

# ERM for Emerging Risks in General Insurance

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## Abstract

This paper is focussed on ERM for emerging risks in general insurance in our world of “unknown unknowns” and the emergence of unexpected risks over time. It illustrates how Chief Risk Officers can focus, with an ERM framework on “risk and opportunity management”, balancing risks against opportunities, whilst being resilient against “unknown unknowns” and their emergence over time as “known unknowns” and “known knowns”. The findings were based on real case studies and review the “lessons learned” and the “early warning indicators” that could (and perhaps should) have been used in order to detect the emerging risks in a timely manner and influenced the CRO function to have taken appropriate remedial action.

The presentation of this paper is scheduled for the GIRO conference and exhibition 2010.

## Availability

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## Keywords

Enterprise Risk Management; Strategic Risks; General Insurance; Governance; Risk Appetite

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## 1. Introduction

The paper is focussed on ERM and strategic business management for general insurance companies in our world of “unknown unknowns” and the emergence of unexpected risks over time. Consideration has been given to how the CRO (Chief Risk Officer) can focus, with an ERM (enterprise risk management) framework on “risk and opportunity management”, balancing risks against opportunities, whilst being resilient against “unknown unknowns” and their emergence over time as “known unknowns” and “known knowns”.

The findings were based on case studies of “unknown unknowns” and their emergence over time as “known unknowns” and “known knowns”. Consideration was given the “lessons learned” and the “early warning indicators” that could (and perhaps should) have been used in order to detect the emerging risks in a timely manner and could have influenced the CRO function to have taken appropriate remedial action. For each case study, a time line” was prepared to record the emerging events (and management reactions) over time.

The research questions addressed include:

- (i) Which ‘key risk indicators’ and ‘early warning indicators’ would you have used, why would you have used these and how would they have informed your decisions?
- (ii) How quickly would you have spotted the emergence of the unexpected event and what would you have done about it?
- (iii) What evidence would you have needed to convince the CEO to take the appropriate remedial action before it was too late?

## Case Studies

**CS1** AIG (American International Group)

**CS2** LTCM (Long Term Capital Management)

**CS3** Union Carbide

## 2. Conclusions

The principal conclusions on ERM for emerging risks on general insurance are summarised below.

### 2.1 Conclusions on the ERM framework model

- a) 6-stage iterative process model with feedback loops
- b) Corporate governance essential → lead from top
- c) Internal systems and controls essential
- d) Internal and external sources of risk
- e) Upside & downside → risk & opportunity management

### 2.2 Conclusions on ERM process model that might have helped

- a) Effective corporate governance, systems & controls
- b) Management awareness of business model & value chains
- c) Corporate culture assessment → regulatory review
- d) Scenario planning → stress testing extreme conditions
- e) Opportunity management of upside potential

### 2.3 Conclusions on timelines for unexpected events

- a) The future is largely unpredictable
- b) The future unfolds rapidly for adverse risk incidents
- c) The historical perspective is often post-rationalised
- d) Timelines are rarely within the management's control
- e) Timely service recovery requires agile management team

### 2.4 Conclusions on emerging risk from unexpected events

- a) The future is not what is used to be
- b) Black swans and fallacy of inductive logic
- c) The trap of false enthusiasm
- d) Emerging risks pro-activity versus re-activity
- e) Emerging risks with the benefit of hindsight

### 2.5 Conclusions on the lessons learned

- a) Lessons from internal risk incident reviews
- b) Lessons from historical reviews and post-mortems
- c) Lessons from management role play exercises
- d) Lessons from scenario planning → team decisions
- e) Lessons from survival training → team decisions

### 2.6 Conclusions on early warning indicators that might have helped

- a) Every early warning indicator should be actionable
- b) Real-time early warning indicator dashboards
- c) Solvency II 'Use Test' → in the driving seat
- d) Indicator dashboard as a tool for management action
- e) Less can be more ...

### 2.7 Conclusions on the corporate governance that might have helped

- a) Early warning indicators for the governing body
- b) Pictures and storyboards → the 'elevator' test
- c) Solvency II 'Use Test' → can not be delegated
- d) Not just a 'box ticking' exercise
- e) No excuses for not understanding the business model

### 3. Summary of Findings

This section provides the summary of findings in respect of the case studies.

#### CS 1 AIG (American International Group)

1. **The AIG story begins just short of 100 years ago in Asia. The history of AIG is impressive and was built to succeed.** AIG started life in Shanghai by a keen business man by the name of C.V. Star. Star had no knowledge of insurance; he did however have a keen eye for business opportunities. He grew AIG into a multinational insurer/broker, spanning multiple countries.
2. **AIG had experienced decent growth but that all changed when Hank Greenberg took the wheel.** He turned AIG into one of the largest companies in the world. Was this all good? Greenberg instilled a culture in AIG to succeed at any cost and he coined the rule of “15”, which was 15% growth in revenue, 15% growth in profit and 15% return on equity. The executive and all employees were encouraged to do what needed to be done to accomplish these figures. Greenberg in the process of growing AIG produced numerous millionaires. Those who succeeded were rewarded very well; this provided even more incentive to succeed!
3. **Greenberg, surrounded himself by a board that could help him.** He selected the board personally, not to provide governance for the company but to connect the company to other organisations that could help AIG to grow. Majority of the AIG board members were known by Greenberg personally prior to becoming a board member. The board was unable / unwilling to perform the duties that a board should take of assessing and questioning the CEO and senior management until it was too late.
4. **The AIG culture led to the first issue in the early 2000.** Two AIG executives were convicted when they colluded with Marsh & McLennan Companies in insurance price fixing. This was the first victim of AIG’s culture. But definitely not the last.
5. **In 2005 Eliot Spitzer New York State Attorney General accused Greenberg of adjusted accounting figures.** Greenberg adjusted the accounting figures slightly to achieve his rule of 15 to satisfy the analysts that AIG was still performing. He managed to do this via manipulating re-insurance contracts through closely held re-insurance companies.
6. **In September 2008, AIG was facing bankruptcy!** Since 2005, AIG had become the poster child for corporate governance, however this was unfortunately too late. Their UK division had started selling large amounts of CDSs to various counterparties. CDSs allowed AIG to collect the “insurance” premium as long as the insured company did not default. Normally this was a great way of collecting money without having to set aside capital to cover the risk as these contracts were derivatives and companies rarely defaulted in good times. In 2008, AIG had an estimate CDS exposure of \$441bn. AIG had treated CDSs as insurance in the sense they assumed that all companies are independent, which in reality is not true. There is a correlation of failure among companies. When the credit crisis unfolded and AIG was under threat of their credit rating being downgraded. It became apparent that they would not be able to cover the margins that would need to be paid to the CDS counterparties. The US government had to step in and bailout AIG to the tune of \$85 bn. This was only the first payment made by the US government.

#### CS 2 LTCM (Long Term Capital Management)

1. **Strategic thinking on business model could have prevented the disaster.** LTCM provides a reminder of the notion that there is no such thing as a risk-free arbitrage. Because the arbitrage positions they were exploiting were small, the fund had to be leveraged many times in order to produce meaningful investment returns. The problem with liquidity is that it is never there when it is really needed.
2. **Rigorous strategic analysis and understanding of the business model should precede development of technical business model systems and a resilient ERM implementation.**

LTCM was essentially a hedge fund founded in 1993 by John Meriwether. Its Board of Directors included Myron Scholes and Robert C. Merton, who shared the 1997 Nobel Memorial Prize in Economic Sciences. LTCM used complex mathematical models to inform relative value or convergence arbitrage trades e.g. exploiting small price differences between related securities such as U.S., Japanese and European government bonds. Trading strategies made returns in excess of 40% in 1995 and 1996. However LTCM's trading strategy relied upon aggressive leverage to boost absolute performance; e.g. trying to earn a 1.0% p.a. return on assets, leveraged 25:1, to yield a 25% p.a. return.

3. **Corporate culture and ethics need to be scrutinised to ensure that they deliver sufficient transparency and disclosure to stakeholders.** In LTCM's case this includes ensuring that the providers of credit were able to assess whether LTCM's aggressive arbitrage strategy was aligned with their own risk appetite. It also included the client investors who paid higher than average fees and were locked in to an initial 3-year relationship with LTCM. Transparency might have solicited intelligence to improve the robustness of the trading strategy and a different response at September 2<sup>nd</sup> 1998. By this point LTCM had just \$400 million in capital. With assets still over \$100 billion, this meant a leverage ratio over 250:1. LTCM's partners lost their own investment (\$1.9 billion), UBS lost \$700 million and other investors lost \$1.8 billion.
4. **LTCM failed because both its trading models and its risk management models failed to anticipate the extreme scenario and cycle of losses following Russia's default on its government debt.** This announcement led to a global review of credit and sovereign risks. Panicked investors sold Japanese and European bonds to buy U.S. treasury bonds. The profits that were supposed to occur as the value of these bonds converged became huge losses as the value of the bonds diverged. LTCM lost \$550 million on 21 August 1998 and by the end of August, the fund had lost \$1.85 billion in capital. With assets at \$1.26 billion leverage had increased to 55:1.
5. **Reliance on VaR based models should have been continually subject to scrutiny.** In the event the models did not foresee or provide for the extreme volatility and violence of the cycle of losses. Stress-testing also needs to be calibrated to the complexity and risk profile of the arbitrage. In this case it was inadequate e.g. the level of volatility of \$44 million anticipated was exceeded with LTCM experiencing \$100 million and above. LTCM's VaR at 10-days was \$320 million - actual losses in August 1998 were over \$1,000 million.

### CS 3 Union Carbide

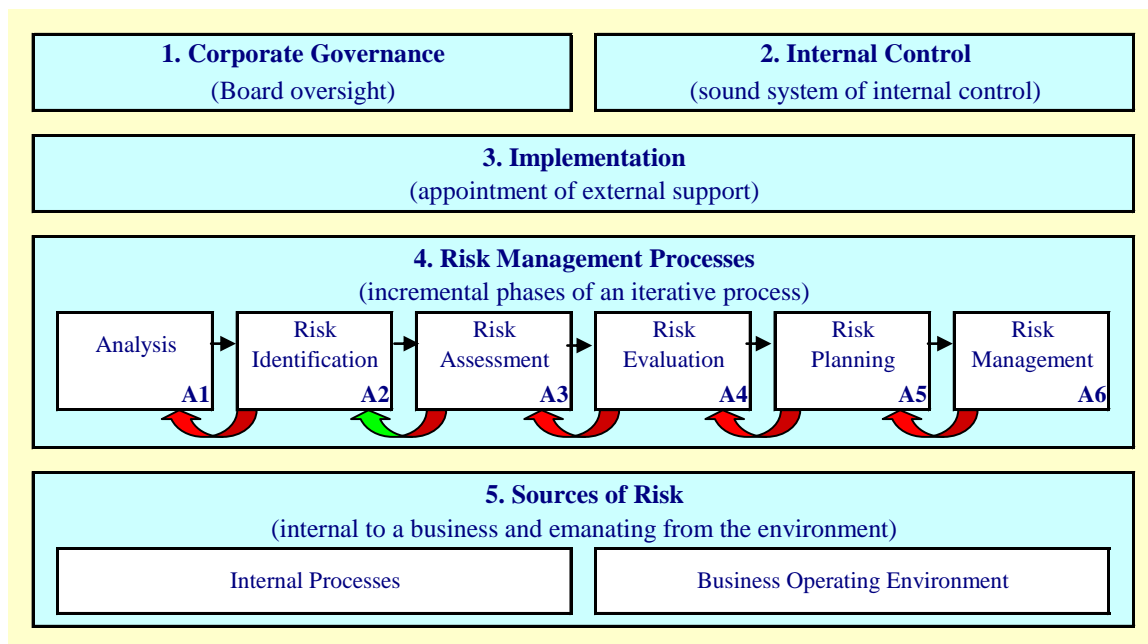
1. **The severity of this accident makes it the worst recorded within the chemical industry.** At midnight a relief valve on a storage tank containing highly toxic methyl isocyanate (MIC) lifted releasing a toxic plume of MIC gas which drifted onto nearby housing exposing 520,000 residents. A total of 521,000 residents were now exposed to the gas. Estimates vary on the death toll. The official immediate death toll was 2,259 and the government of Madhya Pradesh has confirmed a total of 3,787 deaths related to the gas release. Other government agencies estimate 15,000 deaths. Others estimate 8,000 to 10,000 died within 72 hours and 25,000 have since died from gas-related diseases. 40,000 more were permanently disabled, maimed, or rendered subject to numerous grave illnesses,
2. **Strategic thinking on the business model might have halted backward integration and inappropriate use of the plant.** If UCIL had analysed the proposed changes in its business model it might have decided not to proceed with backward integration – certainly without a robust ERM implementation – and have avoided the unacceptable level of risk exposure from attempting to maintain whilst decommissioning processes and safety equipment.
3. **Strategic thinking about the business model should identify the broadest view of the firm's value chain and apply the ERM framework across the value chain.** UCIL should have applied their entire value chain and have identified the risks attached to poor safety equipment

and standards; prioritising the provision and maintenance of specific plant (Flare system, Vent Gas System, operative Refrigeration with coolant) and identify areas where there was insufficient knowledge within the organization to manage any processes e.g. the risk and management of runaway reactions in a gas storage tank.

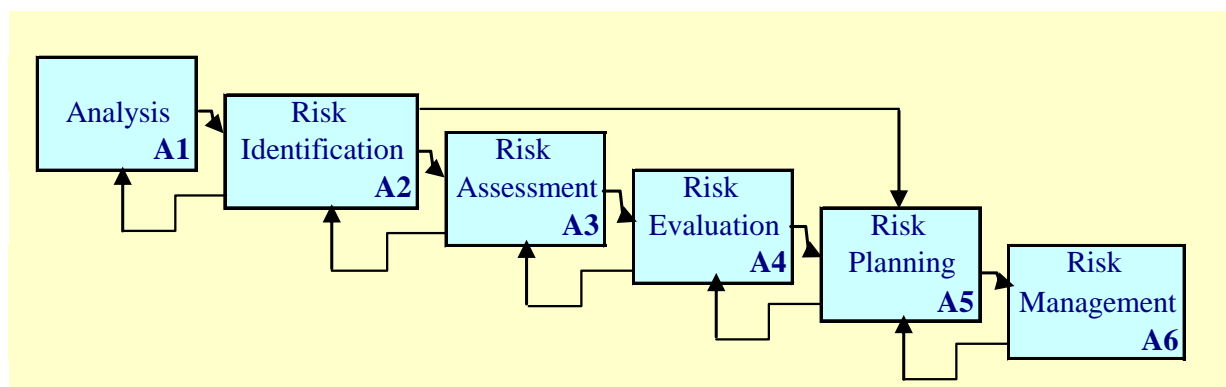
4. **Corporate culture needs to encourage and promote adherence to risk management.** UCIL, some suggest, is an example of double standards for multinational corporations operating in developing countries. This engendered a corporate culture within the subsidiary which led to degraded safety procedures and equipment.
5. **Corporate culture and ethics need to be scrutinized and addressed to ensure that they ensure sufficient transparency and disclosure to stakeholders.** The Bhopal facility was operating with safety equipment and procedures far inferior to its US sister plant. The local government wanted to retain UCIL as a large employer and, so, were reticent to impose safety and pollution controls despite their awareness of the poor standards at the plant. UCIL changed the plant's activities from a relatively lower-risk assembly of the final pesticide product to a more hazard and complex backward integration process involving processing of raw materials, production of intermediate compounds and assembly of the final Sevin pesticide. Full consultation on the evolving business model would have enabled the local authority to consider the implications for its (and its residents) risk appetite. The UCIL plant was operating outside of its zoning requirements for light industry in a residential area when the incident occurred.
6. **Effective internal controls and risk incident reporting should have alerted the management hierarchy to breaches in safety equipment and standards at the plant in critical equipment** e.g. VGS and the potential runaway reaction in the storage tank. Failings in technical measures at the plant included:
  - i) The flare system was a critical (UCIL did not recognise this) element of the plant's protection system had been out of commission for 3 months
  - ii) Hazards from runaway reactions in a chemical reactor are understood but an occurrence within a storage tank had received little research
  - iii) The ingress of water caused an exothermic reaction with the process fluid. The exact point of ingress is uncertain though poor modification/maintenance practices may have contributed.
  - iv) Decommissioning of the refrigeration system (a plant modification) contributed to the accident as without this system the temperature within the tank was higher than the design temperature of 0°C.
7. **The absence of risk planning and management can serve to increase the severity and impact of a major incident.** UCIL did not lead consultation with the local authority and public services to plan, scenario test and implement a plan to manage a major incident. When at around 1.00 AM, December 3, a safety valve gave way sending a plume of MIC gas into the early morning air, an estimated 3,800 people died immediately, many in the poor slum colony near the UCIL plant. No sirens were used to warn residents and the public services, including the hospitals, had no information on what the gas was or what its effects were.

## 4. ERM Framework Model

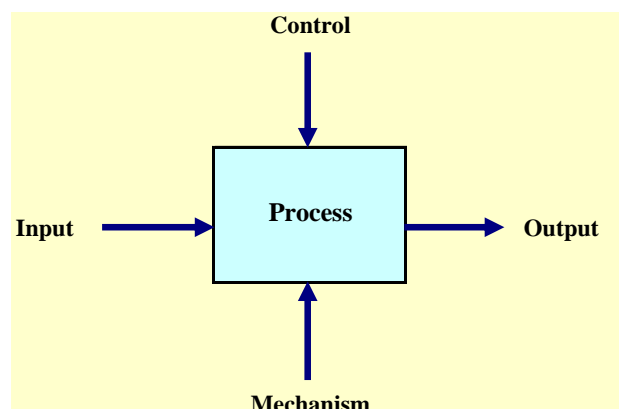
The ERM framework model which has five elements, as illustrated below.

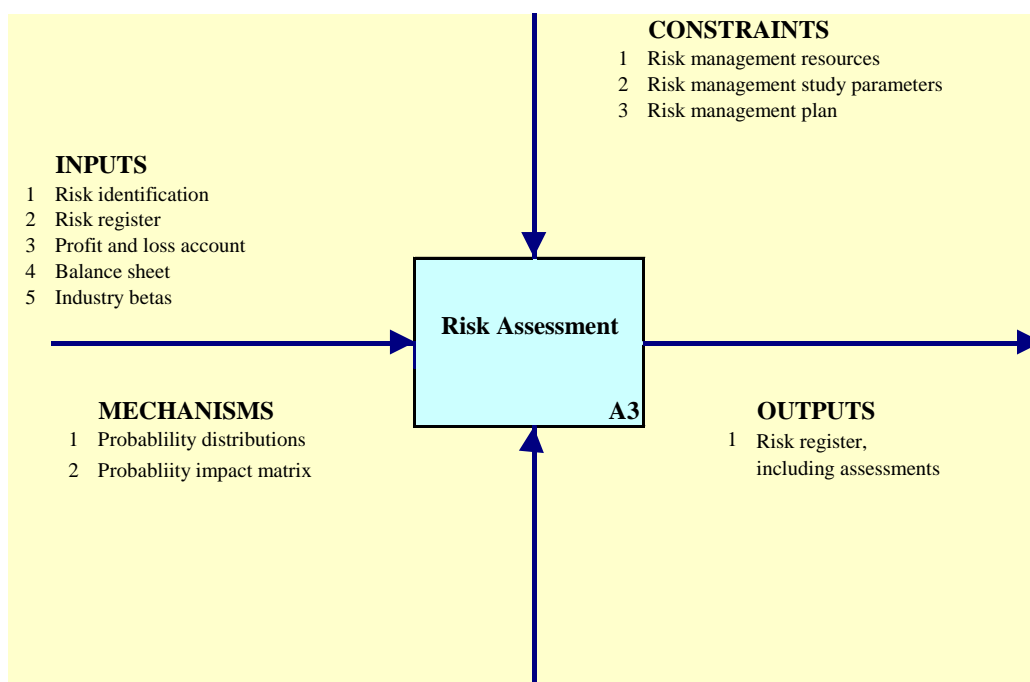
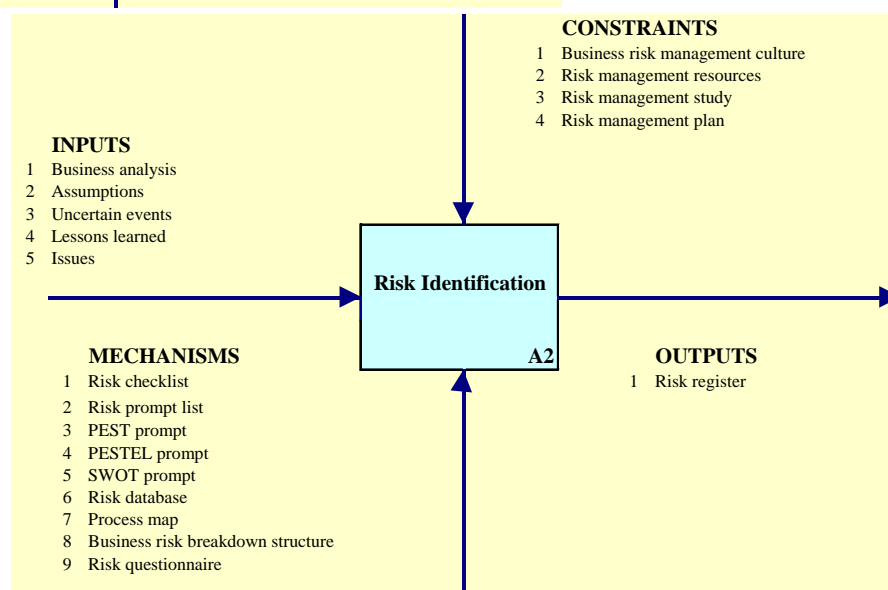
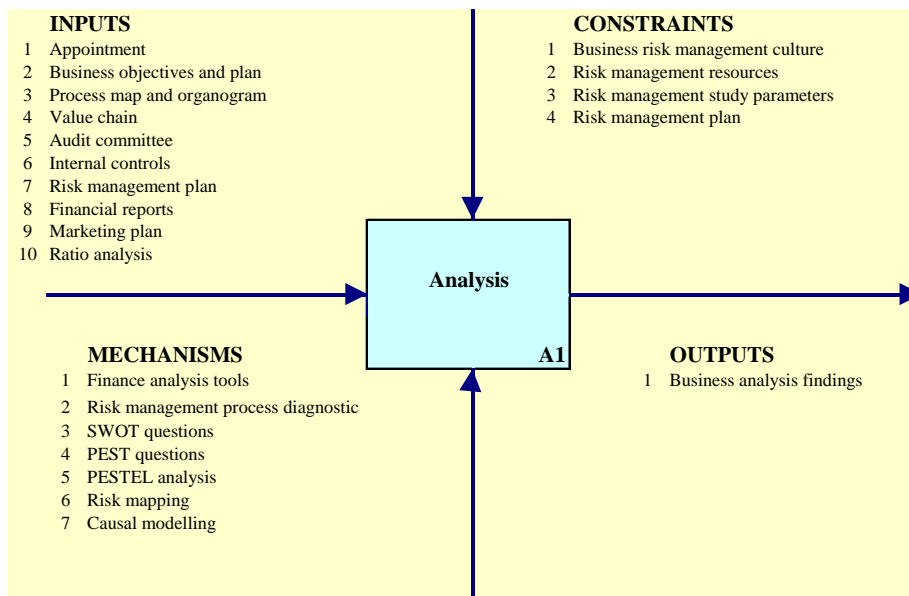


The risk management process is a 6-stage iterative process, with feedback control loops at each stage. These are necessary to develop a robust and resilient ERM framework that can be embedded within the organisation and serve to facilitate real-time risk response strategies.

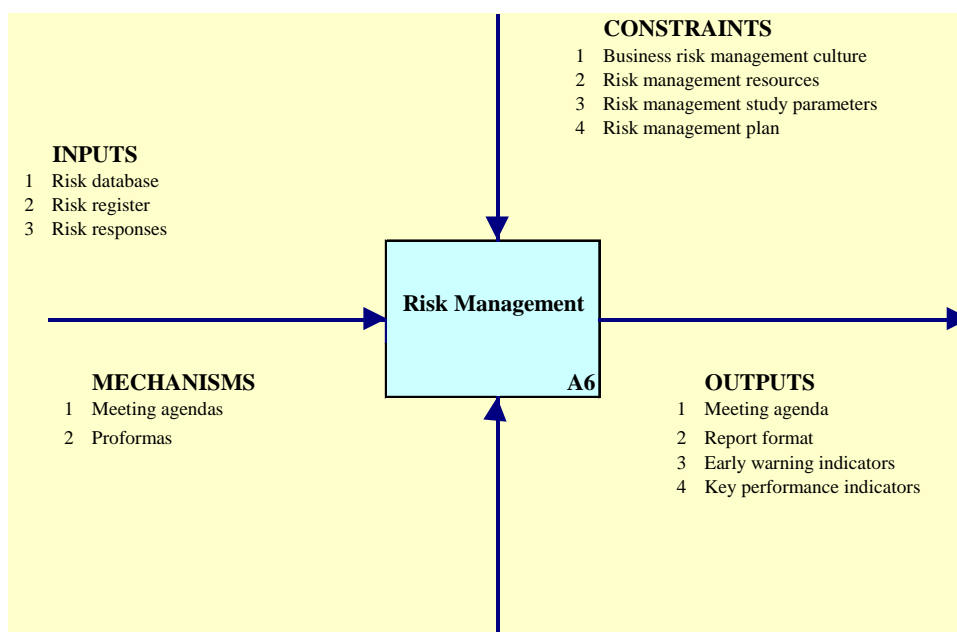
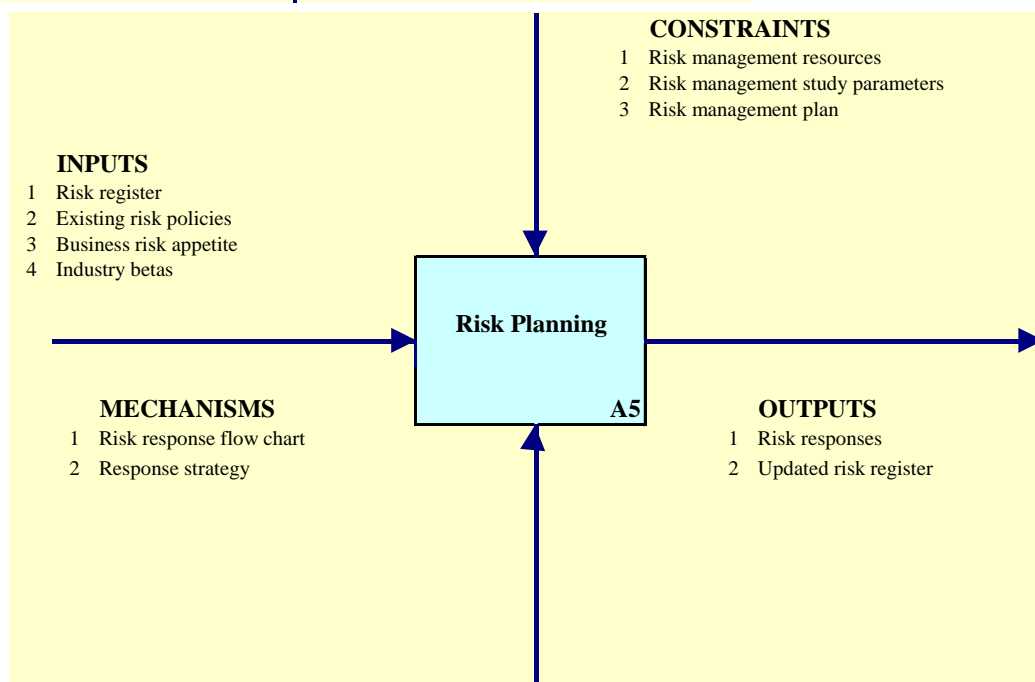
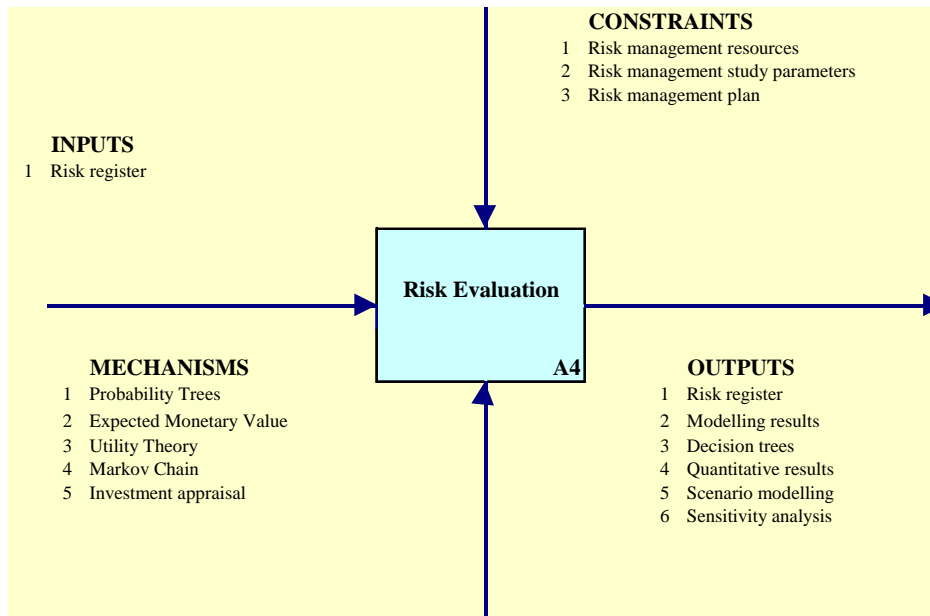


Each of the six risk management processes has inputs, outputs, control and mechanisms. The modes of data connectivity can be charted using the IDEF0 (Integration Definition for Function Modelling) process mapping technique.









## 5. Early Warning Indicators and Lessons Learned

### CS 1 AIG (American International Group)

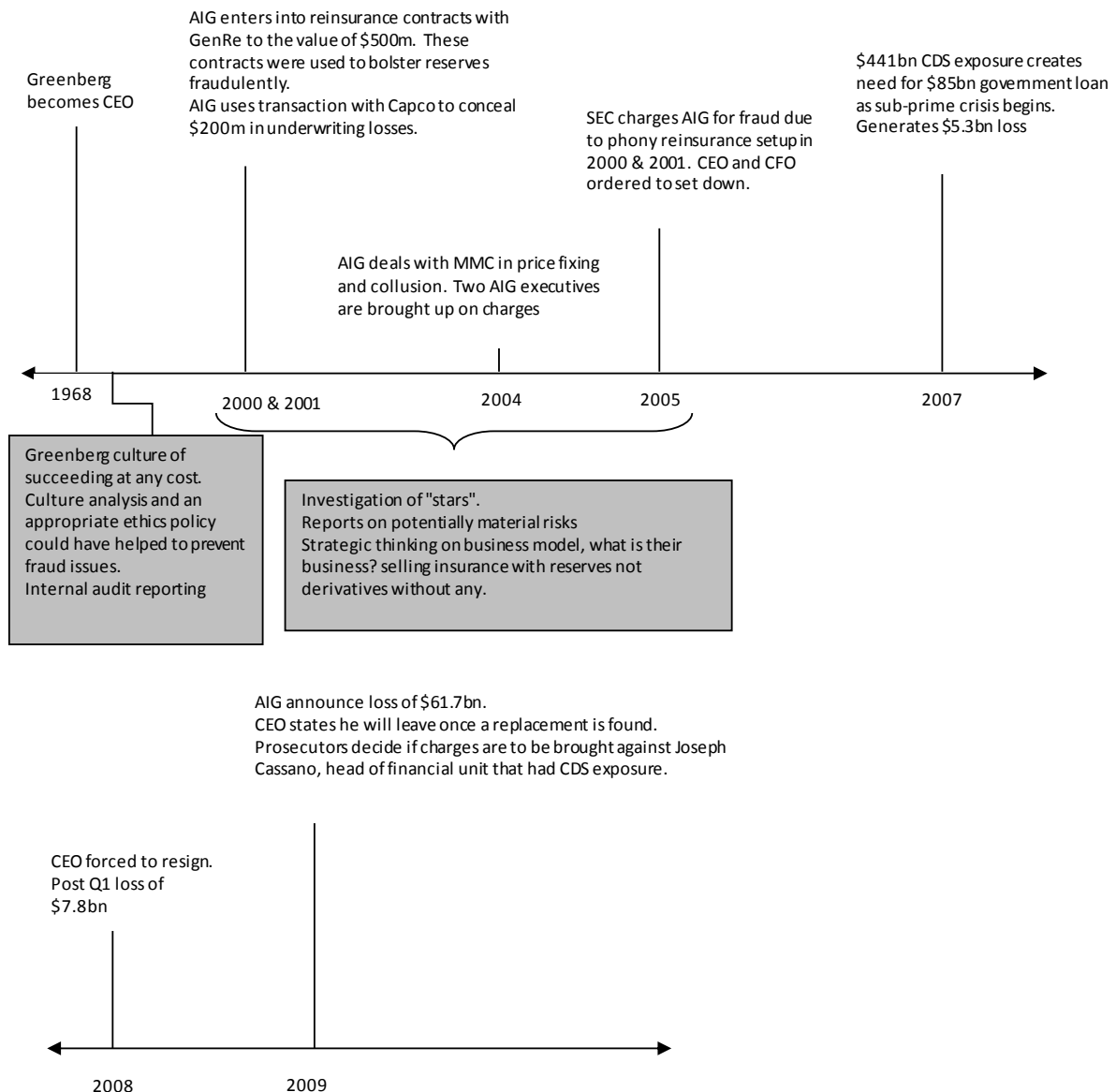
#### Early warning indicators that could have been useful:

1. Corporate culture analysis, monitoring and tracking
2. Corporate ERM governance policy and its implementation
3. Corporate ethics policy and its implementation
4. CRO reports on ERM implementation and issues
5. Strategic thinking on business model (value chain, process)
6. Investigation of 'stars' (e.g. business units, individuals)
7. Whistle blowing reports, analysis tracking
8. Internal audit reporting, training and culture
9. Risk incident reporting, training and culture
10. Management controls reports on all potentially material risks
11. Business model systems and internal controls

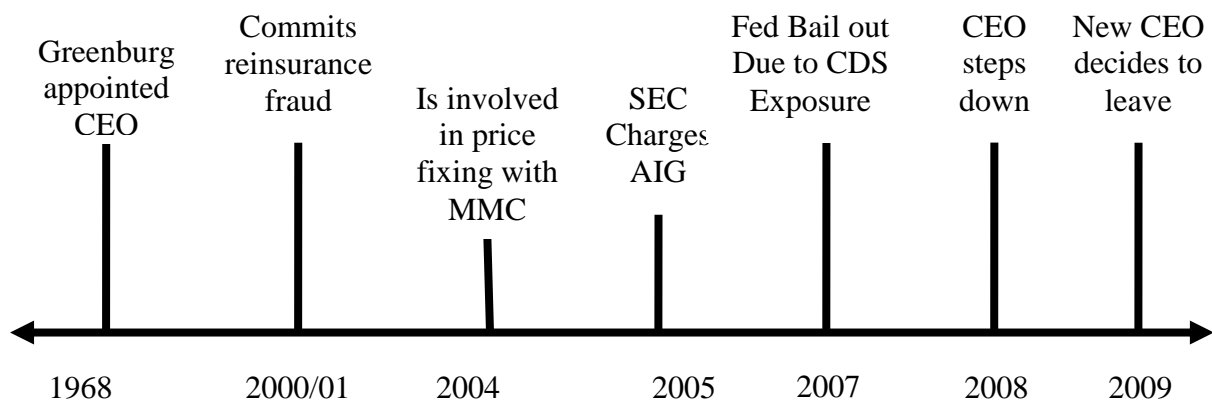
#### Lessons learned:

1. A controlled corporate culture could have prevented employees going too far. The culture at AIG was heavily focused on succeeding at any cost. Adjusting accounting figures and dealing illegally with insurance companies could have been avoided if the company employed an effective corporate ethics policy.
2. A single business unit can bring down a whole organisation. A chain is only as strong as its weakest link.
3. Always consider all risks regardless of how unlikely they are to occur. Remember the Black swan effect.
4. Effective management controls could have prevented the disaster.
5. Effective risk monitoring could have identified over exposure to certain risks.
6. With the benefit of hindsight, the organization had lost sight of its core business model, which was that of an insurance firm and not an investment bank.

## CS 1 AIG (American International Group) Timeline



## CS1 AIG - Summary Timeline



## CS 2 LTCM (Long Term Capital Management)

Early warning indicators that could have been useful:

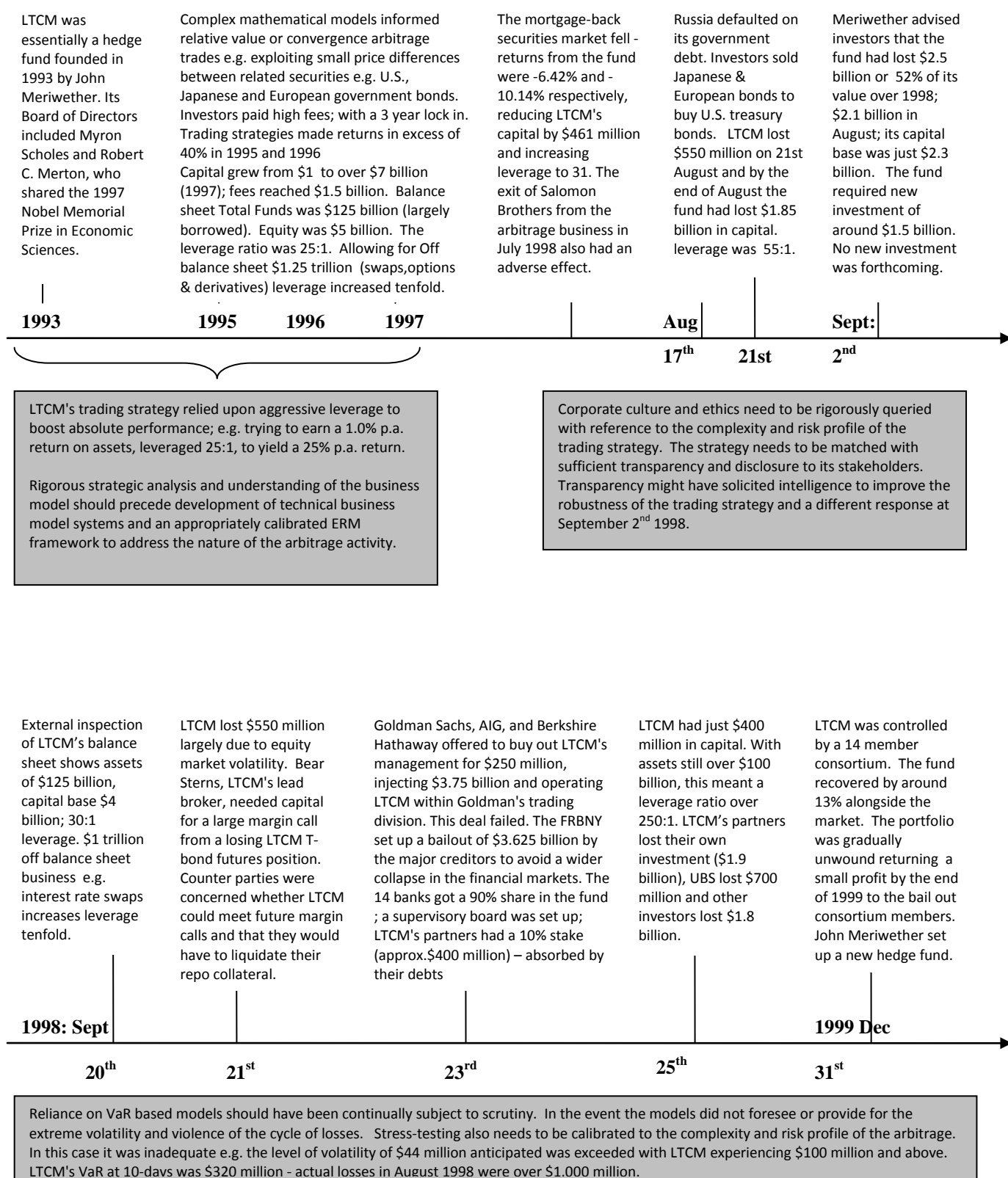
1. Corporate culture analysis, monitoring and tracking
2. Corporate ERM governance policy and its implementation
3. Corporate ethics policy and its implementation
4. Strategic thinking on business model (value chain, process)
5. Reputational loss exposure watch list (stakeholders, risks)
6. Investigation of 'stars' (e.g. business units, individuals)
7. Whistle blowing reports, analysis tracking
8. Internal audit reporting, training and culture
9. Risk incident reporting, training and culture
10. Management controls reports on all potentially material risks
11. Business model systems and internal controls

Lessons learned:

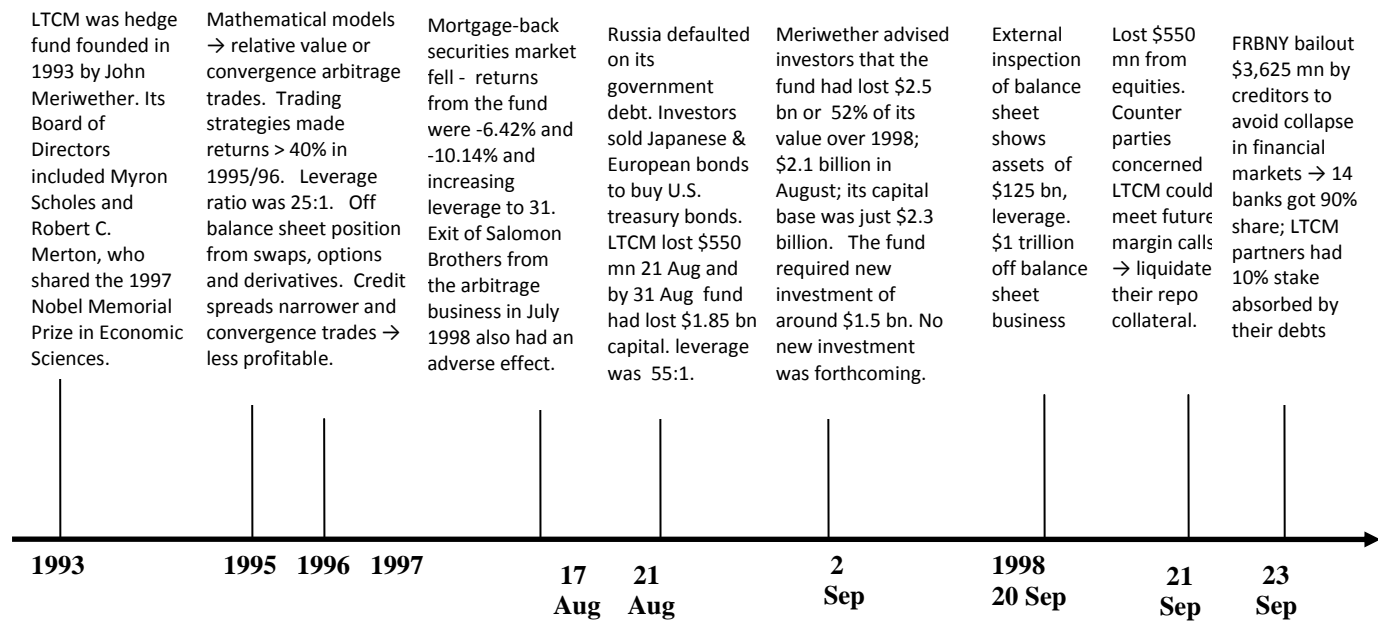
1. An organisation is only as strong as its weakest link.
2. Strategic thinking on business model could have prevented the disaster.
3. **VaR** has proved to be unreliable as a measure of risk over long time periods or under abnormal market conditions. The danger posed by exceptional market shocks can be captured only by means of supplemental methodologies.
4. The catastrophic losses were caused by systemic risks that LTCM had not foreseen in its business model. The failure of the hedge fund LTCM provides a classic example of model risk in the financial services industry.
5. LTCM provides a reminder of the notion that there is no such thing as a risk-free arbitrage. Because the arbitrage positions they were exploiting were small, the fund had to be leveraged many times in order to produce meaningful investment returns. The problem with liquidity is that it is never there when it is really needed.
6. As LTCM's capital base grew, they felt pressed to invest that capital and had run out of good bond-arbitrage bets and led it to undertake more aggressive trading strategies.
7. LTCM failed because both its trading models and its risk management models failed to anticipate the cycle of losses during an extreme crisis when volatilities rose dramatically, correlations between markets and instruments became closer to 1, and liquidity dried up.
8. Risk control at LTCM relied on a VaR model. However, LTCM's risk modelling was inappropriate and let it down.
9. The theories of Merton and Scholes took a public beating. In its annual reports, Merrill Lynch observed that mathematical risk models "may provide a greater sense of security than warranted; therefore, reliance on these models should be limited."
10. Effective management controls could have prevented the disaster.

## CS 2 LTCM (Long Term Capital Management)

## Timeline



## CS 2 LTCM Summary Timeline



### **CS 3 Union Carbide**

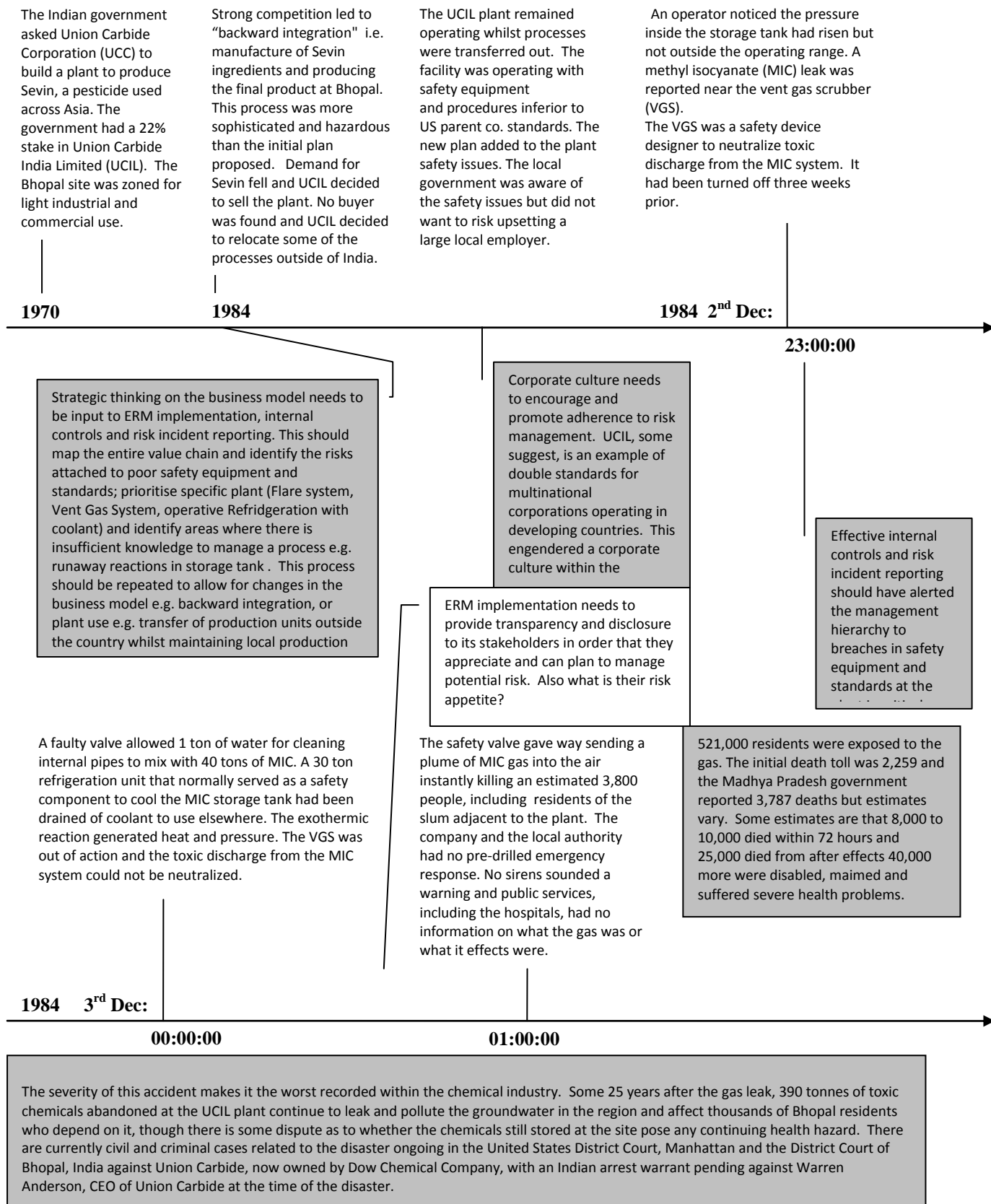
#### **Early warning indicators that could have been useful:**

1. Corporate culture analysis, monitoring and tracking
2. Corporate ERM governance policy and its implementation
3. Corporate ethics policy and its implementation
4. Strategic thinking on business model (value chain, process)
5. Reputational loss exposure watch list (stakeholders, risks)
6. Investigation of 'stars' (e.g. business units, individuals)
7. Whistle blowing reports, analysis tracking
8. Internal audit reporting, training and culture
9. Risk incident reporting, training and culture
10. Management controls reports on all potentially material risks
11. Business model systems and internal controls

#### **Lessons learned:**

1. An organisation is only as strong as its weakest link.
2. Reputational damage travels swiftly and is difficult to salvage.
3. Strategic thinking on business model could have prevented the disaster.
4. Corporate ethics policy based on best practice could have prevented the disaster.
5. The court proceedings revealed that management's cost cutting measures had effectively disabled safety procedures essential to prevent or alert employees of such disasters.
6. The severity and impact of the event were also made worse by the lack of safety standards and effective containment measures at the factory in Bhopal. The physical manifestations of these failures included unreliable monitoring equipment, inoperative safety equipment, unsuitable and inadequate gas suppression equipment and alarm systems which failed.
7. Although Dow Chemical has since taken over Union Carbide and denies responsibility for this disaster, the fact that it is much larger than what was once Union Carbide and its Union Carbide India Ltd. subsidiary, ongoing litigation continues to haunt the parent company.
8. Each operational business unit needs to recognise the likelihood and consequences of the risks that they face. A risk event at a small foreign subsidiary can bring down the entire enterprise - risk management at all levels should recognise that the potential for catastrophes always exists and that their impact can have both a large scale and a long-term impact.
9. We can never predict risks of this major consequence, but an enterprise should accept that the risk always remains of a catastrophic disaster. The foundation of a risk management strategy needs to be strong in its fundamentals, such as adherence to appropriate safety standards.
10. Effective management controls could have prevented the disaster.

### CS 3 Union Carbide Timeline





	Early Warning Indicators	AIG	LTCM	Union Carbide
1	Corporate culture analysis, monitoring and tracking	1	1	1
2	Corporate ERM governance policy and implementation	2	2	2
3	Corporate ethics policy and its implementation	3	3	3
4	CRO reports on ERM implementation progress and issues	4		
5	Strategic thinking on business model (value chain, process)	5	5	5
6	Reputational loss exposure watchlist (stakeholders, risks)		6	6
7	Investigation of 'stars' (e.g. business units, individuals)	7	7	
8	Whistle blowing reports, analysis tracking	8	8	8
9	Internal audit reporting, training, compliance culture	9	9	9
10	Risk incident reporting, training and culture	10	10	10
11	Management controls on all material risks	11	11	11
12	Business model systems and internal controls	12	12	12

# Appendix B

## Case Studies - Lessons Learned

Early Warning Indicators		CS 1 AIG	CS 2 LTCM	CS 3 Union Carbide
1	Corporate culture analysis, monitoring and tracking	A controlled corporate culture could have prevented employees going too far. The culture at AIG was heavily focused on succeeding at any cost;	LTCM was founded by a highly-talented group of individuals including John Meriwether (expert relative value trader from Salomon bond traders) and Myron Scholes and Robert C. Merton, who shared the 1997 Nobel Memorial Prize in Economic Sciences. The business culture of entrepreneurial, high performance supported by highly complex mathematical modelling was too volatile to sustain the business without other external and independent criticism and scrutiny.	Some commentators have argued that the way in which UC established and operated the Bhopal plant suggests evidence of a double standard for multinational corporations operating in developing countries. This engendered a corporate culture within the subsidiary which led to degraded safety procedures and equipment.
2	Corporate ERM governance policy and implementation	An effective system of corporate governance would have provided more scrutiny and mandated for robust, sustainable improvement in business performance, ensured accurate accounting and promoted more ethical behaviour at all levels of the corporate hierarchy. ERM should inform all stages of the corporate governance cycle (policy, strategy, governance and operations).	LTCM's trading strategy relied upon aggressive leverage to boost their absolute performance; for example, trying to earn a 1.0% p.a. return on assets, leveraged 25:1, to yield a 25% p.a. return. Corporate ERM governance and policy needs to be calibrated and matched to the nature of the financial trading and also to be applied to ensure that the business model is robust and sustainable.	Corporate governance and ERM have a similar focuses on strategic direction, corporate integration and motivation from the top management. Not only was poor risk management to blame for the incident, but so too was ineffective corporate governance. Companies with poor corporate governance practices often have poor risk management skills, and vice versa.
3	Corporate ethics policy and its implementation	Adjusting accounting figures and dealing illegally with insurance companies could have been avoided if the company employed an effective corporate ethics policy and monitored ethical standards.	LTCM's trading strategy was not accompanied by sufficient transparency and disclosure to its stakeholders until a crisis point had been passed.	Corporate ethics policy based on best practice could have prevented the disaster - it would have ensured the chemical processes were appropriate for the licence granted and the location; it would have ensured that safety standards and equipment were considered over-arching priorities and would have led to strong engagement with all local community stakeholders inc. management of public health and safety.
4	CRO reports on ERM implementation progress and issues	ERM must be embedded within the 'Executive Suite' and the corporate governance cycle. There is also evidence that the ERM process stage of 'business analysis' was flawed in that AIG management did not understand the CDS business model and were therefore ill-equipped to identify, assess, evaluate and plan to manage the risks associated with the products.		

Early Warning Indicators		CS 1 AIG	CS 2 LTCM	CS 3 Union Carbide
5	Strategic thinking on business model (value chain, process)	The organization had lost sight of its core business model, which was that of an insurance firm and not an investment bank. The development of the financial products division's CDS activities and those within the RBMS market involved moving away from AIG's core business model into a product market which was closer to selling options than insurance.	Strategic thinking on business model could have prevented the disaster. LTCM provides a reminder of the notion that there is no such thing as a risk-free arbitrage. Because the arbitrage positions they were exploiting were small, the fund had to be leveraged many times in order to produce meaningful investment returns. The problem with liquidity is that it is never there when it is really needed.	There seems to have been little analysis of how the plant's business model was changing and the implications for production processes at the plant, including safety equipment and standards. UCIL switched from less hazardous production of the final pesticide product to backward integration involving more sophisticated and hazardous processes to generate the ingredients for the pesticide. Next a decision was made to decommission units of the plant whilst continuing production and plan to relocate production to other sites
6	Reputational loss exposure watchlist (stakeholders, risks)		Reputational damage travels swiftly and is difficult to salvage. It was already too late for any remedial action to engage investors before Meriwether wrote to request \$1.5 billion of new money to stay in operation. At this stage the fund had lost \$2.5 billion or 52% of its value during 1998; \$2.1 billion in August and its capital base was just \$2.3 billion. LTCM's reputation was irrevocably damaged.	Reputational damage travels swiftly and is difficult to salvage. The reputational damage from the subsidiary UCIL has cross-generational effects - possibly justifiably it tarnished the reputation of Union Carbide, the parent company, and in turn has left a legacy for Dow Chemicals.
7	Investigation of 'stars' (e.g. business units, individuals)	A single business unit can bring down a whole organisation. A chain is only as strong as its weakest link. The reliance upon bid-rigging and CDS were at the same time capable of generating high-profits but were also high risk strategies where the cost of failure risked the core business operation.	LTCM's trading strategy relied upon aggressive leverage to boost their absolute performance; for example, trying to earn a 1.0% p.a. return on assets, leveraged 25:1, to yield a 25% p.a. return. LTCM's obtained over-generous lending credit and its strategy was not critically analysed by its lenders. Star performers are sometimes judged subject to the Tinkerbell Phenomenon (see Barings) when instead their high performance should be subject to more scrutiny and investigation to avoid fraud or hubris.	
8	Whistle blowing reports, analysis tracking	The dominant culture of 'generating growth and making the numbers' may have disincentivised and suppressed critical reports. Whistle-blowing should be channelled by the organisation as it can prompt effective scrutiny and investigation of its business conduct and performance.		UCIL did not appear to take action following reported incidents and there would appear to have been little encouragement for staff to proactively identify issues. The local government were also concerned that unfortunate news reports might expedite UCIL's closure of the local plant and cause unemployment.

	Early Warning Indicators	CS 1	CS 2	CS 3
		AIG	LTCM	Union Carbide
9	Internal audit reporting, training, compliance culture	The functions of internal audit and compliance were ironically described in this quote by Robert Graham, Senior VP, GenRe: "their [AIG's] organizational approach to compliance issues has always been pay the speeding ticket..." (recording, 7 March 2001). Studies and comment on AIG indicate that the CEO and Board of Directors created the dominant culture of aggressive growth which saw these areas as a constraint.		An organisation is only as strong as its weakest link. The evidence of failings in technical measures at the plant included critical equipment which had been out of commission for 3 months, poor modification and maintenance practices and the decommissioning of the refrigeration system which was a major contributor to the accident as without this system the temperature within the gas tank was higher than the design temperature of 0°C.
10	Risk incident reporting, training and culture	This activity relies upon an understanding of a product/service, a business process and its linkages to other processes. The outputs also need to be seen to be valued and utilised by management and the 'Executive Suite'.		A day prior to the gas leak an operator noticed the pressure inside the storage tank was higher than normal although not outside the working pressure of the tank. A methyl isocyanate (MIC) leak was reported near the vent gas scrubber (VGS). The Vent Gas Scrubber, a safety device designed to neutralize toxic discharge from the MIC system, had been turned off three weeks prior. No action was taken this is one of a series of equipment failures which led to the accident.
11	Management controls on all material risks	Always consider all risks regardless of how unlikely they are to occur. Effective management controls could have prevented the disaster. The downside of bid-rigging e.g. reputational damage, loss of major corporate clients, legal resources and costs, and the risks attached to the selling of CDS and RMBS activity marketing of CDSs e.g. 80% government ownership and the divestment of profitable non US operations such as the Asian, AIA unit.	LTCM failed because both its trading models and its risk management models failed to anticipate the cycle of losses during an extreme crisis when volatilities rose dramatically, correlations between markets and instruments became closer to 1, and liquidity dried up	Effective management controls could have prevented the disaster. Each operational business unit needs to recognise the likelihood and consequences of the risks that they face. A risk event at a small foreign subsidiary can bring down the entire enterprise - risk management at all levels should recognise that the potential for catastrophes always exists and that their impact can have both a large scale and a long-term impact.
12	Business model systems and internal controls	The financial products unit reported a very low "capital markets trading" value-at-risk (VaR) at December 2007 for the financial AIG stated that the VaR calculation reflects interest rate, equity, commodity and foreign exchange risks. But it excluded, "Credit-related factors, such as credit spreads or credit default, are not included in AIGFP's VaR calculation." (AIG 2007 Form 10-K, p. 124.) This suggests possible weaknesses concerning AIG's fundamental understanding of the CDS business and its risk modelling.	VaR was unreliable measure of risk over long time periods or under abnormal market conditions. Dangers from exceptional market shocks can be captured only by means of supplemental methodologies. CAT losses were caused by systemic risks that LTCM had not foreseen in its business model. Its failure is classic example of model risk in the financial services industry. LTCM failed because both its trading models and its RM models failed to anticipate the cycle of losses during an extreme crisis when volatilities rose dramatically, correlations between markets and instruments became closer to 1, and liquidity dried up.	We can never predict risks of this major consequence, but an enterprise should accept that the risk always remains of a catastrophic disaster. The foundation of a risk management strategy needs to be strong in its fundamentals, such as adherence to appropriate safety standards.

# Appendix C

## Case Studies – Literature Review

### Case Studies

- C.1**     AIG (American International Group)
- C.2**     LTCM (Long Term Capital Management)
- C.3**     Union Carbide

## Appendix C.1

### CS 1 AIG (American International Group)

<http://www.sec.gov/news/press/2006-19.htm>

#### **AIG to Pay \$800 Million to Settle Securities Fraud Charges by SEC**

##### ***Over \$1.6 Billion to be Paid to Resolve Federal and New York State Actions***

*Washington, D.C., Feb. 9, 2006* — The Securities and Exchange Commission announced today the filing and settlement of charges that American International Group, Inc. (AIG) committed securities fraud. The settlement is part of a global resolution of federal and state actions under which AIG will pay in excess of \$1.6 billion to resolve claims related to improper accounting, bid rigging and practices involving workers' compensation funds.

The Commission announced the settlement in coordination with the Office of the New York State Attorney General, the Superintendent of Insurance of the State of New York and the United States Department of Justice, which have also reached settlements with AIG. The settlement with the Commission provides that AIG will pay \$800 million, consisting of disgorgement of \$700 million and a penalty of \$100 million, and undertake corporate reforms designed to prevent similar misconduct from occurring. The penalty amount takes into account AIG's substantial cooperation during the Commission's investigation.

Linda Chatman Thomsen, Director of the Commission's Division of Enforcement, said, "This important settlement arose out of our industry wide investigation into the misuse of finite insurance and reinsurance. While this settlement concludes our investigation of AIG, our investigation continues with respect to others who may have participated in AIG's securities laws violations."

Mark K. Schonfeld, Director of the Commission's Northeast Regional Office said, "In this settlement, we have sought to balance AIG's historical misconduct – which was substantial – with its new approach to compliance and cooperation with regulators and law enforcement. The Commission's settlement will also deliver meaningful monetary relief to those harmed by AIG's prior conduct."

The Commission's complaint, filed today in federal court in Manhattan, alleges that AIG's reinsurance transactions with General Re Corporation (Gen Re) were designed to inflate falsely AIG's loss reserves by \$500 million in order to quell analyst criticism that AIG's reserves had been declining. The complaint also identifies a number of other transactions in which AIG materially misstated its financial results through sham transactions and entities created for the purpose of misleading the investing public.

Specifically, the Commission's complaint alleges that in December 2000 and March 2001, AIG entered into two sham reinsurance transactions with Gen Re that had no economic substance but were designed to allow AIG to improperly add a total of \$500 million in phony loss reserves to its balance sheet in the fourth quarter of 2000 and the first quarter of 2001. The transactions were initiated by AIG to quell analysts' criticism of AIG for a prior reduction of the reserves. In addition, the complaint alleges that in 2000, AIG engaged in a transaction with Capco Reinsurance Company, Ltd. (Capco) to conceal approximately \$200 million in underwriting losses in its general insurance business by improperly converting them to capital (or investment) losses to make those losses less embarrassing to AIG. The complaint further alleges that in 1991, AIG established Union Excess Reinsurance Company Ltd. (Union Excess), an offshore reinsurer, to which it ultimately ceded approximately 50 reinsurance contracts for its own benefit. Although AIG controlled Union Excess, it improperly failed to consolidate Union Excess's financial results with its own, and in fact took steps to conceal its control over Union Excess from its auditors and regulators. As a result of these actions and other accounting improprieties, AIG fraudulently improved its financial results.

Shortly after federal and state regulators contacted AIG about the Gen Re transaction, AIG commenced an internal investigation that eventually led to a restatement of its prior accounting for approximately 66 transactions or items. In its restatement, AIG admitted not only that its accounting for certain transactions had been improper, but also that the purpose behind some of those transactions

was to improve financial results that AIG believed to be important to the market. AIG also conceded in its restatement that certain transactions may have “involved documentation that did not accurately reflect the true nature of the arrangements ... [and] misrepresentations to members of management, regulators and AIG’s independent auditors.” Furthermore, the restatement summarized several transactions that AIG accounted for improperly, including, among others, two sham reinsurance transactions with Gen Re and certain transactions involving Capco and Union Excess. As a result of the restatement, AIG reduced its shareholders’ equity at December 31, 2004 by approximately \$2.26 billion or 2.7%.

In the Commission’s settlement, AIG has agreed, without admitting or denying the allegations of the complaint, to the entry of a Court order enjoining it from violating the antifraud, books and records, internal controls, and periodic reporting provisions of the federal securities laws. The order also requires that AIG pay a civil penalty of \$100 million and disgorge ill-gotten gains of \$700 million, all of which the Commission will seek to distribute to injured investors. AIG has also agreed to certain undertakings designed to assure the Commission that future transactions will be properly accounted for and that senior AIG officers and executives receive adequate training concerning their obligations under the federal securities laws.

AIG’s remedial measures include, among other things, (i) appointing a new Chief Executive Officer and Chief Financial Officer; (ii) putting forth a statement of tone and philosophy committed to achieving transparency and clear communication with all stakeholders through effective corporate governance, a strong control environment, high ethical standards and financial reporting integrity; (iii) establishing a Regulatory, Compliance and Legal Committee to provide oversight of AIG’s compliance with applicable laws and regulations; and (iv) enhancing its “Code of Conduct” for employees and mandating that all employees complete special formal ethics training. This proposed settlement is subject to court approval.

The settlement takes into consideration AIG’s cooperation during the investigation and its remediation efforts in response to material weaknesses identified by its internal review. From the outset of the investigation, AIG gave complete cooperation to the investigation by the Commission’s staff. Among other things, AIG (i) promptly provided information regarding any relevant facts and documents uncovered in its internal review; (ii) provided the staff with regular updates on the status of the internal review; and (iii) sent a clear message to its employees that they should cooperate in the staff’s investigation by terminating those employees, including members of AIG’s former senior management, who chose not to cooperate in the staff’s investigation.

The Commission acknowledges the assistance and cooperation of the Office of the New York State Attorney General, the Superintendent of Insurance of the State of New York, the U.S. Department of Justice, Fraud Section, Criminal Division, and the U.S. Postal Inspection Service

[http://www.usatoday.com/money/industries/insurance/2004-10-15-spitzer-insurance\\_x.htm](http://www.usatoday.com/money/industries/insurance/2004-10-15-spitzer-insurance_x.htm)

### **Marsh & McLennan accused of price fixing, collusion**

By Thor Valdmanis, Adam Shell and Elliot Blair Smith, USA TODAY

NEW YORK — The nation's biggest insurers are mired in a brewing scandal that many executives fear could shake the industry to its core.

After months of complaints from industry watchdogs, New York Attorney General Eliot Spitzer launched the first salvo against alleged conflicts of interest Thursday, charging the insurance brokerage arm of Marsh & McLennan (MMC) with price fixing and collusion. A damning civil suit accuses Marsh of steering clients to favoured insurers and working with major insurers to rig the bidding process for property-casualty insurance coverage. The lawsuit says the victims ranged from large companies to school districts to individuals. In addition to the civil complaint, Spitzer announced two guilty pleas on criminal charges against two executives at American International Group (AIG). They are cooperating with the investigation, which could ensnare other insurance giants and executives.

"This investigation is catching like wildfire. These charges radiate out to other insurance companies and brokerages," Spitzer said in an interview. "The entire business model of this industry seems to be predicated on the type of egregious behaviour outlined in our complaint."

Some of the nation's largest insurance companies are accused in Spitzer's suit of steering contracts and bid rigging, including AIG, ACE (ACE), The Hartford (HIG) and Munich American Risk Partners. Other insurance companies are being investigated in a scheme that Spitzer said raises everyone's insurance premiums. Wall Street reacted harshly Thursday, wiping out more than \$26 billion in market value of the four companies traded in the USA. Munich is a subsidiary of Germany's Munich Re. Marsh and others named in the complaint said they are cooperating with Spitzer. Some industry analysts were quick to point out a family connection to Spitzer's probe. Business legend Maurice "Hank" Greenberg runs AIG, while his sons Jeff and Evan are CEOs at Marsh & McLennan and ACE, respectively. Spitzer said he has no evidence of any family ties to the scandal. Most industry watchers expect Spitzer's investigation to trigger sweeping reform as well as massive lawsuits.

Plaintiffs lawyer John Stoia, who brought civil lawsuits against Marsh & McLennan, Aon and the Willis Group in California and New York — alleging many of the same unfair practices prior to the New York attorney general's complaint — said in a statement that the companies had falsely "represented themselves as honest brokers offering their customers the best coverage from many insurers at the lowest cost, (but) they steered them instead to a few companies that gave them kickbacks and other payoffs."

Spitzer said his six-month investigation was sparked by an anonymous letter and the Washington Legal Foundation, a conservative public policy think tank that in February urged regulators in New York and California to probe so-called contingent commissions.

The industry trade group, the Council of Insurance Agents & Brokers, responded by saying it believed the arrangements, which are at the heart of the Spitzer allegations of kickbacks and conflicts of interest, were being adequately disclosed. Last month, Marsh disclosed some contingent commission-related data and its code of conduct. At the time, Marsh CFO Sandra Wijnberg said, "What we found is that the bigger clients already were pretty knowledgeable, and they haven't been particularly agitated about this."

That did little to satisfy Spitzer, who noted that Marsh collected \$800 million in contingent commissions in 2003 alone, more than half of its \$1.5 billion net income. Spitzer said that when he first contacted Marsh executives, they said, "Don't waste your time." Some critics say the ambitious New York attorney general, who is eyeing the state governor's mansion, may be over-reaching. Steve Smith, a partner at law firm Bryan Cave, has represented Marsh & McLennan in professional liability cases. "Many of the allegations in the complaint are not very specific," Smith says. "The A.G. will have to come forward with evidence to support his case." But other industry veterans say the lawsuit is warranted. "Spitzer's right on this one," says former AIG executive Marc Vivori. "They were not acting in the best interests of their clients. At a minimum, they had an obligation to disclose any contingent commission arrangement with their clients."

In May, Advisen, an insurance industry research company, found that 69% of the 330 risk managers it canvassed in an anonymous survey considered contingent commission arrangements a conflict of interest. And 82% said broker disclosure of contingent commissions "was less than fully adequate." Advisen Executive Vice President Dave Bradford, who conducted the survey, said, "Whatever the outcome of the New York case, the enormous pressure this is going to exude on the industry is going to force it to abandon the contingent commission business or restructure it in a significant way." Bradford adds, "My feeling is this is the first domino. The other state attorneys general and insurance commissioners are pretty likely to follow suit." Unlike the securities industry, the insurance industry is not federally regulated.

Whether the arrangements constitute a conflict of interest is a question that may have to be litigated. But insurers may be legally vulnerable if they have not disclosed the arrangements. In 1998, the New York State Insurance Department issued a policy letter requiring that all compensation between brokers and insurers be disclosed to buyers "prior to the purchase so as to enable (them) to understand



the costs of the coverage and the motivation of their broker in placing the business." In that same letter, the department said undisclosed compensation "is sufficient to create the perception that brokers are conflicted in their loyalties." In the Advisen survey, 56% responded that their broker didn't disclose the agreements.

Thursday's dramatic action is Spitzer's latest crackdown on unethical and criminal behaviour in the power corridors of Corporate America, after tackling tainted Wall Street research and fraud in the mutual fund industry. "It makes you wonder what the other attorney generals and industry regulators are doing to earn their paychecks," says Columbia University law professor John Coffee. "Spitzer has had an extraordinary rate of success in uncovering smoking guns." Spitzer said the victims in this latest scandal were mostly large corporations, but also included small and midsize businesses, municipal governments, school districts and individuals who were deceived into buying property and casualty coverage that may have cost more than it should have.

For Marsh, the allegations are potentially disastrous. All three of its major businesses are now tainted by scandal. The company's Putnam mutual fund arm was charged last year in Spitzer's mutual fund crackdown. Its Mercer consulting unit was criticized for executive compensation work that helped to justify the \$140 million salary of former New York Stock Exchange chairman Richard Grasso. "We believe that the continuing stream of negative news continues to serve as an overhang for (Marsh & McLennan)," J.P. Morgan insurance industry analyst David Sheusi wrote in a recent report. "Each of its business segments is under significant accounting, regulatory and legal scrutiny."

Thursday's news sent Marsh shares tumbling 24%, which wiped out \$5.9 billion in market value. Although AIG shares fell only 10%, that erased \$18.2 billion in market value because of its many shares outstanding. AIG is in a tricky position. Karen Radke, 42, a senior vice president of an AIG division, and co-worker Jean-Baptist Tateossian pleaded guilty Thursday to felony charges of scheming to defraud in state Supreme Court in Manhattan. They face up to four years in prison, but their sentence will depend on how much more they cooperate, Spitzer said.

Spitzer relied on internal e-mail and memos, in which, he said, insurance executives openly discussed actions that were aimed at maximizing Marsh's revenue and insurance companies' revenue, without regard to clients, who ranged from distilled-spirits maker Fortune Brands to a public school district in Greenville County, S.C. Marsh stressed to insurance companies that it would more aggressively sell the policies of those companies who paid the biggest contingent commissions, the complaint states. Marsh employees who "moved" clients to insurers who paid big commissions were also "rewarded" with pay increases, Spitzer says.

In February 2002, one managing director at Marsh informed nine co-workers that "some (contingent commission agreements) are better than others." He added, "I will give you clear direction on who (we) are steering business to and ... who we are steering business from." Bid manipulation also appears to be widespread. In his complaint, Spitzer outlined this scheme involving AIG: When a policy with incumbent carrier AIG was up for renewal, Marsh took the following steps to assure that AIG would win back the business. First, Marsh provided AIG with a "target premium and the policy terms" for the quote. If AIG agreed to the quote, it got to keep the business, regardless of whether it could have quoted a lower premium. But for the deceit to succeed, Marsh had to let other carriers know what the winning quote was and ask them to submit a so-called backup quote, or "B Quote," that was higher, thus putting them out of contention for the business. Spitzer said the cooperation was nothing more than an "entrance fee" for future business.

In December 2002, the lawsuit says, ACE quoted \$990,000 for the excess casualty business of Fortune Brands. But the insurer later revised its bid higher to \$1.1 million. An e-mail from an ACE assistant vice president to ACE's vice president of underwriting explained the revision this way: "Original quote \$990,000. ... We were more competitive than AIG in price and terms. MMGB (Marsh McLennan Global Broking) requested we increase the premium to \$1.1M to be less competitive, so AIG does not lose the business," the complaint alleges.

Clients who were allegedly abused are not amused. "We're already investigating the matter," said Fortune Brands Vice President C. Clarkson Hine.

## **Prosecutors to decide whether to charge former AIG executive**

By Greg Farrell in New York

Published: September 12 2009 03:00 | Last updated: September 12 2009 03:00

Federal prosecutors are close to deciding whether to bring criminal charges against former AIG executive Joseph Cassano over the adequacy of disclosures about the value of credit default swaps issued by AIG's financial products division, say people familiar with the matter.

A spokesman for the US attorney in Brooklyn, New York, which is working on the case with the Justice Department in Washington DC, declined to comment, as did AIG.

If charges are filed, Mr Cassano would be the most senior banker accused in the US of wrongdoing related to last year's financial crisis.

The possibility of criminal charges was first reported in the Wall Street Journal.

According to a person familiar with the matter, prosecutors are focusing on statements made by Mr Cassano on a conference call with investors in December 2007.

In that call, Mr Cassano assured investors of the overall health of AIG's CDS portfolio.

However, he also said that his division's numbers were unaudited, and in a state of flux.

F. Joseph Warin, Mr Cassano's attorney, did not return a call for comment.

Last year, federal prosecutors in Brooklyn accused two former Bear Stearns employees, Ralph Cioffi and Matthew Tannin, of misleading investors about the financial health of two hedge funds that had significant exposures to sub-prime mortgages. The case against the two men is scheduled to go to trial next month.

As head of AIG's financial products division, Mr Cassano championed the sale of credit default swaps (CDS), which insured banks and investors against counterparty risk on hundreds of billions of dollars of bond investments.

In the years leading up to the financial crisis, CDS sales generated billions in profits for AIG, with what seemed to be relatively low risk.

When the sub-prime mortgage crisis struck the US in 2007, the value of many bonds backed by credit default swaps began to sink.

In early 2008, AIG acknowledged that its auditor had discovered "material weaknesses" in the way the insurance company accounted for its CDS holdings.

Using a different valuation method, AIG posted a loss of \$5.3bn for the fourth quarter of 2007, led by \$11bn in CDS losses.

After the collapse of Lehman Brothers one year ago, AIG's debt was downgraded by rating agencies, forcing it to put up billions of dollars it didn't have.

Concerned about the effect on the financial system that an AIG collapse would have on top of Lehman's failure, US regulators stepped in, pumping \$85bn into the company and also acquiring a majority stake in it.

As AIG's financial condition worsened, the government stepped up again and again, turning the once respected insurance company into a poster child for the excesses of the financial crisis.

### ***AIG forms keystone of financial system***

By Andrea Felsted and Kate Burgess in London. Published: September 16 2008 03:00 | Last updated: September 16 2008 03:00

American International Group was until recently the world's biggest insurer by market capitalisation, but it remains a key part of the US financial system.

"Not every insurance group could approach the Federal Reserve and ask for liquidity. It is the sheer size of AIG. It is colossal. It is definitely the equivalent to, say, Citigroup in the insurance world," says one person who knows its business well. "It is much more than an insurance company. They are in so many different financial transactions, some of which got them into trouble," says Ronald Shelp, who has written a book on AIG. Allowing AIG to fail would be like "taking the foundation stone out of a skyscraper", said Trevor Jones, managing director of consultants Insurance Security Services.

AIG is the biggest provider of commercial insurance in the US, one of the biggest writers of life assurance there, and the biggest provider of fixed annuities, a popular retirement savings product. It has enormous global operations. But it also has a financial products division that acted like an investment bank and has been at the heart of the current problems.

"The key difference here is they were running at AIG a mini investment bank, a mini trading operation," says the person familiar with AIG's business. It is a counterparty in a large number of swap and hedging transactions. It wrote credit default swaps, which insure against corporate default, some protecting against losses on collateralised debt obligations, which sparked the problems. AIG has total derivative exposures of \$441bn, according to RBS.

John Coffee, law professor at Columbia University, says that if AIG were to fail, a number of other institutions that thought they were insured against default would find themselves "naked and exposed".

Bank of America chief executive Ken Lewis told CNBC: "I don't know of a major bank that doesn't have some significant exposure to AIG. That would be a much bigger problem than most that we've looked at."

Mr Jones says the picture is also complicated because AIG "lost the one guy who knew how it worked, which is Hank Greenberg". Mr Greenberg was ousted as chairman and chief executive in 2005 after 40 years with the group.

But while the focus has been on financial products, observers point out AIG's businesses generating sales and profits, such as general and life insurance.

There are questions about what would happen to AIG policyholders in the event of a failure. But investors and analysts were doubtful yesterday AIG would be allowed to collapse, hence an agreement with New York state to free up \$20bn.

The head of equities at one of the UK's biggest investors said the repercussions should AIG fail were "potentially bigger than Lehman's. It is too big to go bust. If it does, we will be eating baked beans out of a tin."

Despite the turmoil, the impact on other insurers was seen as limited. A London-based analyst estimated European insurers could face a "couple of hundred million euros" of investment losses each.

Others could be attracted by parts of AIG, for example its Asian operations. Analysts said these could appeal to Prudential, the UK life insurer, as could some of AIG's US assets.

"There is going to be a bit of damage and debris in terms of the investment losses. The more significant question is going to be who wants to buy what, if it ultimately comes to that," the London-based analyst says.

Fallen Giant: The Amazing Story of Hank Greenberg and the History of AIG. Ron Shelp(Author) and Al EhrBar(contributor).

## **Risky Trading Wasn't Just on the Fringe at A.I.G. Sign in to Recommend**

By MARY WILLIAMS WALSH, Published: January 31, 2010

Ever since the American International Group nearly collapsed, the conventional wisdom has been that the exotic derivatives that drove it to the brink were the product of a lone, unregulated subsidiary in London. The Federal Reserve chairman, Ben S. Bernanke, called the London branch “a hedge fund, basically, attached to a large and stable insurance company.”

### **American International Group**

But the suggestion that A.I.G.'s core insurance business did not dabble in derivatives is not quite true. One of its biggest insurance units, incorporated in Delaware, was also dealing in the derivatives known as credit-default swaps, according to regulatory filings with the state. Though the Delaware division had a much smaller portfolio of those swaps than the London unit, and its portfolio did not pose a similar risk to the world financial system, the very presence of the swaps in a regulated insurance company points to a weakness in insurance oversight.

There is a continuing dispute over whether such swaps are insurance products or something else; who, if anyone, should regulate them; and whether insurers should have to set aside reserves to secure the promises that swap contracts make. A.I.G.'s insurance business did not set aside such reserves. Efforts afoot now in Washington to strengthen financial regulation tend to focus on banking, with insurance, which is regulated by the states, almost an afterthought. The Senate Banking Committee plans to consider a financial regulatory overhaul on Tuesday. The House has already passed a measure that would create a national office to gather information on insurance but would leave insurance regulation to the states. The bill does not treat credit-default swaps as a form of insurance.

“You have this blind spot on insurance companies,” said Christopher Whalen, a co-founder of Institutional Risk Analytics, a research firm. The National Association of Insurance Commissioners says insurers were the third-biggest issuers of credit-default swaps, after banks and hedge funds, with 18 percent of the market in 2007. “We have a desperate need for federal regulation and federal disclosure by the insurance companies,” Mr. Whalen said. “But even after A.I.G., we still don't have a proposal for federal regulation, or even enhanced disclosure, and that's the dirty secret here.”

Credit-default swaps, in essence, work like bond insurance, in which the issuer promises to make a bondholder whole in case of problems like a default. But the swaps differ from conventional insurance in important ways. There are no required reserves, for instance. And any institution can buy the swaps — not just bondholders. That has led critics to liken the use of swaps to buying insurance on a neighbour's house, in hopes of a payday when he has a fire. A.I.G.'s London branch used these swaps in huge volume, causing a disaster when the purchasers all descended at once, demanding payments, and A.I.G. ran out of money.

The Delaware insurance unit with the credit-default swaps is one of A.I.G.'s biggest. Known as Alico, or the American Life Insurance Company, the unit does its conventional insurance business overseas in more than 40 countries. Its counterparties on the swaps, though, are big United States banking companies. If the measure passed by the House became law, an insurer like Alico that used swaps to sell protection against bond defaults would be designated a “swap dealer,” and have to comply with capital requirements and other rules. That way, the company would be required to have money to stand behind its promises, said Andrew Williams, a spokesman for the Treasury Department, which supports the provision.

Insurance regulators said Delaware did not consider credit-default swaps to be insurance. “I don't think an insurance commissioner should tread on the toes of the banking industry,” said Karen Weldin Stewart, the commissioner in Delaware. “This started out as a bank product.” Her special deputy for examinations, John Tinsley, explained the reasoning. “In insurance, you're putting together a pool,” he said. Each customer would be charged a premium based on the total risk of the pool. A credit-default swap cannot be insurance, Mr. Tinsley said, because it does not involve a pool. There is just one seller and one buyer for every contract.

“It’s an investment product,” he said. “It’s closer to buying an option.”

Not everyone agrees. Eric R. Dinallo, New York State’s insurance superintendent when A.I.G. imploded, said he believed credit-default swaps were insurance and should be regulated as such. Even at its peak, in 2007, Alico’s portfolio of credit-default swaps was just a fraction of the one at A.I.G. Financial Products, the London shop whose collapsing business led the United States government to prop up A.I.G., the biggest bailout in American history.

If Alico’s entire portfolio had blown up that year, the maximum possible loss — a little more than \$1 billion — would not have wiped out the company’s total reported surplus of \$7 billion. Alico’s executives said they considered their swap program much safer as well. Michael Buthe, the chief investment officer, said that the company had sold protection only on investment-grade bonds, which the company considered unlikely to default.

Alico’s chief financial officer, Christopher J. Swift, added that the bonds were issued by companies in many commercial sectors, which diversified the portfolio. That differed starkly from A.I.G. Financial Products, whose swaps gave A.I.G. a vast, undiversified exposure to the housing markets. “This isn’t tied to real estate,” Mr. Swift said of his company’s program. “It diversified our holdings and increased yield.”

When the markets soured in 2008, the company realized a \$52 million loss as it terminated many of the contracts. “We’re constantly monitoring the market, and we saw the economics changing,” Mr. Buthe said. The program has been unwound, with only a few swaps remaining, and Mr. Buthe said the company was not planning.

<http://www.reuters.com/assets/print?aid=USMAR85972720080918>

## **How AIG fell apart**

Thu, Sep 18 2008, By Adam Davidson

(The Big Money) When you hear that the collapse of AIG or Lehman Bros. or Bear Stearns might lead to a systemic collapse of the global financial system, the feared culprit is, largely, that once-obscure (OK, still obscure) instrument known as a credit default swap.

So, what is a CDS, and why is it so dangerous? At first glance, a credit default swap seems like a perfectly sensible financial tool. It is, basically, insurance on bonds. Imagine a large bank buys some bonds issued by General Electric. The bank expects to receive a steady stream of payments from GE over the years. That's how bonds work: The issuer pays the bondholder some money every six months. But the bank figures there's a chance that GE might go bankrupt. It's a small chance, but not zero, and if it happens, the bank doesn't get any more of those payments.

The bank might decide to buy a CDS, a sort of insurance policy. If GE never goes bankrupt, the bank is out whatever premium it paid for the CDS. If GE goes bankrupt and stops paying its bondholders, the bank gets money from whoever sold the CDS.

Who sells these CDSs? Banks, hedge funds, and AIG.

It's easy to see the attraction. Historically, bond issuers almost never go bankrupt. So, many banks and hedge funds figured they could make a fortune by selling CDSs, keeping the premium, and almost never having to pay out anything. In fact, beginning in the late '90s, CDSs became a great way to make a lot more money than was possible through traditional investment methods. Let's say you think GE is rock solid, that it will never default on a bond, since it hasn't in recent memory. You could buy a GE bond and make, say, a meagre 6 percent interest. Or you could just sell GE credit default swaps. You get money from other banks, and all you have to give is the promise to pay if something bad happens. That's zero money down and a profit limited only by how many you can sell.

Over the past few years, CDSs helped transform bond trading into a highly leveraged, high-velocity business. Banks and hedge funds found that it was much easier and quicker to just buy and sell CDS contracts rather than buy and sell actual bonds.

As of the end of 2007, they had grown to roughly \$60 trillion in global business. So, what went wrong? Many CDSs were sold as insurance to cover those exotic financial instruments that created and spread the sub-prime housing crisis, details of which are covered here. As those mortgage-backed securities and collateralized debt obligations became nearly worthless, suddenly that seemingly low-risk event—an actual bond default—was happening daily. The banks and hedge funds selling CDSs were no longer taking in free cash; they were having to pay out big money. Most banks, though, were not all that bad off, because they were simultaneously on both sides of the CDS trade. Most banks and hedge funds would buy CDS protection on the one hand and then sell CDS protection to someone else at the same time. When a bond defaulted, the banks might have to pay some money out, but they'd also be getting money back in. They netted out.

Everyone, that is, except for AIG. AIG was on one side of these trades only: They sold CDS. They never bought. Once bonds started defaulting, they had to pay out and nobody was paying them. AIG seems to have thought CDS were just an extension of the insurance business. But they're not. When you insure homes or cars or lives, you can expect steady, actuarially predictable trends. If you sell enough and price things right, you know that you'll always have more premiums coming in than payments going out. That's because there is low correlation between insurance triggering events. My death doesn't, generally, hasten your death. My house burning down doesn't increase the likelihood of your house burning down. Not so with bonds. Once some bonds start defaulting, other bonds are more likely to default. The risk increases exponentially.

Credit default swaps written by AIG cover more than \$440 billion in bonds. We learned this week that AIG has nowhere near enough money to cover all of those. Their customers—those banks and hedge funds buying CDSs—started getting nervous. So did government regulators. They started to wonder if AIG has enough money to pay out all the CDS claims it will likely owe. This week, Moody's Investors Service, the credit-rating agency, announced that it was less confident in AIG's ability to pay all its debts and would lower its credit rating. That has formal implications: It means AIG has to put up more collateral to guarantee its ability to pay.

Just when AIG is in trouble for being on the hook for all those CDS debts, along comes this credit-rating problem that will force it to pay even more money. AIG didn't have more money. The company started selling things it owned—like its aircraft-leasing division. All of this has pushed AIG's stock price down dramatically. That makes it even harder for AIG to convince companies to give it money to pitch in. So, it's asking the government to help out. AIG might be in trouble. But what do I care? Because the global economy could, possibly, come to a halt. Banks all over the world bought CDS protection from AIG.

If AIG is not able to make good on that promise of payment, then every one of those banks has lost that protection. Overnight, the banks have to buy replacement coverage at much higher rates, because the risks now are much worse than they were when AIG sold most of these CDS contracts. In short, banks all over the world are instantly worth less money. The numbers seem to be quite huge—possibly in the hundreds of billions. To cover that instantaneous loss, banks will lend out less money. That means other banks can't borrow to pay this new cost, and weaker banks might not have enough; they'll collapse. That will further shrink the global pool of money. This will likely spur a whole new round of CDS payouts—all those collapsed banks issue bonds that someone, somewhere sold CDS protection for. That new round of CDS payouts could cause another round of bank failures.

Generally, with enough time, financial markets can adjust to just about anything. This, though, would be an instantaneous transformation of the global financial system. Surely, the worst part will be the confusion. CDS are largely over-the-counter instruments. That means they're not traded on an exchange. One bank just agrees with another bank to do a CDS deal. There's no reliable central repository of information. There's no way to know how exposed a bank is. Banks would have no way of knowing how badly other banks have been affected. Without any clarity, banks will likely simply stop lending to each other.

Since we're only just now getting a handle on how widespread and intertwined they have become, it seems possible that AIG, alone, could bring the global economy to something of a standstill. It's also possible that it wouldn't.



## Appendix C.2

### CS 9 LTCM (Long Term Capital Management)

Lam, James (2003). *Enterprise Risk Management - from Incentives to Controls*. John Wiley & Sons, Inc., New Jersey, USA.

The LTCM (Long Term Capital Management) hedge fund suffered catastrophic losses in 1998. LTCM was a state-of-the-art hedge fund that was run by the trader John Meriwether and was associated with Myron Scholes (of Black-Scholes option pricing formula fame).

The catastrophic losses were caused by systemic risks that LTCM had not foreseen in its business model. As a result, the Federal Reserve Bank of New York managed to arrange (in September 1998) a US \$3,500 million bail out (via its creditor banks) of the liabilities that LTCM had incurred.

With the benefit of hindsight, the trigger for LTCM's eventual downfall was Russia's technical default on its sovereign debt obligations in August/September 2008. This led to repercussions across the world's financial markets. Panic spread quickly throughout emerging markets, even those that had little to do with Russia. In turn, the world's financial institutions were hit hard. The world's top 50 financial institutions reported overall losses in excess of US\$ 17,000 million during 1998 Quarter 3. Furthermore, the general "flight to quality" in the credit markets and the accompanying dwindling of liquidity led to the unprecedented spectacle of investors discriminating between near-identical US Treasury Bonds on the grounds of credit risk.

The associated losses from the above resulted in the downfall of LTCM, which was bailed out by its creditor banks to cover losses of US\$ 3,500 million. Several copycat hedge funds and proprietary trading desks also suffered large losses. In the aftermath, some of the interbank markets (e.g. option volatility market) were changed for good.

McNeil, Alexander J. et al, (2005). *Quantitative Risk Management: Concepts, Tools, Techniques*, Princeton Series in Finance, Princeton University Press, New Jersey, USA.

Any useful measures of **VaR** must take into account the costs of liquidation on the prospective basis. The events surrounding the near-bankruptcy of the hedge fund **LTCM** in the summer of 1998 clearly showed that such concerns are justifiable. In fact, the illiquidity of markets in nowadays regarded by many risk managers as the most important source of model risk.

In September 1998, "The Observer" newspaper, referring to the downfall of **LTCM**, summarised the mood of the times as "... *last week, free market economy died. 25 years of intellectual bullying by the University of Chicago has come to a close.*" The article continued: "*the derivatives markets are a rarefied world. They are pooled with individuals with an extraordinary grasp of mathematics – a strange collection of Greeks, misfits and rocket scientists*". Referring to the Black-Scholes formula, the article asked: "*is this really the key to future wealth? Win big, lose bigger.*"

A particular concern in multivariate modelling is the phenomenon of dependence between extreme outcomes, when many risk factors move against us simultaneously. Regarding the **LTCM** case, "Business Week" magazine (September 1998) quoted:

*"Extreme, synchronised rises and falls in financial markets occur infrequently but they do occur. The problem with the models is that they did not assign a high enough chance of occurrence to the scenario in which many things go wrong at the same time – the "perfect storm" scenario."*

In a perfect storm, the risk manager discovers that the diversification he thought he had is illusory; practitioners describe this also as a concentration of risk. Myron Scholes, has argued against the regulatory overemphasis of **VaR**, in the face of the more important issue of co-movements in times of market stress.

Crouhy, Michael et al, (2006). *The Essentials of Risk Management*, The McGraw-Hill Companies, Inc., USA.

**VaR** can provide a powerful way of assessing the overall market risk of trading positions over a short horizon, such as a 10-day period, and under “normal” market conditions. The methodology generates the capture of a single number the multiple components of market risk, such as curve risk, basis risk and volatility risk.

However, each time there is turmoil in the world’s markets, the limitations of even the most sophisticated measures of market risk are revealed. **VaR** has proved to be unreliable as a measure of risk over long time periods or under abnormal market conditions. The danger posed by exceptional market shocks, such as the crisis in the world markets in 1998 that led to near-collapse of **LTCM**, shocks that are often accompanied by a drying up of market liquidity, can be captured only by means of supplemental methodologies.

The failure of the hedge fund **LTCM** in September 1998 provides a classic example of model risk in the financial services industry. The failure shocked the financial community, not only because of the reputation of LTCM’s principals, but also because of the unprecedented amounts of capital represented by the firm’s positions. LTCM employed US\$ 125,000 million in total assets with an equity base (before the crisis) of US\$ 4,800 million, a leverage ratio in excess of 25.

LTCM’s crisis was triggered on 17 August 1998, when Russia devalued the rouble and declared a debt moratorium. LTCM’s portfolio value fell 44%, giving it a year-to-date decline of 52%, which amounted to a loss of almost US\$ 2,000 million. The hedge fund’s positions in the market were so great that the Federal Reserve Bank of New York took the unprecedented step of facilitating a bailout of the fund to avoid any risk of a meltdown in the world markets.

How could such a market event, however serious, have affected LTCM so badly? LTCM’s arbitrage strategy was based on “market neutral” or “relative-value” trading, which involves buying one instrument and simultaneously selling another. These trades are designed to make money whether prices rise or fall, as long as the spread between the two positions moves in the appropriate direction.

LTCM, like other hedge funds in early 1998, had positioned its portfolio on the basis of particular bets, albeit bets that seemed pretty safe at first sight. For example, LTCM bet that the spreads between corporate bonds and government Treasuries in different countries (e.g. USA and UK) were too large and would eventually return to their normal range (as they had always done before). Such strategies are based on intensive empirical research and advanced financial modelling. A trade to capture the relative-value opportunities uncovered by such modelling might consist of buying corporate bonds and selling the relevant government bonds short. Other positions involved betting on convergence in the key European bond markets by selling German government bonds against the sovereign debt of other countries, such as Spain and Italy, which were due to sign up for European EMU (economic and monetary union). When the spread in yield narrows, such positions make money, irrespective of whether the price level goes up or down.

The return on such apparently low-risk strategies tends to be quite small, and it becomes smaller and smaller as more players enter the market to take advantage of the “opportunity”. As a result, hedge funds are obliged to use leverage aggressively to boost their absolute performance. LTCM, for example, was trying to earn a 1.0% p.a. return on its assets, leveraged 25 times, which would yield a 25% p.a. return. LTCM was able to obtain large loans, collateralised by the bonds that it had invested in, because the strategy was widely viewed as safe by the institutions that were its lenders.

LTCM failed because both its trading models and its risk management models failed to anticipate the vicious cycle of losses during an extreme crisis when volatilities rose dramatically, correlations between markets and instruments became closer to 1, and liquidity dried up.

Risk control at LTCM relied on a VaR model. However, instead of the envisaged US\$ 44 million daily volatility, the fund experience daily volatility of US\$100 million and higher. While the 10-day VaR was US\$ 320 million, LTCM suffered losses from mid-August 1998 in excess of US\$ 1,000 million. In summary, LTCM’s risk modelling was inappropriate and let it down.



Drobny, Steven. (2003). *Inside The House Of Money*. John Wiley & Sons, Inc., New Jersey, USA.

LTCM was started in 1994 by the infamous Salomon Brothers trader John Meriwether, who hired an all all-star cast of financial minds including the Nobel Prize winners Robert Merton and Myron Scholes, the pioneers of option pricing theory and methodology.

LTCM started with US\$ 1.3 billion in assets and initially focused on fixed income arbitrage opportunities, which had become more attractive as spreads widened after the bond market rout of 1994. The original core strategy was to bet on the convergence of the spread between “off-the-run” and “on-the-run” bonds, as well as other relative value and arbitrage opportunities, primarily in fixed income. Due to the small spread of these arbitrage trades, the fund was leveraged many times in order to generate the annual returns of 40% plus that it posted for the first few years of its existence.

LTCM’s success at exploiting these arbitrages caused assets under management to grow at the same time that the opportunities were disappearing. It decided to increase its leverage in order to maintain returns as well as to allocate its risk capital into markets and trades that were beyond its original scope of expertise. Going into 1998, LTCM has US\$ 5 billion in assets with notional outstanding positions estimated at well over US\$ 1,000 billion. At the same time, risk arbitrage trades (bets on mergers and acquisitions), directional positions, and emerging market bets had become a larger portion of its portfolio risk.

As the summer of 1998 approached, global markets became increasingly unsettled. Russia’s eventual devaluation and default then led to a large scale reduction in risk appetite and a global flight to quality. Long-term fundamental values were deemed irrelevant by investors, causing a further widening of the spreads on LTCM’s arbitrage and relative value trades. Given the leverage and size of its positions, liquidation was all but impossible. At the same time, LTCM’s counterparties knew that they were in trouble and at risk of imploding, leading them to hedge their own counterparty risk, further compounding LTCM’s mark-to-market woes. To mitigate default, the Federal Reserve Bank of New York implemented its bailout package.

The LTCM collapse offers insight into some of the potential failings of risk management systems. Risk management systems that are based on historical prices provide one way to look at risk, but are in no way faultless. Financial market history has been filled with theoretically low probability or fat tail events. In LTCM’s case, its risk modelling systems calculated a 1-in-6 billion probability of a major blow-up. Ironically, LTCM neglected to consider the correlation coefficient of positions that were linked for no other reason than the fact that they were in LTCM’s portfolio. In other words, their risk models did not provide for the LTCM liquidity premium.

LTCM provides a reminder of the notion that there is no such thing as a risk-free arbitrage. Because the arbitrage positions they were exploiting were small, the fund had to be leveraged many times in order to produce meaningful investment returns. This put them at risk to their lender’s financing fees as well as general market liquidity. The problem with liquidity is that it is never there when it is really needed.

**Long-Term Capital Management (LTCM)** was a U.S. hedge fund which used trading strategies such as fixed income arbitrage, statistical arbitrage, and pairs trading, combined with high leverage. It failed spectacularly in the late 1990s, leading to a massive bailout by other major banks and investment houses, which was supervised by the Federal Reserve. It was founded in 1994 by John Meriwether. The Board of Directors included Myron Scholes and Robert C. Merton, who shared the 1997 Nobel Memorial Prize in Economic Sciences. Initially enormously successful with annualized returns of over 40% (after fees) in its first years, in 1998 it lost \$4.6 billion in less than four months following the Russian financial crisis and became a prominent example of the risk

John Meriwether headed Salomon Brothers' bond trading desk until he was forced to resign in 1991 when his top bond trader, Paul Mozer, admitted to falsifying bids on U.S. Treasury auctions. Because Salomon was the largest bidder on treasury bonds at auction, the Treasury department feared that Salomon would be able to take a strategic position on the bonds in order to influence the price. In 1993 he announced that he would launch a hedge fund called LTCM. Meriwether used his well-established reputation to recruit several Salomon bond traders and some brilliant mathematicians.

The company used complex mathematical models to take advantage of fixed income arbitrage deals (termed *convergence trades*) usually with U.S., Japanese, and European government bonds. Government bonds are a "fixed-term debt obligation", meaning that they will pay a fixed amount at a specified time in the future. Differences in the bonds' present value are minimal, so according to economic theory any difference in price will be eliminated by arbitrage. Unlike differences in share prices of two companies, which could reflect different underlying fundamentals, price differences between a 30 year treasury bond and a 29 and three quarter year old treasury bond should be minimal—both will see a fixed payment roughly 30 years in the future. However, small discrepancies arose between the two bonds because of a difference in liquidity. By a series of financial transactions, essentially amounting to buying the cheaper 'off-the-run' bond (the 29 and three quarter year old bond) and shorting the more expensive, but more liquid, 'on-the-run' bond (the 30 year bond just issued by the Treasury), it would be possible to make a profit as the difference in the value of the bonds narrowed when a new bond was issued.

As LTCM's capital base grew, they felt pressed to invest that capital and had run out of good bond-arbitrage bets. This led LTCM to undertake more aggressive trading strategies. Although these trading strategies were non-market directional, i.e. they were not dependent on overall interest rates or stock prices going up (or down), they were not convergence trades as such. By 1998, LTCM had extremely large positions in areas such as merger arbitrage and S&P 500 options (net short long-term S&P volatility). LTCM had become a major supplier of S&P 500 vega, which had been in demand by companies seeking to essentially insure equities against future declines.

In a memorandum to Long Term's management committee dated November 12, 1996, Myron Scholes wrote: "We must decide in the near future (1) how to allocate these capital losses; (2) how to "trade" them so that they are held in high-valued hands; and (3) how to plan to be able to enjoy the benefits of the use of these losses for the longest period of time. If we are careful, most likely we will never have to pay long-term capital gains on the 'loan' from the Government." He went on, "How should LTCM pay those who brought the Tax Losses to Fruition and allocate the expenses of undertaking the trade?"

Although much success within the financial markets arises from immediate-short term turbulence, and the ability of fund managers to identify informational asymmetries, factors giving rise to the downfall of the fund were established prior to the 1997 East Asian financial crisis. In May and June 1998 returns from the fund were -6.42% and -10.14% respectively, reducing LTCM's capital by \$461 million. This was further aggravated by the exit of Salomon Brothers from the arbitrage business in July 1998. Such losses were accentuated through the Russian financial crises in August and September 1998, when the Russian Government defaulted on their government bonds. Panicked investors sold Japanese and European bonds to buy U.S. treasury bonds. The profits that were supposed to occur as the value of these bonds converged became huge losses as the value of the bonds diverged. By the end of August, the fund had lost \$1.85 billion in capital.

As a result of these losses, LTCM had to liquidate a number of its positions at a highly unfavourable moment and suffer further losses. A good illustration of the consequences of these forced liquidations is given by Lowenstein (2000). He reports that LTCM established an arbitrage position in the dual-listed company (or "DLC") Royal Dutch Shell in the summer of 1997, when Royal Dutch traded at an 8-10% premium relative to Shell. In total \$2.3 billion was invested, half of which long in Shell and the other half short in Royal Dutch. LTCM was essentially betting that the share prices of Royal Dutch and Shell would converge. This may have happened in the long run, but due to its losses on other positions, LTCM had to unwind its position in Royal Dutch Shell. Lowenstein reports that the premium of Royal Dutch had increased to about 22%, which implies that LTCM incurred a large loss on this arbitrage strategy. LTCM lost \$286 million in equity pairs trading and more than half of this loss is accounted for by the Royal Dutch Shell trade.

The company, which was providing annual returns of almost 40% up to this point, experienced a flight-to-liquidity. In the first three weeks of September, LTCM's equity tumbled from \$2.3 billion at the start of the month. By September 25, LTCM had just \$400 million in capital. With assets still over \$100 billion, this translated to an effective leverage ratio of more than 250-to-1.

LTCM did business with nearly everyone important on Wall Street. As LTCM teetered, Wall Street feared that its failure could cause a chain reaction in numerous markets, causing catastrophic losses throughout the financial system. After LTCM failed to raise more money on its own, it became clear it was running out of options. On September 23, Goldman Sachs, AIG, and Berkshire Hathaway offered then to buy out the fund's partners for \$250 million, to inject \$3.75 billion and to operate LTCM within Goldman's own trading division. The offer was stunningly low to LTCM's partners because at the start of the year their firm had been worth \$4.7 billion. Buffett gave Meriwether less than one hour to accept the deal; the time period lapsed before a deal could be worked out.

Seeing no options left the Federal Reserve Bank of New York organised a bailout of \$3.625 billion by the major creditors to avoid a wider collapse in the financial markets. In return, the participating banks got a 90% share in the fund and a promise that a supervisory board would be established. LTCM's partners received a 10% stake, still worth about \$400 million, but this money was completely consumed by their debts. The partners once had \$1.9 billion of their own money invested in LTCM, all of which was wiped out.

The fear was that there would be a chain reaction as the company liquidated its securities to cover its debt, leading to a drop in prices, which would force other companies to liquidate their own debt creating a vicious cycle. The total losses were found to be \$4.6 billion.

Unsurprisingly, after the bailout by the other investors, the panic abated, and the positions formerly held by LTCM were eventually liquidated at a small profit to the bailers.

Some industry officials said that Federal Reserve Bank of New York involvement in the rescue, however benign, would encourage large financial institutions to assume more risk, in the belief that the Federal Reserve would intervene on their behalf in the event of trouble. Federal Reserve Bank of New York actions raised concerns among some market observers that it could create moral hazard.

LTCM's strategies were compared (a contrast with the market efficiency aphorism that there are no \$100 bills lying on the street, as someone else has already picked them up) to "picking up nickels in front of a bulldozer"— a likely small gain balanced against a small chance of a large loss, like the payouts from selling an out-of-the-money option.

After the bailout, LTCM continued operations. In the year following the bailout, it earned 10%. By early 2000, the fund had been liquidated, and the consortium of banks that financed the bailout had been paid back; but the collapse was devastating for many involved. Goldman Sachs CEO Jon Corzine, who had been closely involved with LTCM, was forced out of the office in a boardroom coup led by Henry Paulson. Mullins, once considered a possible successor to Alan Greenspan, saw his future with the Reserve dashed. The theories of Merton and Scholes took a public beating. In its annual reports, Merrill Lynch observed that mathematical risk models "may provide a greater sense of security than warranted; therefore, reliance on these models should be limited."

## Appendix C.3

### CS 3 Union Carbide

Skipper, Harold D. and Kwon, W, Jean. (2007). *Risk Management and Insurance: Perspectives in a Global Economy*, Blackwell Publishing Ltd., Oxford, England.

This case study illustrates how a small foreign subsidiary can severely damage a global enterprise.

In December, 1984, over 40 tons of poisonous gases leaked from a pesticide factory in Bhopal, India, belonging to Union Carbide, killing more than 20,000 residents. The event has also had long-term health consequences for those victims who survived but with serious health problems. After much corrective action and legal wrangling, Union Carbide, which built the plant in 1969, settled a civil suit brought by the Indian government in 1989 by agreeing to pay US\$470 million for damages suffered by the 500,000 people who were exposed to the gas. The company maintained that the payment was made out of a sense of 'moral' rather than 'legal' responsibility since the plant was operated by a separate Indian subsidiary, Union Carbide India Ltd.

The court proceedings revealed that management's cost cutting measures had effectively disabled safety procedures essential to prevent or alert employees of such disasters. A chemical reaction was caused by the entry of water into a MIC (Methyl isocyanate) storage tank. This was the immediate cause of the gas leakage. The severity and impact of the event were also made worse by the lack of safety standards and effective containment measures at the factory in Bhopal. The physical manifestations of these failures included unreliable monitoring equipment, inoperative safety equipment, unsuitable/inadequate gas suppression equipment and alarm systems which failed. These internal factors were compounded by the lack of awareness, expertise, readiness and co-ordination of the public agencies to provide an effective response.

Dow Chemical has since taken over Union Carbide and denies responsibility for this disaster. However, because of the large loss of life there and the fact that Dow Chemical is much larger than what was once Union Carbide and its Union Carbide India Ltd. subsidiary, ongoing litigation continues to haunt Dow Chemical. The public agencies are also considered by some to have failed in their responsibility to help the survivors more than 20 years after the event. The Bhopal gas leak is an example of how a risk event at a distant and relatively small unit can have disastrous consequences on a firm and how the impact of a risk event can be heightened by an inadequate response from public agencies.

This case study demonstrates the need for thorough 'risk identification' and 'risk assessment' processes that consider catastrophic incidents, such as one this magnitude. Each operational business unit needs to recognise the likelihood and consequences of the risks that they face. A risk event at a small foreign subsidiary can bring down the entire enterprise - risk management at all levels should recognise that the potential for catastrophes always exists and that their impact can have both a large scale and a long-term impact. We can never predict risks of this major consequence, but an enterprise should accept that the risk always remains of a catastrophic disaster. The foundation of a risk management strategy is also often in strong fundamentals – in the case of Union Carbide the need to establish and ensure adherence to safety standards designed to fit the nature of the chemical processes and production activity which was taking place.

Lam, James (2003). *Enterprise Risk Management - from Incentives to Controls*. John Wiley & Sons, Inc., New Jersey, USA.

In December, 1984, a Union Carbide pesticide plant in Bhopal, India, was the site of what was then called the *"world's worst industrial accident"* in history. A tank in the pesticide plant leaked 5 tons of poisonous methyl isocyanate gas into the air, killing more than 3,000 people and injuring tens of thousands of people. Following this incident, the Indian Government successfully sued (in 1989) Union Carbide for US\$ 470 million. The associated criminal proceedings are still outstanding (as at 2003).

[http://en.wikipedia.org/wiki/Union\\_Carbide](http://en.wikipedia.org/wiki/Union_Carbide)

**Union Carbide Corporation** (*Union Carbide*) is one of the oldest chemical and polymer companies in the United States, currently employing more than 3,800 people. It became infamous for the worst ever industrial accident that took place in its Bhopal, Madhya Pradesh, India plant in 1984. Union Carbide was found liable for the disaster, but has denied responsibility.

Union Carbide became a wholly owned subsidiary of The Dow Chemical Company on February 6, 2001, following completion of its settlement and opening of The Bhopal Memorial Hospital and Research Centre, ending its chapter in India in the same year. It sells most of the products it manufactures to Dow Chemical. It is a former component of the Dow Jones Industrial Average.

In 1920, its researchers developed an economical way to make ethylene from natural gas liquids such as ethane and propane, giving birth to the modern petrochemical industry. Today, Union Carbide possesses some of the industry's most advanced process and catalyst technologies, and operates some of the most cost-efficient, large-scale production facilities in the world. Before divesting them, the chemical giant owned consumer products Eveready and Energizer batteries, Glad bags and wraps, Simoniz car wax and Prestone antifreeze. The company divested other businesses before being acquired by Dow including electronic chemicals, polyurethane intermediates, industrial gases and carbon products.

Union Carbide primarily produces chemicals and polymers that undergo one or more further conversions by customers before reaching consumers. Some of these materials are high-volume commodities, while others are specialty products meeting the needs of smaller market niches. The end-uses served include paints and coatings, packaging, wire and cable, household products, personal care, pharmaceuticals, automotive, textiles, agriculture and oil and gas.

### **Bhopal disaster**

The Bhopal disaster was an industrial catastrophe that took place at a pesticide plant owned and operated by Union Carbide India Limited (UCIL) in Bhopal, Madhya Pradesh, India on December 3, 1984. At midnight on 3 December 1984, the plant released methyl isocyanate (MIC) gas and other toxins, resulting in the exposure of over 500,000 people. Estimates vary on the death toll. The official immediate death toll was 2,259 and the government of Madhya Pradesh has confirmed a total of 3,787 deaths related to the gas release. Other government agencies estimate 15,000 deaths. Others estimate 8,000 to 10,000 died within 72 hours and 25,000 have since died from gas-related diseases. 40,000 more were permanently disabled, maimed, or rendered subject to numerous grave illnesses; 521,000 exposed in all.

Some 25 years after the gas leak, 390 tonnes of toxic chemicals abandoned at the UCIL plant continue to leak and pollute the groundwater in the region and affect thousands of Bhopal residents who depend on it, though there is some dispute as to whether the chemicals still stored at the site pose any continuing health hazard. There are currently civil and criminal cases related to the disaster ongoing in the United States District Court, Manhattan and the District Court of Bhopal, India against Union Carbide, now owned by Dow Chemical Company, with an Indian arrest warrant pending against Warren Anderson, CEO of Union Carbide at the time of the disaster

As of early 2010, no one had yet been prosecuted for the disaster. However, a successful prosecution was eventually determined on 7<sup>th</sup> June 2010, when seven former executives of Bhopal were convicted of “death by negligence”, as reported below.

<http://www.independent.co.uk/news/world/asia/seven-found-guilty-of-bhopal-gas-tragedy-1993535.html>

### **Seven found guilty of Bhopal gas tragedy - Monday, 7 June 2010**

Local activists insist the death toll was around 15,000

Seven former chemical company executives were today convicted of "death by negligence" for their roles in the Bhopal gas tragedy that killed 15,000 people more than 25 years ago in the world's worst industrial disaster.

Their firm, Union Carbide India Ltd., was convicted of the same charge. But the company no longer exists. The former employees, many of them in their 70s, face up to two years in prison. The judge did not immediately announce sentences. Large groups of survivors and relatives, along with rights activists, gathered in the city saying the verdict was too little, too late.

Early on December 3, 1984, a pesticide plant run by the subsidiary of US company Union Carbide leaked about 40 tons of deadly methyl isocyanate gas into the air in Bhopal in central India, quickly killing about 4,000 people. The lingering effects of the poison raised the death toll to about 15,000 over the next few years.

Local activists insist the real numbers are almost twice that, and say the company and government have failed to clean up toxic chemicals at the plant, which closed after the accident.

The verdicts, which were in a local court and are likely to be appealed, came as the case crawled through India's notoriously slow and ineffective judicial system.

India's Central Bureau of Investigation, the country's top investigative agency, had originally accused 12 defendants: eight senior Indian company officials; Warren Anderson, the head of Union Carbide at the time of the gas leak; the company itself and two subsidiary companies.

Seven of the eight Indian company officials were convicted today. The other one has since died. Anderson and Union Carbide have never appeared in court proceedings.

Union Carbide was bought by Dow Chemical in 2001. Dow says the legal case was resolved in 1989 when Union Carbide settled with the Indian government for 470 million dollars, and that all responsibility for the factory now rests with the government of the state of Madhya Pradesh, which now owns the site.

Last July, the same court in Bhopal had issued a warrant for Anderson's arrest and also ordered the Indian government to press Washington for his extradition.

Anderson was briefly detained immediately after the disaster, but he quickly left the country and now lives in New York. It was not immediately clear if the Indian government had begun to process the Bhopal court's request. Extradition proceedings are usually mired in a complex tangle of legal paperwork and can take years to complete.

Investigators say the accident occurred when water entered a sealed tank containing the highly reactive gas, causing pressure in the tank to rise too high.

Union Carbide said the accident was an act of sabotage by a disgruntled employee who was never identified. It has denied the disaster was the result of lax safety standards or faulty plant design, as claimed by some activists.

The Central Bureau of Investigation said the plant had not been following proper safety procedures.



## **The Bhopal disaster and its aftermath: a review**

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### **Abstract**

On December 3 1984, more than 40 tons of methyl isocyanate gas leaked from a pesticide plant in Bhopal, India, immediately killing at least 3,800 people and causing significant morbidity and premature death for many thousands more. The company involved in what became the worst industrial accident in history immediately tried to dissociate itself from legal responsibility. Eventually it reached a settlement with the Indian Government through mediation of that country's Supreme Court and accepted moral responsibility. It paid \$470 million in compensation, a relatively small amount of based on significant underestimations of the long-term health consequences of exposure and the number of people exposed. The disaster indicated a need for enforceable international standards for environmental safety, preventative strategies to avoid similar accidents and industrial disaster preparedness.

Since the disaster, India has experienced rapid industrialization. While some positive changes in government policy and behaviour of a few industries have taken place, major threats to the environment from rapid and poorly regulated industrial growth remain. Widespread environmental degradation with significant adverse human health consequences continues to occur throughout India.

### **Review**

December 2004 marked the twentieth anniversary of the massive toxic gas leak from Union Carbide Corporation's chemical plant in Bhopal in the state of Madhya Pradesh, India that killed more than 3,800 people. This review examines the health effects of exposure to the disaster, the legal response, the lessons learned and whether or not these are put into practice in India in terms of industrial development, environmental management and public health.

### **History**

In the 1970s, the Indian government initiated policies to encourage foreign companies to invest in local industry. Union Carbide Corporation (UCC) was asked to build a plant for the manufacture of Sevin, a pesticide commonly used throughout Asia. As part of the deal, India's government insisted that a significant percentage of the investment come from local shareholders. The government itself had a 22% stake in the company's subsidiary, Union Carbide India Limited (UCIL). The company built the plant in Bhopal because of its central location and access to transport infrastructure. The specific site within the city was zoned for light industrial and commercial use, not for hazardous industry. The plant was initially approved only for formulation of pesticides from component chemicals, such as MIC imported from the parent company, in relatively small quantities. However, pressure from competition in the chemical industry led UCIL to implement "backward integration" – the manufacture of raw materials and intermediate products for formulation of the final product within one facility. This was inherently a more sophisticated and hazardous process.

In 1984, the plant was manufacturing Sevin at one quarter of its production capacity due to decreased demand for pesticides. Widespread crop failures and famine on the subcontinent in the 1980s led to increased indebtedness and decreased capital for farmers to invest in pesticides. Local managers were directed to close the plant and prepare it for sale in July 1984 due to decreased profitability. When no ready buyer was found, UCIL made plans to dismantle key production units of the facility for shipment to another developing country. In the meantime, the facility continued to operate with safety

equipment and procedures far below the standards found in its sister plant in Institute, West Virginia. The local government was aware of safety problems but was reticent to place heavy industrial safety and pollution control burdens on the struggling industry because it feared the economic effects of the loss of such a large employer.

At 11.00 PM on December 2 1984, while most of the one million residents of Bhopal slept, an operator at the plant noticed a small leak of methyl isocyanate (MIC) gas and increasing pressure inside a storage tank. The vent-gas scrubber, a safety device designed to neutralize toxic discharge from the MIC system, had been turned off three weeks prior. Apparently a faulty valve had allowed one ton of water for cleaning internal pipes to mix with forty tons of MIC. A 30 ton refrigeration unit that normally served as a safety component to cool the MIC storage tank had been drained of its coolant for use in another part of the plant. Pressure and heat from the vigorous exothermic reaction in the tank continued to build. The gas flare safety system was out of action and had been for three months. At around 1.00 AM, December 3, loud rumbling reverberated around the plant as a safety valve gave way sending a plume of MIC gas into the early morning air. Within hours, the streets of Bhopal were littered with human corpses and the carcasses of buffaloes, cows, dogs and birds. An estimated 3,800 people died immediately, mostly in the poor slum colony adjacent to the UCC plant. Local hospitals were soon overwhelmed with the injured, a crisis further compounded by a lack of knowledge of exactly what gas was involved and what its effects were. It became one of the worst chemical disasters in history and the name Bhopal became synonymous with industrial catastrophe.

Estimates of the number of people killed in the first few days by the plume from the UCC plant run as high as 10,000, with 15,000 to 20,000 premature deaths reportedly occurring in the subsequent two decades. The Indian government reported that more than half a million people were exposed to the gas. Several epidemiological studies conducted soon after the accident showed significant morbidity and increased mortality in the exposed population.

Immediately after the disaster, UCC began attempts to dissociate itself from responsibility for the gas leak. Its principal tactic was to shift culpability to UCIL, stating the plant was wholly built and operated by the Indian subsidiary. It also fabricated scenarios involving sabotage by previously unknown Sikh extremist groups and disgruntled employees but this theory was impugned by numerous independent sources.

The toxic plume had barely cleared when, on December 7, the first multi-billion dollar lawsuit was filed by an American attorney in a U.S. court. This was the beginning of years of legal machinations in which the ethical implications of the tragedy and its affect on Bhopal's people were largely ignored. In March 1985, the Indian government enacted the Bhopal Gas Leak Disaster Act as a way of ensuring that claims arising from the accident would be dealt with speedily and equitably. The Act made the government the sole representative of the victims in legal proceedings both within and outside India. Eventually all cases were taken out of the U.S. legal system under the ruling of the presiding American judge and placed entirely under Indian jurisdiction much to the detriment of the injured parties.

In a settlement mediated by the Indian Supreme Court, UCC accepted moral responsibility and agreed to pay \$470 million to the Indian government to be distributed to claimants as a full and final settlement. The figure was partly based on the disputed claim that only 3000 people died and 102,000 suffered permanent disabilities. Upon announcing this settlement, shares of UCC rose \$2 per share or 7% in value. Had compensation in Bhopal been paid at the same rate that asbestosis victims were being awarded in US courts by defendant including UCC – which mined asbestos from 1963 to 1985 – the liability would have been greater than the \$10 billion the company was worth and insured for in 1984. By the end of October 2003, according to the Bhopal Gas Tragedy Relief and Rehabilitation Department, compensation had been awarded to 554,895 people for injuries received and 15,310 survivors of those killed. The average amount to families of the dead was \$2,200.

At every turn, UCC has attempted to manipulate, obfuscate and withhold scientific data to the detriment of victims. Even to this date, the company has not stated exactly what was in the toxic cloud that enveloped the city on that December night. When MIC is exposed to 200° heat, it forms degraded MIC that contains the more deadly hydrogen cyanide (HCN). There was clear evidence that the



storage tank temperature did reach this level in the disaster. The cherry-red colour of blood and viscera of some victims were characteristic of acute cyanide poisoning. Moreover, many responded well to administration of sodium thiosulfate, an effective therapy for cyanide poisoning but not MIC exposure. UCC initially recommended use of sodium thiosulfate but withdrew the statement later prompting suggestions that it attempted to cover up evidence of HCN in the gas leak. The presence of HCN was vigorously denied by UCC and was a point of conjecture among researchers.

As further insult, UCC discontinued operation at its Bhopal plant following the disaster but failed to clean up the industrial site completely. The plant continues to leak several toxic chemicals and heavy metals that have found their way into local aquifers. Dangerously contaminated water has now been added to the legacy left by the company for the people of Bhopal.

### **Lessons learned**

The events in Bhopal revealed that expanding industrialization in developing countries without concurrent evolution in safety regulations could have catastrophic consequences. The disaster demonstrated that seemingly local problems of industrial hazards and toxic contamination are often tied to global market dynamics. UCC's Sevin production plant was built in Madhya Pradesh not to avoid environmental regulations in the U.S. but to exploit the large and growing Indian pesticide market. However the manner in which the project was executed suggests the existence of a double standard for multinational corporations operating in developing countries. Enforceable uniform international operating regulations for hazardous industries would have provided a mechanism for significantly improved safety in Bhopal. Even without enforcement, international standards could provide norms for measuring performance of individual companies engaged in hazardous activities such as the manufacture of pesticides and other toxic chemicals in India. National governments and international agencies should focus on widely applicable techniques for corporate responsibility and accident prevention as much in the developing world context as in advanced industrial nations. Specifically, prevention should include risk reduction in plant location and design and safety legislation.

Local governments clearly cannot allow industrial facilities to be situated within urban areas, regardless of the evolution of land use over time. Industry and government need to bring proper financial support to local communities so they can provide medical and other necessary services to reduce morbidity, mortality and material loss in the case of industrial accidents.

Public health infrastructure was very weak in Bhopal in 1984. Tap water was available for only a few hours a day and was of very poor quality. With no functioning sewage system, untreated human waste was dumped into two nearby lakes, one a source of drinking water. The city had four major hospitals but there was a shortage of physicians and hospital beds. There was also no mass casualty emergency response system in place in the city. Existing public health infrastructure needs to be taken into account when hazardous industries choose sites for manufacturing plants. Future management of industrial development requires that appropriate resources be devoted to advance planning before any disaster occurs. Communities that do not possess infrastructure and technical expertise to respond adequately to such industrial accidents should not be chosen as sites for hazardous industry.

### **Since 1984**

Following the events of December 3 1984 environmental awareness and activism in India increased significantly. The Environment Protection Act was passed in 1986, creating the Ministry of Environment and Forests (MoEF) and strengthening India's commitment to the environment. Under the new act, the MoEF was given overall responsibility for administering and enforcing environmental laws and policies. It established the importance of integrating environmental strategies into all industrial development plans for the country. However, despite greater government commitment to protect public health, forests, and wildlife, policies geared to developing the country's economy have taken precedence in the last 20 years.

India has undergone tremendous economic growth in the two decades since the Bhopal disaster. Gross domestic product (GDP) per capita has increased from \$1,000 in 1984 to \$2,900 in 2004 and it continues to grow at a rate of over 8% per year. Rapid industrial development has contributed greatly

to economic growth but there has been significant cost in environmental degradation and increased public health risks. Since abatement efforts consume a large portion of India's GDP, MoEF faces an uphill battle as it tries to fulfil its mandate of reducing industrial pollution. Heavy reliance on coal-fired power plants and poor enforcement of vehicle emission laws have result from economic concerns taking precedence over environmental protection.

With the industrial growth since 1984, there has been an increase in small scale industries (SSIs) that are clustered about major urban areas in India. There are generally less stringent rules for the treatment of waste produced by SSIs due to less waste generation within each individual industry. This has allowed SSIs to dispose of untreated wastewater into drainage systems that flow directly into rivers. New Delhi's Yamuna River is illustrative. Dangerously high levels of heavy metals such as lead, cobalt, cadmium, chrome, nickel and zinc have been detected in this river which is a major supply of potable water to India's capital thus posing a potential health risk to the people living there and areas downstream.

Land pollution due to uncontrolled disposal of industrial solid and hazardous waste is also a problem throughout India. With rapid industrialization, the generation of industrial solid and hazardous waste has increased appreciably and the environmental impact is significant.

India relaxed its controls on foreign investment in order to accede to WTO rules and thereby attract an increasing flow of capital. In the process, a number of environmental regulations are being rolled back as growing foreign investments continue to roll in. The Indian experience is comparable to that of a number of developing countries that are experiencing the environmental impacts of structural adjustment. Exploitation and export of natural resources has accelerated on the subcontinent. Prohibitions against locating industrial facilities in ecologically sensitive zones have been eliminated while conservation zones are being stripped of their status so that pesticide, cement and bauxite mines can be built. Heavy reliance on coal-fired power plants and poor enforcement of vehicle emission laws are other consequences of economic concerns taking precedence over environmental protection.

In March 2001, residents of Kodaikanal in southern India caught the Anglo-Dutch company, Unilever, red-handed when they discovered a dumpsite with toxic mercury laced waste from a thermometer factory run by the company's Indian subsidiary, Hindustan Lever. The 7.4 ton stockpile of mercury-laden glass was found in torn stacks spilling onto the ground in a scrap metal yard located near a school. In the fall of 2001, steel from the ruins of the World Trade Centre was exported to India apparently without first being tested for contamination from asbestos and heavy metals present in the twin tower debris. Other examples of poor environmental stewardship and economic considerations taking precedence over public health concerns abound.

The Bhopal disaster could have changed the nature of the chemical industry and caused a re-examination of the necessity to produce such potentially harmful products in the first place. However the lessons of acute and chronic effects of exposure to pesticides and their precursors in Bhopal has not changed agricultural practice patterns. An estimated 3 million people per year suffer the consequences of pesticide poisoning with most exposure occurring in the agricultural developing world. It is reported to be the cause of at least 22,000 deaths in India each year. In the state of Kerala, significant mortality and morbidity have been reported following exposure to Endosulfan, a toxic pesticide whose use continued for 15 years after the events of Bhopal.

Aggressive marketing of asbestos continues in developing countries as a result of restrictions being placed on its use in developed nations due to the well-established link between asbestos products and respiratory diseases. India has become a major consumer, using around 100,000 tons of asbestos per year, 80% of which is imported with Canada being the largest overseas supplier. Mining, production and use of asbestos in India is very loosely regulated despite the health hazards. Reports have shown morbidity and mortality from asbestos related disease will continue in India without enforcement of a ban or significantly tighter controls.

UCC has shrunk to one sixth of its size since the Bhopal disaster in an effort to restructure and divest itself. By doing so, the company avoided a hostile takeover, placed a significant portion of UCC's assets out of legal reach of the victims and gave its shareholder and top executives bountiful profits.

The company still operates under the ownership of Dow Chemicals and still states on its website that the Bhopal disaster was "cause by deliberate sabotage".

Some positive changes were seen following the Bhopal disaster. The British chemical company, ICI, whose Indian subsidiary manufactured pesticides, increased attention to health, safety and environmental issues following the events of December 1984. The subsidiary now spends 30–40% of their capital expenditures on environmental-related projects. However, they still do not adhere to standards as strict as their parent company in the UK.

The US chemical giant DuPont learned its lesson of Bhopal in a different way. The company attempted for a decade to export a nylon plant from Richmond, VA to Goa, India. In its early negotiations with the Indian government, DuPont had sought and won a remarkable clause in its investment agreement that absolved it from all liabilities in case of an accident. But the people of Goa were not willing to acquiesce while an important ecological site was cleared for a heavy polluting industry. After nearly a decade of protesting by Goa's residents, DuPont was forced to scuttle plans there. Chennai was the next proposed site for the plastics plant. The state government there made significantly greater demand on DuPont for concessions on public health and environmental protection. Eventually, these plans were also aborted due to what the company called "financial concerns".

## **Conclusions**

1. The tragedy of Bhopal continues to be a warning sign at once ignored and heeded. Bhopal and its aftermath were a warning that the path to industrialization, for developing countries in general and India in particular, is fraught with human, environmental and economic perils.
2. Some moves by the Indian government, including the formation of the MoEF, have served to offer some protection of the public's health from the harmful practices of local and multinational heavy industry and grassroots organizations that have also played a part in opposing rampant development.
3. The Indian economy is growing at a tremendous rate but at significant cost in environmental health and public safety as large and small companies throughout the subcontinent continue to pollute. Far more remains to be done for public health in the context of industrialization to show that the lessons of the countless thousands dead in Bhopal have truly been heeded.