.	I feel I have good future job prospects with BNFL.	1	2	3	4	5	6	7	(30)
l.	On the whole, good work is rewarded.	1	2	3	4	5	6	7	(31)
m.	A 'pat on the back' for making a good job of things in my place of work is usual.	1	2	3	4	5	6	7	(32)
n.	People in my place of work sometimes get blamed when it's not their fault.	1	2	3	4	5	6	7	(33)
o.	You don't get promoted at Sellafield if you're good where you are.	1	2	3	4	5	6	7	(34)
p.	Practical skills deserve more recognition.	1	2	3	4	5	6	7	(35)
q.	Graduate 'whizz kids' are pampered at Sellafield.	1	2	3	4	5	6	7	(36)
r.	Everyone takes risks in the home and it's difficult to switch over at work.	1	2	3	4	5	6	7	(37)
s.	I sometimes experience stress in my work.	1	2	3	4	5	6	7	(38)

◀ Disagree - Agree ▶

- t. I sometimes have to turn a blind eye to the strict safety rules to get the job done on time. 1 2 3 4 5 6 7 (39)
- u. Because of the type of work, I sometimes lose my concentration. 1 2 3 4 5 6 7 (40)
- v. Most accidents just happen - there's not much you can do about it. 1 2 3 4 5 6 7 (41)
- w. I know the job so well that I am extremely unlikely to have an accident or be involved in one. 1 2 3 4 5 6 7 (42)
- x. There are certainly risks in working at Sellafield. 1 2 3 4 5 6 7 (43)
- y. The risks at Sellafield are completely cancelled out by the safety precautions. 1 2 3 4 5 6 7 (44)
- z. I never think about the risks, now I am used to the work. 1 2 3 4 5 6 7 (45)
- aa. A certain amount of risk is no problem if you have 'what it takes'. 1 2 3 4 5 6 7 (46)
- bb. It is management's responsibility to improve safety. 1 2 3 4 5 6 7 (47)
- cc. I can influence the safety procedures in my place of work, if I go about it the right way. 1 2 3 4 5 6 7 (48)
- dd. There is very rarely any "horseplay" where I work 1 2 3 4 5 6 7 (49)
- ee. Shift workers get the more interesting jobs. 1 2 3 4 5 6 7 (50)
- ff. Work that would make my job more interesting is too often put out to contractors. 1 2 3 4 5 6 7 (51)
- gg. Do you work in the active area?
(If yes, please answer the following questions:)
(If no, please go to Section 2.)
Please ring 'yes' or 'no'
Yes (1) (52)
No (2)
- ◀ Disagree - Agree ▶
- hh. I feel 'trapped' working in the active area. 1 2 3 4 5 6 7 (53)

2. Safety committee/officers/health physicists		◀ Disagree - Agree ▶							
a.	In my place of work there are too few:								
	Safety Officers	1	2	3	4	5	6	7	(54)
	Health Physicists	1	2	3	4	5	6	7	(55)
b.	There should be more independence from management on the part of:								
	Safety Officers	1	2	3	4	5	6	7	(56)
	Health Physicists	1	2	3	4	5	6	7	(57)
c.	A pretty good job is done, all things considered, by:								
	Safety Officers	1	2	3	4	5	6	7	(58)
	Health Physicists	1	2	3	4	5	6	7	(59)
d.	When you really need one, it is not easy to contact a:								
	Safety Officer	1	2	3	4	5	6	7	(60)
	Health Physicist	1	2	3	4	5	6	7	(61)
e.	Safety committees don't prevent accidents, they just talk about them.	1	2	3	4	5	6	7	(62)
f.	Management don't take notice of what Safety Committees say.	1	2	3	4	5	6	7	(63)
g.	The recommendations of the Safety Committee reach all levels of the workforce	1	2	3	4	5	6	7	(64)

3. Safety Reps

◀ Disagree - Agree ▶

a.	Safety reps do a pretty good job, all things considered.	1	2	3	4	5	6	7	(65)
b.	The management do not respond quickly enough to safety rep suggestions.	1	2	3	4	5	6	7	(66)
c.	Making suggestions for safer working is a waste of time in my place of work.	1	2	3	4	5	6	7	(67)

4. Lost time reporting

◀ Disagree - Agree ▶

- | | | | |
|----|--|---------------|------|
| a. | People come back to work before they are fit - just to keep the lost time accident record low. | 1 2 3 4 5 6 7 | (68) |
| b. | Once they are into 'lost time' people tend to spin it out and take a break | 1 2 3 4 5 6 7 | (69) |
| c. | If I were "off sick" a visit to my home would be welcomed if made by a:- | | |
| | supervisor or manager | 1 2 3 4 5 6 7 | (70) |
| | union representative | 1 2 3 4 5 6 7 | (71) |
| | member of the medical department | 1 2 3 4 5 6 7 | (72) |

5. The Safety Rules and/or Instructions in your Plant

◀ Disagree - Agree ▶

- | | | | |
|--|--|---------------|------|
| a. | The standards of safety are very high in my place of work. | 1 2 3 4 5 6 7 | (73) |
| b. | The written safety rules and instructions are too complicated for people to pay much attention | 1 2 3 4 5 6 7 | (74) |
| c. | Too much attention is given to radiological and not enough to ordinary accidents in my place of work | 1 2 3 4 5 6 7 | (75) |
| d. | My job is overburdened by paperwork | 1 2 3 4 5 6 7 | (76) |
| e. | Safety instructions are specified in so much detail you can't see the wood for the trees. | 1 2 3 4 5 6 7 | (77) |
| f. | The safety rules in my place of work are reasonable and practicable | 1 2 3 4 5 6 7 | (78) |
| <i>Coder: Skip cols 79-80
Duplicate cols 1-5</i> | | | |
| g. | Rules about protective clothing are always strictly enforced. | 1 2 3 4 5 6 7 | (6) |
| h. | Safety rules and instructions are not generally well known. | 1 2 3 4 5 6 7 | (7) |
| i. | It is hardly possible to keep up with changes in the written safety instructions. | 1 2 3 4 5 6 7 | (8) |

- ◀ Disagree - Agree ▶
- j. If the safety rules were simplified, people would know when they are breaking one. 1 2 3 4 5 6 7 (9)
- k. If the safety rules were publicised better, people would know when they are breaking one. 1 2 3 4 5 6 7 (10)

6. The Permit to Work System

- a. Is your work generally or sometimes subject to Permits to Work? *Please ring 'yes' or 'no'*
- Yes (1) (11)
- No (2)

(If Yes, please answer Section 6 from your direct experience)
(If No, EITHER:
Respond to any questions on which you have formed an opinion
(leave others blank) OR
Go to Section 7

- ◀ Disagree - Agree ▶
- b. means different things to different people 1 2 3 4 5 6 7 (12)
- c. is usually filled in properly 1 2 3 4 5 6 7 (13)
- d. ensures safe working 1 2 3 4 5 6 7 (14)
- e. stops people thinking 1 2 3 4 5 6 7 (15)
- f. is used consistently in different plants 1 2 3 4 5 6 7 (16)
- g. is an unnecessary formality 1 2 3 4 5 6 7 (17)
- h. is an essential, if cumbersome, precaution 1 2 3 4 5 6 7 (18)
- i. needs radical overhaul 1 2 3 4 5 6 7 (19)
- j. would be hard to improve on 1 2 3 4 5 6 7 (20)
- k. is just a way of covering people's backs 1 2 3 4 5 6 7 (21)
- l. should more often be replaced by the Approved Scheme of Work, where practicable 1 2 3 4 5 6 7 (22)
- m. often causes frustrating queues 1 2 3 4 5 6 7 (23)

7. Monitoring; Logs etc.

◀ Disagree - Agree ▶

- a. Action in response to entries on safety, in logs, is usually prompt. 1 2 3 4 5 6 7 (24)
- b. I believe that "near misses" are always reported properly. 1 2 3 4 5 6 7 (25)
- c. Minor accidents in active areas cause so much hassle they are quite often ignored. 1 2 3 4 5 6 7 (26)
- d. Accident forms are always completed truthfully. 1 2 3 4 5 6 7 (27)
- e. A prize incentive scheme would improve safety in my place of work. 1 2 3 4 5 6 7 (28)
- f. Publicising of information about accident and 'near misses' in the interest of future safety is not done adequately 1 2 3 4 5 6 7 (29)
- g. Not enough is done to 'spot' potential hazards. 1 2 3 4 5 6 7 (30)

8. Emergency Instructions/Alarms

◀ Disagree - Agree ▶

- a. There are so many different alarms across the site, that it is easy to be confused. 1 2 3 4 5 6 7 (31)
- b. The alarm system in my place of work is completely efficient. 1 2 3 4 5 6 7 (32)
- c. I am satisfied that the emergency instructions will work well if the need arises. 1 2 3 4 5 6 7 (33)
- d. The emergency procedures at my place of work are not well understood by:
 - Workers 1 2 3 4 5 6 7 (34)
 - Itinerants 1 2 3 4 5 6 7 (35)
 - Contractors 1 2 3 4 5 6 7 (36)

◀ Disagree - Agree ▶

e. Alarms at my place of work are responded to promptly by:

Workers 1 2 3 4 5 6 7 (37)

Itinerants 1 2 3 4 5 6 7 (38)

Contractors 1 2 3 4 5 6 7 (39)

9. The NII (The Nuclear Installations Inspectorate)

a. Does your work bring you into direct contact with the NII Inspectors

*Please ring 'yes' or 'no'*Yes (1) (40)
No (2)*(If Yes, please answer Section 9 from your direct experience)**(If No, - EITHER:**Respond to any questions on which you have formed an opinion (leave others blank) OR**Go to Section 10*

◀ Disagree - Agree ▶

b. Regulation by NII works well, on the whole. 1 2 3 4 5 6 7 (41)

c. Having the NII makes me feel safe. 1 2 3 4 5 6 7 (42)

d. NII inspectors act too much like 'big brother'. 1 2 3 4 5 6 7 (43)

e. NII inspectors are remote and unapproachable. 1 2 3 4 5 6 7 (44)

10. Design of Plant/Buildings

◀ Disagree - Agree ▶

a. There is not enough done to bring the old plant and buildings up to standard. 1 2 3 4 5 6 7 (45)

b. More consultation is needed with the 'hands-on users' when plant and buildings are designed. 1 2 3 4 5 6 7 (46)

c. Unsafe *conditions of work* result from plant and buildings designed on paper by 'boffins' who don't know the work. 1 2 3 4 5 6 7 (47)d. Unsafe *working practices* result from plant and buildings designed on paper by 'boffins' who don't know the work. 1 2 3 4 5 6 7 (48)

11. Training/Induction/Selection

◀ Disagree - Agree ▶

- | | | | | | | | | | |
|----|--|---|---|---|---|---|---|---|------|
| a. | People in my place of work are left too much alone to learn things for themselves. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | (49) |
| b. | Training in my place of work is satisfactory for: | | | | | | | | |
| | Workers | 1 | 2 | 3 | 4 | 5 | 6 | 7 | (50) |
| | Supervisors | 1 | 2 | 3 | 4 | 5 | 6 | 7 | (51) |
| | Managers | 1 | 2 | 3 | 4 | 5 | 6 | 7 | (52) |
| c. | There are very few 'square pegs in round holes' in my place of work amongst: | | | | | | | | |
| | Workers | 1 | 2 | 3 | 4 | 5 | 6 | 7 | (53) |
| | Supervisors | 1 | 2 | 3 | 4 | 5 | 6 | 7 | (54) |
| | Managers | 1 | 2 | 3 | 4 | 5 | 6 | 7 | (55) |
| d. | The introductory familiarisation/training on safe working practices given to personnel first moving into this plant is satisfactory for: | | | | | | | | |
| | Workers | 1 | 2 | 3 | 4 | 5 | 6 | 7 | (56) |
| | Supervisors | 1 | 2 | 3 | 4 | 5 | 6 | 7 | (57) |
| | Managers | 1 | 2 | 3 | 4 | 5 | 6 | 7 | (58) |

12. Teamwork/Trust/Commitment

◀ Disagree - Agree ▶

- a. Those who would keep things as they are rather than encourage 'flexible team' working are:
- | | | |
|------------------------|---------------|------|
| myself | 1 2 3 4 5 6 7 | (59) |
| senior management | 1 2 3 4 5 6 7 | (60) |
| my boss | 1 2 3 4 5 6 7 | (61) |
| the average supervisor | 1 2 3 4 5 6 7 | (62) |
| industrial workers | 1 2 3 4 5 6 7 | (63) |
| unions | 1 2 3 4 5 6 7 | (64) |
| middle management | 1 2 3 4 5 6 7 | |
| safety reps | 1 2 3 4 5 6 7 | (65) |
- b. 'Flexible team' working would increase accidents due to lack of skill/*more than* reduce accidents due to boredom.
- | | | |
|--|---------------|------|
| | 1 2 3 4 5 6 7 | (66) |
|--|---------------|------|
- c. Relationships between workers and supervisors in my place of work are in general
- | | | |
|----------------------------------|---------------|------|
| easy and relaxed, sometimes warm | 1 2 3 4 5 6 7 | (69) |
|----------------------------------|---------------|------|
- d. Relationships between the different worker/management levels in my place of work are in general:
- | | | |
|----------------------------------|---------------|------|
| easy and relaxed, sometimes warm | 1 2 3 4 5 6 7 | (72) |
|----------------------------------|---------------|------|
- e. Relationships between middle management and senior management levels in my place of work are in general
- | | | |
|----------------------------------|---------------|------|
| easy and relaxed, sometimes warm | 1 2 3 4 5 6 7 | (75) |
|----------------------------------|---------------|------|

*Coder: Skip cols 76-80
Duplicate cols 1-5*

◀ Disagree - Agree ▶

f. Suggestions for improving safety in my place of work are most likely to come from:

myself	1	2	3	4	5	6	7	(6)
senior management	1	2	3	4	5	6	7	(7)
my boss	1	2	3	4	5	6	7	(8)
the average supervisor	1	2	3	4	5	6	7	(9)
industrial workers	1	2	3	4	5	6	7	(10)
unions	1	2	3	4	5	6	7	(11)
middle management	1	2	3	4	5	6	7	(12)
safety reps	1	2	3	4	5	6	7	(13)

g. The ones who are likely to be *decisive* about disciplinary action for safety violations in my place of work are:

senior management	1	2	3	4	5	6	7	(14)
my boss	1	2	3	4	5	6	7	(15)
the average supervisor	1	2	3	4	5	6	7	(16)
industrial workers	1	2	3	4	5	6	7	(17)
unions	1	2	3	4	5	6	7	(18)
middle management	1	2	3	4	5	6	7	(19)
safety reps	1	2	3	4	5	6	7	(20)

h. In my place of work, the ones who *know* the safety rules and instructions best are:

senior management	1	2	3	4	5	6	7	(21)
my boss	1	2	3	4	5	6	7	(22)
the average supervisor	1	2	3	4	5	6	7	(23)
industrial workers	1	2	3	4	5	6	7	(24)
unions	1	2	3	4	5	6	7	(25)
middle management	1	2	3	4	5	6	7	(26)
safety reps	1	2	3	4	5	6	7	(27)

i. In my place of work the ones who are most careful in applying the safety rules and instructions are:

- myself 1 2 3 4 5 6 7 (28)
- senior management 1 2 3 4 5 6 7 (29)
- my boss 1 2 3 4 5 6 7 (30)
- supervisors in general 1 2 3 4 5 6 7 (31)
- industrial workers 1 2 3 4 5 6 7 (32)
- unions 1 2 3 4 5 6 7 (33)
- middle management 1 2 3 4 5 6 7 (34)
- safety reps 1 2 3 4 5 6 7 (35)

j. Multi-trade teams make work more "safety oriented".

1 2 3 4 5 6 7 (36)

k. So far as safety is concerned, you can trust most people in my place of work.

1 2 3 4 5 6 7 (37)

l. You can't trust anyone with your own safety except yourself.

1 2 3 4 5 6 7 (38)

m. It is particular personalities, not 'roles' that I wouldn't trust with my safety.

1 2 3 4 5 6 7 (39)

n. You only see senior management when something goes wrong.

1 2 3 4 5 6 7 (40)

o. No line manager above supervisor level is really concerned about minor accidents.

1 2 3 4 5 6 7 (41)

p. The technical support staff are 'a law unto themselves'.

1 2 3 4 5 6 7 (42)

q. The people from elsewhere on-site who come into my place of work tend to 'cut corners' on safety.

1 2 3 4 5 6 7 (43)

r. There should be more 'safety walkabouts' by senior managers from outside my place of work

1 2 3 4 5 6 7 (44)

s. General housekeeping to ensure safety around my place of work is good.

1 2 3 4 5 6 7 (45)

t. Production takes precedence over safety.

1 2 3 4 5 6 7 (46)

◀ Disagree - Agree ▶

u. There is sometimes pressure to put production before safety, from:

myself	1 2 3 4 5 6 7	(47)
senior management	1 2 3 4 5 6 7	(48)
my boss	1 2 3 4 5 6 7	(49)
the average supervisor	1 2 3 4 5 6 7	(50)
my fellow workers	1 2 3 4 5 6 7	(51)
middle management	1 2 3 4 5 6 7	(52)
safety reps	1 2 3 4 5 6 7	(53)