INTEGRATED RISK MANAGEMENT

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The theme of this conference is an integrated approach to risk control. Sometimes I wonder why in 1999 we can still look at this concept as something relatively new, which we should be doing and should be striving for. What these words really represent is the beginning of a total risk management philosophy. The reality is that without effective management of all business risks, survival into the 21st Century for many organisations may be seriously compromised.

The development of formalised risk management processes most likely had its genesis in the chemical industry some years ago in response to accidents at Flixborough, Seveso and Bhopal. This led to the appearance of OH&S, Plant and Dangerous Goods legislation in the 1970's. During the 1980's this increased regulation, plus heightened union and community concerns resulted in increased awareness by many organisations that managing their plant safely was a part of their business. Some organisations began to adopt regular risk assessment methodologies and other management techniques to further improve.

Towards the end of the 1980's and into the 1990's the environment, and the performance of industry in this area in particular, became a front page topic. Some organisations responded with environmental management principles and philosophies, while some played lip service to the notion with fancy manuals that did nothing other than sit on shelves where they could be seen but not used. Through all this time we were still fragmented in our approach. The reason why I use the term fragmented is because we are reactive, not proactive. For example, industry has recently swung much of its efforts behind environmental issues, only to find the public focus, in light of many recent food scares, has switched dramatically to microbiological contamination of food products, including the concerns about genetically modified (GM) foods. As 1999 is drawing to a close, many of us are now concentrating on Y2K. By the time this conference is held, who knows what the next "big issue" will be…..Instead of following the trends we need to demonstrate the benefits of total risk management. Maybe it is about time we tried using an integrated approach……..

Keywords: risk management, hazard analysis

THE TOTAL MANAGEMENT PHILOSOPHY

HISTORICAL PERSPECTIVE

We have progressed from the early 1970's, through the OH&S revolution, into the 1980's and now the 1990's, which has been an environmental revolution. Or has it? Can every corporation head look at themselves every morning in the mirror and tell themselves that they are doing all that they can to operate in a manner consistent with our conference theme? For that matter can plant operators do the same thing? I would suggest not.

Before I get attacked for being negative, consider what is happening in many western countries at the current time. With more conservative governments, and public opinion now clearly focussed on trying to reduce unemployment, increase value added export potential and improve health and welfare spending the environment is starting to look to many like a luxury we cannot afford.

There are many reasons why this is the case. Part of the problem is that despite evidence to the contrary, proper environmental management and compliance is still seen as a cost. In this instance one of the major difficulties is the quantification of environmental costs. Where programmes have been put in place to improve safety records the cost of these initiatives can be offset against the reduced accident rate and the costs associated with these. However, the equivalent environmental management programmes are difficult to sell due to the perceived lack of quantifiable benefits.

A classic example is the current grappling with the Greenhouse Effect. While the world could unite to reduce the risks posed by the destruction of the ozone layer by CFC's, we are not capable of doing the same with the problem of increasing amounts of carbon dioxide, methane, and other gases which contribute to global warming. While I admit that a significant contributing factor is the constant debate about the validity of the greenhouse scenarios, surely the major impediment to reducing the production of the principle concern, carbon dioxide, is the cost. This is despite the fact that reducing the reliance on fossil fuels for energy and transport purposes would have enormous environmental benefits in terms of cleaner air. The savings from the reduction in bronchial disorders such as asthma would most likely pay for the investment in new technologies to replace fossil fuels many times over.

Companies are grappling with new issues such as Corporate Governance, ever diminishing returns on investment and greater shareholder scrutiny. They are also trying to deal with these things with fewer resources as the new "leaner and meaner" industry attempts to compete with new arrivals in the marketplace from the Far and Middle East. In many cases organisations, through mergers, are becoming larger but slimmer as flatter management structures become more popular. One of the major problems with a flat management structure is the procurement and dissemination of information and procedures. This becomes even more complex when through mergers various different cultures may still exist. All these factors conspire to make consistent application of risk management difficult.

Another difficulty compounded by the mergers and flatter organisational structures of today is the "brain drain" of qualified and experienced people in lower and middle management due to redundancies. As Trevor Kletz said, many organisations have no memory and accidents recur. A significant contributing factor to this is the loss of these experienced personnel, who are invariably the ones that are excess to requirements when the next big merger is announced.

Consider these problems. It is without doubt easier to divide your risk portfolio up into more manageable segments, but many risks are spread across more than one portfolio and trying to address these issues then becomes complex. In particular, new proposals can be problematic as risks outside the scope of the various portfolios can slip through the cracks. With the fragmented management philosophy that is so prevalent in many of today's organisations I fear that all too often the controls may be lacking due to a lack of input from all concerned parties.

Consider an example from a plant I worked on in Australia. This plant was a pilot plant manufacturing oil from brown coal using a liquefaction process; principally, hydrogenation of a hydrocarbon based slurry at high temperature and pressure. Operational requirements dictated a typical manufacturing run of approximately six to eight weeks, with a two to three month shutdown during which the plant was effectively dismantled, investigated, modified, and reassembled before another run was attempted. The usual management of change controls were in place for major engineering modifications, but on one shutdown an additional piece of lagging on the outlet pipe of the hydrogen reformer led to an explosion and immediate shutdown of the hydrogen plant. As this plant was critical to the entire operation, the whole site was shutdown for six weeks while the subsequent investigation and repairs were carried out.

The accident was caused by the installation of the lagging. The outlet pipe on the reformer was a metal sandwich, designed specifically to have a temperature gradient across its thickness. By lagging the external surface of the pipe, this gradient was altered, causing the steel to operate above the temperature at which this grade could be annealed. Unlike many units of this type, the reformer was started up and shut down four or five times a year. The steel was gradually work hardened over a period of eight years until it was incapable of containing the pressure within the pipe.

Can any plant managers be confident that their change management systems would have detected this possibility? Even if HAZOPs, or similar, are done on all process modifications without a metallurgist or the original equipment designer I don’t think this scenario could have been envisaged. Even with these available there is room for doubt. But with an integrated approach to risk management there is at least a chance it would have been.

This event was serious enough. Fortunately, the fact that the accident happened on the night shift meant that nobody was killed. Also fortunately, the fact that the plant in question was not a commercially viable business also meant that there was no substantial business impact in monetary terms. However, picture a similar incident at a commercial refinery and imagine the business impact of a six week interruption. I’m not going to tell you that management of change procedures were state of the art at this facility because they weren’t. In fact, I can think of many other places where installation of lagging on a piece of pipe wouldn’t even warrant a risk assessment. But the key point is that if there had been a procedure for even the most cursory evaluation of the potential hazards by all affected parties, this accident may have been avoided.

PRESENT SITUATION

In the organisations of today the risk portfolios have been split up into respective disciplines. We have a Safety Officer, an Occupational Health and Safety Manager, an Environmental Manager, and the list goes on. That is the reason why I used the term fragmented earlier. We are reactive, not proactive. For years industry has been pushed in the direction governments and regulators believe it should go, rather than leading in the direction it knows in its heart it should go. And the direction governments push industry are influenced primarily by what the electorate perceives as important. Or, as a cynical colleague of mine recently observed, what the loudest pressure groups think is important. For that reason industry has swung much of its efforts in recent times behind environmental issues, only to find the public focus, in light of many recent food scares, has switched dramatically to microbiological contamination of food products and other issues related to food safety. One of the major driving forces behind this was of course the BSE crisis.

Don't get me wrong; I am a big believer in democracy. However, what the public perceives to be the major risks and what are the major risks are frequently worlds apart. I'm not going to delve too far into the mechanics of risk communication, as I'm sure we could have a separate conference on this topic alone. Suffice it to say that until recently industries preferred to keep their business behind locked gates and what the community needed to know they were told. Nowadays consultative committees and joint environment improvement plans between communities and industry is becoming the norm, and this can only improve the community's understanding of risk. This, consequently, will hopefully improve the opinion the public has of industry in general, and the chemical industry in particular.

Instead of following the heavily legislated path trodden by government regulators, and responding piecemeal to a variety of management philosophies such as ISO9000, ISO14000 and Responsible Care, what is needed is a more all embracing philosophy, such as "Integrated Risk Management". While I applaud the vision of industry moving towards a sustainable future, this will not occur purely by considering plant safety, quality and environmental issues in isolation.

The management philosophy that is required is a 360 degree view of risk, which encompasses proper controls on ALL risks. These include occupational health and safety, plant safety, environmental, public and products liability, product quality, business interruption and contingency planning, credit risk, risks from mergers and acquisitions, company image and a host of financial investment risks. Only when a total risk management philosophy is in place for all these issues will industry sustainability become possible.

In 1995 the first risk management standard in the world was promulgated. The joint Australian and New Zealand Standard on Risk Management (AS/NZS 4360)[1] exhorts us to use risk management on all risks. They propose a matrix of probability and severity (see Figure 1) to qualitatively assess risks and prioritise them for control. This approach was developed independently by Zurich in Switzerland some 15 years ago and has been used the world over (as the Zurich Hazard Analysis or ZHA) for all types of business risks ever since. Since 1996 Zurich has been developing a series of tools based on the ZHA known as Total Risk Profiling (TRP) and Dynamic Risk Simulation (DRS), which take this concept further.

RISK MANAGEMENT

ZURICH HAZARD ANALYSIS

There are a host of different risk management tools, many of which I'm sure you are familiar with. They include the gross hazard analysis systems such as Zurich's own Zurich Hazard Analysis (ZHA), which has been used to audit everything from product safety through to a management control system for investment purposes, and just about everything in between. The philosophy is similar to the matrix approach in AS/NZS 4360 alluded to above, and is presented as a figure in Figure 2.

The ZHA was developed by Zurich Risk Engineering in Switzerland some 15 years ago. It is a team based brain storming exercise led by an experienced team leader. The team follow through a series of guide words on their defined scope, identifying hazards and developing loss scenarios through a hazard, cause and effect time line. The guide words, known as the "tickler list", are designed to promote thought and encourage the identification of hazards that would not otherwise be found. These scenarios are then rated for probability and severity, and plotted on a risk profile (similar to the one attached). The line plotted on the profile represents the teams defined level of an acceptable risk. By definition, anything which falls below this Risk Tolerance Boundary (RTB) is an acceptable risk.

The next step is to perform a quality check on the results to ensure that the team is satisfied with the relative ratings of hazards. Once this is completed, risk reduction strategies for each identified risk above the RTB are proposed. Following this step the risk reduction measures are catalogued, and the new position of the risks on the profile determined to ensure that they have been eliminated or reduced to an acceptable level. The risk reduction catalogue is then monitored to ensure that the preventative measures are carried out by the appropriate people in the designated time frame.

In comparing the Risk Profile to the matrix in AS/NZS 4360, it is easy to see that the risks rated high (H) and significant (S) could be considered above the RTB, the risks rated low (L) below the RTB, and the risks rated moderate (M) requiring further thought.

NEW DEVELOPMENTS

Further development work by Zurich has lead to the creation of the TRP and DRS tools mentioned above. Total Risk Profiling, or TRP, is a modification of ZHA, in that a new series of guide words are used to address all risks present on a single site. The scope can be varied as necessary to include financial elements, or purely to address operational risks only. This methodology has been used successfully in the UK for a major automotive manufacturer and is applicable across all sizes and types of industry.

The ultimate package is Dynamic Risk Simulation or DRS, which will be only briefly mentioned here. This solution is ideally packaged to large multinationals with a significant number of premises, and involves a number of consolidation steps from various individual site TRP analyses to build up a risk profile across the entire corporation. There is then input from actuaries and the use of sophisticated computer risk simulation packages to quantify major risks and address corporate wide risk management strategies.

What this total package now gives the customer for the first time is hazard identification, prioritisation and remediation package which can be used across the entire spectrum of risk. By setting severity and probability definitions (see example, Figure 4) for all types of risk it allows all of the risks facing a single department, site, company or corporation to be viewed on a single page. This brings the ideal of an integrated risk management approach one step closer.

OTHER HAZARD ANALYSIS TECHNIQUES

Attendees are probably more familiar with systematic PID based systems such as Hazard and Operability studies (HAZOP) or Hazard Analysis (HAZAN), or diagnostic failure tools such as Fault Tree Analysis (FTA) and Failure Modes and Effects Analysis (FMEA). Lastly, there are also several techniques that have been developed purely for one industry (such as Hazard Analysis and Critical Control Point (HACCP) for the food industry).

These tools are all unique and have varying degrees of applicability. Each one has their strengths and weaknesses. ZHA is a qualitative system of prioritising hazards and can be used for any system. It is particularly useful in identifying areas of concern that may require detailed analysis (such as with HAZOP or FMEA), or for product safety and quality issues. However, the major benefit of the ZHA and TRP is the ability of the methodology to analyse any risk. Much of our customer research has identified a desire for a single methodology to prioritise all risks. It was with this in mind that led to development of Total Risk Profiling, which has maintained the strengths of the team based methodology and applied this to the 360 degree view of risk spoken about earlier.

HAZOP is recognised worldwide as the best hazard analysis tool for the chemical industry. The unique line by line approach enables all facets of the chemical process to be evaluated for hazards. The diagnostic tools, such as FTA and FMEA can be used to track back from identified scenarios to accurately identify the root causes and corresponding hazards that need to be controlled. This is always of significant importance, as by not correctly identifying the hazard you may inadvertently specify a control mechanism for the symptom, rather than treating the underlying threat that triggers it.

However, having access to these systems is only half of the equation. In many organisations a quick look at a senior executive’s shelves will tell you whether or not programs are in place, but it is how they are used that is critical. A program enforced upon the workplace by senior management or an “Health and Safety” group with huge expertise but no line management responsibility is doomed to failure. The most successful management programs involve the employees that have to implement the controls that are required. By making the employees highly qualified and involved in the hazard management process they will feel ownership of the systems and be more forthcoming in improvements. And at the end of the day, you need to find all the hazards.....or at least as many as possible. By alienating part of your workforce you simply turn off the tap on creative input from that section, and a risk management plan that controls only half of your exposures is not likely to be successful.

Many organisations are now realising that the flatter management structures I alluded to earlier, coupled with the traditional management philosophy of procedures and standards, is ineffective in the modern world. In many cases the operators on the "ground floor" know the best ways of doing the job, and the successful organisations will be those that encourage them to be involved in the decision making process. That has encouraged the growth of "self managed teams" or "work groups", within which operational day to day decisions, including risk assessment and management, are made at the "sharp end". Management provide the guidance and framework to work within, which is where effective communication of company policies, missions, ethics and objectives are so important.

A PROPOSED MODEL FOR INTEGRATED RISK MANAGEMENT

IMPLEMENTING WHAT WE KNOW

Having discussed all of the issues above, and looking around at the assessment and management tools available today, it is clear that we are not lacking in systems, procedures and tools with which to analyse and prioritise our risks. The key ingredients needed to pull all of these systems together are the consistent hazard analysis method and a management system to handle the results.

Here ISO9000 becomes very important. Having been involved in the implementation of ISO9001 systems in three of my five employers since graduating as a chemical engineer, I can relate to those who sometimes dismiss it as nothing more than an elaborate paper generating exercise. A colleague of mine often says that it would be possible to obtain ISO9001 registration for a plant manufacturing concrete life jackets, which is probably correct. While I wouldn't go that far, I don't think that anybody would dispute that an ISO9001 system in isolation does not provide very good protection against accidents and other safety related issues.

What ISO9001 does of course deliver is the management system and traceability to the management process, which monitors the continuous improvement and ensures procedures are followed. Coupled with the ZHA/TRP, or similar system, we have for the first time a combination of elements which can be used to deliver an integrated risk management approach. This allows elements of financial risk, occupational health and safety, environmental risks, process safety hazards, and an infinite number of other disciplines to be monitored together under one framework. This is represented graphically on Figure 3.

INSURANCE ROLE IN RISK MANAGEMENT

INSURANCE INDUSTRY PERSPECTIVE

As a final comment, it would be remiss of me not to remark upon the relationship between risk and the insurance industry. In todays world it is no longer possible for companies to obtain financial recompense for losses and simply carry on. Things have got much more complicated. Despite the availability of financial recompense, insurance cannot guarantee that your business will recover to its former position in the marketplace. Statistics tell us that more than 80% of those businesses suffering major losses never recover.....why? Apart from the fact that many businesses are under insured, the major reason is from a lack of adequate

contingency planning for business continuity. As the old saying goes, failing to plan is effectively planning to fail.

Remember - insurance will not recover your market share after a fire has obliterated your factory. It will only pay for the physical assets and the profits lost while you were not distributing product. Insurance will not stop environmental pressure groups from calling for your company to be denied planning permission to rebuild, or calling for your products to be blacklisted after you pollute a river. Neither will insurance keep your directors and CEO's out of jail if a major accident occurs.....

In the world of yesterday, customer loyalty was expected. The world moved more slowly, and a loss of supply for three months meant a loss of profits until the operation resumed and you recommenced supply to your customers. That world has gone. Now we are faced with tougher competition and lower margins. An inability to supply a market for three months can mean expulsion, an inability to supply an export market for that long can mean extinction.

In addition to this, industries are facing pressure from all sides, including local councils, community groups and environmental organisations. Evidence both locally and around the world suggests that companies which do not have adequate controls over their operations can expect widespread public condemnation. Who would have predicted the outrage with which the decision to scuttle the Brent Spar would be met? Who would have predicted the boycotts of Shell products in Europe that followed? Only now is the Brent Spar meeting its final destiny, but the oil industry in Europe and around the world is still scratching its head about what to do with scores of unwanted offshore oil platforms.

More recently, we have had the E Coli outbreak in Scotland, the ever present concern about salmonella in chicken and eggs, and of course BSE. There are hundreds of recalls every year announced in the media, and many attract widespread consumer criticism and in some cases condemnation. Quite simply, insurance does not cover any of the costs involved with public reactions of this type.

The risk control hierarchy is simple - eliminate, substitute, reduce, transfer (insure) and retain. There are three steps before insurance, and they are all processes which will improve the ability of your organisation to recover from a variety of business losses. The theme of this conference is "Integrated Risk Management". In this short period of time I have tried to show that beyond plant and environmental safety there are many other issues that need to be considered as part of a Total Risk Management Philosophy.

REFERENCES

1. Australian and New Zealand Joint Standard on Risk Management (AS/NZS 4360), Appendix A, Page 20.

PROB'TY	A	SIGN.	SIGN.	HIGH	HIGH	HIGH
	B	MOD.	SIGN.	SIGN.	HIGH	HIGH
	C	LOW	MOD.	SIGN.	HIGH	HIGH
	D	LOW	LOW	MOD.	SIGN.	HIGH
	E	LOW	LOW	MOD.	SIGN.	SIGN.
		1	2	3	4	5
		SEVERITY				

PROBABILITY RATINGS

A	ALMOST CERTAIN
B	LIKELY
C	MODERATE
D	UNLIKELY
E	RARE

LEGEND

HIGH	HIGH RISK
SIGN.	SIGNIFICANT RISK
MOD.	MODERATE RISK
LOW	LOW RISK

SEVERITY RATINGS

1	INSIGNIFICANT
2	MINOR
3	MODERATE
4	MAJOR
5	CATASTROPHIC

FIGURE 1 – PROBABILITY vs SEVERITY MATRIX (Reproduced from AS/NZS 4360)

HAZARD CAUSE LEVEL	IV	III	II	I
A				
B	18	23 38.2	17	
C	11 13	5 20 29 35		3
D	12	25	8 21 38.1	2 4 14 19 26 28
E			24 30	6 7 9 15 22 27 32 33 37 40
F				31

HAZARD EFFECT CATEGORY →

HAZARD CAUSE LEVEL:
- A Frequent
- B Moderate
- C Occasional
- D Remote
- E Unlikely
- F Practically impossible

HAZARD EFFECT CATEGORY:
- I Castastrophic
- II Critical
- III Marginal
- IV Negligible

FIGURE 2 – ZURICH HAZARD ANALYSIS, EXAMPLE RISK PROFILE

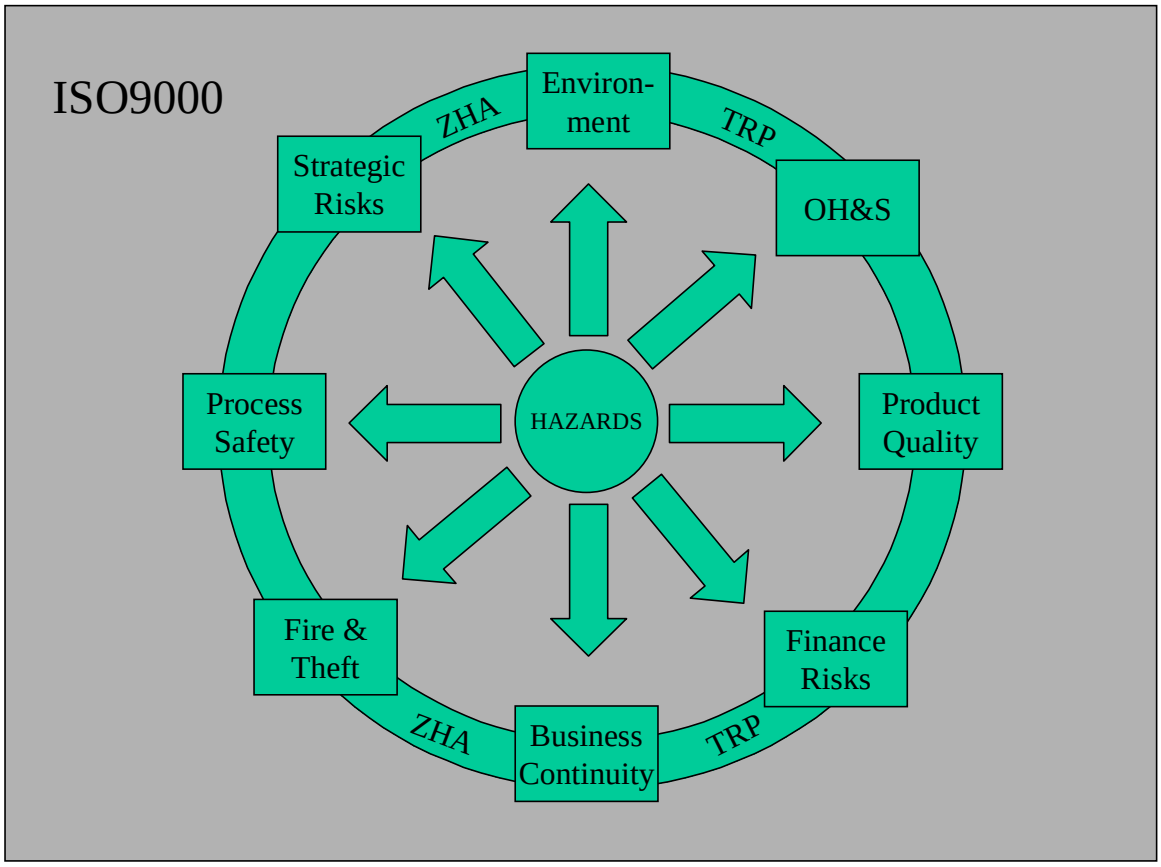

FIGURE 3 – INTEGRATED RISK MANAGEMENT

SEVERITY DEFINITIONS

Risk Criteria	Negligible	Marginal	Critical	Catastrophic
Employee Injury	Cut finger Sprained wrist Mild concussion	Broken limb Partial hearing or sight loss	Loss of use of limb Permanent loss of sight or hearing	Death of employee
Business Continuity	Unable to supply for one month No loss of market share	Unable to supply for three months 5-10% loss of market share	Unable to supply for six months 10-25% loss of market share	Unable to supply for twelve months 25-50% loss of market share
Environmental	Near miss incident such as a fully contained spill	Release of materials outside containment Notifiable incident	Major on site contamination	Major off site contamination
Process Safety	Near miss incident such as failure of redundant safety interlock	Overpressure or over temperature incident due to multiple failures of procedures and/or safety interlocks	Major incident resulting in significant damage to plant due to multiple failure of procedures and/or safety interlocks	Major explosion with off site implications
Product Quality	Poor quality product manufactured and picked up by ISO9000 system	Poor quality product dispatched to agents and warehouses but able to be recalled	Poor quality product enters market place and is recalled	Poor quality product enters market place. Delay in recall results in injuries or deaths with resultant damage to company reputation

PROBABILITY DEFINITIONS

Frequent	Once a week
Moderate	Once a month
Occasional	Once a year
Remote	Once in two years
Unlikely	Once in ten years
Practically Impossible	Once in a hundred years

FIGURE 4 – EXAMPLES OF SEVERITY AND PROBABILITY DEFINITIONS